Opportunities for Cooperatives to Lead Transformational Change Through Energy Innovation

Rural Electric Management Development Council

November 2019

Table of Contents

Executive Summary

Electric cooperative leaders have seen the writing on the wall, but the verse keeps changing. Finding solutions to challenges confronting the electric industry has been a primary objective for REMDC members, and considerable change occurring within the electric industry and throughout the national marketplace has prompted development of new strategic planning, as well as consideration for restructuring conventional service delivery methods that are more responsive to diverging consumer expectations and service needs.

The term Energy Innovation was adopted in 2008 as a primary focal point among the nation's electric cooperatives and became the platform from which a new philosophical approach in member service was launched. The program marked the beginning of a proactive effort to promote consumer awareness in personal energy management and reemphasized the cooperative business model's member-centric service relationship with member-owners.

Energy Innovation has since evolved to encompass distributed energy resources (DERs) as defined in this review, and has benefitted cooperatives and end-users in a variety of ways:

• It challenged members to accept accountability for their energy use and energy management.
• It created additional opportunities for face-to-face member engagement and a proactive response to member expectations.
• It helped co-ops earn more credibility as trusted energy advisors through free home energy audits and onsite analysis of DG projects, as well as many other interactions.

Nevertheless, accelerated transitions within the electric industry, technology, consumer service and retail environments have precipitated the need to expand the scope and emphasis of Energy Innovation to allow more consideration and room for innovation at the edge of new and developing service opportunity trends.

A case for that position today is easily made by looking at the rampant restructuring that is occurring everywhere within retail markets today. Due to the growth of social media and the rapid expansion of major e-commerce market influences like Amazon, all brands and retailers who wish to survive are having to rethink the way they package their products and services, the ways in which they deliver those services, the way they price those services, the way they engage consumers. Those transitions are being made with the end goal being able to provide a consumer experience that stands out from everyone else.

From a historical perspective, commerce's biggest losers have often been those who have balked at change, or who haven't recognized the need for change until it was too late to affect it.

Despite clear differences between the two, parallels are often drawn between the industry paths shared between the telecommunications and electric industries. Certainly, the sea changes that have transpired within the telecommunications industry in the recent past serve as an example of the resulting business and market losses that can result from apathy or denial that change is

happening, or that modifying business practices to take advantage of technological advancements and changing consumer expectations is necessary.

After Congress opened the telecommunications market to competition in the late 1990s, innovation within the industry exploded. Coinciding advancements in communications such as wireless, cable, satellite and internet technologies converged and virtually ended the legacy landline services that were the industry staple for ages. Since then, the industry has morphed into modern digital voice, entertainment, data and e-commerce platforms that are ubiquitous in society today.

Perhaps more specific to this study's analyses and subsequent recommendations for the future advancement of electric cooperatives, are the implications stemming from—as seen routinely in the telecommunications industry and others today—the widening expansion and intrusion of niche commercial ventures into service domains once thought largely immune to competition from industry outsiders, and the increasing trend for consumers to defect from or bypass providers who are not offering the products, integrated service options or value they perceive may be available elsewhere within the marketplace.

While most observers agree electric cooperatives have successfully branded their not-for-profit commercial operations as uniquely-modeled business partnerships with member-owners; and that they have earned the distinction of having led the electric utility sector on many fronts that have ultimately contributed to service value, such as energy efficiency, operational efficiency, competitive rate structures, safety and service reliability, deployment of advanced technology, etc., cooperative executives realize those intrinsic qualities alone aren't enough today to meet evolving consumer service expectations and positive retail experiences precipitated largely through the conveniences of digital commerce today.

This study, conducted among REMDC member electric cooperative leaders, concluded the long-term success of electric cooperatives in the future will hinge on a host of factors that include tapping into new technologies to serve increasingly sophisticated consumers; expanding opportunities to capture more value from DER and community energy projects; experimenting with new business models that provide more flexibility in managing power supply and costs; shifting resources, methods and planning to provide for the introduction or enhancement of new behind-the-meter products and services members desire.

By developing and adding new options, applications and approaches to existing core services that benefit members today, cooperatives can further leverage the trusted relationship they have with members and open new member engagement opportunities by being more attentive to evolving member service expectations.

Some Selective Calls to Action from Different Industry Shifts:

- Cooperatives must continue to actively monitor consumer expectations.
- Cooperatives should continue to evaluate new technologies that are beneficial for the cooperative and the member.
- Cooperatives should consider adoption of Energy as a Service (EaaS) options as an opportunity to match consumer expectations.

- Cooperatives should be prepared to work in tandem with G&Ts, statewide or national associations to address proposed regulatory changes and to assist in developing and implementing solutions to meet member expectations.
- Cooperatives should engage members in discussions about change and challenges that the cooperative and the electric industry are facing.
- Cooperatives should develop communication strategies that reinforce member trust in the cooperative as a creditable resource for information and advice.
- Cooperatives should continue focus on providing exceptional service and value.
- Cooperatives should continue their leadership in service applications and in consumer education.
- Cooperatives must establish and be able to demonstrate tactical plans and preparedness for response to a cyber or physical security breach.
- Cooperatives should evaluate member partnership opportunities that can enhance service reliability, i.e. rebate programs for specific technology, load management programs, etc.

It is clear that cooperatives have certain competencies within their organizations that enable them to meet member needs today. With the industry change that is undoubtedly occurring, these competencies must shift in order to meet the needs of members well into the future. Simply said, the workforce and skillsets of the cooperative today will not be successful for the cooperative tomorrow. Changes will affect every department and division within the cooperative, obviously to different levels. Further, some cooperatives have no current workforce today in areas that will be required in the future. This requires planning and execution by the leadership teams at cooperatives across the country.

Some Selective Challenges from Different Business Units:

- Business plans, exit strategies, cost accounting strategies – all important in the new era of services
- Billing complexity is a major concern – DSO operation, markets, distributed generation
- Cooperative data systems will need to adjust to providing tools and access to data residing in their independent systems
- For cooperatives to operate in the future, data communications must be widespread and very reliable
- Demographics is important – cooperatives should understand their demographics and market and communicate accordingly
- Employees need to be engaged and active participants in member education
- Members will expect services for solar, home automation, EV charging and support, just to name a few – the cooperative has a great opportunity
- Engineering models and planning for multitude of DERs – need to support multiple sources and those be an active part of the system model
- Uptime and reliability of internal networks is paramount – with a connected utility – it is imperative the network is always operational

- Attracting and retaining employees is difficult and will likely become even more challenging
- MSRs will need to shift to frontline sales representatives
- Dispatchers are no longer just dispatchers – shifting to system operators
- DERs and prosumers will affect the traditional G&T-Distribution Co-op relationship at some point – the G&T should get in front of this as much as possible and prepare
- New business opportunities and new services will require new flexibility and agility by procurement staff
- Safety will shift to include member premise
- Personnel training, skills, technical capabilities are important and continually expanding
- GM/CEO's should be strategic leaders of their organizations
- The GM/CEO should work closely with the board in establishing strategic direction and decisions
- The GM/CEO should ensure the organization has the necessary staff to meet the strategic direction of the cooperative – will continually need to review the organization and personnel of the cooperative

Introduction to the Rural Electric Management Development Council (REMDC)

The function and purpose of the Rural Electric Management Development Council (REMDC), since its inception in 1958, has been to explore ways to improve the effectiveness of management at rural electric cooperative systems. Each of the rural electric cooperative systems that are members of the REMDC acquired that membership by being able to demonstrate they were not only practicing modern management, but they were willing to share their successes and failures with others, and contribute to research in finding ways to improve the practice of management at rural electric systems.

The REMDC is comprised of about 55 rural electric cooperative systems from across the country, from the Pacific Northwest to Florida and continues to add members that wish to experience the benefits of being a part of the REMDC organization. Member systems range in size from fewer than 5,000 consumers, to systems with well over 100,000 consumers. The members of the REMDC serve over 1,400,000 consumers nationally. All the members of the REMDC are also members of the National Rural Electric Cooperative Association (NRECA).

The REMDC membership reflects a size and demographic profile of the rural electric cooperative program of the 21st century. We feel strongly that the challenges to today's rural electric cooperative systems are best met by a highly skilled management team comprised of board members who understand and are trained in the practice of their trusteeship responsibilities, a highly skilled, professional manager, management staff and a competent, informed and motivated work force who have a vision and commitment to meet the challenges of the rapidly changing business climate in which rural electric cooperatives systems must function.

Today's rural electric cooperative systems need leadership and vision that recognize not only the diversity of needs and interests that exist nationally among rural electric cooperative systems, but also the diversity of needs and interests that exist locally among the members they serve.

REMDC has a clear vision and objectives for the membership of the organization.

Statement of Viewpoints

- We believe the objectives of the Rural Electric Program can best be achieved through dynamic management and leadership that is based on sound cooperative philosophy and coupled with modern management principles and techniques.
- We believe cooperative philosophy and management principles and techniques must receive constant study and scrutiny, and that research and development of new concepts and approaches must be undertaken if rural electric systems are to effectively fulfill the responsibilities inherent in the objectives of the Rural Electric Program.
- We believe there exists within rural electric cooperatives, and their industry associations, the knowledge, experience and the professional perspective necessary to identify industry needs and solutions.

- We believe there exists among rural electric cooperatives, and their industry associations, those who are willing to innovate, evaluate and improve cooperative management principles and practices, and who will then translate the results of such studies into meaningful programs.
- We believe rural electric system management will be enhanced where there has been a free exchange of ideas and experiences among those organizations that are innovating, studying and applying contemporary principles and techniques.
- We believe all consumer-owned rural electric systems should have the opportunity to share conclusions stemming from such management practice innovation, and further that such shared information can best be provided through NRECA and other associated organizations.

Statement of Objectives

- To assemble rural electric management professionals who have exemplified the application of contemporary cooperative philosophies, management principles and techniques, and who exhibit an interest and willingness to contribute to further study, research and innovation sought in the application of effective management concepts and techniques in rural electric system operations.
- To enhance overall electric system management through management research in areas of current concern and interest.
- To develop new cooperative management concepts, approaches and techniques that help identify and provide the resources and leadership required for meeting the needs of cooperative members in an ever-changing environment. To develop the means where such management research and innovation can be interpreted and widely disseminated to rural electric systems, and to encourage its effective application.

REMDC Project - Energy Innovation

REMDC Subcommittee Project – Energy Innovation

It became clear to REMDC members during a severe 2008 U.S. recession that a cooperative movement was needed to help members waste less energy—a movement that could provide the stimulus for helping member reduce power costs. Simultaneously, other industry-related organizations and federal, state and local governments began encouraging energy efficiency to offset not only the effects of the national recession, but also in response to concurring natural gas volatility and subsequent spikes in wholesale power costs.

As a result of those formidable issues, a subcommittee of the REMDC membership was formed to try to bring cohesiveness to a strategy to help consumer-members waste less energy—a strategy that could be employed by any electric cooperative that had the same desires of the REMDC membership.

The committee realized quickly that a simple and concise label would need to be created to establish a banner under which such a strategy would be developed— the term Energy Innovation was coined to fulfill that need. After numerous meetings in person, along with multiple conference calls, the subcommittee established the definition of Energy Innovation: assisting cooperative members in reducing their energy use through 1) Conservation, 2) Energy Efficiency, 3) Demand Response and 4) Distributed Resources (generation). These points were discussed and opportunities were sufficiently detailed in a white paper released by the subcommittee entitled "The Energy Conservation Paradigm." The white paper was widely utilized for many years throughout the electric cooperative industry, with significant NRECA promotion, and included a member resolution that was approved by the NRECA's membership in support of cooperatives adopting and supporting Energy Innovation. NRECA even utilized its research resources and hosted an Energy Innovation conference for NRECA members. NRECA also established the Energy Innovation Membership Advisory Group that worked to bring ideas for research to the Cooperative Research Network. Through the work of the subcommittee, REMDC was able to create a national dialogue that led a nationwide effort by electric cooperatives to assist their members through Energy Innovation programs. Cooperatives across the country still have Energy Innovation programs in place and have helped countless electric cooperative members save energy dollars since the movement began.

A New Opportunity

There is no doubt that the electric utility industry is in the middle of exceptional change. Electric cooperatives are in no way insulated from the headwinds of this change. With change, however, is opportunity. At the 2018 REMDC annual meeting, cooperative leaders discussed what the future of the electric cooperative could look like if the industry does in fact flex to accommodate changing dynamics within the marketplace. As a result of these discussions, the REMDC established a new committee to study a future scenario in which electric cooperatives were operating as a distribution system operator (DSO) and providing energy as a service (EaaS) for the benefit of their members. The end result of this work was expected to be a whitepaper that

sufficiently detailed industry shifts and opportunities for electric cooperatives, a full definition of DSO and EaaS, and a list of concepts cooperatives could review and rely on as a recommended roadmap in preparing for the future.

With this new task, the committee examined whether these initiatives may be what distribution cooperative members need, want now, or may want in the future. The committee made recommendations based on the ideal that the purpose of an electric cooperative is to meet the needs of its members and the communities it serves. Cooperatives who would implement any recommendation should be keenly aware of their community and member attributes, and their needs. Community and member needs will vary for different cooperatives. In any case, ***cooperatives should be prepared to lead the utility industry and set the bar for operating as the utility of the future.*** To remain relevant to consumer-owners, cooperatives must take a hard look at what the future may likely look like. The committee, and subsequently the REMDC, believes Energy Innovation has grown beyond the parameters of the previous definition as set by REMDC. Energy Innovation should be expanded to include shifts in operational philosophies as a response to the many changes that are occurring in the electric industry, and the marketplace. Cooperatives have always been innovators. The industry shifts that are occurring today require cooperatives to implement programs that will meet and hopefully exceed member expectations in this new era of Energy Innovation.

Defining the New Energy Innovation

Defining the New Energy Innovation – What is a DSO, EaaS and Related Terms

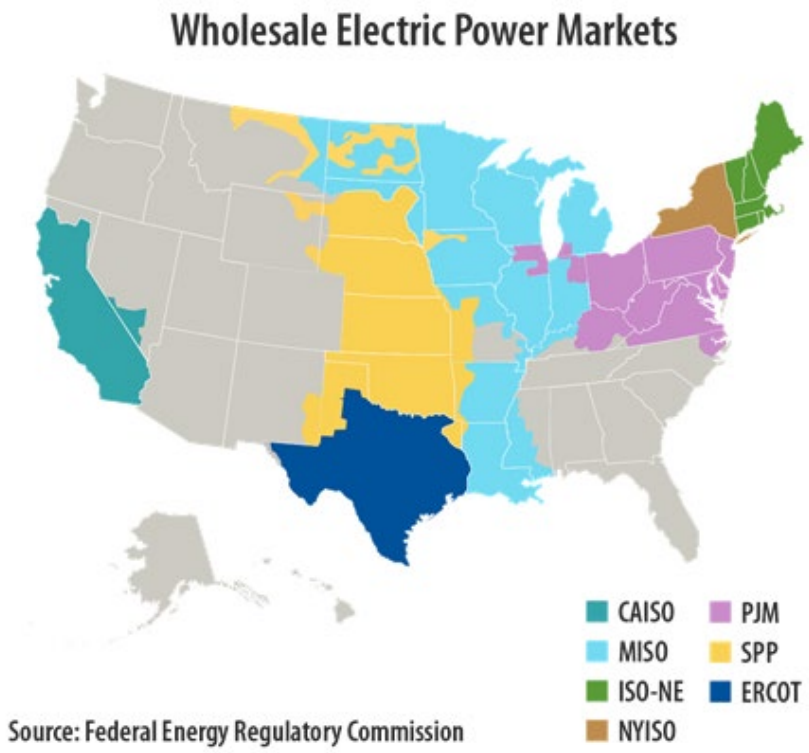
This study includes definitions for certain terminology, and are intended to clarify how those terms were viewed as a basis for the study.

Definition of ***Electric Distribution System*** – *The Electric Distribution System represents all of the electric facilities below the interconnection point with the Transmission Owner but stopping at the point of common coupling with the member (typically the electric meter)*.

Definition of ***Wholesale Energy Market*** – Obtaining power from the wholesale energy markets (either organized or not), or through short, medium or long-term power purchase agreements as well as bilateral supply options from all types of generation. The committee generally supports the EPA definition of wholesale energy markets as detailed below:

U.S. electricity markets have both wholesale and retail components. Wholesale markets involve the sales of electricity among electric utilities and electricity traders before it is eventually sold to consumers. Retail markets involve the sales of electricity to consumers. Both wholesale and retail markets can be traditionally regulated or competitive markets.

Some parts of the U.S. wholesale electricity market are traditionally regulated (gray areas), meaning that vertically integrated utilities are responsible for the entire flow of electricity to consumers. They own the generation, transmission and distribution systems used to serve electricity consumers.



https://www.epa.gov/greenpower/us-electricity-grid-markets

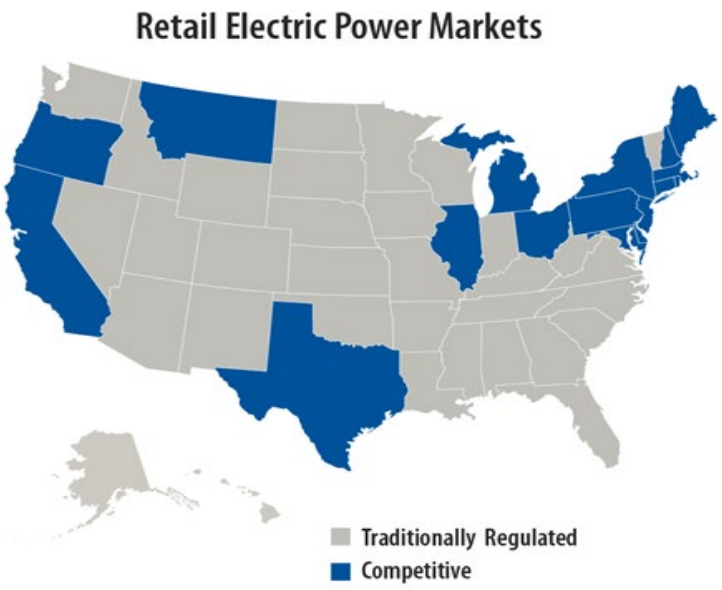
Other parts of the wholesale market (Northeast, Midwest, Texas, and California) are restructured competitive markets. These markets are run by independent system operators (ISOs) (we use ISOs to stand for both RTOs and ISOs). ISOs use competitive market mechanisms that allow independent power producers and non-utility generators to trade power. In restructured competitive markets, "utilities" are commonly responsible for retail electricity service to customers and are less likely to own generation and transmission resources.

Definition of ***Retail Energy Market*** – A multitude of rate options from co-op pass through of G&T or market energy from Wholesale Energy Market or transactions between members on the same distribution system, or organized retail market providers in competitive retail choice areas. The committee generally supports the EPA definition of retail energy markets as detailed below:

Retail markets are determined at the state-level and can be traditionally regulated or competitive. In a traditionally regulated retail electricity market (gray), consumers cannot choose who generates their power and are required to purchase from the utility in that area. Traditionally regulated electricity markets dominate most of the Southeast, Northwest and much of the west (excluding California). In these states, most renewable energy projects are utility-owned. As a result, developing a large green power project in a traditionally regulated state and claiming renewable energy use can often be challenging.

Competitive retail electricity markets (blue) allow electricity consumers to choose between competitive retail suppliers. These electricity markets have opened generation for competition

from independent power producers in 24 states (e.g., California, Texas and most states in the Northeast). Eighteen of these states and Washington D.C. have also introduced retail choice, which allows residential and/or industrial consumers to choose their own electricity provider and generation options, including renewable energy. There is greater flexibility around the structure of a retail supply contract, the location of the project, and the scale of selected renewable source.



https://www.epa.gov/greenpower/us-electricity-grid-markets

In these competitive markets, municipally owned utilities may not offer their customers retail choice. It is important to note that the market is not always divided clearly between traditionally regulated markets and competitive market states. Some states, like California, are partially restructured markets and only permit certain consumers to engage in retail choice.

It should be noted though; similar to municipally-owned utilities in retail choice states, the rules under which electric cooperatives operate are often different. Moreover, even within a state, there are sometimes differences among co-ops. For example, nearly all of Virginia's thirteen cooperatives operate within the PJM wholesale market, but only a couple of the cooperatives are required by statute and Commission regulations to offer retail access to their members, and that is only under certain unique circumstances. Obviously state statutes across the country have introduced a variety of different requirements relating to retail energy markets and electric cooperatives.

Definition of **Distributed Energy Resource (DER)** –Presently, there doesn't seem to be a standard DER definition that is applicable for every organization. For example, some organizations consider DER to include any resource downline from the wholesale meter. However, for the purposes of this review, the assumption is that *DER is any resource that provides energy and/or capacity to the distribution system directly or from the consumer/member's side of the meter,*

which includes Conservation, Efficiency, Demand Response, Distributed Generation and Energy Storage. The DER can be owned by a utility or third party and can be operated by either entity or in a collaborative effort. Consumer/members who implement DER at their homes and business are becoming "**Prosumers**" – who consume and produce energy and capacity.

Definition of ***Energy as a Service (EaaS)*** – *Energy as a Service provides energy, capacity and/or reliability utilizing innovative technology, data management, and member and/or utility control. Energy as a Service replaces traditionally provided rate-based energy and capacity, with the purpose of helping members control, monitor and optimize their energy usage.* It is understood that EaaS could be provided by a third party, but cooperatives should consider providing EaaS in all areas that are expected and desired by its members—either directly or by establishing alliances and partnerships.

Definition of ***Distribution System Operator (DSO)*** – *A Distribution System Operator plans, operates, maintains, controls and optimizes the Electric Distribution System and coordinates and facilitates access to energy from Retail Energy and/or Wholesale Energy Markets, Distributed Energy Resources and Energy as a Service to meet members' needs and expectations.*

It is very important to consider the full definition of a DSO as defined above when reading this white paper in its entirety.

INDUSTRY SHIFTS REQUIRING COOPERATIVE INNOVATION

Potential Industry Shifts Could Drive the Need for Cooperatives to Operate as DSOs

Empirical evidence today suggests both residential and C&I consumers are developing a growing appetite and an expectation that they should be given more autonomy and personal command of their retail electric purchases and delivery options. Among residential members, there is a desire to have choices in rate plans, in having options to tap into behind-the-meter or localized sources of generation and in having the ability to integrate electric service delivery with other home services. Commercial and industrial members continue to seek more cost and utilization control options, as well as options for tapping into renewable generation capacity and self-generation capability. These new member expectations are forcing industry shifts that have the potential to change the industry landscape and how cooperatives operate.

With those considerations, and as the basis for this study, cooperative executives were asked to identify industry challenges, limitations and/or shifts within the national marketplace that today or tomorrow stand to affect business and service delivery methods across conventional cooperative business units, and then re-examine the potential needs and potential for future growth opportunities.

A brief summary of these shifts is listed below followed by an expanded look into each change coming in a later section of this review.

1. Expansion of Smart Homes, Smart Buildings and Smart Cities, Smart Areas—the Internet of Things (IoT will prompt cooperatives to consider broadband availability and technology options for future development.
2. Expanding Member Expectations—Driven largely by Amazon, Uber, Netflix, etc., consumers are beginning to expect their cooperative to be innovating as well. Cooperatives should also be paying particular attention to the options being offered by competing service providers. Convenience and bundled service option solutions are favored by modern consumers.
3. Transformation from Volumetric Sales to Service Models—Many services members now buy are not tied to purchase volume, but rather to having the availability of the service over time.
4. Moving from Central Station Generation to Local Generation—More members are choosing to install or purchase energy from local generation for either specific needs, such as reliability, cost or retail purchases that are guided by their ideals, i.e. renewable energy, low-carbon generation, etc.
5. Increased Regulatory Involvement—Some governmental authorities are forcing change. One example is California's mandate to install solar in new developments, renewable mandates, etc.
6. Increased Development and Potential Offering of EaaS by third parties—A growing number of companies are developing products and services that are designed to attract electric consumers.

7. Market Forces Within Generation Market—Fossil Fuel generators have an uphill battle in developing new construction (due to financing and project risk), leading to potentially less reliable and more costly wholesale energy markets (due to less capacity and more reliance on renewables without significant storage).
8. Variability of Load Growth—Many distribution systems across the country are losing load, which has a negative impact on margins and thus rates.
9. Transportation Electrification—It is clear the train has left the station on transportation electrification. This has many impacts on the utility, but the movement offers some great benefits at the same time if cooperatives have planned for such opportunities in advance.
10. Need for a Trusted Energy Advisor—Consumers are growing bolder in breaking away from conventional electric delivery—members will begin to look for someone with demonstrated expertise to consult with them before or during a decision to purchase, implement, operate and maintain new and existing technologies.
11. The Need for Security—Distribution utilities are facing new challenges in Cyber and Physical security, and cooperatives must plan for those potential threats.
12. The Need for Reliability—The generation that first benefitted from the marvel of rural electrification is fading away, and younger generations have expectations that aren't drawn from any experience where electricity wasn't always at hand. Younger generations expect the power to be on all the time, and they may be willing to pay more to ensure it stays on during outage events. This generational dynamic could lead to more serious consideration of local generation, microgrids and energy storage as new alternatives in power distribution.
13. The New Rise of Aggregation—While cooperatives are the perfect example of aggregating costs, there may be a day when cooperative member groups, or a member with multiple services may wish to couple their interests and expect their cooperative to facilitate transactions as community choice aggregation.
14. Data Analytics and Artificial Intelligence—Resourcing data acquisition and data analytics will be linchpins in cooperative operations of the future. Both assets will play vital roles in decision-making processes and future product and service offerings.

Expansion of Smart Homes, Smart Buildings, and Smart Cities with the Internet of Things (IoT)

The Internet of Things (IoT) enabled brisk development of smart homes and smart buildings and the market niche continues to expand dramatically. The Internet of Things (IoT) is defined as a system of devices connected to the internet. In an IoT environment, sensors are used to communicate, collect and exchange data from one device to another and data from these devices can be used to optimize products, services and operations, and achieve operational efficiencies and optimize business practices. In 2016, the IoT industry was valued at $31 billion globally, and is expected to reach $158 billion by 2024. Growth in IoT devices is expected to grow 23% annually between 2017 and 2024 (Market Watch, 2019). There are many entrants in the smart devices market, including Amazon Alexa, Apple HomeKit and Google Home/Nest—each providing consumers with platforms that communicate to a myriad of devices using artificial intelligence. These platforms enable users to monitor devices such as thermostats, electric vehicle chargers, alarm and security systems and lighting, just to name a few. Other prominent players in the market include Honeywell, Ecobee and LG.

IoT Implementation by Cooperatives

The sheer complexity and interoperability of IoT devices can be overwhelming for both consumers and utilities. There are a number of companies now operating to assist energy utility companies with IoT developments that are important to members and customers. Companies such as SmartEnergyIP assists utilities in helping consumers understand Smart Homes and how the utility can play a role in IoT. See: http://smartenergy-ip.com/research.html. Adding IoT devices can be as simple as replacing a lightbulb or two, or in a larger fashion they can be implemented as end-to-end IoT systems for commercial and residential applications in new construction buildings or retrofits. Just a few of the benefits of IoT include increasing security, improving energy management and advancing human resource functions.

Smart Workplaces

As previously mentioned, IoT applications can be implemented commercially with smart workspace applications such as those offered by AsureSoftware. With integration of such software platforms, workplace sensors detect lighting, occupancy, temperature levels. The data from these sensors can then be interconnected to the facility's Building Automation Systems (BAS) and Asure Software can monitor environmental factors, reduce energy costs, allocate heating and lighting: all based on actual, real-time demand. Asure's software also allows employees to reserve conference rooms, enter time in payroll systems, among other options. See https://www.asuresoftware.com/ for more information about AsureSoftware.

Smart Homes

IoT can also be integrated in residential applications, and if integrated with the cooperative, it can be a powerful member engagement tool. Ultimately, if a cooperative can leverage IoT devices and smart meters together and proactively communicate to members about their

electric use, members should never be surprised over a bill when they receive it at the end of the month.

IoT integration can assist cooperatives in communicating spikes in energy usage, monitoring and restoring outages, gauging peak usage, as well as guide the development of new services and products. One interesting IoT application some utilities have launched include internet-enabled electric vehicle chargers, such as those provided by EMotorWerks (see https://emotorwerks.com/utilities), which allows utilities and consumers to monitor, schedule, and manage electric vehicle charging to reduce demand on the grid.

IoT integration is being utilized at a macro-level to serve communities, so-called "smart cities" across the country. According to recent SEPA article, a smart city "relies on gathering and processing large amounts of data, usually collected by inexpensive, ubiquitous sensors spread throughout the jurisdiction. It is this data that allows city leaders and managers to make better decisions about where to invest, build and provide critical services, such as ensuring public safety" (2017). Local utilities can play a critical role in the successful implementation of smart cities—whether they help shape policy and regulation around smart cities, or use their existing assets to attach IoT sensors and provide technical expertise to the local community. For example, San Diego Gas and Electric is tapping their experience and service capabilities in assisting the city with its goal of 100% renewables by 2035. In Ohio, AEP is working closely with the city of Columbus and is participating on three out of four teams that Columbus created to investigate smart city implementation. (SEPA, 2017)

Shift Towards IoT

The shift toward IoT devices is rapidly growing and utilities offer a natural fit in providing IoT enabled services: cooperatives already have access to member information and member energy usage. Implementing IoT solutions may be a good solution if the utility is willing to partner with complimenting firms who provide other services such as telecommunications, software or data analytic solutions. Cooperatives should begin to pay attention to the ways in which their members are using technology, and the shift among a variety of companies toward being more consumer-centric. With recent disruptions in the service sector due to the aggressive business attributes and associated technologies used by Uber, Lyft, AirBnB, and UberEats, members may begin to expect similar, consumer-centric applications from their cooperatives. The increasing availability of IoT devices and growing consumer interest and acceptance of them presents cooperatives with a unique opportunity to inform and educate their members on myriad electric services, while at the same time improving member engagement. For instance, cooperatives can use new tools through e-commerce sites to sell energy efficient, internet-connected devices such as smart thermostats, LED lighting, or energy efficient filters.

Impacts to the Cooperative

IoT devices require internet connection. In many rural areas where cooperatives provide electric service, internet bandwidth required for IoT is not widely available. This hurdle can

make developing programs falter if the internet connectivity of the service area is not considered in program design. It is estimated by the FCC that today there are 6.3 million electric cooperative members that lack high-speed internet access. There are more than 100 electric cooperatives across the US that are currently helping bridge the digital divide through internet service offerings according to NRECA. Depending on local circumstances, laws and regulations and an electric distribution co-op Board's interest in being part of the highly competitive and technology-centric telecommunications business, some co-ops are getting into the high-speed internet business. Other electric co-op's are opting to build a fiber network for their telecommunications needs, and some are making dark fiber available to third party internet service providers who are interested in serving rural communities.

During program design, cooperatives can combine resources with other cooperatives or G&Ts to create scale in IoT programs. IoT programs can help cooperatives leverage their goals in member engagement, energy expertise and load reduction during peaks. Cooperative employees should have basic knowledge and understanding of new energy management software and product availability, especially if they are selling or promoting products. For example, cooperatives should provide the product to employees as a pilot (for example, EV Charger or Smart Thermostat), so employees can better anticipate member needs in utility based programs.

Call to Action:

- Continue to evaluate new technologies to find "synergies" that are beneficial for the cooperative and the member.
- Have discussions with the cooperative's software solution providers about the future.
- How "smart" do the members want their homes to be? Is the cooperative prepared to empower the member to invest in the desired technology?
- Form alliances with technology providers that will assist with member engagement.
- Educate employees about new technologies that are being adopted by the cooperative and the members.
- Pilot different products before promoting to members.
- Consider providing or enabling broadband services to members.

References

Kruger, Mike (Feb 23, 217). Smart Electric Power Alliance. *Can Electric Utilities be the Platform for Smart Cities of the Future?* Retrieved from: https://sepapower.org/knowledge/can-electric-utilities-platform-smart-cities-future/

MarketWatch. (April 2019*) IoT Devices Market 2019- Global Industry Analysis by Key Players, Segmentation, Consumption, Growth, Trends, Share and Forecast by 2024.* Retrieved from: https://www.marketwatch.com/press-release/iot-devices-market-2019--global-

industry-analysis-by-key-players-segmentation-consumption-growth-trends-share-and-forecast-by-2024-2019-04-04

NRECA (April 2019). Fact Sheet. Electric Cooperatives Part of Solution to Expand Rural Broadband. Retrieved from: https://www.cooperative.com/programs-services/government-relations/Documents/Legislative%20Issues/Broadband%20Fact%20Sheet.pdf

Nicols, M (Oct 23, 2018). The Internet of Things Will Have a Huge Impact on Utilities. Retrieved from: www.theiotmagazine.com

Expanding Member Expectations

Member-consumer expectations are changing at breakneck speed today. While some consumers still engage their electric utility via a simple monthly billing transaction or occasional outage event, many seek more involvement and support from electric utilities in how they should use, obtain and manage their energy-related needs. Therefore, the manner in which utilities engage members and consumers is a moving target that necessitates cooperatives demonstrate the agility to change how they maintain relevancy in meeting members' needs.

According to an E Source report, there are five shifts occurring with consumer expectations in the utility sector:

- More buying choices
- Social status
- Convenience and flexibility
- Speed and efficiency
- Custom options

With regard to buying choices, the energy management sector already has an abundance of options available for energy management. In addition, as products and services like Alexa and Google Home become more mainstream in consumer homes, the energy expertise cooperative members expect will be vastly different from what it is today. Consider that just recently consumers were given the ability to use a simple voice command to their "pal" Alexa to manage their home energy load shape. Rather than manually flipping a switch or pushing a button on a thermostat to manage energy usage, technology such as this now provides gadget-crazed consumers another way to demonstrate their modernization to friends and family.

The Tesla brand is another example for changing consumer interests. As *Business Insider* put it, nearly 400,000 consumers put down $1,000 to pre-order the all-electric Model 3 automobile—not just to buy a car, but also to "join a club." While it might be "cool" to be in the club, the Tesla owners will surely seek other ways to leverage the cars' technology to modify their respective home energy load shapes, shifting how cooperatives deliver, or perhaps receive electricity to and from Tesla owner homes.

The adoption of smart home and web-enabled technologies is an obvious example of consumer desire for convenience, speed and efficiency. American consumers want life to be easier and they trust new technology to help make "easy" happen. Remember "The Clapper" light switch? Today, we can program home energy management devices to respond to single-word commands. Simply put, new energy technology solutions promise to make many members' lives easier. While adoption rates will vary by member segment, it seems likely increased consumer interest in new technological advances will flourish.

Monitoring consumer expectations must be a constant exercise for cooperatives. According to the American Customer Satisfaction 2018-1019 Energy Utilities Report, cooperatives have a slight consumer satisfaction edge over investor-owned utilities (75 vs. 73). However, there is a significant delta between satisfaction levels with cooperatives, and for example, Amazon, which boasts an 82. The general takeaway is that status quo will not be deemed satisfactory in future cooperative member satisfaction surveys. Satisfaction levels will drop unless cooperatives revolutionize or embrace other innovators' solutions and services and fold them into their own portfolio of offerings.

The National Survey on the Cooperative Difference has a wealth of data that shows how cooperatives can move the member engagement/satisfaction needle with regard to DER preparedness. The report has a number of recommendations related to the DER space, in addition to the cooperative as a whole:

- Engage members in a dialogue about the issues and challenges that lay ahead for electric cooperatives and the electric utility industry. An informed member will be more receptive to change.
- Provide balanced and objective advice to members with questions about energy efficiency or renewable energy.
- Increase the cooperative's online presence with digital strategies so members find you when they turn to the internet for advice and information.
- Continue to build on the cooperative's reputation as members' trusted energy resource.
- Use technology to enhance the member experience by offering solutions that allow greater control over energy usage, alerting members when monthly usage exceeds reasonable levels, and proactively communicating with members during service interruptions.
- Develop demand response programs benefiting both member and cooperative by reducing costs to all parties with minimal disruption of the daily routine. Educate members on how participation in programs and behavior modification contributes to a lower electric bill, not just for them, but also for all cooperative members. Focus communications on segments likely to have interest in participation.
- Engage members in a discussion on electric vehicles, including the benefits of lower fuel costs and off-peak battery recharging programs. Cooperatives have much to gain as EVs move into the mainstream and need to establish themselves as the "go to" source for this emerging transportation market. Focus targeted communications on segments likely to have interest in the technology.

Where members have viewed both the cooperative and the internet as 'go-to' sources for information about how to save energy in the home, the companies cited above boast brand awareness that a majority of cooperatives will likely never realize. Will cooperative members ever perceive that their electricity provider can offer products and services as contemporary or consumer friendly as a Google, Amazon or Tesla? Monitoring consumer expectations must be a constant exercise for cooperatives.

Call to Action:

- Cooperatives must continue to actively monitor consumer expectations.
- Engage members in dialogue about change and challenges that the cooperative and the electric industry are facing.
- Be able to provide balanced and objective advice to members who want to know more about technology that could impact consumption.
- Utilize technology that will enhance member experience and provide solutions to meet the member's changing energy needs.
- Continue to build on the cooperative's reputation as the trusted energy resource.

Transformation from Volumetric Sales to Service Models

Shrinking investment costs for distributed generation systems, coupled with more energy efficient electric products, have caused kWh sale declines for electric utilities. In the past, consumer cost to generate electricity was prohibitively expensive and such investments also didn't obtain a significant threshold in electric efficiency. As a result, an electric utility was able to make long-term business decision based on captive consumers who had an ever-growing appetite for more of their product. In 2007, an inflection point was reached where traditional annual electric load growth expectations slowed or stopped. This inflection point was most likely driven by the outsourcing of heavy industry, self-generation, and increased electric efficiencies.

This dynamic has forced electric utilities to reexamine how they charge consumers for power delivery. At the same time, consumers have become more receptive to purchasing goods and services via subscription rather than per unit—e.g., Netflix or Amazon Prime. An example of how cooperatives are already utilizing subscription-based pricing is with area lights/street lights. Most cooperatives today charge a monthly rate for area lighting/street lighting based on the size or type of light, rather than billing variable monthly usage.

Continued electricity sales contraction could produce an environment where cooperatives will need to shift a larger part of a member's bill to the fixed portion rather than the variable portion of the bill. This can be done in different ways, but the subscription-based model represents a potential win-win where utilities can provide a billing structure that has become more accepted by consumers, while also meeting a cooperative's revenue needs. One example of subscription-based pricing is when it is applied to electric vehicle charging. Imagine a subscription where the cooperative offers the member unlimited EV charging, during specific hours of the day, at a set price per month for the member. If the member has a need to charge outside of the specific times set, they are still able to charge their vehicle, but at a significantly higher cost. Perhaps there could be different tiers of this plan that offer fewer on-peak hours in exchange for a higher monthly subscription fee. Obviously the right technology needs to be utilized to capture the full value, but there are EV chargers today that have revenue grade metering that could be netted against the electric meter to determine the correct bill for the member.

Cooperatives would be well-served to start understanding this industry trend and becoming comfortable with the technology through pilots and studies to ensure organizational readiness. Going forward, cooperatives may be able to stabilize revenue and thus rates, by shifting to a service-based rate, and potentially even grow their revenue with the addition of new services to their offerings. In the future, it will be important to ensure that rates and services are measured against those in other markets to ensure that they are not out of line with what members expect and/or desire. In other words, the cooperative's members are becoming more accustomed to paying for services, and at some point, they will expect the same options from the electric cooperative

Call to Action:

- Continue to be engaged with membership to figure out what services are desired.
- Piloting programs will be beneficial for the cooperative to become familiar with this trend.
- Study/ evaluate other industry leaders to understand the subscription/service model.
- Look internally to see if the cooperative is already offering such service model options.
- Evaluate internal software solutions (CIS, Billing, and Accounting) to see if they are capable of managing, billing, and operating other services.

Transition from Central Generation to Local Generation

Most of the energy produced and consumed in the legacy U.S. grid comes from generating units in large, centralized power stations. It is transported through high-voltage transmission lines to load centers where it is distributed through medium voltage lines to local areas where transformers ultimately serve end-use consumers with low voltage lines. This came about due to persistent economies of scale, increasing efficiency of large generation plants, and safety and security concerns. Nationally today, there are 20,000 generating units that produce a megawatt or more at 7,300 power stations—the power from which is transmitted through 650,000 miles of transmission lines, 70,000 transmission substations and 5,500,000 miles of distribution (medium and low voltage) lines.

The 1973 OPEC oil embargo and the subsequent 1978 Public Utility Regulatory Policy Act was an inflection point that marked what has continued to be a shift toward smaller, distributed generation units. For the first time, federal law required electric utilities to buy power from independent power producers who operated qualifying facilities (i.e., renewable energy, cogeneration, waste energy, biomass, or geothermal of 80 MW or less) at their avoided costs (i.e., what their next planned generation unit would cost). As a result, many thousands of megawatts of independently owned, distributed generation were built; and some continue to be built.

Coincidentally, in the early 1970s, the time of the OPEC oil embargo and PURPA, the steady improvement in the efficiency of steam-fired generation plants topped out at about 34% or 10,000 Btu/kWh. Thomas Edison's first coal-fired generating plant at Pearl Street Station had a heat rate of 139,000 Btu/kWh, or an efficiency of less than 3%. In addition, central station generation became even less efficient as time went on due to equipment modifications that had to be made, and output restrictions that had to be met in order to reduce environmental impacts.

In the past few years, the quest for renewable energy, increased efficiency, local reliability and reduction of greenhouse gas emissions led to what is now a major shift in the legacy grid paradigm. Not only in the U.S., but worldwide, the deployment of new generation is shifting from central station utility scale generation to distributed generation. Even many electric utilities are deploying distributed generation.

Even if environmental concerns were no longer an issue, the lifecycle cost of new conventional generation steadily increases while the lifecycle cost of solar, wind, and battery storage steadily decreases. By 2013, solar and wind were competitive with retail rates in some areas across the U.S. In the past year some solar and wind PPAs have been less expensive than conventional generation or wholesale power costs in competitive markets.

There are two new intermodal DER trends of note. First, is the rapidly growing penetration of electric vehicles that will eventually be portable DERs. Second, virtual power plants, which are created by scheduled or permanent reduction in consumer demand, are proliferating at an increasing pace. Again, electric vehicles, being both energy consumers and energy producers,

represent prime candidates for virtual distributed generation as their charging and discharging can be scheduled in the same way that residential appliances and commercial/industrial equipment can be scheduled.

Today, there are millions of DERs and the numbers are increasing compared to thousands of conventional utility generators with decreasing numbers. This is no longer an emerging trend, it is a profound and persistent change in the electric utility generation paradigm. In addition, DERs are predominantly a distribution system phenomenon with growing significance for electric cooperatives.

The bottom line is we need to aid our members however they need assistance in the context of local generation.

Call to Action:

- Cooperatives should evaluate existing tariffs and policies they have in place for distributed generation. Make sure the tariffs and policies are aligned with the cooperative's mission and meet member expectations.
- Make sure interconnection policies are favorable to allow members to meet their generation desires. In addition, the cooperative should evaluate the interconnection process, and simplify that process if needed.
- Reimbursement for energy and capacity should be considered for any energy and capacity that flows back onto the distribution grid. There are many different methods to accomplish this and assist members with their projects.
- It is important that cooperatives keep track of what is being interconnected into their distribution system. All interconnecting systems should be included into the cooperative's GIS system.
- Cooperatives should consider assisting members in installation of DERs, or they should at least develop partnership with local contractors that have been vetted by the cooperative to cover this service.
- Cooperatives should consider opportunities to assist members in operation and maintenance of such systems. Vendors typically come and go and when systems break, the original vendor is not around in many cases, leaving members in a tough situation.
- Cooperatives can also consider ways to assist with the high up-front cost of DERs, such as on-bill financing or working with a program similar to the CFC-National Cooperative Bank residential financing program.
- Community solar is another option for members that do not have the financial means to install solar on their homes. There are a number of different ways that cooperatives have set up successful community solar programs.

Increased Regulatory Involvement

There is an acknowledgement from both state regulatory commissions and regulated utilities that the current regulatory model is the largest impediment to the evolution of utility business models.[1] The traditional investor-owned utility regulatory model, based on a rate of return for investments in the power systems, is threatened by customer efficiency and distributed energy resources (DER) adoption. State legislative and regulatory bodies have responded by opening utility grid modernization and business model reform efforts that look to expand utility earning opportunities and broaden DER adoption through non-wire alternatives, data sharing and other initiatives.

Many states are approaching this industry shift as a grid modernization effort—which includes utilities falling outside traditional rate regulation by the state commission. California, Illinois, Minnesota, Massachusetts, Maryland, the District of Columbia, Ohio and others are all moving ahead with modernization plans that include updating the distribution system to accommodate resources like storage, microgrids, community solar and electric vehicle charging infrastructure.

Beyond the state regulatory dockets, there are three industry-wide efforts underway to assist state commissions in their grid modernization efforts by looking at integrated distribution planning (IDP). The Department of Energy's (DoE) next generation distribution system planning effort is called DSPx and is targeting state grid modernization and planning processes.[2] Smart Electric Power Alliance's (SEPA) renovate effort is focusing of innovation friendly regulatory processes and practices, including solutions roadmaps that move states and utilities towards "a modern, reliable grid."[3] Lastly, the National Association of Regulatory Utility Commissioners (NARUC) and the National Association of State Energy Officials (NASEO) have started a task force on comprehensive electricity planning to develop "state-led pathways" toward a more resilient, efficient, and affordable grid.[4]

State Regulatory Efforts

Grid modernization efforts are commonly focused on integrating new technologies into the electric system in response to real or perceived customer demands.[5] Regulatory efforts are also shaped by state policies and political interests in resiliency, efficiency, decarbonization, smart cities planning, electric mobility solutions, and renewable energy development. Grid modernization regulatory efforts vary by state since each state is unique in its policies, demographics, regulatory structure, and market design.

---

[1] https://www.utilitydive.com/news/why-utilities-dont-think-trump-will-stop-the-clean-energy-transition/439138/
[2] https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx
[3] https://sepapower.org/renovate/
[4] https://pubs.naruc.org/pub/83CECF9B-91AB-2791-CD6D-FFBD459AFCC9
[5] https://gridwise.org/grid-modernization-index-2018/

New York's Reforming Energy Vision (or NYREV) was the first coordinated large-scale grid-modernization regulatory effort.[6] The NYREV was started in part as a response to Superstorm Sandy and an interest in building a more resilient electric system. The initiative has focused on integrating distributed resources and "recalibrating and optimizing New York's electricity market". [7] New York Utilities and third-party service providers have developed pilot programs on storage, non-wires-alternatives, microgrids, and customer engagement.

Minnesota has approached grid modernization through the Great Plains Institute (GPI), facilitated e21 Initiative[8] and through a formal commission process[9]. The e21 Initiative, currently in the third and final phase, seeks to create consensus recommendations to move Minnesota towards a "more consumer-centric, performance-based regulatory approach and utility business model". The e21 Initiative includes Minnesota's three investor-owned utilities and a variety of stakeholders including environmental groups, state regulators, and city planners. Electric cooperatives and municipal utilities participated as observers since the initiative was focused on potential reforms to the investor-owned utility regulatory construct. The Minnesota Commission (MNPUC) opened a docket during the second phase of the e21 Initiative to expand the discussion. After a series of hearing, information, and gathering, the staff released a report on grid modernization in the state complete with shared principles[10]. The Commission process will be used to shape grid modernization efforts in the state going forward including discussions on distribution system planning.

The Ohio Commission (PUCO) developed a roadmap to the state's energy future called PowerForward. The PowerForward initiative reviews "the latest in technological and regulatory innovation that could service to enhance the consumer electricity experience".[11] The PowerForward initiative includes work groups focused on collaboration, data, the modern grid, and distribution system planning.

Systems Integration Rhode Island (SIRI) is a combined effort by Rhode Island state agencies and the state's investor-owned utility (National Grid) to "take the first steps at mapping out key issues related to the future of Rhode Island's electric grid and offer early stage recommendations for addressing opportunities, filling gaps, and gaining efficiencies in existing state processes."[12] The SIRI effort focuses on "system integration" of distributed energy resources in accordance with Rhode Island's policies supporting "clean energy deployment and greenhouse gas emissions reduction."[13]

---

[6] https://rev.ny.gov/
[7] https://www.greentechmedia.com/articles/read/5-important-questions-about-new-yorks-energy-reform
[8] http://e21initiative.org/progress/
[9]https://www.edockets.state.mn.us/EFiling/edockets/searchDocuments.do?method=showPoup&documentId={E04F7495-01E6-49EA-965E-21E8F0DD2D2A}&documentTitle=20163-119406-01
[10] https://www.utilitydive.com/news/how-minnesota-is-approaching-grid-modernization-as-a-vertically-integrated/417136/
[11] https://www.puco.ohio.gov/industry-information/industry-topics/powerforward/
[12] http://www.energy.ri.gov/documents/siri/SIRI%20Executive%20Summary%202015.11.12.pdf
[13] http://www.energy.ri.gov/siri/

Grid modernization efforts started in California in the early-2000s, making them the oldest regulatory efforts in the country. The California legislatures have also provided some direction to the largely piecemeal approach to grid modernization with the California Commission (CPUC) submitting an annual report to the Governor and Legislature on the California Smart Grid.[14] The California grid modernization effort has created procurement targets for electric vehicles, energy storage, renewable energy, and energy efficiency. The CPUC also requires the state's investor-owned utility to submit detailed plans for siting valuing, integrating and managing demand side resources.[15]

Industry-Wide Efforts

The DSPx (Next Generation Distribution System Planning) effort from the Department of Energy (DoE) seeks to assist states in meeting their grid modernization mission and principles by creating a strategy and planning process.[16] The DSPx effort is working with a steering committee (representing state regulatory commissions) and stakeholders (including NRECA) to develop functional requirements, assess the maturity of technology, and articulate key consideration for the staged deployment of advanced grid capabilities.[17] The initial stages of the DSPx process have looked at the grid as a platform and the distribution system operator (DSO) models.

The Smart Electric Power Alliance (SEPA) Renovate grid modernization initiative includes regulators, utilities, consumer advocates, legislators, technology companies (termed solution providers), and state energy offices.[18] Focused on regulatory reform, the SEPA Renovate initiative seeks to advance "state regulatory processes and practices in order to address the scalable deployment of innovative technologies and business operating models that support the transition to a clean and modern energy grid."[19] While SEPA will not directly advocate specific regulatory reform, it hopes the Renovate effort will facilitate discussions among stakeholders on ways to increase innovation within the regulatory model.

The NARUC/NASEO grid modernization (titled the Task Force on Comprehensive Electricity Planning) effort is focused on electricity planning as a way to integrate emerging technologies, decrease overall systems costs, respond to consumer preferences, and create greater alignment of resource and distribution system planning.[20] The NARUC/NASEO initiative will include four in-person working group meetings through 2021 to develop example approaches

[14] http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/About_Us/Organization/Divisions/Office_of_Governmental_Affairs/Smart%20Grid%20Annual%20Report%202017.pdf
[15] https://www.utilitydive.com/news/herding-cats-california-puc-president-picker-on-the-new-der-action-plan/436492/
[16] https://gridarchitecture.pnnl.gov/modern-grid-distribution-project.aspx
[17] https://emp.lbl.gov/sites/default/files/10._dspx_necpuc_092817.pdf
[18] https://sepapower.org/renovate/
[19] https://www.energycentral.com/c/cp/why-did-sepa-launch-renovate-tackle-state-regulation-conversation-julie-hamm-sepa
[20] https://pubs.naruc.org/pub/83CECF9B-91AB-2791-CD6D-FFBD459AFCC9

and state action plans. Sixteen states will participate, with leadership from Colorado, Utah, Ohio, and California.[21]

While cooperatives may not be directly subject to the grid modernization efforts in many states, the discussions and outcomes will nevertheless influence how cooperatives operate in their states and what programs and services they can offer their member-owners.

Call to Action:

- It is imperative for cooperatives to continue to monitor things happening around them that could affect them for years to come.
- Cooperatives should be prepared to work together through their G&T, statewide or national associations to deal with proposed regulatory changes and to assist in their development and implementation.
- Cooperatives should work to enhance relationships with regulators and legislators that have the potential to influence the future of cooperative members—they need to hear cooperative perspectives on issues, not only those of the largest municipal and investor-owned utilities.
- Cooperative personnel that have the experience necessary should attempt to serve on steering and program development committees where possible and practical to ensure cooperative issues are considered.

[21] https://www.naruc.org/about-naruc/press-releases/naruc-naseo-comprehensive-electricity-planning-task-force-announces-16-state-members/

Increased Development and Potential Offering of EaaS by Third Parties

Cooperatives by default could be considered a DSO. They own, operate and maintain their distribution systems. Cooperatives have always provided EaaS in some ways. When the oldest cooperatives were first formed over 100 years ago, cooperatives turned the "lights" on for their first members. Pioneers who banded together to form their cooperatives recalled the day, "The lights came on!" Over the years, cooperatives began to drift away from seeing service as their primary basis and commonly refer to themselves as a seller of units— the kWh. This occurred because cost recovery focused on usage instead of service charges. However, the history of service is evident in the traditional billing structure. Even today, the bill is split between a "service charge" and an "energy charge". Some utilities have also expanded on this structure to include a third charge, distinguished on the bill as a "capacity" or "demand" charge. The service charge has slowly eroded into a small portion of the actual costs, and full recovery was done thru the kWh sales or demand charges. This trend is slowly reversing, but cooperatives may need to reverse this more quickly and get back to their roots of being service "providers."

Two terms are being discussed throughout the industry: WireCo and ServCo. The "WireCo" or wires company (also referred to as the DSO function), encompasses the part of the cooperative that has to exist in order to supply electricity to homes. This is the service charge or monthly flat rate fee that is spread to all members. The monthly charge is often referred to through a variety of names that include base charge, minimum charge, customer charge, service charge, availability charge, lines charge, wires charge, infrastructure charge, etc. "Wire charges" are typically calculated to include the static cost of owning and maintaining the distribution lines including debt costs, taxes, office expenses, employee costs and equipment costs. Historically, most cooperatives have not collected enough revenue through socialized monthly charges to offset operational costs, so they have instead made up the bulk of the revenue from the actual usage, kWh sales, or "energy charge." As more companies or utilities begin to offer EaaS—utilizing the distribution utility's wires, but not directly selling the energy—the local "WireCo" distribution utility could be affected negatively on the revenue side. Several utilities have recognized this and have begun to slowly increase their monthly service fee. Many cooperatives provide explanations on their websites about the monthly charge. One from United Electric Cooperative (http://www.ueci.coop/content/service-availability-charge) states, "To make service available to all members, no matter how far off the beaten path, cooperatives need to have some form of service availability charge. This charge helps to cover the minimum costs that are required to deliver service to every meter on the system—costs that remain no matter how much electricity is sold."

The ServCo is the services piece of the cooperative. EaaS can encompass a larger scope of services beyond kWh sales. EaaS can include everything from kWh sales, as co-ops have done in the past, to offering other services such as home energy monitoring, prepay services, community solar, residential solar and myriad distributed generation functions, pre-packaged and partnering with home automation and security system vendors, and electric vehicle

charging options—including possibilities for installation services or other electrical services that traditionally were offered through contractors outside of the utility business.

The difference in recent years for EaaS is that third party providers and non-utilities have been offering products and services to members with and without the utility's consent or consultation. EaaS has been further enabled by both distributed generation, such as solar, natural gas, thermal and wind interconnected directly on the distribution grid, as well as new technology such as blockchain for financial and real-time transactive data exchange. This is a global phenomenon and could represent a major economic challenge for distribution utilities in almost all markets.

Examples of third party vendors who are already offering EaaS include Arcadia Power, the Brooklyn MicroGrid project, and Bangkok's Microgrid.

- Arcadia Power, from a Groupon ad found on April 5, 2019, markets "Clean energy and automatic savings, all at no cost when a utility account is enrolled with Arcadia Power." PCWorld posted an article on February 21, 2019 with the offer "Save up to 30% on your power bill with Arcadia Power" where "Members start by connecting their local utility account to the platform and enrolling in clean energy and savings programs. Price alerts leverage the community's buying power to automatically find and connect eligible members to lower electricity rates. Arcadia Power also helps members save by connecting them to community solar projects, as well as home efficiency solutions." https://www.pcworld.com/article/3340134/save-up-to-30-on-your-power-bill-with-arcadia-power.html
- Brooklyn MicroGrid "reimagines the traditional energy grid model through a communal energy network. While the utility provider still maintains the electrical grid that delivers power, the actual energy is generated, stored, and traded locally by members of the community, for a more resilient and sustainable clean energy model." Utilizing blockchain, "a permissioned data platform that creates localized energy marketplaces for transacting energy across existing grid infrastructure" has been developed to expand this project to a future EaaS model that is anticipated to spread rapidly throughout the area. https://www.brooklyn.energy/
- The microgrid project in Bangkok "Bangchak Corporation Public Co. Limited (BCP), a petroleum refiner in Thailand, is testing and demonstrating a commercial microgrid and blockchain energy trading platform at a community shopping mall anchored by a BCP fuel station in Bangkok…the project serves as 'an experimental sandbox system' for a microgrid system that Bangchak may deploy across its network of gas stations and commercial properties" as reported in an article on Microgrid Knowledge entitled "Thailand Petroleum Co. Tests Commercial Microgrid with Blockchain for Mall and Fuel Station"— posted on March 7, 2019 by Andrew Burger. https://microgridknowledge.com/commercial-microgrid-blockchain-thailand/

Numerous publications and presentations have highlighted this topic both online, at conferences and across education and government groups:

- Utility of the Future: An MIT Energy Initiative response to an industry in transition published December 2016- https://energy.mit.edu/wp-content/uploads/2016/12/Utility-of-the-Future-Full-Report.pdf
- Changing Dynamics—Using Distributed Energy Resources to Meet the Trilemma Challenge, published 2017 - https://www.worldenergy.org/wp-content/uploads/2017/11/World-Energy-Trilemma-2017_Full-report_WEB.pdf
- Two separate posts: Utilities Running Out Of Time To Adapt To Energy Revolution and Utilities Should Become Energy Services Providers by Jeff McMahon, posted Oct 18, 2015 on https://www.forbes.com/sites/jeffmcmahon/2015/10/18/utilities-run-out-of-time-to-adapt-to-energy-revolution/#ba139031efa9 and https://www.forbes.com/sites/jeffmcmahon/2015/10/18/utilties-should-become-energy-services-providers/#26cffcb295d7
- Back to the Future: What Role Will Electric Utilities Play in 2030? Posted on June 7, 2016 by Lisa Schwartz at https://www.greentechmedia.com/articles/read/back-to-the-future-what-role-will-electric-utilities-play-in-2030#gs.4i87og

Blockchain applications will increasingly enable microgrids to allow a neighbor to sell to a neighbor, over the utility's wires, and if the utility does not proactively engage, the prosumer will continue to change the business model. This will require creativity, and potential trial and error, before the right EaaS model is adopted that works best for each utility. Microgrids offer a unique opportunity to both provide a generation source on the distribution system, as well as to improve reliability. An introductory article on microgrids can be found at https://microgridknowledge.com/definition-of-microgrid/ "A microgrid is a self-contained power system, confined to a small geographic area. It will have one or more power plants, which are usually relatively small in size. It might also have some means to store energy, such as batteries." Based on this definition, with local generation in place and communication to monitor devices and controllers, an entire cooperative's distribution grid could be considered a microgrid in the future. Cooperatives may place microgrids into their system at several different levels:

- Single residence or building level—i.e. solar with batteries and an EV car
- A neighborhood level—this could be community solar with direct connection to the grid, with or without batteries, and an isolation point at the lateral tap of the neighborhood during system level outages, or this could be multiple single residence installations that continue to support each other during the outage. This would still require an automatic solution point from the grid at the neighborhood level.
- Substation level—large batteries connected to the grid and available for a 4-6 hour ride through during a transmission outage
- Full distribution grid level

All of these are "microgrids" and some distribution systems already have a microgrid in place. However, the missing links are communications and control back to the utility. The future of the microgrid will be enabled through multiple communication options that could include fiber installation by the utility, radio systems such as AMI networks with channels dedicated to the

control of the grid, or cellular communications by a trusted partner using either existing 4G LTE or next generation 5G technology.

Generation options in the past were large scale and required transmission to connect generation to load. Changing market forces on the generation side will continue to evolve. It is no longer a market where new generation procurement leads to lower cost. In contrast, new generation is raising costs in a cooperative's vertical integration. This will require cooperatives to look at other, potentially local, generation options to control costs. Cooperatives across the nation have been investing in community solar during the last decade, but not strictly as a power cost management tool. These projects were typically driven by membership desire for renewable energy. As distributed generation prices continue to drop, and traditional generation sources costs continue to increase, the need for local generation within the distribution system, controlled and owned, in full or part, by the distribution utility could continue to rise. Microgrid examples such as those above, driven by third parties, or by the distribution utilities, may play a large role in changing the available generation portfolio. Further discussion on microgrids can be found in the section, "Transition from Central Generation to Local," as well.

A major impact to the distribution cooperatives and their members is the degradation of the cooperative-member relationship. Cooperatives must understand member needs and wants and continue to provide added value to members. It will be necessary to understand and adapt to member **expectations** and explore new ways to enhance member **experience**. EaaS is about consumer choice, with or without the utility. In 2017, "The World Energy Council predicts that such decentralized energy will grow to about a quarter of the market in 2025 from 5 percent today," —as reported in an article written by Reuters correspondent, Rina Chandran. The article was published in collaboration with the Thomas Reuters Foundation, www.trust.org.

https://www.weforum.org/agenda/2018/08/in-a-posh-bangkok-neighbourhood-residents-trade-energy-with-blockchain based on the report found at https://www.worldenergy.org/wp-content/uploads/2017/11/World-Energy-Trilemma-2017_Full-report_WEB.pdf, page 20.

Cooperatives need to either partner with trusted EaaS providers or ***become one themselves***. This could be a hybrid approach. Any long-term generation/sales contracts cooperatives have may dictate the approach each utility chooses. For example, most utilities have lists of recommended local electricians when members need work on their side of the meter. What if the utilities become that electrician? Why should a distribution cooperative not be the preferred provider for installing solar panels, or electric vehicle chargers, or at least coordinating those services with a trusted contractor on behalf of the member?

Members will become prosumers whether the distribution cooperative takes part or not. Alexa, Google Home, NEST, Facebook, and other IoT providers are already in most homes and allow for usage data to be collected and used for non-utility purposes. New monitors in the homes, such as SENSE https://sense.com, Neerio https://www.neur.io, or TED "The Energy Detective" http://www.theenergydetective.com, for example, can allow prosumers the means to run checks on their residential utility meter. Some full home security systems in the homes integrate this, and provide control similar to load control programs, but within a home and prompted by the homeowner. These are all real examples of how third-party service vendors

are providing prosumers a way to make more personal choices in their management of energy usage and purchases.

There are few services available where members have support options available for the plethora of IoT devices on the market. Cooperatives are again in a unique position to provide and support such service for their members—potentially gaining new revenue streams, or using new technology to solve longstanding problems. Many cooperatives have had load control programs in place, particularly on water heaters and HVAC systems. As these systems near their service life, the utilities will have to look for next generation solutions. With the IoT environment, it would not be unreasonable to partner with a technology company, utilize smart plugs or other devices, and allow load control to flow to the Cloud and back to the utility's monitoring systems. NEST has successfully provided this type of service to utilities for several years. More opportunities such as these will become available.

Another area that is undergoing major change is the transportation industry, at both the individual consumer and fleet levels. Consumer-level electric vehicles will impact the distribution grid and cooperative load curves as more vehicles hit the road. EaaS could be a method for proactively engaging with transportation providers in the utility service territory, such as FedEx, UPS, USPS, school districts, county transportation departments, city service departments, or even airports to determine their timeline for upgrading fleets to electric. On April 8, 2019, Tesla released a video showing a Tesla Semi delivering a Model X to a customer. https://electrek.co/2019/04/08/tesla-semi-electric-truck-prototype-deliver-model-x-customer-video .

An example already in place and supported by the utility industry was the 2017 pilot project for an electric school bus. "First Electric School Bus Comes to Minnesota" was posted on http://www.driveelectricmn.org/first-electric-school-bus-comes-to-minnesota on July 25, 2017.

"Great River Energy (GRE), a partner of Drive Electric Minnesota, just wrapped up its tour of the first electric school bus in Minnesota (and even the Midwest). The bus will be back in the fall, transporting children in Lakeville, MN to and from school, powered by 100% wind energy through GRE's Revolt program.

There are many reasons why school buses offer the perfect case for going electric including:

- They have multiple stops allowing them to take full advantage of the regenerative braking technology.
- They offer a 100-mile range while the average school bus route is 66 miles.
- They save $12,000 annually on operation and maintenance costs compared to traditional buses.

More discussion on this topic can also be found in the section "Transportation Electrification". It is mentioned here in the EaaS as a supporting reference. The transportation industry will have EaaS providers emerge. Cooperatives, both individual utilities and their G&Ts, are in a unique position during this transformative period to either lead or be led.

Some cooperatives will become a WireCo/DSO exclusively. New cooperatives, or third-party providers, may continue to have greater impact in the industry that are exclusively EaaS, whether they choose to partner with the local DSO/WireCo cooperative. Other cooperatives may successfully be both. Watching and actively participating in the changing marketplace and finding solutions to membership needs will help cooperatives stay relevant. EaaS should be considered as a way for cooperatives to go back to their roots and focus on the services that enable their communities to prosper.

Call to Action:

- Start questioning how moving away from kWh sales to services that sell kWh could affect the cooperative business model. Could EaaS replace kWh unit sales in some cases?
- Look at the cooperative's current rate structure. If needed, complete a cost of service analysis to ensure that the service charge versus usage charge is economically viable for the future.
- It will be necessary for cooperatives to understand and adapt to customer **expectations** and find new ways to improve consumer service **experience.**
- EaaS should be considered as a way for cooperatives to go back to their roots and focus on the services that help their communities prosper.
- Cooperatives need to either partner with trusted EaaS providers or ***become one themselves***.
- Cooperatives will need to gain experience with microgrids, solar or other distributed generation resources, as additional means of assisting their memberships.
- The transportation industry is going to undergo rapid change to electric-powered vehicles of all types, and cooperatives are in a unique position to partner with manufacturers earlier, rather than later, in that transition away from combustion vehicles.

Market Forces in the Generation Market

The electric generation market is in the midst of a shift that is likely to accelerate in coming years as it becomes increasingly difficult to justify and build more traditional electric generation. This dynamic is being witnessed across the country with the postponement and, in some cases, the cancellation of projects currently in the planning or even construction phase. Additionally, significant amounts of existing generation will become less competitive because of changing markets, therefore forcing tough decisions.

Several factors that are contributing to shifting market conditions include the transition to regional wholesale markets across the U.S., growth in utility-scale renewable generation, negative future growth in the amount of energy residential consumers purchase from their utilities, and explosive growth in Distributed Energy Resources.

Some distribution cooperatives will find it increasingly attractive to manage the risk associated with wholesale power over time, and instead concentrate on being electricity distributors. At the same time, the role of the distributor is changing to that of Distribution System Operators in the new market, which will present both challenges and opportunities for distribution cooperatives.

Electric Generation Industry Has Shifted

Some significant market changes threaten the economic viability of fossil generation and, with it, the owners and operators of that generation. These major changes include:

1. Transition from largely independently-operating generation owning utilities to centrally-operated regional markets in much of the US
2. Growth of utility scale renewable generation, especially in solar and wind
3. Expected negative growth in residential energy deliveries by utilities (actual in some cases)
4. Expected explosive growth of Distributed Energy Resources.

These changes are significant on their own and are coinciding to cripple nuclear and coal-fired generation, and they will put a meaningful dent in the once-exploding market for energy produced by natural gas-fired generation.

Transition to Regional Markets

Through much of the history of the electric generation industry, utilities were largely responsible for building and operating their own generation fleets. Utilities planned and operated largely on their own, each responsible for meeting their legally mandated obligation to supply the energy needs of their customers. While transactions were negotiated between utilities and emergency arrangements in place, suppliers operated largely with independence.

The implementation of regional markets in much of the U.S. and the opening of markets to non-utility generation resources, has not only eliminated the need for utilities to plan and operate generation in isolation, but has also threatened the viability of many of the generating units built

under that independent philosophy. As a result, pricing has not been supportive of the construction of more traditional generation resources.

Average on-peak prices in the largest regional markets for 2017, as reported by FERC[22], ranged from $26.46 per MWh in ERCOT to $34.30 in PJM and MISO. These prices were below the variable cost of many existing fossil units and, given these were annual averages, the prices in many hourly instances were even lower.

On the capacity side, the picture is even more dismal for both new and existing traditional generating units[23]. PJM saw a capacity price of $2.30 per kW-month in 2017, with a price of $0.05 in MISO. ERCOT does not have a capacity price component. Not only were these prices too low to support new investment in traditional generation, they were lower than needed to support the ongoing capital investment needed to keep many existing units, especially nuclear units, in operation.

Growth of Utility Scale Renewable Generation

A combination of tax incentives and consumer demand for clean power fired the early growth of renewable generation throughout the U.S. Those factors, in turn, drove production scale and technology advancement, which have resulted in new-build capacity costs that are lower than most fossil-fuel generation costs.

According to an EPRI whitepaper[24], the installed cost of utility scale solar and wind generation has fallen to $2,000 per kW and lower. With no fuel cost, the total cost of energy from these resources is lower than the cost of building and operating most fossil fueled generation, making it harder to justify and garner financing for traditional generating plants.

Not only does renewable generation push aside plans for new fossil generation, it threatens the viability of existing generation as well. Numerous reports from cooperatives and other industry sources indicate the cost of new utility solar installations and PPAs is near or below $25 per MWh, with wind being even lower. Those are both lower than the 2017 average cost of $35.41 per MWh for fossil steam generation, as reported by the Energy Information Administration (EIA)[25].

Residential Energy Deliveries

Improved efficiency in the use of electricity across all customer sectors is depressing load growth across the U.S. One of the most acute concerns for cooperatives is the projection for negative growth in energy deliveries to residential customers.

The EIA[26] projects electricity deliveries per residential household to drop 10% from 2018 through 2029, despite increases in the number of electric devices in homes. This projected drop is due to

[22] FERC Staff Report, State of the Markets Report 2017; published April 2018; page 18.
[23] FERC, page 20.
[24] EPRI Whitepaper, Developing a Framework for Integrated Energy Network Planning: 10 Key Challenges for Future Electric System Resource Planning; July 2018; page 25.
[25] EIA Electric Power Annual 2017; published October 2018; page 170.
[26] EIA Electric Power Annual 2017, supporting data tables.

both increased energy efficiency and behind-the-meter generation that is offsetting purchases from utilities.

Distributed Energy Resources

"Rapid Deployment" (EPRI) and "Explosive Growth" (Greentech Media) are just two of the predications for Distributed Energy Resources (DERs) on utility systems in the coming years. These typically include distributed generation, energy efficiency, demand response, and energy storage. According to Greentech Media[27], distributed solar, small-scale CHP, residential smart thermostats, electric vehicles, and energy storage combined to produce an impact of 46.4 GW on the summer peak demand of the US in 2017, approximately 6% of the total. By 2024, Greentech Media expects that impact to grow to 104 GW, representing close to 10% of the U.S. peak.

Electric cooperatives, both distribution cooperatives and the G&Ts that provide power to many of them, are facing significant impacts from the industry shifts if they can't prepare for and adapt. Cooperatives will increasing be squeezed from both the wholesale power and retail markets as a result of the shifts.

As traditional generation, especially high capital investment baseload generation, becomes noncompetitive, for-profit utilities are writing off their investment in higher cost units and retiring them. Unless cooperatives are able to manage the cost of similar noncompetitive resources, they face becoming noncompetitive from a price standpoint when members compare purchases from their cooperative to increasingly attractive DERs and open retail markets.

Continued investment in fossil generation is going to become increasingly difficult for cooperatives to justify from the standpoint of not only economics, but also public policy and member demands for renewable generation. At the same time, members will increasingly invest in DERs, whether through the abiding support of their cooperative or on their own--and potentially with support from entities such as Google and Apple.

In some cases, distribution cooperatives may find their G&T contracts, which formerly insulated them from much of the market risk, to be risks. G&Ts, without third party shareholders onto which they can pass the costs of write-offs, will be forced to pass increasingly noncompetitive wholesale power costs onto members, who will find their own members (retail customers) increasingly unwilling to pay those prices.

Unless cooperatives (both the distribution and G&T) begin to plan and adapt now, the market changes could produce a spiral that could result in legislative or regulatory responses to force change for members who are increasingly willing to sell their cooperative to entities they see as more likely to adapt or even regulate options to mitigate retail market complaints/concerns.

---

[27] Article: "Distributed Energy Poised for 'Explosive Growth' on the US Grid"; June 21. 2018; https://www.greentechmedia.com/articles/read/distributed-energy-poised-for-explosive-growth-on-the-us-grid#gs.3e7uhl

It is important for distribution cooperatives and G&T's that have long-term wholesale power contracts with those distribution cooperative members to realize and begin preparing today for a future that is starkly different than they've become accustomed to as an operational norm. Adaptation is key for both the distribution cooperatives and G&T cooperatives. It is essential for G&Ts to figure out new ways to work with their distribution members if distribution co-ops are to be successful in providing a new level of flexibility that the retail members will expect and deserve. Believing business practices that have served the industry for the last 40-50 years will continue to lead to success is dismissive in light of historical precedent previously seen in the telecommunications sector. It would seem unlikely that the retail market distribution cooperative members will be tolerant or patient enough to accept a business as usual, laisser-faire, approach in future cooperative service offerings. This trending concern is becoming evident in parts of the country where distribution cooperative directors (retail members) are beginning to reevaluate the practicality of their G&T relationships--due to a lack of understanding and action by the G&Ts in identifying and implementing business methods that enable distribution cooperatives to respond to the options and choices cooperative consumers are beginning to demand. Flexibility is the buzz word of the day, and a working compromise can be the best and only resolution to longevity of longstanding mutual interests and partnerships.

For distribution cooperatives, adapting to the change may mean transitioning from the role of retail power supplier to Distribution System Operator (DSO). As DSOs, cooperatives would become managers of their distribution systems and the power flows, enabling members to meet their energy needs in a manner they desire from a combination of energy consumption management, behind-the-meter generation, and purchases from wholesale suppliers.

Adapting to changes driven within the shifting generation market will require some tough decisions and likely some trials, but many distribution cooperatives will see opportunities for themselves and their members if they face the challenges the market shifts present.

Call to Action:

- G&T's and their member cooperatives should begin to address how to manage contracts, power costs, and flexibility for the retail members of the distribution cooperative.
- Cooperatives should examine existing power contracts and actively look for ways to manage longer-term contract risks.
- The G&T and distribution cooperatives should consider ways of working together to support retail desires of implementing DERs.
- Cooperatives should consider implementing a portion of their portfolio into low cost renewables which can be a cost-effective alternative.

Variability of Electric Cooperative Growth

Anecdotally, from a national level perspective, average electrical system sales growth has been declining ever since the 1970's oil embargo and President Jimmy Carter's infamous fireside chat encouraging Americans to conserve energy by wearing a sweater. It was not uncommon in the late 1970's to forecast load growth in the 3-12% range. Those substations in high growth areas near metro areas were near 12% load growth levels, while rural substations were typically flat to no growth unless a big industry was locating in the substation footprint.

In the late 1970's and early 1980's load growth stagnated. However, by the mid 1980's load growth was returning. From 1985 through 2005, average system growth in the range of 3-6% was common.

When we look back today, we can see that historical data shows a dramatic slowdown in growth after 2005. Many observers attribute the slowdown to the housing crisis, the great recession and the increase in homeowner use of energy efficient appliances, LED lighting, and technology that assists homeowners in improving their energy efficiency and conservation practices.

Today, most average system load forecasts are in the 1% range. The spread between growth in rural areas compared to metropolitan areas remains significant and some would say that metric is increasing. Since 2005, most rural areas are experiencing no growth to significant load loss, while in metropolitan areas such as Atlanta, Nashville and Austin, more robust growth is occurring. Below find several graphs from the National Rural Utilities Cooperative Finance Corporation "CFC" showing the diversity of growth across the rural electric cooperative landscape.

Exhibit #1

The left axis (orange font) represents consumers per mile and the right axis (blue font) represents the average annual growth in kWh Sales. The average annual growth in kWh sales (blue columns) are sorted from low to high by state. Consumers per mile is shown in (area-orange).

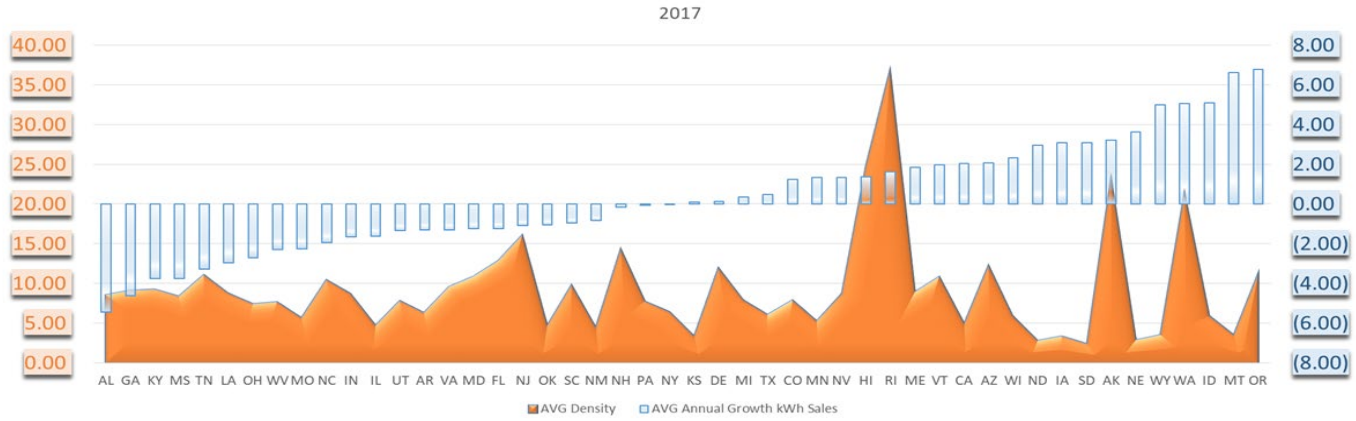
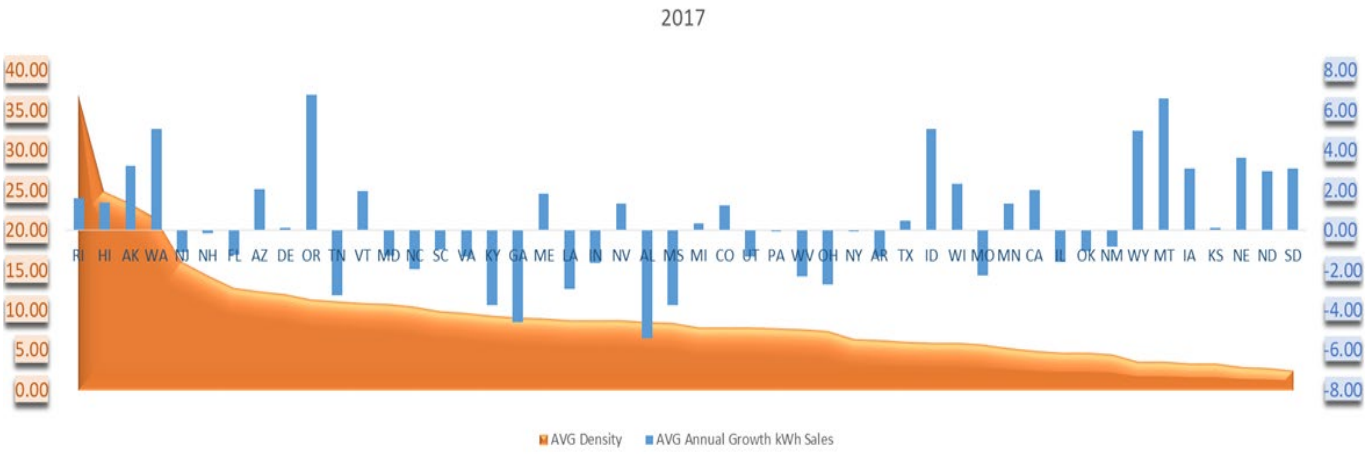
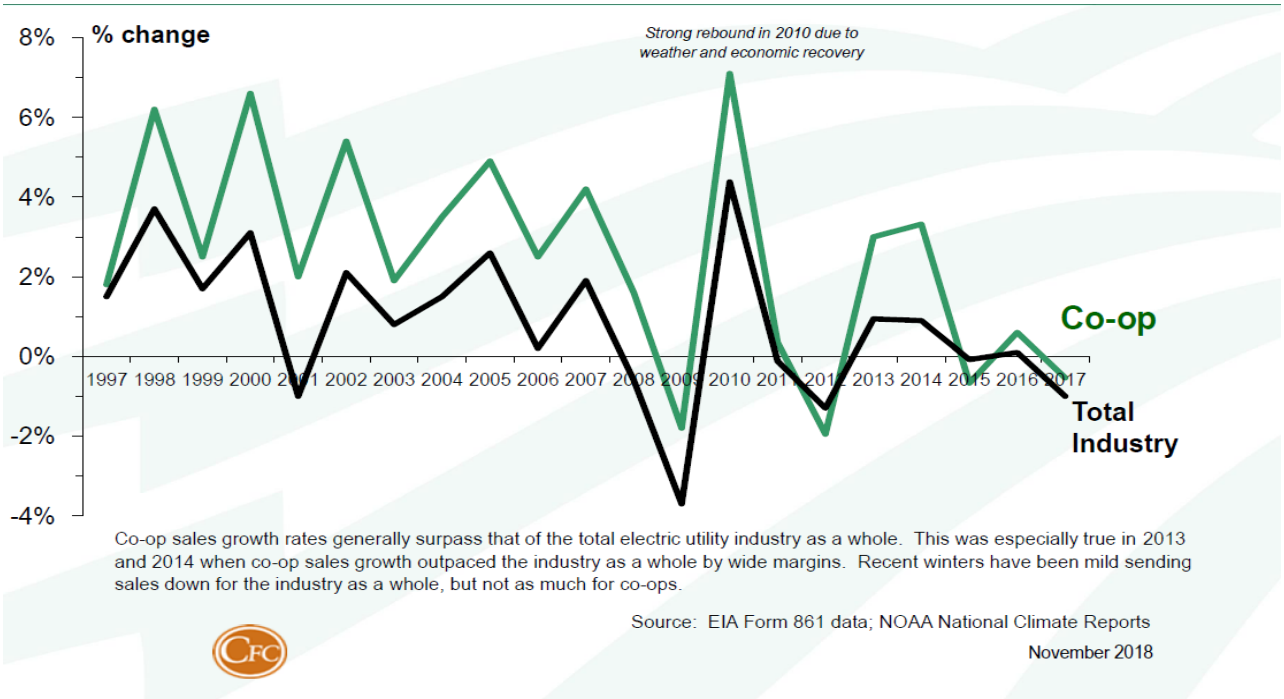


Exhibit #2

The left and right axes represent consumers per mile and average annual growth in kWh Sales, the same as Exhibit #1. In this case, the data is sorted by the consumer per mile (area-orange) from high to low, and the chart illustrates the average annual growth in kWh sales (blue columns) for each of the states.



While the above graphs are just snapshots of 2017, they show the variability of kWh sales state to state. Over time, sales kWh growth at co-ops have been declining, as shown in the graph below. Growth is primarily dependent on three factors: weather, economic conditions, and the number of new consumers. The latter two factors should interest co-ops that are trying to encourage kWh sales growth.



Impacts

During extended economic downturns, there can be a significant sales loss in rural areas as consumers move to urban areas to seek employment. The lack of modern services such as broadband internet and other amenities can also limit growth in rural areas, especially among younger generations. No load growth or negative load growth can put significant rate pressures over time on remaining members because there are fixed costs that must be covered regardless of the amount of energy sold. If rates are not kept competitive with more populated areas, then that metric becomes yet another obstacle to new growth.

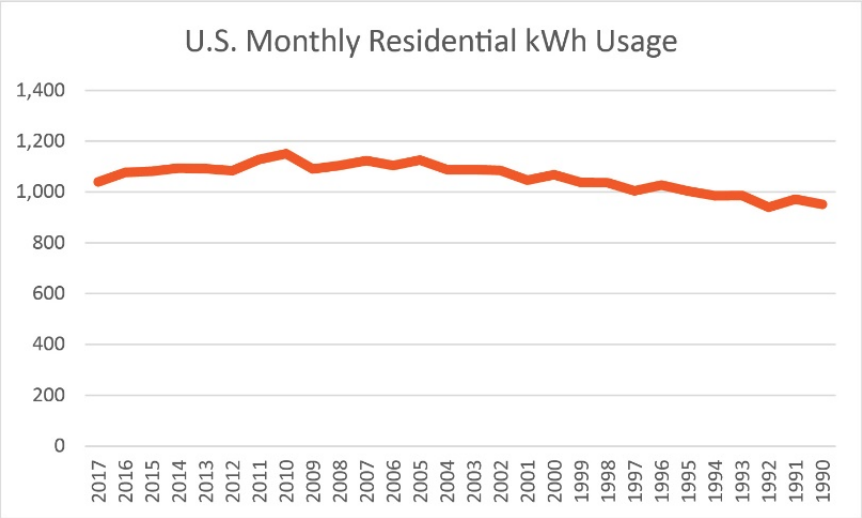
Call to Action:

- Strive to be “lean and mean” – ensuring every dollar spent leads to member value.
- Smaller co-ops can look into merging or consolidating with neighboring cooperatives to bring new value to members through shared overhead costs.
- Consider shifting revenue balances from kWh charges to true fixed/facilities charges based on cost of service studies.
- Consider promoting economic development in all ways possible-- sitting back and waiting for load growth to present itself will not work. Working with communities and cities creatively to attract development to the service territory is paramount.
- Consider other opportunities to grow revenue and provide needed community services--e.g., solar, broadband, etc. that will also make rural communities more attractive to new consumers and commerce.

Transportation Electrification

Electric vehicles are on the rise in manufacturing, with a majority of automotive manufacturers either offering or actively developing EV models. In the United States, monthly sales have more than doubled in the past three years. Global EV sales reached a cumulative 1,000,000 units sold in 2015. By January 2017, EV sales had already reached a second cumulative million vehicles. In 2018, global EV sales exceeded 2 million units. The United States is certainly a leader in EV sales. Second only to China, U.S. electric vehicle sales topped 361,000 units in 2018. But of those, 48 percent were sold in California, almost ten times the level of next highest performing state--Georgia, at 4.8%. While EVs are commonplace in metro areas like Atlanta, where shorter commutes and a robust charging infrastructure dramatically increase acceptance. Contrarily, rural areas only a few miles away have fewer EVs in driveways.

It is no secret that electric revenue has steadily fallen across the country. Since the beginning of the great recession in 2008, many cooperatives have struggled to attract substantive load growth and are now only just beginning to see positive change in meter growth. However, kWh usage per account has fallen steadily for more than a decade. Structural, appliance and HVAC efficiency will continue to erode kWh sales.



Electric vehicles are rapidly gaining market share, both globally and in the United States. Despite many states lacking tax incentives, consumers are drawn to the environmental benefits, fuel and maintenance savings afforded by EVs. Much of the current EV sales, public charging infrastructure, public transportation systems and auto dealers who are actually stocking electric vehicles are located in metropolitan areas, primarily benefiting investor-owned utilities. “At work” and public charging may occur within areas served by IOUs. To take advantage of the growing potential for energy sales attributed to EVs, some that are possibly off-peak, it is

incumbent upon electric cooperatives to encourage interest in and demand for electric vehicles, as well as providing attractive incentives that make residential charging more practical from an investment standpoint, behind cooperative meters. Cooperatives should evaluate installing charging stations strategically throughout their territories to help with the range anxiety concern some members might have. With the increasing range of today's EV's, range and charging anxiety may not be as acute as initial early adopters once felt. The extended range of a variety of EVs today (200-plus miles in some instances) will make EVs more attractive to rural America consumers.

Electric vehicles, when charged at home, at businesses, or at public chargers behind cooperative meters, represent significant energy sales. Each new EV would add 3,500 to 5,000 kWh annually, and would represent the potential for millions of kilowatt-hours in new sales.

At a time when utilities in metropolitan areas are embracing the wave of interest in EVs, many rural cooperatives have chosen to remain on the sidelines, uncertain of how EVs fit in rural America. Chargers installed in public spaces, at work and in retail parking areas are capturing many of those new kWh sales on IOU and municipal utility lines. Likewise, a network of DC fast chargers, installed by Tesla and Electrify America, are being built along interstate corridors, bisecting rural cooperative territories.

In the 1950s, electric cooperatives leveraged the trust of their membership as they undertook a remarkable rural electrification program. Across the country, cooperatives built "community rooms" with kitchens, hired or trained experts who became home economists and taught rural America to embrace all of the benefits of "electrification". Ultimately, special designations, such as Gold Medallion Homes, and declining rates were developed to incentivize homes that were "total electric". That same level of education and creative programming is needed to break down the barriers, both perceived and real, that are discouraging rural residents from adopting and embracing EVs.

As battery performance increases and investment cost declines in storage alternatives, EV range and the availability of home battery storage devices will likely converge. This will afford the DSO the opportunity to develop demand-side management, peak-shaving, standby generation and revenue growth programs that are grid enabled. Members will benefit from greater control of their energy rates, through time-of-use rates, load control programs, and transportation savings.

Call to Action:

- Research: As with any new program, understanding the mindset and the commuting patterns of cooperative members is important. This means intellectual and physical boundaries must be ascertained.
- Create Ambassadors: Before any members can be convinced that EVs are a viable transportation alternative, cooperative employees must first be converted as advocates of the technology.

- Create Allies: Identify and develop natural allies to assist with educational and marketing programs. These can include NRECA, G&Ts, Clean Air Coalitions, dealerships, EV car clubs, and others.
- Leadership by Example: Credibility among membership and community starts at home, leading by example. This means purchasing and deploying electric vehicles and installing chargers as working models of the technology.
- Creating Believers: While logic and reason may win minds, ultimately the best way to sway our members to see EVs fitting in their garage is by putting "butts in seats". Every opportunity should be taken to create opportunities for cooperative members to try electric vehicles.
- Incentives: Create rebates, time-of-use rates, and other incentives necessary to bridge the final gap (costs) between electric vehicles and cooperative members.
- Rates: Does your cooperative have an existing time-of-use rate in place? Do your existing general service rates work with DC fast chargers that might require several dozen to several hundred kW? Is there an EaaS model that works for charging EVs?
- Get Creative: Seek creative partnerships for beneficial electrification. Are grant funds available for public transportation or charging projects? Could a cooperative partner with a school system or residential developer to provide infrastructure for charging in exchange for energy sales?

Trusted Energy Advisor

For over a decade, cooperatives have led the charge in creating an Energy Innovation culture. Cooperatives have led by example, and through education and communication initiatives, have trained member-consumers to manage their usage. Trusted energy advisors have become the face of many co-ops, serving as a major ambassadors of communication, energy efficiency awareness and as educational resources for members regarding all aspects of the co-op, not just Energy Innovation.

With a multitude of products and services available on the market, members will continue to rely on cooperatives for assistance in decision-making, including when purchasing and implementing technologies and services. If a cooperative does not have an employee for this role, it has missed a great opportunity. Until recently, trusted energy advisors served the membership as consultants, but now are being looked to for a host of services behind the meter. Cooperatives should become the first resource members turn to when they purchase, implement, operate and/or maintain new technologies.

Members feel empowered when they are given different energy options, and co-ops need to prepare for a future where members have choices. Members want convenience, simplification and control at their fingertips. Third party vendor penetration into the market continues to increase, and cooperatives will need to figure out how they can provide and simplify these offerings. If cooperatives can pair their reputations with a one-stop-shop mentality, cooperatives will continue to have the competitive advantage. A cooperative's willingness to adapt to new technologies, and provide members services behind the meter will be key for cooperatives to remain at the forefront as trusted energy advisors.

Members are growing more curious and are willing to adopt new energy savings technologies. The use of smart home appliances, thermostats and other internet-connected devices make up a large portion of these new technologies. Members are starting to enjoy the ease of controlling everything at the touch of a finger on their smart phones or tablets. The membership is in search of products that lower energy usage and give them more control at a reasonable price. A great example is the growing popularity of smart thermostats.

There are multiple factors contributing to this shift. Younger members are joining cooperatives and they want data, transparency, and more options. They want choice with different rates, additional services and products. The current generational and cultural climate has played a role in the shift. There is a greater emphasis on social responsibility and environmental impact. This is evident in the adoption of DG and electric vehicles (EVs). According to Bloomberg NEF, "in 2040, some 60 million EVs are projected to be sold, equivalent to 55% of the global light-duty vehicle market." The number of EV models available on the market are projected to increase over the next couple of years, leading to increased adoption. Cooperatives must encourage this adoption and create creative rates and programs designed around EVs.

There has been a noticeable shift in the energy innovation sector within the last few years. The focus has shifted from simple energy efficiency and conservation to renewable energy, battery

storage, and other energy options: Distributed Energy Resources (DER). Currently, members have an increasing interest in renewable energy, and this rings true even for member-consumers in areas of the country with lower energy costs. According to Energy Sage, "Solar power accounts for enough capacity to power 11 million of the 126 million households in the country. Concurrent with an increase in solar panel efficiency, the cost of solar energy has fallen substantially. In the last decade alone, the cost of solar panel installation fell over 60 percent, and many industry experts predict that prices will continue to fall in the years to come." Due to this shift, the role of the trusted energy advisor has had to evolve. Renewable energy will continue to gain momentum across the country, especially when battery technology becomes more streamlined and affordable. Cooperatives will need to consider DER adoption and determine how to capitalize on other revenue streams while keeping the best interest of the membership in mind. Energy Advisors should stay engaged with the membership and offer their expert assistance in every step of the process. New technologies are constantly being introduced and marketed heavily to the public. Third party brokers, aggregators and technology vendors are offering services in the market, causing increased pressure for us to offer the same services and options to our membership. Cooperative members are being inundated with information and propaganda. Members are looking to their cooperatives to simplify the plethora of information available and to decipher what is truth or fiction. They are looking to their trusted energy advisors for options and cooperatives should be able to fulfill these member expectations.

In order to remain relevant to the membership, cooperatives and energy advisors must continue to keep a pulse of the market and know what products/services are available. They should remain the experts and be aware of any areas where the membership's needs are not currently being met. The energy advisors must develop and offer useful programs to the membership in order to meet these needs. When appropriate, the cooperative should take the place of the intermediary or third party contractor. This not only will help keep it simple for the membership, it will also help keep the membership shielded from unscrupulous contractors and companies. This will also leverage the foothold cooperatives have on their niche in the market, keeping cooperatives sustainable into the future.

These trends in our cultural and societal norms also are becoming an increasing threat to the trusted energy advisor position and cooperatives in general, with the overwhelming success of companies like Amazon, assessing services that stand to enhance consumer convenience. These trends also show the need for cooperatives to be prepared for a future where members look to their co-op as the one source for all their energy needs. For example, cooperative already serve as a bridge between the membership and contractors that perform services for them (i.e., HVAC technician, insulation contractor, and solar contractors). Imagine a future that removes the contractor or independent serviceman and instead has the member call on their cooperative to provide these services for them. Cooperatives must be the experts and in many cases are.

The internet of things (IoT) is another potential threat to cooperatives and energy advisors. Third party organizations are nudging their way into the energy sector and are gaining valuable information about consumer energy usage habits. Eventually, this traction may give third

parties more information about our members' load profiles than we have. They could potentially have more access to members' applications in their home, and offer more creative ways to lower energy usage. The internet is also causing less of a need for personal interaction. In the future, some members may prefer convenience and quicker response. Having a face-to-face appointment at a member's home may be regarded as more of a disturbance than a benefit by some members. Cooperatives must continue to show that they are available to their members. If cooperatives can continue to offer excellent customer service and value to the membership, the membership will continue to support cooperatives.

Call to Action:

- Continue to focus on providing exceptional service and value.
- Be engaged and empathetic to the membership and recognize when needs are not being met.
- Transition from only being consultants to offering services behind the meter.
- Bridge the gap between members and contractors where possible, filling service voids that are easily filled by third party contractors (becoming the one-stop-shop).
- Keep a pulse on the market and remain experts on all products and services that have trending consumer interest. Build expertise where it does not exist if members need support in a certain area.
- Remain open-minded and invite change and offer flexible rates and useful product offerings.
- Develop strategic partnerships/alliances with third parties where needed (could be G&Ts, other distribution cooperatives or local contractors).
- Digest and condense complex data for member's use.
- Bolster efforts to be recognized as an industry leader in application and education – communications of skills and services will be key to success.

Need for Security

The utility sector has always viewed security as a major component of the business. In the latter half of the 20th century, the focus in this area was on the generation segment (specifically the nuclear realm). Since the turn of the century, the focus has expanded to the transmission system where NERC CIP compliance has become a guiding force. With the industry shifts outlined in this report, physical and cyber security is now a big focal point at the distribution level. The industry drivers outlined in this report show risk exposure levels and their pace will likely increase dramatically.

Cooperatives are showing the appropriate ramp-up of efforts to combat rising risk levels. However, the industry shifts outlined in this report indicate that the increased risk, stemming from transitions cooperatives will make as they become system operators and trusted energy providers, is going to cause increased cyber and physical security issues, and at a faster pace than found in many other industries.

Cooperatives are experienced practitioners when it comes to handling safety issues--where even a small lapse in attention can be a life-threatening scenario. While nothing will ever reach the importance of safety, it is becoming clear that the growing potential for a cyber or physical security breach are requiring cooperatives to treat cyber and physical security with the same focus and resolve in which they treat safety.

Outlined below are some industry shifts that will accelerate the pace and increased exposure risks cited above. The list is not intended to be all-inclusive. The threat to data and to the grid, as well as to the resources that will be necessary to protect these areas, are highlighted below. For the purposes of this report it is important to identify what actions cooperatives should be considering to prepare for, prevent, and in worst case scenarios, react to these threats.

Data is King

The most commonly recognized Cyber threat is the potential for breach of the massive amounts of secured member data Cooperatives are entrusted to keep safe. Industry shifts outlined in this report suggest member data collection will expand to include not only basic information about the member, but also significant detail about members' lifestyles, what equipment members have in their homes and how the equipment is used. As cooperatives try to help members meet goals related to their energy services, this information will become more available in cooperative databases. With the implementation of automated meter reading equipment over the past two decades, co-op members are very concerned about privacy. Members naturally want reassurances that this type of information will never be lost to cyber theft or misused.

Increasing phishing attacks to acquire this type of data, higher vulnerability due to developments within the industrial Internet of Things (IoT), and the crippling effects resulting from any breach are a hazard cooperatives must identify and prepare response.

The Canadian government conducted a study and found that roughly 156 million phishing emails are sent globally every day. Of that 156 million, 16 million make it through email spam filters, eight million of those are opened, 800,000 links are clicked on, and 80,000 individuals fall for a scam and share their personal information. Cyberattacks on business systems are ubiquitous. Protecting secured data systems requires situational awareness, just as in safety, and mental acuity to "think before you click". Risk assessments should be regularly performed and security measures should be rigorously tested.

Securing Industrial Control Systems (ICS) is a monumental, if not universal, task. However, secure coding and validation does not always take precedence over the release of a new product, which gives attackers more vulnerabilities to exploit. The Internet of Things (IoT) revolution, as well as a resurgence acceptance for "Bring Your Own Device (BYOD)," add additional complexity and vulnerabilities. The only way for cooperatives to stay ahead of data security is to ensure all the available cyber protections are maintained at a high level.

The costs attributed to securing vital information and insuring losses caused by potential breaches require assessment. The amount of data at risk, and the vulnerability to exposure is increasing, which raises cost exposures for breaches. According to IBM, the average cost of a data breach in 2018 for incidents where less than 10,000 records were compromised, was $2.2 million. If there were more than 50,000 compromised records the cost was more than $6.9 million dollars. As these statistics show, data breaches can be crippling to any organization.

The Grid

Beyond very real cyber security concerns, cooperative must also focus on their important roles in preventing potential threats to the grid (both cyber and physical). Many communities have been involved in long-range disaster planning. At the core of this planning is what happens when the power grid is unavailable for significant periods, and the probable effects of such an occurrence within a community, whether a disaster was natural or the result of terrorism. Most studies have intuitively shown that when a grid is lost, socioeconomic pressures increase dramatically within a community. While natural events are always possible, the likelihood of the grid being targeted to cause this type of damage is more probable than any other time in recent history. Shifts in distributed energy resources, distribution automation, distribution planning, and distribution system operations will require more real-time response to manage the grid, given that the same vulnerabilities that exist for data theft also threaten the grid. For those reasons, some of the same physical and cyber security requirements that have migrated from the generation sector to the transmission sector, will likely migrate to the distribution sector as well. Due to the vast increase in control points within a distribution system, additional cyber and physical security measures will need to be built into distribution systems. As a result, cooperatives of the future will need to plan for increases in both cost and complexities stemming from the addition of these safeguards into the distribution systems now and in the future.

Resource Availability

With the inclusion of vast amounts of technology in all walks of life, resourcing solutions for cyber and physical security threats are increasingly difficult for all businesses. Internal awareness campaigns emphasize and encourage cyber security consciousness among cooperative employees, but despite those and other continuing security provisions, there is no end in sight for countering cyber threats, or for a cooperative's need to recruit cyber security professionals to combat them. A study conducted in 2017 by the Center for Cyber Safety and Education projected a shortage of 1.8 million cyber-professionals globally by 2022. This increased demand is also affecting the costs associated with cyber security.

So what should cooperatives be doing to plan for and address these issues now and in the future? The action items below are intended to provide guidelines that will help cooperatives combat the high risks associated with cyber and physical security.

Call to Action:

- Ensure cyber and physical security reviews are baked into a co-op's processes, especially those relative to project development and execution.
- Look for ways to leverage technologies implemented elsewhere (i.e., fiber deployment, inspection technologies, etc.) to increase the co-op's cyber and physical security capabilities. IR cameras deployed in substations for inspection purposes could also monitor security.
- Build a cyber and physical security process very similar, and in parallel, to the co-op's safety program. This process should include solid cyber and physical security policies that includes awareness, constant training and root cause analysis of "near misses" that occur, staying current in industry-related threats, as well as establishing a solid testing and evaluation process.
- Due to cost resourcing challenges, developing internal training and providing cyber and physical security tools to every position within the cooperative will help manage risk potential more effectively and also establish, as with safety, a mentality that success rests with individual awareness and not only through the oversight of an IT or security department.
- Utilize tools like NRECA's Rural Cooperative Cybersecurity Capabilities Program (RC3). RC3, which receives funding from the U.S. Department of Energy, is aimed at helping co-ops create a culture of cybersecurity with resources, tools and training that are tailored to their specific needs.
- Procure cyber insurance as protection against financial losses resulting from a security breach.
- Develop an emergency response plan-- members will expect quick, thorough communications and a clear plan for how the cooperative will return to normal business functions after an emergency incident.
- Test your cyber and physical security practices periodically with external vendors.

The Need for Reliability

Power delivery has undergone significant change over the last 50 years, but no shift will be greater than the one that lies before us.[28] Technology improvements, including real-time data, have allowed utilities to monitor and control equipment, an evolution towards a smarter grid. The linear integrated power grid is also changing with the addition of more behind-the-meter generation and storage capacity, allowing consumers to operate in parallel or isolated from the grid all together.

Distribution cooperatives will need to continue improving reliability on the electric grid while integrating with distributed resources behind-the-meter. Incremental improvements in service reliability will benefit most consumers but some will want a higher level of reliability and are willing to pay for it.

Customer's Expectation for Greater Reliability

For utilities, reliability continues to be the most important issue facing the industry. The chart below from a 2018 Black & Veatch Strategic Directions Report ranks reliability as the most important issue the industry is facing.

FIGURE 2

Please rate the importance of each of the following issues to the electric industry using a 5-point scale, where a rating of 5 means "Very Important" and a rating of 1 means "Not Important At All." (Please select one choice per row)

Rank	Top Issues Over the Last Five Years				
	2014	2015	2016	2017	2018
1	Reliability (4.58)	Aging infrastructure (4.52)	Reliability (4.56)	Reliability (4.69)	Reliability (4.65)
2	Environmental regulation (4.41)	Reliability (4.38)	Cybersecurity (4.37)	Cybersecurity (4.52)	Cybersecurity (4.49)
3	Cybersecurity (4.26)	Environmental regulation (4.38)	Environmental regulation (4.37)	Aging infrastructure (4.31)	Aging infrastructure (4.28)
4	Aging infrastructure (4.23)	Cybersecurity (4.33)	Aging infrastructure (4.36)	Environmental regulation (4.30)	Long-term investment (4.23)
5	Economic regulation (4.22)	Aging work force (4.12)	Long-term investment (4.13)	Long-term investment (4.29)	Physical security (4.18)

Source: Black & Veatch

In the same report, nearly 64% of utilities plan to improve grid reliability and system hardening efforts over the next five years as part of their grid modernization plans, with 55% improving network communications and security. Utilities are implementing these improvements depending on their specific loads and what makes economic sense for their areas. Some examples include evaluating pole class and pole types for certain areas (e.g., using steel in fire-prone areas), use of more fiberglass for pole hardware, improved vegetation management and

[28]Black & Veatch Strategic Directions: Electric Report; FERC Staff Report, State of the Markets Report 2018; page 4.

automatic restoration schemes. Unfortunately, nearly 60% of utilities also cited funding such improvements as their biggest challenge.

Need for Uninterruptible Power - Shift to Behind-the-Meter Generation and Microgrids

Due to technological advancements and inexpensive natural gas, customers are installing generation behind-the-meter, or grouping loads and installing micro-grids to supply critical loads.

- During Hurricane Sandy in 2012, a combined heat power (CHP) facility at Long Island's South Oak Hospital operated seamlessly during the hurricane. In contrast, NYU's Langone Medical Center relocated 200 patients while waiting for power restoration. [29]
- North Carolina has about 1 megawatt of battery storage, mostly in the form of micro grids, self-sustaining energy systems that can disconnect from the larger grid. [30]

New systems are not just diesel or natural gas gen-sets, but new technologies that provide increased efficiencies over traditional back-up generation. They also provide load-shaping resources during peak times, helping to economically justify the systems.

Impacts on Cooperatives

As the expectations of consumers continually increase, utilities will improve and become more efficient with existing maintenance programs and long-term planning, as well as incorporating distributed energy resources to increase reliability.

On the cooperative side, evaluating existing construction and maintenance programs can offer improved reliability and grid resilience during major events. Increasing use of data to analyze programs and monitor the electric grid will be key to successful completion of such improvements. Currently, more than 70% of co-ops are using AMI in some form and pursuing increasing grid automation through meter data management systems, automated distributed devices and data analytics capabilities.[31]

Behind-the-meter resources can help with grid reliability and give consumers back-up power during outages. This could also be an opportunity for the cooperatives to provide and install the equipment, thus enabling an opportunity for utility control. A few cooperatives already provide this service today. In addition to traditional outage management systems, distributed energy resource management systems (DERMS) may be needed to optimize the full capacity of distributed resources behind the meter.

Cooperative and consumer-owned resources will require additional communication infrastructure to bring the information back to the central office. These systems will need to be fast and two-way to realize the full potential of DERMS.

---

[29]Black & Veatch Strategic Directions: Electric Report; FERC Staff Report, State of the Markets Report 2018; page 50.
[30]Study: Batteries are coming to N.C., but how many, how soon depends on policy; Energy News published 2018
[31]The 51st State Phase II The Consumer –Centric Utility Future; NRECA; published March 2016

Member expectations for better reliability will continue to escalate. Cooperatives should ensure routine maintenance is being performed and appropriately budgeted to optimize timelines that result in the greatest impact on reliability indices (SAIFI, SAIDI, CAIDI, MAIFI, etc.).

As cooperatives gain industrial and commercial members, it will be important for cooperatives to be informed about the latest reliability-based technologies, and to be prepared to offer members enhanced reliability options.

Reliability has always remained a top priority for utilities since the beginning of the electric power age. Embracing and implementing new technological advances can be a win-win for the cooperative and the consumer.

Could reliability be offered as a service? Would members be willing to pay more for different levels of reliability? These are considerations cooperatives should continue to explore. Technology is available that could provide the redundancy necessary to guarantee a satisfactory level of reliability, but will members be willing to absorb additional costs to receive it? This is another example of the services cooperatives could offer under the EaaS model.

Call to Action:

- Identify the proper channels to communicate with members who are experiencing reliability issues.
- Evaluate opportunities to partner with members to increase reliability measures (Rebate programs for specific technology, Load management programs, etc.).
- Evaluate and implement, if feasible, technology that will assist with reliability.
- Evaluate existing routine maintenance plans to make sure they are adequate.
- Are members willing to pay a premium for increased reliability? Does the cooperative need to offer different levels of reliability plans?
- Determine how data can be used to improve reliability.

The New Rise of Aggregation

Aggregation incorporates four D's of utility distribution: distributed, decarbonization, digitized, and democratized. The distributed model will increasingly use decentralized generation sources spread throughout the network. Aggregating these decentralized or distributed energy resources (DER) may increase their value and improve the economics around integration and system control.

Many members, policymakers, and regulators want decarbonization. The decreasing costs of renewables, coupled with increasing societal preference for green generation resources will lead members (and other stakeholders) to demand their cooperative do more. Aggregation of renewable energy projects and the use of blockchain-enabled transactive energy platforms will allow new entrants into the renewable energy credits (RECs) markets and may one day lead to a local transactive energy platform where members are buying and selling locally produced renewable generation.

Increasing technological capabilities and decreasing technology costs may create a digital twin of nearly every asset on the electric grid. This large-scale digitization, coupled with the internet of things (IoT), may create a level of communications that could make grid operation more autonomous. Blockchain technologies, data storage and cloud computing will be needed to aggregate resources on this digitized grid to maximize value and reduce waste.

While cooperatives have always had democratic member control, increasing member choices today (even in a fully regulated market) are promoting a new kind of democratization. Members are self-generating or controlling their load and asking more from their cooperative. Members already have an ability to sell their excess electricity back to their cooperative and many want their cooperative to help them be part of an aggregation program that would allow participation in the energy supply chain.

Distribution Energy Resources Aggregation

Utilities have aggregated demand response at the C&I level for years but these programs do not have the flexibility grid operators need today. States like New York, Pennsylvania, and California are looking at ways to manage today's dynamic grid and rising levels of various renewables. Aggregating these distributed energy resources could do more than manage peaks, it could also aid distribution utilities in managing voltage and frequency fluctuations, shifting loads and over-generation. This type of DER aggregation will require more communications, controls, knowledge and integration.

Blockchain and Transactive Energy[32]

Blockchain, the technology that underpins cryptocurrency transactions, is being used to match clean-energy buyers and sellers.[33] An example of this transactive energy platform is being

[32] https://www.greentechmedia.com/articles/read/a-how-to-guide-for-transactive-energy#gs.4wdo7y
[33] https://www.gridwiseac.org/about/transactive_energy.aspx

piloted at PJM, using a digital ledger system to track capacity generated from wind and solar power plants as it's produced, delivered, traded and sold. Designed to manage the creation and trading of renewable energy credits, the platform should enhance a smaller users' ability to participate in trading and may reduce administrative costs.[34]

Blockchain can create a transactive energy marketplace that puts buyers and sellers together more effectively, but it relies heavily on data and analytics. Some start-ups and third party service providers are developing technology solutions to help consumers reduce risk and create a portfolio of renewable energy or other utility services. Data analytics can ultimately lead to a decentralized network that allows peer-to-peer energy transactions in a connected community.[35]

The Arizona Corporation Commission recently opened the nation's first docket on transactive energy.[36] The Commission expects the docket to address the IoT, cybersecurity, utility accounting, tracking renewable energy credits and applications for distributed ledger technologies on the grid. The PUC of Nevada opened a narrower docket on transactive energy in March of 2019 that focuses on alternative methods of tracking RECs.[37]

Community Choice Aggregation

One third of California's investor-owned utility customers get their electricity from community choice aggregators (CCAs), with the number expected to grow exponentially by the mid-2020s.[38] The number of CCAs also are increasing in Illinois, Massachusetts, New Jersey, New York, Ohio and Rhode Island. Originally set up to cure a problem with deregulation, CCAs allow residential consumers to aggregate through their city or county to negotiate a better rate from a retail provider. While cost was the original driver, the new push is coming from a desire to meet environmental goals and bolstered by consumer advocate support for local decision-making. CCAs are governed by a city council or county commission (or a separate board) and still use utility infrastructure including poles, wires, billing and state/federal mandated programs (ex. efficiency). The success of the programs often comes down to the infrastructure fee the CCA members need to pay, called the power charge indifference adjustment (PCIA) in California.[39] Legislation to allow CCAs is being discussed in Connecticut, Maryland, New Mexico, Oregon, Arizona, Colorado, Nevada, Washington State and New Hampshire.

FERC DER Aggregation

The Federal Energy Regulatory Commission has issued a final rule requiring regional transmission organizations (RTOs) and independent system operators (ISOs) to enable storage resources, including those connected to distribution systems or behind the meter, to allow

---

[34] https://www.nist.gov/engineering-laboratory/smart-grid/transactive-energy-overview
[35] https://www.sciencedirect.com/science/article/pii/S1876610217308007
[36] https://www.utilitydive.com/news/arizona-regulators-open-first-us-transactive-energy-docket/527900/
[37] https://www.utilitydive.com/news/blockchain-could-help-modernize-nevadas-renewables-tracking-system/551643/
[38] https://www.energy.ca.gov/releases/2017_releases/2017-04-11_Retail_Choice_En_Banc_ma.pdf
[39]http://www.cpuc.ca.gov/uploadedfiles/cpuc_public_website/content/news_room/fact_sheets/english/pciafactsheet010917.pdf

participation in the wholesale market. FERC has also proposed the same approach for all aggregated distributed energy resources (DER). The DER proposal gives FERC the last word over how distributed resources are integrated into wholesale markets. It also hands FERC the final opinion in the regulation of significant aspects of retail electric service, distribution service, and efforts by co-ops and other local utilities to plan and operate their systems for the benefit of all consumers.

Call to Action:

- Driven by consumer choice, co-op members may wish to join aggregate similar groups and will look to the cooperative to be a facilitator.
- With the rise of third party service providers and program offerings, there will be others who are interested in delivering value to members if the cooperative is not interested or willing to offer the service.
- Cooperatives may choose to develop strategic partnerships with third party service providers or create a joint service provider with other distribution local cooperatives, G&T or statewide association.
- Cooperatives should be ready, willing and able to put member groups together for the joint purpose of providing that group the distribution system participation they desire (such as energy or capacity procurement).
- Cooperatives need to understand the attraction and effectiveness of CCAs or other aggregators in markets where they currently operate.[40]
- Cooperatives should also consider how they could compete with CCAs or other aggregators and should authorize language allowing their creation in their state.[41]

[40] http://leanenergyus.org/
[41] https://www.utilitydive.com/news/as-california-customer-choice-expands-are-reliability-and-affordability-at/526906/

Data Analytics and Artificial Intelligence

Data analytics are increasingly important for electric cooperatives—so much so that they warrant their own business unit within the cooperative now and in the future. During the past 20 years, electric utilities found it necessary to collect, organize, analyze and act on increasing amounts of data ("big data"). This began with wide deployment of automatic meter reading (AMR), which was used to collect aggregated energy consumption, and in some cases, demand for billing purposes. This was followed by the advent of advanced metering infrastructure (AMI), which allowed real-time, on-demand communication with smart meters. AMI systems can be used to verify power outages and service restoration, perform remote-service disconnects and reconnects, facilitate prepaid metering, allow automated net metering, transmit demand-response and load-management messages, measure power quality (e.g., voltage, current, phase angle, blinks, surges), interrogate and control distribution-automation equipment and DER. Subject to the AMI system bandwidth, some or all of this data can be provided in real time or near real time.

Data analytics have become even more important due to rapidly growing deployment of distributed energy resources (DER), made up of energy sources, energy storage devices and energy management systems on both the cooperatives' and the consumers' sides of the meter. This is because DER increases the complexity of planning, operating, and managing an electric distribution system. This requires cooperatives to obtain, analyze and act upon even more data, and do much of that in real time or near real time. Doing so successfully is necessary to maintain reliability, safety, security, economy, and service quality. If properly managed, data analytics can bring many benefits to both the cooperative and to its members.

The magnitude, resolution and frequency of collected data will ultimately dictate that the data analytics and corresponding actions be performed automatically by intelligent machines, likely involving artificial intelligence.

The growing importance of data analytics as well as the specialized facilities, equipment, skills, required activities and applications across all business units in the cooperative, warrant consideration for having data analytics become its own business unit, rather than an adjunct to one of the cooperative's other business units.

Call to Action:

- Cooperatives should consider taking an inventory of all data sources and consider how such data could be used for the benefit of cooperative members.
- Cooperatives should consider training or hiring data evaluation resources in order to better utilize the data and to improve the operations of the cooperative.
- Data organizations (SEDC, NISC, and Daffron) should work with their cooperatives to enable better access to data, as well as provide tools that help manage data.

Preparing for Industry Shifts as a DSO – Implementing and Establishing the New Energy Innovation

All electric distribution cooperatives operate similarly, but many have different organizational structures. Regardless of structure, there are areas that may need to change before the organization can function as DSO and successfully adapt to the industry's changing dynamics. Cooperatives who choose to make those adjustments will be implementing and establishing the new **Energy Innovation**. A brief summary of each business unit covered in this review is listed below. For each item, cooperative challenges will be presented. Following this summary section, a much more detailed discussion of all business units will be presented.

1. **Finance & Accounting**—When a cooperative looks at the DSO and EaaS models, the committee believes the Finance and Accounting department will need to modify or change its approach to many functions, although core functions will still continue. However, the methods by which the Finance and Accounting department collects and categorizes its information may require significant changes to meet the future needs of the cooperative.
2. **Billing & Collections**—The rise of e-commerce has influenced member expectations for billing—from how a bill is presented to them, whether the content it contains is easy to interpret and whether the cooperative is providing enough convenience and options for paying their bill.
3. **Data Analytics**— Data analytics will open up limitless possibilities for the DSO of the future.
4. **Data Communications**—For the future cooperative to grow and prosper as a DSO, there must be a recognition of the need for and implementation of advanced communications.
5. **Communications & Marketing**—In order for cooperatives to be successful, it is imperative that they acknowledge that once standard communications and marketing strategies will need a significant shift in focus and priority.
6. **Energy Services**—Cooperatives need to be proactive and offer services that assist members in evaluating, investing, installation and maintenance of new technologies.
7. **Engineering & Planning**—The P&E department can help shape how the industry shifts affects the cooperative. This department will be forced to "think outside the box" and look for solutions in areas beyond the substation yard and outside distribution lines.
8. **Information Technology**—In an age of around the clock social media, the Internet of Things, instant convenience, and constant information, IT will continue to play a key role in the evolution of the cooperative.
9. **Human Resources**—HR will have traditional objectives, but will need to continue to develop new strategies to attract and retain top talent.
10. **Member Services & Key Accounts**— Member expectations are shifting and member services and key accounts will need a different "toolbox" and skills than they did just a few years ago.
11. **Operations**—Operations crews will not only need to have a thorough understanding of line work, they also will need to understand the technologies that will be used to make their jobs more efficient and safe. They will also need to have an understanding of DERs and how their job is affected by their deployment.

12. **Power Supply**—No one doubts that the traditional utility environment is changing and is being disrupted by new technologies. Technologies that enable the prosumer are impacting the cooperatives traditional approach to power supply.
13. **Procurement**—The electric utility industry is becoming increasingly complex. Digitization and the proliferation of internet-connected devices throughout the utility system and behind-the-meter are fundamental forces driving this change and complexity. This will present electric cooperatives with new business risks, as well as opportunities, in procurement practices and across supply chains.
14. **Safety—** Safety has to be embedded in all employees' thoughts, concerns, work practices and daily routines and a thorough safety culture must be developed and maintained.
15. **Tech Services**—Tech services have the unique ability to not only improve the efficiency of cooperative systems, but also to simultaneously improve the lives of the members and communities cooperatives serve.
16. **Strategic Leadership**—It is vital that strategic discussion and coordination between boards of directors and general managers occur at electric cooperatives across the country. Strategic planning, discussion and development of new industry initiatives should also be occurring between the electric distribution cooperatives and their associations.

BUSINESS UNITS – CHALLENGES

Finance & Accounting

As member-driven industry shifts occur, cooperative finance and accounting personnel must be prepared to meet the needs and diversified expectations of all classes of stakeholders. Changes to the way energy is delivered and consumed, as well as the introduction of new product and service offerings, will likely influence how financial information is collected and presented. Rate design and billing systems will have to accommodate myriad volumetric and flat fee transaction types, prompting the necessity to closely monitor the proper allocation of costs and margins. Budgets and financial forecasts must adapt and provide cooperative boards of directors and executive management teams with critical information needed for critical decision-making.

More than ever, a finance and accounting staff will need to be engaged with the cooperative network. Cooperative associations, lenders, auditors and vendors need to work together. There is great value in sharing knowledge and best practices that occur as natural byproducts within the cooperative network. This is a strength that will be vitally important as cooperatives tackle the challenges and opportunities facing our industry.

Challenges:

- Utility accounting is still necessary – may be some new ways of doing things in accounting and finance
- Electric Cost of Service study may not be applicable to developing new rates for new services
- Business plans, exit strategies, cost accounting strategies – all important in the new era of services
- Work to ensure no subsidization by electric – not as simple as it seems - new options not impacting electric rates
- Ability to account for energy, capacity, etc. in the DSO world with different markets and different providers (wholesale, retail, consumer (prosumer))
- Financing challenges – some may finance some ventures, others may not
- New types of accounting personnel may be needed

Billing & Collections

As cooperatives begin to offer more behind-the meter retail services to members, billing systems must be capable of billing multiple products on both a fixed and variable schedule basis. From an electric cooperative's perspective, there are typically two options that could make such changes possible. The first is to use a cooperative's in-house electric billing system. The second is to use a third-party billing provider, either in-house or outsourced. In addition to making sure

a robust billing system is in place to accommodate various product and service offerings, decisions will need to be made regarding personnel and processes. Assuming the billing system allows as much automation as is needed, a cooperative will still need to determine if additional employees are required in the billing department. Beyond all of these things, a cooperative needs a billing system robust enough to ensure accuracy and provide flexibility.

Challenges:

- Billing complexity is a major concern – markets, distributed generation
- Billing rates for various products and services
- Billing multiple lines versus separate bills
- Collections priority on multiple lines – which gets paid first? Electric disconnection allowed for non-payment of other services?
- New ways to accept payment – following other options of other industries – i.e. Apple Pay
- Member Financing options – on-bill, third party, etc.
- Multiple billing methods for different services and platforms
- Systems integration – how to track everything and make sure data is accurate

Data Analytics

Utilities have always analyzed data to improve the operation of the electric grid and their processes. However, utilities today have access to exponentially greater amounts of complex data sets. Sources of these new data sets come from all parts of the electric distribution system, including transmission data, distribution data, meter data, asset data, and geographic information system (GIS) data. Once security issues have been addressed, big data collection in power systems suffers from three primary challenges: they can be incomplete in nature; they come from heterogeneous sources and therefore are difficult to merge and systems update or make data available at different intervals and rates. The biggest immediate impact will be the sheer volume of data a utility can access, integration of data with legacy systems and ownership of data. Data analytics allows the cooperative to offer a more dynamic range of rate structures and could facilitate a decentralized network that allows peer-to-peer energy transactions in a connected community, in addition to an overall improvement in customer engagement opportunities. Opportunities with AI will also abound, providing great detail and opportunities for both the utility and its consumers. With the industry moving forward and the natural progression of member expectations, the potential of data analytics will open limitless possibilities for cooperative.

Challenges:

- Most cooperatives do not have a business unit for data analytics

- A significant amount of data is being collected at utilities nationwide
- Data being collected has a significant value – but this value must be extracted from the data
- Smart Meter data has tremendous capabilities to aid in understanding the electric system – most cooperatives are not even scratching the surface
- Data collection will be a significant issue to ensure operations as a DSO are efficient
- Data personnel will be required to translate the data into actionable work
- Cooperative data systems will need to adjust to providing tools and access to data residing in their independent systems
- With significant data, AI can begin to provide opportunities for the cooperative

Data Communications

Advanced communications infrastructure must be part of today's future planning. A robust and scalable ecosystem of IP networks and data communications platforms will be necessary to accommodate the future distribution service operator's energy portfolio and physical grid structure. The convergence of artificial intelligence, IOT, and future grid technologies, along with advanced two-way metering infrastructure must be topics of strategic planning for the future cooperative. Government regulations regarding physical, cybersecurity and critical infrastructure will require any network communications to also be effectively secured against a variety of attacks. The architecture of future DSO cooperatives will require substantial collaboration between cooperatives, suppliers, technology providers, and members. For the future cooperative to grow and prosper as a DSO, there must be a recognition of the need for and the implementation of advanced communications.

Challenges:

- For cooperatives to operate in the future, data communications must be widespread and very reliable
- Data will be key, so it will need to be communicated near real time
- Due to a lack of communications in many rural areas, cooperatives may need to consider developing a high-capacity fiber network in order to facilitate the communications necessary
- Cybersecurity of data will be a necessity – cooperatives will need to develop staff for ensuring data security
- Will need to interface with many different technologies, data collection and integration will require resources that cooperatives may or may not have today

Communications & Marketing

Communications and marketing will continue to be paramount for cooperatives to navigate successfully with the evolution of energy innovation. While the majority of cooperatives have evolved and strengthened their communications efforts over the last decade to meet the resource needs of their respective memberships, shifts in consumer behavior, service expectations and reshaping within the retail sector will require an even greater expansion and advancement in the manner and methods in which cooperatives engage, communicate with and market their service offerings to members. With safe, reliable and affordable electric delivery being the emphasis for the first 75 or so years of the electric cooperative business model, cooperatives have enjoyed being, for the most part, the "Lone Ranger" when it comes to meeting member-consumer electricity needs. This obviously changed with the surge in distributed generation options, namely solar PV, in the last decade. Though many cooperatives were early advocates of their members jumping into the DG arena, there were—and still are—a significant number who have ignored this perceived threat or challenge to their legacy core business of distributing electricity. Of more concern, these respective cooperatives have missed the public relations and ember engagement opportunities DG activities could have provided for their organizations and memberships.

Consumer expectations are on a continuously accelerating ascent and they are in the driver's seat when it comes to reshaping how services and products are offered. The good news is cooperatives are already very well positioned to "win" their members over with new services and products. They just need to identify what the members' expectations are and how to take that information and shape it into their marketing efforts. To go along with that advantage over the current and future competitors is that most cooperatives have started a two-way relationship with their membership through surveys, social media, years and years of annual meetings, community outreach, and economic development activities. Now layered on top of those meaningful engagements is an almost unending stream of member-consumer data that has barely been evaluated. With ever changing member demographics, it is imperative for cooperatives to know rather than guess the attributes of the consumer-owners they serve—such marketing homework will most assuredly have been performed by retail competitors.

No matter what size a cooperative is, it cannot afford to leave anything on the table in respect to its communication and marketing outreach and engagement effort with members, nor in finding the means to determine where the cooperative is falling short in meeting member service expectations.

Challenges:

- Members will need to understand new services and offerings – the cooperative will need to be effective with these communications
- Sales will be important – cooperatives are not generally good at this
- Communications over multiple media will be required – co-op magazines are not the only way to communicate

- Social media is here to stay – cooperatives need to ensure all source their members use are utilized
- Demographics is important – cooperatives should understand their demographics and market and communicate accordingly
- Employees need to be engaged and active participants in member education
- The cooperative network should be utilized – i.e. NRECA, Touchstone Energy, etc.

Energy Services

Today's energy services department must be capable of performing duties and responsibilities that do not end at the source side of the meter, and that are more often focused on the member's side of the meter. Being able to serve in such a dual capacity not only makes an energy services department unique among other cooperative departments, but also an asset to the cooperative and to the membership. In today's world, cooperative members' expectations are being shaped by companies such Amazon and Netflix, so it is critical for cooperatives to maintain their consumer centric focus by exploring opportunities for integrating new services into existing service portfolios.

Energy services team duties often include:

- Program development
- Demand Response (DR) asset management and operation
- Managing and administrating rebate programs
- Performing energy audits for commercial and residential members
- Evaluating member usage and troubleshooting high bill complaints
- Evaluating contract proposals and educating members on distributed energy resources

Many cooperatives across the country are experiencing cultural shifts and changing membership demographics, which includes both younger members and members who have never received service from an electric cooperative and who don't immediately perceive the difference, the value or the nuances between being a member-owner rather than a customer. Further, younger members want data transparency and more options. They also want to be empowered with the option to choose different rates, services and products. In addition, a growing number of consumers today expect their service provider to place a greater emphasis on social responsibility and in providing solutions to environmental concerns. These cultural shifts are evident in the increasing interest in residential DER and EV. Rather than being resistant to such changes, cooperatives must be willing to evolve and adapt to the changing needs and interests of their memberships, and discover ways to participate with consumers in those interests on a retail level.

Challenges:

- Members need a go-to for information concerning conservation, energy efficiency, demand response, distributed generation and energy storage - (DERs) – cooperatives must meet this need
- Members will expect the cooperative to provide these services, and if it doesn't someone else will
- Energy services employees need to be up to date on services and offerings in order to assist members – different skill sets and training required
- Members will expect services for solar, home automation, EV charging and support, just to name a few – the cooperative has a great opportunity

Engineering & Planning

Cooperative planning and engineering departments are going to have to get comfortable with change as the conventional distribution grid and its associated electrical model evolves. And the challenges that come from that evolution will stem from a shift away from a centralized power flow model to a more distributed, two-way power flow mode, which mandates increasing numbers of high-speed communication devices attached to equipment on the distribution system and behind the meter, as well as the massive amounts of granular data that will be made available from these devices and the associated data analytics required to take advantage of that data. Going through such an evolution inherently represents a reversal of the way utilities will plan and design the future distribution system, including training employees to ensure safety first for workers and members. New technologies are also emerging that challenge traditional planning and design processes and solutions. A shift in traditional methodology and thinking needs to occur to maximize cost savings for the utility in the future. Ideally, modern systems will establish the GIS model as the data center with integrations to other systems such as AMI, and ensure the model is continuously updated so that the most accurate models are utilized for all utility functions. The utility of the future will require a new generation of worker who has a cross-disciplinary skillset, with the capability of overseeing a power grid that incorporates power engineering, cybersecurity, data analytics and communication networks. For planning and engineering employees who enthusiastically embrace every challenge the future holds, exciting changes to the traditional methods and tools are coming.

Challenges:

- Detailed load flow modeling – shifting to real-time analysis
- Engineering models and planning for multitude of DERs – need to support multiple sources and those be an active part of the system model
- GIS needs to be more accurate and capable than ever before
- Systems and personnel integration across systems and departments critical

- Preparing on better O&M and maintenance with future tools and technologies (AI, drones, high speed communications, new AMI meters)
- Must ensure personnel are trained and kept up-to-date on new methods, technologies and potential procedures
- Focus on reliability and availability

Information Technology

The growth of information technology (IT) has accelerated perhaps faster than any other area of the cooperative business in recent years. For most electric cooperatives, much of what accounted for IT activity and investment 10-15 years ago was a server-based customer information/general accounting system and a personal computer-based local network. From both internal demand for new platforms and an exponential escalation of consumer expectations for member-facing products, demands on electric cooperatives to purchase and implement hardware and software and train employees, consultants, and members on these systems has dramatically increased. In an age of around the clock social media, the Internet of Things, and instant convenience and constant information, IT will play a key role in EaaS, which will put pressure on budgets, connectivity, cloud based solutions, security issues and personnel.

Challenges:

- Uptime and reliability of internal networks is paramount – with a connected utility – it is imperative the network is always operational
- Security is imperative – threats will continue to occur and change – must stay on top of this in all ways possible
- Data storage and availability – need to be prepared for large amounts of data and have equipment that can process such for employees as necessary
- Need to have strong access to the internet – prepared for future remote work force as needed
- Cloud computing may bring benefits to the cooperative
- NERC CIP requirements could affect distribution cooperatives long-term

Human Resources

Human Resources serves as a strategic business partner to leadership by providing guidance, coaching and direction regarding personnel matters, organizational development and design positive employee relations. Human resources will be tasked with developing, promoting, and maintaining a human resource strategy that is aligned with the business strategy and corporate values of the cooperative. This department will establish guidance and direction regarding human

capital and talent management to maximize the cooperative's overall effectiveness while providing both long-and short-term information and recommendations for resource planning. Human resources researches, designs, develops and plans programs for recruitment, employee development, performance management, compensation, benefits, retirement and total rewards. This iterative process is undertaken to attract, retain, engage, and develop talent on a continuous basis.

According to a recent Gallup report, 21% of millennials have switched their job within the last year and this is three times the number of non-millennials. Many millennials are not engaged at work and this statistic leads all other generations. In comparison, past generations of cooperative employees have made many personal and family sacrifices to ensure that the cooperative is successful in its mission of providing exceptional service to a cooperative's membership. Because of those clear generational differences, employee cultures and expectations are changing. For example, today it is still not uncommon for many veteran cooperative employees to have been professionally engaged with a cooperative for decades. As cited in the above comparison, this trend will most likely not continue since millennials are expected to comprise 75% of the workforce by 2025.

To offset these cultural and generational gaps and shifts, resources will need to be adaptive in order to be competitive in the recruitment and retention of future talent pools.

Challenges:

- Attracting and retaining employees is difficult and will likely become even more challenging
- Culture of openness and transparency is important
- All employee ideas are important and should be considered
- Develop and maintain pipeline of interns
- Promote and encourage diversity in the workforce
- Competitive wages and benefits are imperative – must continually evaluate this
- Keep employees engaged and informed on issues at and outside of the cooperative
- Utilize technology to assist in the hiring process

Member Services & Key Accounts

Employees who serve in the member services department have traditionally served as front-line communicators for cooperatives—responding to members over the phone, in-person, or via email. Since member service representatives are the first cooperative representative that members meet in most cases, members form their first and most lasting impression of the cooperative from that initial personal interaction. So, it is vitally important for MSRs to be

representative of the cooperative's service culture, and to be able to portray their professional pride in having an important role in it.

Key account representatives serve a similar role as member service representative, but are they are the individual point of contact and liaison for commercial and industrial (C&I) members with usage above a specific threshold, or who have unique business circumstances. Key account representatives should understand the complex and unique needs of each of their accounts and the need to be able to communicate on a multitude of issues, including reliability and economic ramifications. Essentially, key account representatives need to build and foster positive relationships with commercial and industrial accounts.

Member expectations are shifting, and member services and key accounts will need a different "toolbox" and skillset than they did just a few years ago to meet those expectations adequately. For instance, having the ability to write concisely and provide accurate and pertinent information in a professional manner via online correspondence is a different skillset than communicating the same information by phone. MSRs should be able to use new technology such as chat functionality (written communication), and they should be able to multitask and navigate across different applications (CIS, MDM, outage system, payment system, call holding applications, etc.) simultaneously.

When we look at the DSO of the future, the member service representative will play key role in the success of the cooperative, just as they do today. However, as the cooperative begins to shift to an energy service provider structure, member service employees will need to develop a different set of member interaction skills that are weighted more heavily toward product marketing. Each conversation should be viewed as an opportunity to provide a retail solution that works for the member, which means the member service employee will need to become more sales oriented. As new services and programs are developed, it will be the responsibility of the member service employees to promote/market/sell these services to the membership.

Challenges:

- Member expectations are changing continually – must keep up with these changes and be prepared to discuss
- MSR education is imperative
- MSRs will need to shift to frontline sales representatives
- Key accounts representatives need to be proactive and understand their accounts versus the opportunities provided by the cooperative
- Proactive communications tools will be needed across all methods of communication
- Member support technology will need to continue to expand

Operations

No matter the size of the cooperative, operations personnel typically construct, operate, and maintain most of the electric infrastructure within a cooperative's distribution system. In performing that work, line personnel must be highly skilled and trained in all areas associated with the construction of new services, retirement and replacement of aging overhead and underground infrastructure such as poles, wire, transformers, power restoration response, trimming and cutting vegetation, as well as operating and maintaining distribution substations in some cases. Naturally, employees should have a proven knowledge of RUS specifications, National Electric Safety Code, OSHA regulations and safe working practices.

A variety of technological advancements will further aid operations personnel in the future, giving them more information in real time and improving their ability to work more efficiently and safely. These advancements include a more refined analysis of the current state of the electric grid; the installation of cooperative-owned or member-owned behind-the-meter distributed energy resources; and technological advancements in the tools and practices utilized by cooperative line personnel.

These industry shifts and enhancements will require a cooperative to stay informed about new technologies as they emerge so they can be considered for field testing, as well as for budgetary consideration and implementation as a new field resource. Improvements in SCADA, mapping technologies, line tools, sectionalizing equipment and training will help improve the overall safety and efficiency of a cooperative's operations in the future. These improvements will play a critical role in improving the overall efficiency and effectiveness of a cooperative's operations; and more importantly, they will help ensure that employees have the tools and training they need to accomplish their work safely every day.

Challenges:

- Reliability and availability are expected – need to set goals and work to meet goals
- Need to utilize technology to improve operations and maintenance
- Be prepared for local generation as opposed to only central generation
- Utilize new data sources to improve operations and maintenance
- Dispatchers are no longer just dispatchers – shifting to system operators
- Safety is imperative – must develop and maintain an active safety culture
- Personnel – need to hire and develop the best possible – this is difficult
- Training – need a robust training program

Power Supply

Power supply is a key area and an asset for cooperatives in assessing and managing wholesale power costs, peak and load forecasts, as well as analyzing the potential for emerging alternative power resources. Power supply plays an even more critical role when DERs and DSOs are implemented. Traditional power supply functions in the cooperative business model (supply chain for electric delivery) includes:

- Wholesale power supply planning, procurement/construction, operations, administration and transmission planning, construction and operation
- Distribution power supply planning, work plans, procurement, operations and delivery

Deregulation or reregulation of the wholesale power market, environmental concerns and technological advances are all factors that cause disruption within the traditional electric utility model. Some of those advances that have become fixtures in the market today include rooftop solar, community solar, electric vehicles (EV), and each relate to activities behind the meter and provide both consumers and distribution utilities the means to produce power without a wholesale power generator's assistance.

Electric cooperatives were established to bring affordable electric service to rural America. And while that founding charge will never change, the range of services and the method in which they are delivered to member-consumers will need to shift to accommodate changing consumer service expectations and service interests. One such example of the shift in service perspectives would be enabling member-consumers to choose the type of electric service they prefer to receive, whether that is providing the delivery of electricity or providing programs that make DER technologies affordable.

In preparation for the developing impact of DERs behind the wholesale meter as well as the retail meter, G&Ts and distribution cooperatives must be able to agree that change is necessary and that a different set of tools and technology, training and education resources are needed to help employees become proficient in providing solutions to changing consumer needs—even if existing resources move from one cooperative to the next. Most of all, there must be a willingness to change the business model throughout the entire electric delivery supply chain. Distribution and G&T cooperatives both must understand the ultimate purpose for those solutions and the larger implications for not making them a reality.

Challenges:

- DERs and prosumers will affect the traditional G&T-Distribution Co-op relationship at some point – the G&T should get in front of this as much as possible and prepare
- G&T's should work with the distribution cooperatives to allow flexibility to meet distribution co-op member needs
- The best case would be for the G&T and Dist Co-op work together to plan and develop strategies on power supply in this new paradigm – need for DERMS

- Fixed, long-term assets will be more difficult to deploy – further, many members are opting for low-cost renewables
- Need to figure out cost issues with declining load
- New rate structures will be needed to fairly allocate cost

Procurement

The electric utility industry is becoming increasingly complex. Digitization and the proliferation of internet-connected devices throughout the utility system and behind-the-meter are fundamental forces driving this change and complexity. This will present electric cooperatives with new business risks as well as opportunities associated with procurement practices and supply chains.

Supply chains are being disrupted by new market entrants and technologies. Potential risks include: cybersecurity challenges, procurement of new and untested technology and the risks associated with untested vendors. While there may be risks associated with cybersecurity, disruptive technologies and untested vendors, digitization also holds great promise for improving procurement and supply chain efficiencies, which can lead to lower overall costs.

Challenges:

- New business opportunities and new services will require new flexibility and agility by procurement staff
- New vendors will be involved – new relationships with unknowns and risks
- Many new products are short shelf life items – lean inventory and turns are important
- Need to ensure technology is integrated into procurement to assist with inventory management (RFID)
- Inventory security and tracking is important – many opportunities for failure
- Cooperation amongst vendors, manufacturers and other utilities necessary

Safety

Safety is the foundation for electric cooperatives across the country. From the first day on the job until the last day on the job, and during personal time, every cooperative employee must possess the competencies to actively mitigate hazards in their daily tasks. Safety is practiced at a cooperative in many ways, but if a true safety culture is ever going to be fully developed and successful, it must start with the leadership, and it must be truly embraced by the employees. As we look forward and identify industry shifts, cooperatives must remain vigilant in ensuring that safety remains the backbone of their operation.

Forward thinking in safety places a cooperative in the best position to handle industry shifts, and also helps a cooperative better prepare for how those shifts will influence proven safety procedures, or what additional safety considerations and resources may need to be made and implemented.

Safety must be more than a program at the cooperative and it must be a part of the culture. When safety is embedded in all employees' thoughts, concerns, and work practices, it becomes a part of their daily routine, but also an important employee character trait. With the significant amount of change that is coming to our industry, and we need to be nimble to allow adjustment in our safety practices. Having a proven safety culture at our cooperatives demonstrates to our employees, our members and the general public that there isn't anything we do at cooperatives that has a greater priority.

Challenges:

- Safety has to be #1 at the cooperative – must have a safety culture
- Laws, rules, procedures continue to change – must have dedicated staff to ensure cooperative is meeting expectations
- Personnel have to be well-connected to the safety industry
- Continual training and preparedness is imperative for safety success
- Understanding how DERs are implemented on the electric system is of key importance
- Safety impacts related to a connected and remotely operable distribution system
- Safety will shift to include member premise

Tech Services

Technical services have played an essential role in the cooperative structure from the very beginning. Although the purpose of technical services was small, in comparison to today, the metering of electric usage was most vital for the REA and the formation of rural electric cooperatives. Measurement of electrical usage has come a long way since Edison's electrolytic meter of 1881, which measured the change in weight of a strip of copper to find the electric usage. Electric metering would then be the first technical service. Advancements over the next century in the areas of metering, data acquisition, data communication, and power generation would bring the technical services of today.

Cooperatives must not stand idly by while the technology and equipment employed today become obsolete. The future is already here. Learning to adapt is imperative because cooperatives have the unique ability to not only improve the efficiency of their systems, but simultaneously improve the lives of the members and communities we serve. By accomplishing this goal, cooperatives can effectively implement, and utilize the tools that are available today and make plans to become the (Distribution System Operator) DSO cooperatives of tomorrow.

Challenges:

- Need an AMI system that has the functionality to meet member expectations – whatever those may be
- Metering must be reliable and available – always on, and near real time communications
- Metering must have capability to deal with wide range of DER technologies
- Smart grid technology provides the opportunity for cooperatives to ensure reliability and availability of the distribution system
- Personnel training, skills, technical capabilities are important and continually expanding

Strategic Leadership

Strategic leadership should be provided at a cooperative through joint discussion and development between the cooperative's board of directors (board) and the General Manager/Chief Executive Officer (GM/CEO). With clear signals that significant industry change is coming, it is imperative that this coordination occur at electric cooperatives across the country. Further, related discussions and development should also be occurring between the electric distribution cooperatives and their regional associations, as well as with their Generation and Transmission Cooperative (G&T), their data cooperative, their statewide association, their financial support organizations, their national association and other related business partners.

Industry shifts that are looming will affect cooperatives in many ways—forcing change that many cooperatives may not be preparing to accommodate. The mere fact these changes are coming will require more strategic planning than ever before. Cooperatives need to try to understand what their members perceive about these shifts and determine how their cooperatives could likely provide solutions to them instead of forfeiting a potential member service offering to other for-profit enterprises who will never have a cooperative members' best interest in mind. Simply put, without strategic planning and member input, how can cooperatives ensure they are meeting and exceeding member expectations?

Implementing strategic planning will require that cooperatives begin to think longer-term to identify trends and potential business risks. In addition, future planning requires a skill set that goes beyond routine management and oversight of the electric distribution system. Some cooperatives may not have sought employees who possess strategic planning skill sets—those who may have an eye and the instinct for spotting and assessing future opportunities and risks. Development of a strategic leadership team can help provide a larger scope of assessments, and with the expertise that comes from experience in different disciplines. Further, cooperatives will need strategic thinkers that understand technology shifts and their potential implications for the business. Finally, developing strategic leadership within an organization should be considered as a way to empower employees throughout the organization and across generational lines—ensuring a cooperative is considering a variety of perspectives when planning and making

decisions that will likely not only be far-reaching, but that will better position a cooperative to seize every opportunity that stands to benefit its members and their changing service expectations.

Challenges:

- GM/CEO's should be strategic leaders of their organizations
- The GM/CEO should work closely with the board in establishing strategic direction and decisions
- The GM/CEO should ensure the organization has the necessary staff to meet the strategic direction of the cooperative – will continually need to review the organization and personnel of the cooperative
- Consider board diversity where opportunities exist
- Cooperation among cooperatives
- Member input is critical (to GM/CEO and board)
- Staff and board succession management is key

BUSINESS UNITS - DETAILED

Accounting & Finance

Cooperatives today have well-established finance and accounting (F&A) departments. Standardized procedures and practices have been in place for several years across the industry. Accounting standards such as GAAP and the RUS/FERC system of accounts guide how cooperatives manage and report financial data to regulatory and financial institutions. While no cooperative is identically organized or structured, the essential functions such as accounts receivable (AR), accounts payable (AP), cash management and payroll are managed through either cooperative employees or by outsourced means. The level of sophistication beyond the basics will vary depending on the size of the cooperative and/or the personnel in place. The F&A department may be headed by an office manager with a bookkeeping background or by a chief financial officer (CFO) that may have an advanced degree and be a certified public accountant (CPA).

The F&A department may be directly responsible or support a number of other functions within the cooperative. Among those are:

a. Rates and rate support: Finance and accounting is integral in providing information to the cooperative's cost of service study, whether done internally or by an outside consultant. The department also may be responsible for determining whether rates and rate classes are providing the required or estimated revenue so that management can know when to recommend adjustments.

b. Financial Forecast: A financial forecast is an important tool to help the Board and management make short and long-term decisions. A forecast uses historical data and accepted assumptions to project the future financial condition of the cooperative for a number of years (typically between five and ten). Forecasts are helpful for estimating the impact of such things as major capital expenditures (e.g. AMI project), capital credit retirements, interest rate changes, growth or loss of load, changes in power cost, and electric rate changes, to name a few. In addition to being an important management tool, forecasts are also normally required by lenders to determine the cooperative's ability to borrow and repay its debt obligations.

c. Treasury: Finance and accounting is responsible for managing the availability of cash for operating expenses and capital expenditures. The two primary sources of cash are electric rates and debt. A construction work plan (CWP) documents the planned capital expenditures for the next two to four years (typically), and the CWP is used as a basis for financing decisions. Other factors that influence financing decisions include equity level requirements/preferences, interest rates, debt type (fixed, variable, bonds) and loan covenant coverage ratios (TIER, DSC, etc.).

d. Tax rules and tax law: Finance and accounting works closely with the cooperative's outside auditors and general counsel to understand the ramifications of business

decisions. Cooperatives enjoy an IRS tax-exempt status that can be endangered by violating the "85/15" rule. No more than 15 percent of the cooperative's income can come from non-operating sources, or the cooperative may lose its tax-exempt status. Finance and accounting must be vigilant to know which income sources are non-operating, and notify management when non-operating income may exceed 15%. The cooperative's general counsel, outside auditors and, potentially, tax counsel may need to be engaged to help make determinations in this area.

When a cooperative looks at the DSO or EaaS model, the committee believes the F&A department will need to modify or change its approach to many of its functions. Core functions will still continue. However, how the finance and accounting department collects and categorizes its information could require a significant change to meet the future needs of the cooperative. For instance, the introduction of various programs, services or products will require more sophisticated planning, rate setting, cost analysis, billing and customer information systems, financial statement composition and presentation, and internal controls. If these changes do occur, cooperatives will need to look for employees with a background in cost-accounting or product costing to develop and track programs and products.

Traditional utility accounting practices will still apply for the poles and wires portion of the business. New or additional products and services will need to be looked at in a different manner. Economic or product life-cycle will guide depreciation and financing decisions rather than engineering life. The F&A department, along with product and program developers, will need to work together to determine the depreciable life for these products. Input from lenders and auditors will also play into the decision. Rate design for new products and services will be crucial in order to avoid adding more pressure on cash flows and margins. Financial forecasts will need to accommodate the additional complexity so that the Board and management can see the overall impact and plan accordingly.

As more products and services are offered, business plans will require more detail. Each product or service will need to stand on its own and have clearly defined costs and revenues assigned to it. The F&A department will need to develop and provide allocations of overhead and shared services costs to ensure there is no subsidization between products or from traditional core services. With each new venture, exit strategies need to be developed to ensure risk to the cooperative is properly mitigated.

Determining if any of the products and services will be provided through a subsidiary is a decision each cooperative will need to make. Many factors will play into the decision. For example, tax, finance, department staffing, technology, statutory and regulatory issues will all need to be considered.

Billing for new products and services may require changes such as bill design, bill frequency and could be impacted by cooperative policies and regulatory considerations. Does the cooperative want to offer combined billing for subsidiary or partnerships? Should it offer on-bill financing for costly products or services? Such decisions could impact the success or failure of programs.

While the DSO or EaaS model may enhance the service aspect of a cooperative's mission, the value aspect must also be considered when evaluating new opportunities. There is more to value than just electric rates. However, electric rates, and reliability, are what matter the most to a large percentage of any cooperative system's membership. Care should be taken to ensure that an unsuccessful new venture presents minimal risk of an electric rate increase.

Billing & Collections

As cooperatives begin to offer more retail services to members, the billing systems must be capable of billing multiple products on a fixed as well as a variable schedule basis. From an electric cooperative perspective, there are typically two options to achieve this. The first is to use the cooperatives in-house electric billing system. The second is to use a third-party billing provider, either in-house or outsourced.

When choosing a billing provider, the following benchmarks are typically critical. However, they may vary widely for different products and applications in a diverse cooperative market.

1. Easy for the member to understand
2. Messaging and member education options available
3. Simple for member service representatives or billing specialists to use the billing system software
4. Fixed price billing option available such as $30 per month
5. Variable price point option available such as xxx cents per kWh
6. Combination of fixed and variable pricing option available
7. System easily handles multiple product and billing structures
8. Flexibility to leverage and combine interval data from the meters and potentially other downstream devices (EV chargers, batteries, inverters, etc.) into the desired billing determinants
9. Ability to support on-bill financing options to improve the value proposition associated with providing DER products and services
10. Providing consumers with the ever-growing number of payment options, including the option of empowering Members to settle transactions across the grid between themselves
11. Accurate quality control and accuracy checks and balances
12. Account information available for inquiry or review on multiple platforms (apps, websites, smart phones, tablets, laptops or personal computers)
13. Paper, text, IVR, email, ACH and multiple billing and payment options available
14. Tracking of new program and support service calls – from start to finish
15. Integration with existing accounting systems

Due to differences in organizational structure, partnerships, legal constraints or regulatory obligations, some cooperatives may choose to use a separate billing system. Others may use the

electric billing system and include all products on one bill. In a case where one bill serves for multiple services, then the cooperative's billing system must have a capability to allocate payments equitably across all product lines in an underpayment situation.

Investigating and choosing an accurate and economical billing system is a critical component to exceeding our member expectations as cooperatives transition to multiple product offerings.

In addition to making sure a robust billing system is in place to accommodate various product and service offerings, decisions will need to be made regarding personnel and processes. Assuming the billing system allows for greater automation, the cooperative will still need to determine if additional employees are needed in the billing department. Whether or not separate bills are issued for each product or service could be a factor in personnel decisions. However, the sheer volume of additional work, along with the skill sets that will be required, may call for more employees. The same decision will need to be made for collections personnel.

Billing and collections processes will need to be reevaluated as well. New ventures may require new procedures (and timelines) to perform quality control before bills are issued to members. In addition, statutory and regulatory (or other) issues may influence how cooperatives respond in the event of nonpayment for products or services. Disconnecting electric service because payment for another service has not been received may or may not be permitted, or preferred.

Margin allocation is another topic that will need to be considered. There are a variety of ways to allocate margins for an electric cooperative – based on kWh usage, revenues, cost of service, etc. New products and services may not be calculated under the same basis, so the billing and customer information system will need to be capable of handling this. Margins may also come from non-members when the cooperative provides future services. This must be reviewed as to how the cooperative must handle with its articles, bylaws and policy. Changes may be required.

Data Analytics

The utility industry is now entering a golden age of data. Efforts by the government and utilities to modernize infrastructures are bearing fruit. Smart grids have become the new norm. The much-heralded Internet of Things (IoT) will make them even more extensive and ubiquitous. Over the past twenty years, electric utilities found it necessary to collect, organize, analyze and act upon increasing amounts of data ("big data"). This began with wide deployment of automatic meter reading (AMR) which was used to collect aggregated energy consumption, and in some cases demand, for billing purposes. This was followed by Advanced Metering Infrastructures (AMIs) which are generating real-time energy usage data as often as every 15 minutes (or more often in some cases). AMI systems can be used to verify power outages and service restoration, perform remote-service disconnects and reconnects, facilitate prepaid metering, allow automated net metering, transmit demand-response and load-management messages, measure power quality (e.g., voltage, current, phase angle, blinks, surges), interrogate and control distribution-automation equipment and DER. Subject to the AMI system bandwidth, some or all of this data can be provided in real time or near real time.

According to Accenture's report on *Realizing the Full Potential of Smart Metering*[5], 500 million smart meters are predicted to deploy in the developed world by 2020. The amount of data utilities will have access to will be overwhelmingly, thus it is commonly referred to as "Big data." Big data refers to data sets that are so large and complex they are not easily manipulated using the commonly available database tools.

Data analytics is not necessarily a new concept to the electric utility industry. Utilities have always analyzed data to improve the operation of the electric grid and their processes, however, utilities today have access to exponentially greater amount of complex data sets. Sources of these new data sets come from all parts of the electric distribution system[1]:

> Transmission data—Technologies such as phasor measurement units (PMUs) are bringing data at speeds of 30 to 60 times a second.
>
> Distribution data—Distribution automation device deployment is growing rapidly, bringing large amounts of data into the utility.
>
> Meter (customer consumption) data—Advanced metering infrastructure (AMI) and smart meters are bringing in more than 35,000 data points per year, based on 15-minute reading intervals per customer. In some cases, even more granular consumption data is available.
>
> Asset data—Utilities can bring large amounts of asset health data, in an economical way, into core systems such as asset health centers.
>
> Geographic information system (GIS) data—Utilities are using GIS to store and correlate their asset characteristics and location (global positioning system coordinates) along with connectivity and geospatial rendering.

While utilities have been collecting data in large volumes, many times those data sets are not fully utilized because they are vast and also come with a level of uncertainty. More data, however, does not necessarily mean better information, or more informed decisions. In fact, many are finding it difficult to use the data. A 2006 study from Koronis[4], reveals that more than 70% of generated data is never used, and suggests that bad data is worse than no data at all. In other cases, at a needed time, the right data is unavailable or in a different format which makes it difficult to analyze. This situation can be termed as "rich data and poor information". Today, big data is driving the decisions of utilities, but how do cooperatives extract information from large warehouses of data? The concept of "rich data and poor information" is being challenged by big data analytics with the advent of Artificial Intelligence (AI). There are many major obstacles to the development and implementation of big data analytics in electric power systems—namely, the lack of innovative use cases and application proposals that convert big data into valuable operational intelligence. As technological advancements like the Internet of Things (IoT) spawns even more data, big data analytics will play an important role for electric utilities.

One of this century's most important innovations is the emerging data analytics capabilities that are allowing utilities to use archived and real-time data to make systems more reliable, affordable and clean. Cost-effective electricity generation from variable renewables is allowing new clean transportation and other electrification initiatives to flourish. But they will make the resulting clean energy economy dependent on a burgeoning and complex power system. Automated data analytics can provide the granular, real-time situational awareness to effectively manage it. Beyond using big data analytics to examine these variables, it's possible to depend on AI to take a predictive approach to the metrics. Such a system may determine that renewable energy sources get used the most during certain hours of the day or that there are areas of a community associated with exceptionally high usage. Data analytics can be complemented with AI to ease the transition to a large renewable energy portfolio.

IoT and big data also brings data security and governance into the picture. The risk of failing to adhere to data privacy and data protection standards is a major concern. Historically, data security has not been much of an issue for utilities because the infrastructure was hard to access, and the potential rewards for hackers were low. The situation has changed as the industry was able to see after the Ukrainian power grid was hacked twice in 2016 and 2017 through the data collecting devices system operators need at control centers. In the future, as smart homes are connected to the transmission network via the distribution grid, it will be easier for hackers to access the power network. This means adequate cyber security measures are needed to combat cyber-attacks. Cyber security is a huge and evolving challenge for the bulk power system, complicated by the advent of big data.

After security issues have been addressed, big data collection in power systems suffer from three primary issues: they may be incomplete in nature; they come from heterogeneous sources and therefore are difficult to merge; and systems update or make their data available at different rates. Heterogeneity in power system data exists because the data was intended for a specific application and not collected for a holistic purpose. Traditional methods are not adequate for handling the large size and ultra-complex distributed data sets. To address the complexity, machine learning, statistics and optimization algorithms such as classification, clustering,

sampling, and linear/nonlinear optimization, algorithms need to be easily scalable. The magnitude, resolution, and frequency of this data will ultimately dictate that the data analytics and corresponding actions be performed automatically by intelligent machines, likely involving artificial intelligence.

The use cases for data analytics are wide-ranging and proliferating. Data analytics-based weather forecasting is prompting pre-hardening of systems against extreme weather events. Data analytics are delivering new services and savings to customers through utility-led energy efficiency programs that lower customer bills and decrease utilities' system costs. In addition, digital simulations are perfecting new hardware before it is installed. Data analytics are also creating significant savings from predictive maintenance. And perhaps the most immediate and fruitful use of data analytics is in the reduction of system losses. Electric cooperatives taking full advantage of AMI systems and distribution automation are realistically targeting system losses of 3% and below. Just as the widespread adoption of computerized spreadsheets in the 1990s unlocked new ways to understand and manipulate data, so can new data tools and analytical techniques that elevate utilities' understanding about their operations and customers. The first important step in unlocking that value is for utility executives to realize the current potential of analytics and experiment with the tools they already have.

Data analytics must be a critical tool in the utility's arsenal. However, for the utility industry, advanced analytics are still in the very early stages. Utilities need to define where the sources of value, are as well as what services and capabilities they want to provide to their customers, employees, regulators and shareholders.

Distribution utilities have installed millions of smart grid devices, creating an unprecedented amount of data available for analysis. The challenge is identifying how, when and where this information can be applied to improve utility operations. Analytics software can help fill this gap but getting started often presents challenges—from both an institutional and a data integration perspective. The biggest immediate impact will be the sheer volume of data a utility can access. There will be a significant number of connected devices at many different points of the utility system. IoT is one of the first markets where forecasts regularly get measured in trillions. It is predicted that IoT will deliver $1 trillion in economic value annually by 2022. UC Berkeley's Alberto Sangiovani-Vincenelli sees a world populated by 7 trillion sensors by 2025. While these forecasts might sound astronomical, they are also likely low. Likewise, the data generated by these devices will grow exponentially. A "smart" building generates on average 250 gigabytes (GB) of data per day. A single household smart meter can generate 400 megabytes (MB) a year. If you multiply that by the 135 million meters in the US it comes to 54 petabytes, or a little more than half of the data uploaded to YouTube a year. And that is for uploads every 15 minutes: if you read meter data every 30 or 60 seconds to better fine tune power forecasts, you're moving into the exabyte territory. Critics will say you can throw most of it away, but it's impossible to determine what data should get thrown away[2].

Access to this amount of data will prompt for new ways of implementing data analytics. The industry shifts to utilizing this data will also mean an increase of communication/broadband expenses. Whether you should solve problems at the cloud or edge will become one of the major challenges in the near term. Sending all of a utility's data to the cloud will not make much sense

in most cases. Going “all cloud” can increase latency or the risk of network outages. At the same time, the cloud will simplify advanced analytics by allowing engineers to spin up thousands of servers quickly. Many believe the ultimate and likely matchless value of the cloud will exist in “cloud computing”. Utilities will need to assess new process flows and computing architectures.

Another impact from the industry shift to more immersive data analytics that cooperatives must consider is the integration of new technologies with their existing legacy systems. A data center server has an average lifespan of three to seven years. Laptops are typically replaced on four-year lifecycles. By contrast, the average age of a transformer is around 40 years. To take full advantage of digital transformation, large power consumers and utilities will have to develop strategies that will effectively allow them to add IoT gateways and new sensors without ripping out their old networks.

Another significant impact on electric cooperatives will be determining the ownership of all this new data. Let’s say a utility has launched a program to optimize its operations by analyzing commercial and residential meter data. To further complicate the matter, imagine that some of the data comes from solar and storage systems deployed through power purchase agreements. Who owns what? The utility might claim it owns it all because it gets generated on its network. Solar providers might complain that they have an ownership stake in their portion and should be compensated for giving access to it. Meanwhile, the analytics vendor will argue that they own it because they turned the raw data into insight. In addition, do not expect consumers and businesses to stay out of the debate. They will also claim to have a stake, and rightly so. Perhaps we need to change the business model.

It is hard to identify to what extent the data analytics shift will impact cooperatives. What we do know is that cooperatives possess a great deal of knowledge and insight. Ultimately, that might be more valuable than electrons. A few specific examples of how data analytics can affect your cooperative would be through predictive asset management, asset utilization and identifying power-quality issues[1].

Predictive asset management—Power outages are prohibitively disruptive for customers and costly for utility companies to fix. Most major outages result from failure happening at the most inopportune moment. Data on equipment usage is present in a broad set of sources (AMI, supervisory control and data acquisition, distribution automation, and others). Using information effectively enables better prediction of equipment failures, resulting in lower cost and reduced customer outages.

Asset utilization—Smart meter data can be aggregated to reflect transformer loading, enabling utilities to compare usage to capacity and perform capacity utilization trend analysis. For example, the following questions can be answered: Which transformers are loaded beyond their electrical or thermal rating and for what duration? What percentage of time is a transformer operating within 10% of its peak rating? What is the minimum size replacement transformer for an aging transformer that can provide adequate capacity and reduce losses?

Power-quality issues—Distributed energy resources (DERs) made up of energy sources, energy storage devices, and energy management systems on both the cooperatives’ and the customers’

sides of the meter are making power quality an important issue. For example, a customer may have issues simply because their neighbor installed rooftop photovoltaic solar power. Using AMI data, utilities can analyze residential DER installations to respond to issues like this proactively, resulting in satisfied customers and improved regulatory relationships. DERs increase the complexity of planning, operating, and managing an electric distribution system. This requires cooperatives to obtain, analyze and act upon even more data, and do much of that in real time or near real time. Doing so successfully is necessary to maintain reliability, safety, security, economy, and quality of service. It can bring many benefits to both the cooperative and to its members.

The utility environment is changing in ways even progressive utilities are not able to fully comprehend at this point. Over the next 10-plus years, utilities will face multiple challenges requiring a solid response and strategy. "Prosumers" are creating new business models with the introduction of entities such as aggregators, who appear to be positioning themselves to take customers away from the utility. Also, utilities are depending too much on institutional knowledge to solve many problems. With every retirement, much of that knowledge is walking out the door. Analytics-based technology will be required to augment the utility staff's skills to ensure utilities can support their evolving business model. It is crucial for utilities to convert all their data to useful information, so the new utility worker will have the right tools to make the right decisions at the right time.

The growing importance of data analytics as well as the specialized facilities, equipment, skills, and activities required as well as their applications across all business units in the cooperative, warrant data analytics being its own business unit rather than an adjunct to one of the cooperative's other business units.

What should cooperatives do to better prepare themselves in this area to assist their members with the shifts that are occurring? It is an interesting question as it relates to data analytics performed at the cooperative (behind the curtain) level and not by the members directly. What will filter down from the cooperative's data analytics exercises will, however, directly impact members via more and varied rate offerings and targeted member engagement opportunities. Through data analytics, member data can now be used to parse members into more diverse classes beyond just residential, small and large commercial, and industrial loads. Cooperatives that have yet to begin the transformation to advanced meters on their systems can only offer the typical two or three component (service charge, energy charge, demand charge) rate structures to its membership.

However, many distribution utilities have installed millions of smart grid devices, including AMI meters, creating an unprecedented amount of data available for analysis. The challenge is identifying how, when and where this information is best applied to improve operations. A strong first step is to focus on analyzing metering data. Of course, this requires an advanced metering infrastructure (AMI) which most utilities have or are in the process of deploying. With the natural progression of homes becoming "smarter" and more connected the cooperative must ensure that they have installed advanced meters and associated meter data management (MDM) systems that enhances the collection of usage data to take advantage of data analytics techniques.

AMI technology allows the cooperative to offer many more dynamic rate structures, such as time of use (TOU) or critical peak pricing (CPP). The first step in the progression, which is already being done within the industry, is to develop dynamic residential rate structures, e.g., TOU, CPP, or electric vehicle (EV) rates. As more EVs and DERs enter the end-user markets, a cooperative will be capable of developing even more advanced residential rates. The ability to communicate with smart devices and DERs in a member's home unlocks a wealth of potential in rate design. Through TOU Rates and incentives, a cooperative will now have the ability to significantly influence member behavior and shift load in beneficial ways.

To reduce peak loads, it is critical to understand which members are contributing to the peak load and their consumption patterns. Annual, seasonal, and daily peak demand periods can be identified at the system level so the relative contribution from individual meters can be determined. This information supports the design of rate structures based on member demographics and consumption patterns, as well as the focus and quantification of demand response programs and energy efficiency initiatives. For example, special rate structures could be designed to discourage consumption during peak demand periods and financial incentives may be offered for demand management programs. An example is offering to pay a member with a storage system an incentive if they agree to discharge the battery at a specific time of day. This type of analysis enhances the demand side management options available to the cooperative by providing greater precision in how to apply those tools to achieve results. Looking to the future, eventually the utility may be able to develop rates based on hourly pricing that the member and utility will use to optimize usage at homes and businesses.

Ultimately, many years down the road, data analytics can lead to a decentralized network that allows peer-to-peer energy transactions in a connected community, but utilities must first fully assimilate and integrate the data and its capabilities.

The main resource the cooperative will need to support dynamic rates will be updated communication mediums. Fast communication is essential for dynamic rates to progress. Utilities generate substantial volumes of data thanks to smart devices and it creates multiple new data points that can put pressure on infrastructure. On top of this, DERs and legacy IT systems bring fresh challenges to utilities that are having to manage and interpret greater volumes of information. For example, thousands of mini-generation plants can sit all over the network, bringing in new data points every minute. Therefore, a system is required to gather and maintain multiple sources of data. Not only will a cooperative need to have the fast connectivity requirements but a significant challenge lies in capturing a single source of dependable information from the data gathered. In order to get the most out of the dynamic rates structures, the DERs on a utility's systems must be able to react quickly either automatically or via direction by the member, the utility, or both. Data should be able to move seamlessly between traditional and modern systems. The modern grid enables the utility to react quickly and effectively in this new complex and demanding environment.

In addition to the fast, complex communication resources needed for dynamic rates, a cooperative will need billing systems (AMI, MDM, etc.) that can handle rates that have components that change frequently and automatically produce bills that are correct. Updating this process will allow a cooperative to minimize the old-school hand billing. In addition, the

cooperatives will need to hire or retrain staff to set up the rates in the billing systems. Utilities will also have to get better at adopting and employing advanced modeling techniques to discover insights in the data. Along with this task, utilities should consider beginning to complement their existing workforces with data-savvy talent that brings advanced analytics, modeling and visualization skills to bear on these efforts. Examples of modeling and visualization programs include Tableau, Python, and R.

Another indirect impact that data analytics will have on a cooperative's membership is overall customer engagement. Since meters are deployed at customer premises, the data can be used to improve customer service. Improvements include notifications of power outages and restoration times, analysis of power quality at the premise, and recommendations on improving energy efficiency. Data analytics can help utilities understand customers and their energy use better—knowledge that utilities can use to design new products and services, such as demand-side management programs that reduce electricity use at peak times[3]. This information will also help the utility segment its members based on usage to best target specific marketing efforts. For example, if a cooperative "sees" a member has solar and battery storage on their system simply by analyzing their load data, the cooperative can then target this member with specific programs to take advantage of this technology.

Additionally, analytics will allow utilities to provide better outage communications with more accurate restoration estimates.

Advanced analytics can help increase reliability by preventing outages through more accurate predictions about when to replace failing equipment or improving outage response through situational awareness (for example, automated dispatch through real-time identification of an issue) and better management of performance[3]. Self-healing grids capable of rerouting power in an outage already exist, but with artificial intelligence utility systems could be capable of predicting equipment failures and outages, helping reduce downtime and the cost of repairs. Projects are underway using data analytics in conjunction with AI, and specifically machine learning, to predict the conditions that cause power outages. A 2017 project at a Department of Energy laboratory sought to identify weak points in the electric grid and proactively repair them before outages occurred. Ten utility partners participated in the multi-year effort, and the goal was to create an autonomous system that handles ordinary fluctuations in power, plus responds to major events like storms. Additionally, in April 2019, the U.S. Department of Energy (DOE) announced a total of $20 million in funding for innovative research and development in artificial intelligence (AI) and machine learning. DOE's Office of Electricity has selected eight projects to receive nearly $7 million in total to explore the use of big data, artificial intelligence, and machine learning technologies to improve existing knowledge and discover new insights and tools for better grid operation and management. Similarly, a research team at Texas A&M University applied big data to improve tree maintenance and prevent overgrown branches from triggering lapses in electricity service. The traditional approach utility companies take is to schedule regular and rotating tree-trimming outings, but that method is both time and cost intensive. The new data-driven option tells utility companies which trees are most likely to cause issues. Then, those entities can prioritize certain areas over others. The created model also accepts information from several sources. For example, a utility can populate the system with operational data or known

statistics about vegetation and growth patterns. By providing more accurate information to customers about power outages, grid updates, and repair work by field crews a utility can significantly increase customer satisfaction which will have a positive effect on engagement.

Other utility use cases for AI assisted data analytics include more efficient use and integration of renewable energy, cybersecurity threat detection and response, and portfolio and asset management. Beyond managing the electric grid, artificial intelligence can play a role in customer-facing interactions through voice response, personalization and matching services to customers. To appeal to members' needs, cooperatives could use a "chatbot" that answers questions about power outages and billing concerns. For example, a member calls in and while being routed to a member service agent (MSA), AI pulls their last 12 months of billing history, determines probability this call is about high bill, and if yes, MSA clicks "High Bill" and is directed to a script where AI has pulled in weather data that is the reason for the high bill. MSA can then be pointed to a script where he/she offer energy efficiency tips or an energy audit. Theoretically, a utility could also apply big data to a chatbot's interaction history to make business decisions. For example, if a higher-than-average percentage of customers had queries about their bills after those documents got redesigned, a company might revert to the old design or make changes that clear up the confusion. Alternatively, if an exceptional number of customers in a subdivision or apartment complex asked the chatbot when they would get power restored after an outage caused by a storm, the company might decide to send its teams there first before other places get tackled.

Data analytics mixed with AI technology will probably be first adopted by utilities serving data centers and other energy-sensitive commercial and industrial customers. This potential AI tool can be offered as a service to the customers by providing demand reduction with no additional infrastructure and possibly adding another revenue stream for the utility. Data centers have levels of redundancy built in for cooling and backup power along with many other inefficiencies facing large systems. Reserve power resources are ubiquitous across power grids, whether for backup or renewable integration. AI can be used to better predict these changes and construct a response that is tuned to expected system behavior over time. Both the extra energy used for cooling and the standby generation on the grid can be better optimized. If you have the right algorithms, you can effectively manage the minimum requirements of both systems. The main resource needed to support the improvement of customer engagement through data analytics will be finding better ways to manage and collect all of the data. As analytics capabilities evolve, utilities will need to adopt more rigorous standards for capturing, storing, and managing data. Cleaning up data is a major challenge, requiring an intense amount of work to interpret data from multiple outlets and restructuring it along common lines so the data can be shared and effectively manipulated. To begin with, many utilities agree that they are still missing key information about their assets. This is because the underlying infrastructure for utility networks used today was deployed decades ago, when recording data was not critical to business. To make up for this limitation, utilities can leverage newly gathered records that come from smart meters and other sources. Once a utility has gained access to this data, the key will be understanding the analytics and understanding with confidence. Once an understanding is developed, a utility will need the ability to manipulate the data in a way that allows them to get the most out of the analysis. The ability to manipulate data in a simple Excel spreadsheet will not be good enough in the new utility

landscape. Cooperative staff will soon need to be re-trained to move away from Excel to programs such as Python and R that provide much more data manipulation capabilities. Finally, the utilities will need a billing system and MDM user interface that allows for easy construction of these big data queries. Evolution to a web-based portal with an easy user interface will go a long way in facilitating the data analytics shifts to the industry.

With the industry moving forward and the natural progression of member expectations, the potential of data analytics will open limitless possibilities for your cooperative. With access to all of this new information, a cooperative must also consider the following questions. When the cooperative knows or has reason to know of anomalies in the pattern of usage by a customer, do we then have an obligation to make that customer aware of a potential problem? Instead of pushing products and services "one way" to consumers, could utilities use digital platforms to make the educated consumer an active participant in the design of new energy services that better meet their needs? Instead of seeing new energy technologies, such as home energy storage batteries as a threat, could utilities take a leading role in their further development, perhaps through collaborations with start-ups? Instead of resisting customer's moves to go off-grid, could utilities use existing distribution assets, network knowledge and transactional platforms to *enable* the self-generation, storage and trading of energy? Smart meters and digital technology give utilities the power and the platform not only to secure their own future, but also to help shape more sustainable and equitable energy markets for everyone. Utilities already have the assets, information and customer relationships they need to redefine their role. But do they have the will to change, to move fast, to innovate and to begin to see customers as partners?

References:

Vadari, Mani. Nov 2018. "Data Analytics Transforms Utilities", T&D World <https://www.tdworld.com/smart-grid/data-analytics-transforms-utilities>

Kennedy, Pat. May 2018. "Six Big Data Challenges for the Power Industry". Utility Dive. <https://www.utilitydive.com/news/six-big-data-challenges-for-the-power-industry/523298/>

Guille, Christophe. August 2016. How Utilities are Deploying Data Analytics Now." Bain & Company. <https://www.bain.com/insights/how-utilities-are-deploying-data-analytics-now/>

Koronis, A., 2006. "*Foreword of challenges of managing information quality in service organizations."* USA: Idea Group Inc.

Accenture analysis, 2013. "Realizing the Full Potential of Smart Metering." Accenture. https://www.accenture.com/t20160413T230144__w__/us-en/_acnmedia/Accenture/Conversion-Assets/DotCom/Documents/Global/PDF/Industries_9/Accenture-Smart-Metering-Report-Digitally-Enabled-Grid.pdf

Data Communications

Many discussions about future communications technology needs at the cooperative often revolve around whether the cooperative should deploy broadband to meet the need of the membership for high-speed internet access in the rural areas. While this is certainly an important discussion to have, it cannot be allowed overshadow the strategic communications planning and implementation necessary to prepare for the demands of tomorrow's electric utility grid. Advanced communications infrastructure must not be made in haste but should be part of today's future planning in all cooperative boardrooms.

The utility grid, in its current state, was built to supply base load generated power in one direction. Today we have massive deployment of DERs that continue to disrupt the infrastructure that was not necessarily designed for the future that utilities now see on the horizon. As future non-traditional distributed power sources, such as electric vehicles and battery storage, become more prevalent, the flow of energy from multiple sources and directions must be rebuilt to support grid structure and stability. The structure must also measure and monetize the transmitted energy to the proper sources. A robust and scalable ecosystem of IP networks and data communications platforms will be necessary to accommodate the future distribution service operator (DSO) cooperative's energy portfolio and physical grid structure.

A cooperative planning to be a full-service DSO, rather than just a wires company, must consider the digital world. New levels of safety, efficiency, reliability, and service delivery is driving up consumer expectations to unprecedented levels. Cooperatives often provide basic technology such as smartphones and tablets to employees as a necessary part of distribution efficiency and customer satisfaction. The convergence of the "Internet of Things" and the utility grid is rapidly becoming a significant part of the critical utility infrastructure; therefore scalable digital communication deployment is a must-have for the future cooperative. Only with sufficient access to integrated real-time data will the cooperative of the future be able to build the most reliable and efficient system for the membership. The network of the future must seamlessly synchronize the smart refrigerator in a member's home, to the EV in the garage, and all the way to the transmission generator on the utility side.

Grid modernization technology will employ millions of sensors, switches, and other connections necessary to automate, measure, and monitor the future omnidirectional utility system. Only secure, compatible, and flexible communications platforms can accommodate the rapid changes expected in the future. The convergence of artificial intelligence, internet, and future grid technologies, along with advanced two-way metering infrastructure must be a topic of strategic planning for the future cooperative.

The networks a cooperative may use, or build, will depend on many factors, but they should all have one thing in common: security. Government regulations regarding physical, cybersecurity, and critical infrastructure will require any network communications to be effectively secured against a variety of attacks. The massive growth of a DSO cooperative's digital data streams supporting the future grid will be even more vulnerable and a significant investment will be needed to support physical and cyber protection efforts. While policy makers and regulators

consider the security aspect, it will also be useful for the regulators to create standards for interoperability.

"As more components are introduced into the communications infrastructure, ensuring interoperability among communications devices via standardized communications protocols and other interface standards will be critical.[7] The U.S. National Institute of Standards and Technology (NIST) Cybersecurity Working Group identified 137 interfaces between different grid systems.[8] For example, every smart meter and most sensors and major pieces of equipment at generating plants and substations will have communications modules using millions of components from potentially hundreds of manufacturers. Software applications will similarly be provided by different developers. After installation, the technologies of the communications infrastructure will continue to evolve, requiring ongoing interoperability assessments and review. "Backward compatibility" will be required since newer equipment will have to operate alongside older equipment, even though this may decrease the functionality available." http://web.mit.edu/mitei/research/studies/the-electric-grid-2011.shtml

The architecture of future DSO cooperatives will require substantial collaboration between the cooperatives, suppliers, technology providers, and members.

For the future cooperative to grow and prosper as a DSO there must be a recognition of the need for and implementation of advanced communications. The Energy as a Service (EaaS) Cooperative should strongly consider playing a role in the deployment of such networks within their systems. Advanced communications systems should become part of the cooperative boardroom conversations today, so that the EaaS provider/DSO of tomorrow will be prepared.

Communications & Marketing

It's not going to surprise anyone that communications and marketing will be paramount for cooperatives to navigate successfully with the evolution of Energy Innovation. While the majority of cooperatives have evolved and strengthened their communications efforts over the last decade to meet the resource needs of their respective memberships, this new paradigm will require an even greater expansion and advancement in the manner and methods in which cooperatives engage, communicate with and market their service offerings to members.

With safe, reliable and affordable electric delivery being the emphasis for the first 75 or so years of the electric cooperative business model, cooperatives have enjoyed being, for the most part, the "Lone Ranger" when it comes to meeting member-consumer electricity needs. This obviously changed with the surge in distributed generation options, namely solar PV, in the last decade. Though many cooperatives were early embracers of their members jumping into the DG arena, there were—and still are—a significant number who have put their proverbial heads in the sand and ignored this threat or challenge to their legacy core business of distributing electricity. Of more concern, these respective cooperatives have ignored the opportunities the DG activities have created for their organizations and memberships. And this trend to stick only to the "core business of delivering safe, reliable and affordable electricity" without acknowledging all of the new services, products and resources available to members that CAN replace some of the "core business" is not going to leave those cooperatives in a good spot.

Consumer expectations are on a continuously accelerating ascent and they are in the driver's seat when it comes to reshaping how services and products are offered. Consider brands like Netflix, Uber and, of course, Amazon. It was not too long ago that they were given minimal consideration as threats by their now-out-of-business competitors who ruled the respective business spaces for decades. For example, when leaving an airport in most major cities today, watch the herd of arriving passengers walk past the taxi line to meet their Uber. The taxi area is usually staggeringly quiet while the Uber and Lyft pickup areas are bustling with energy. Cooperatives must be ahead of, or at a minimum, keeping pace with member expectations in terms of the energy needs or they could suffer a similar contraction in business transactions.

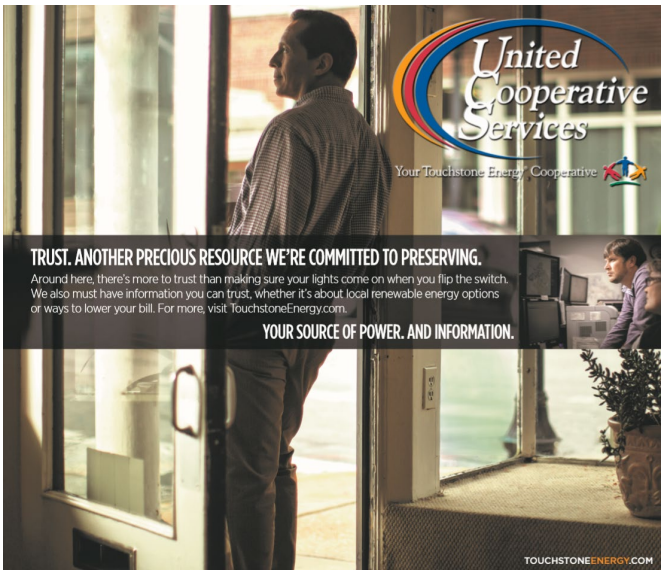
For cooperatives to be successful, it is imperative that they acknowledge that the communications and marketing strategies on which we have depended will need a significant shift in focus and priority. As cooperatives embrace new DER offerings, leadership teams will need to be the positive forces promoting these new services and resources. Next, employees who maintain a "we've always done it this way" attitude will need to be led and educated by senior leadership on the need to take on the expanded role of co-op brand ambassador in the changing electric utility landscape. Internal communications, cross-departmental cooperation and collaboration are going to need much greater attention in this new paradigm. The "once-a-year" all-employee meeting will need to be supplanted by regular education and information sharing sessions (both in person and through collaborative technology platforms)—the "disruptive" players are bringing new products and resources almost daily and cooperative

employees need to keep pace in order to be able to communicate with members about these resources.

Since most of cooperative service territories do not have areas with retail competition, a significant philosophical pivot with regards to competing for consumers will need to occur in a DER environment. While cooperatives are active in seeking new loads—in the C&I space especially—they haven't necessarily gone "toe to toe" with another retail service provider like, for example, the mobile phone network providers battling against each other for market share. Therefore, as cooperatives shift their business models to allow for new and multiple service and product offerings, they'll encounter a much more competitive, albeit cutthroat, environment in which marketing tactics and communications messages are likely to be more intense and aggressive—a major departure from "the way we've always done it." That shift will be more akin to the ABC sales tactics—Always Be Closing—to which cooperatives' existing employees will likely need to adjust. Adopting a more retail sales mindset will also require cooperatives to modify job descriptions and postings to attract applicants who have those characteristics and expertise.

As tactics change so will the ways in which cooperatives deliver messages and promotions to the members. The monthly statewide association magazines, in which most of cooperatives take advantage of 4-12 pages customized for their respective cooperative, is typically the flagship communications vehicle. In this new paradigm, it will still serve a valuable purpose in getting the word out. However, leveraging additional touchpoints (and staying current on the latest social media trends) is going to be essential for cooperatives to be the source of choice for members seeking DER services and resources. Cooperatives will need to have employees dedicated to keeping up with these latest trends and this will be especially important in capturing that "hard to engage" younger member who will only give the average organization/service provider a few seconds to capture his/her attention before they seek alternatives on Amazon, Google, etc.

It should be noted that the cooperative network has a treasure trove of resources that can be tapped to begin transitioning the communications messaging of yesterday to meet the member expectations of today. For example, consider the Touchstone Energy brand. Within its current campaigns there exists a messaging platform that can be easily modified to fit just about any service or product offering cooperatives elect to push: The "Your Source" campaign positions the cooperative as the source for power and information. It includes a variety of media and communication assets that can be tagged by the cooperative. However, it's not just positioning the cooperative as the "Your Source" for energy, it's a campaign that allows cooperatives to be "Your Source" for ANYTHING. As a network, we should leverage these types of resources today to ensure our members already consider us their source as cooperatives enter other service and product spaces.



The good news is cooperatives are already very well positioned to "win" their members over with new DER services and products. They just need to identify what the members' expectations are and how to take that information and shape it into their marketing efforts. To go along with that advantage over the current and future DER competitors is that most cooperatives have started a two-way relationship with their membership through surveys, social media, years of annual meetings, community outreach, economic development activities, etc. Now layered on top of those meaningful engagements is an almost unending stream of member-consumer data that has barely been evaluated.

Energy Services

Today's Energy Services department wears many hats in terms of duties and responsibilities. Unlike other departments, the energy services responsibilities do not end at the source side of the meter, but rather on the load side of the meter. This in itself makes the Energy Service department unique and a great asset to the cooperative and to the membership. Member expectations are being increasingly shaped by companies such Amazon and Netflix, so cooperatives must continue to maintain a consumer centric focus.

As mentioned, the duties and responsibilities of the energy service team are focused primarily on the load side of the meter, with duties that include development and administration of member-facing programs, performing energy audits, answering questions about consumption, and evaluating new technologies.

Energy Services duties often include:

- Program development—As our member's needs and wants change it is important that Cooperatives maintain the flexibility to develop services and programs that add value to the membership.
- Demand Response (DR)—DR programs have become very popular over the past few years in an attempt to reduce demand cost allocated to the cooperative. Managing the DR programs is not necessarily labor intensive, but it does require a resource (employee) to evaluate data to justify utilization of the DR assists, as well as evaluating post event data to determine the effectiveness of the controlling event. Post event, have the ability to Perform Cost benefit analysis to determine the annual benefits of the program.
- Rebates—Rebate programs are process oriented and could be overwhelming if the correct processes are not in place or the program is understaffed. Technology can assist with the flow of processing rebates. Some rebates, especially the higher dollar value rebates, might require verification equipment is installed according to a cooperative's specifications.
- Energy Audits—Many cooperatives offer audit services to their membership, while some offer energy audits to both residential and commercial, or offer the service to residential members and contract out the Commercial and Industrial audits to a third-party source for a small fee to the member. Either way, the cooperative is providing a service to assist their membership with energy needs. Typically, there are three different reasons for an energy audit request.
    - The member had a high bill and wants to understand why
    - The member is curious about how efficient they are
    - The member is interested in upgrading equipment or facilities or behind the meter generation.

In any case, the goal of energy audits is energy efficiency and to determine ways member can waste less energy.

Energy Audits should be viewed by a cooperative as an opportunity to demonstrate its expertise in energy management and to reinforce the cooperative's role as the trusted energy advisor. Many cooperatives are introducing cutting-edge technology into their programs, including infrared cameras and software that can estimate ROI based on different energy efficiency upgrades. In the past, a member's goal was to become more efficient with their energy usage. Today, the members' interest go beyond energy efficiency. More members are expecting their cooperatives to assist them with Distributed Energy Resources. Again this is another opportunity for the cooperative to take on the role as the members' trusted energy advisor.

- Usage evaluation—The granularity of the meter data will depend on the metering system the cooperative has implemented. Typically, meter reads will either be daily, hourly, or 15 min. obtaining more granular data provides a better snapshot of a member's usage patterns. An experienced energy auditor will be able to troubleshoot what is causing high usage by evaluating meter data and comparing it to weather data.

- DG analysis— Most cooperatives have developed tools to assist their members with the DG evaluation. These tools will model the monthly impact a Solar PV system could have on a member's monthly bill and project ROI. Below is an example of an evaluation tool being used by a cooperative.

Solar Energy Offset Model - Consumption Vs. Solar Production

System Size (DC) kW:	16.9	Utility Cost of Energy:	$ 0.0839
Tilt	20	Buyback Rate:	$ 0.07170
Azimuth	270	Fixed Charge	$ 17.50
		Minimum Bill	$ 25.00

Zipcode location	76446
Latitude	32.45
Longitude	97.54

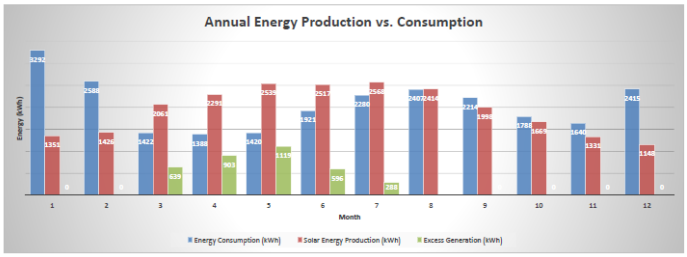
Member Energy Usage and Bill

Month	kWh's	Utility Bill Without Solar
January	3292	$ 293.70
February	2588	$ 234.63
March	1422	$ 136.81
April	1388	$ 133.95
May	1420	$ 136.64
June	1921	$ 178.67
July	2280	$ 208.79
August	2407	$ 219.45
September	2214	$ 203.25
October	1788	$ 167.51
November	1640	$ 155.10
December	2415	$ 220.12

Projected Solar PV Energy Production

Month	kWh's	Excess Generation (kWh)	Excess Generation $	Bill w/ Solar	Billed kWh Offset (%)
January	1351			$ 180.35	41%
February	1426			$ 114.99	55%
March	2061	639	45.82	$ 25.00	145%
April	2291	903	64.75	$ 25.00	165%
May	2539	1119	80.23	$ 25.00	179%
June	2517	596	42.73	$ 25.00	131%
July	2568	288	20.65	$ 25.00	113%
August	2414	7	0.50	$ 25.00	100%
September	1998			$ 35.62	90%
October	1669			$ 27.48	93%
November	1331			$ 43.43	81%
December	1148			$ 123.80	48%
			254.68		

Total Yearly Bill without Solar:	$ 2,288.62
Total Yearly Bill With Solar:	$ 636.52
Annual Electricity Bill Savings	$ 1,652.10
Electricty Bill Yearly % Savings:	72%
Total Yearly kWh Electricity Usage:	24,775
Total Yearly kWh Solar Production:	23,313
Total Yearly kWh % Bill Offset:	94%
Est. Installed cost per watt (dc)	$ 3.18
Estimated cost of installed system	$ 53,753.48
Investment Tax Credit (30%)	$ 16,126.04
United's Rebate	$ 500
Years to Break Even	22



- DG Verification—Most cooperatives have interconnection procedures and guidelines for interconnection to the distribution system. To ensure members and contractors are installing DG systems according to the cooperatives specifications, an employee of the cooperative will

audit the site to verify the equipment, labels and system size matches the information submitted in the interconnection documents.

- Member and Employee Education—In every task mentioned above, energy service employees have a responsibility to educate and inform members. As new technology and programs become available to the membership or third party vendors, a cooperative's energy services department must be able to educate members and employees about the pitfalls and the potential benefits of each development.

For such programs to be successful, energy service employees should work with other departments to explore solutions for evolving services. An example of this is developing new programs such as an On-bill financing program. The energy service employee will need to have access to employees in multiple departments such as Accounting and Member Services to make sure the program is functional.

Certifications or Training

Most cooperatives understand that the greatest asset of the cooperative are the employees. Even with the advancement of technology and tools that offer cooperatives more automation in energy services, continuing investment in energy services employees and training is critical. Today, there are three different certifications that are typically recommended for energy services employees: RESNET, BPI, and the CEM. Each vary according to the type of audit and the depth of training required for certification The NABCEP certification is another credential that will be beneficial to the Energy Services department in the future. The NABCEP certification will provide the knowledge and experience needed to process member inquiries about Solar PV.

Members today are more curious and willing to experiment with new technologies. The use of smart home appliances, thermostats and other internet-connected devices make up a large portion of these new technologies. Members are starting to enjoy the ease of controlling everything at the touch of a finger on their smart phones or tablets. Increasingly, members are in search of products that lower energy usage and give them more individual control of their energy management and usage. This trend also is opening a niche of outside vendors to provide whole home solutions to our members.

Shifting member service expectations are being guided by a younger membership that wants data transparency, and more options. They want to be empowered by choice with different rates, services and products. Cultural changes have played a role in the shift, too. Today's consumers place more emphasis on social responsibility and environmental impact. This is evident in the increasing adoption rate for DG and also Electric Vehicles (EVs). Cooperatives must be willing to adapt to evolving member expectations by providing members with information or rate structures that assist their adoption and utilization of new technologies.

In a similar fashion, cooperatives should be adept in demonstrating the cooperative is a credible partner in DER and EV applications, perhaps through learning lab environments that provide members an opportunity to kick the tires before investing in those areas. These learning labs will also demonstrate to the membership the willingness of the cooperative to investigate and invest in emerging technologies.

On the other side of these developing service trends, is that the energy services of tomorrow might truly be in the service industry—forcing cooperatives to compete for market share. Cooperatives are not completely familiar with retail services competition, and it would appear they should become more experienced in strategies that include doing more.

Becoming a "one-stop shop" for consumers' services might include backup generators, installation of smart home automation and technology, EV charging stations, HVAC technical services. Some cooperatives might be interested in keeping everything in-house from the sales to the installation and maintenance; other cooperatives might be more concerned with head count. For those who are concerned about consumer numbers, there might be value in developing partnerships with local vendors that have been closely vetted by the cooperative. It is important that the partnering company understands the value cooperatives place on member service and who are willing to provide services that meet a cooperative's expectation for delivering superior service and value.

There are opportunities for the cooperative to be the DSO of the future, but considerations for doing so require the outlook that if it involves electricity the cooperative is going to provide the service solution.

Engineering & Planning

Depending on the size of a utility, the engineering and planning departments may be a single person or be split into separate departments. The responsibilities within these areas have evolved over the last few decades and continue to increase the requirements for highly trained and educated personnel. It is not uncommon for new technology projects, including operational technology initiatives, to land in the planning and engineering department. Project management efforts, vendor management and contract development, in addition to the technical job functions also are common responsibilities.

Planning departments have historically looked at the long-range needs of the electrical system and typically take the lead in developing the multi-year work plans, forecasting load growth and working closely with the utility's G&T to ensure the distribution system can accommodate projected loads. Engineering departments also have traditionally focused on a system's physical design and details needed to carry out multi-year work plans, as well as developing close relationships with local developers, county and city entities to understand external plans for the service territory, determining requirements in supporting community growth and grid improvements such as where and when to build new substations, or extend the three-phase backbone.

Functional tasks often include:

- Overhead and underground line extensions and rebuilds, including structure and guying strength calculations, clearance reviews and rights of way requirements, obtaining necessary easements and developing project plans and budgets complete with permits and flagging plans as necessary to complete a job.
- Distribution system modeling, one-lines, and grid studies. System Analysis, including load analysis and phase balancing, voltage drop, capacitor placement, feeder optimization, and fault current analysis, as well as protective coordination studies. Duties typically also including administering, managing and optimizing software used to support these analysis capabilities.
- Project management tasking to develop processes and procedures for tracking projects from cradle to grave including budget, schedule and scope, while ensuring all system data for financials and customer information is accurately updated at end of project.
- Compliance with NESC, NERC, FERC or other entity's requirements that may have jurisdiction over a distribution grid, assuming that the grid has been classified as part of the bulk electric system or simply for best practices. This can include whether a communications and control system meet or exceeds the NERC CIP cybersecurity requirements. Some utilities may be required to self-report, while others may be relatively informal, or some can require annual audits to show compliance.

- Asset management for the equipment that comprise the electric grid such as substation equipment, transformers, poles, and meters typically fall to one of these functional entities. More focus is put on equipment with a longer expected life and higher capital cost. It is not uncommon for this type of equipment to still be in service 30-50 years after installation. However, as technology continues to evolve at a much faster pace, the expected life of some of this power equipment is expected to decrease, resulting in the realization more emphasis will be required on managing and monitoring equipment.
- Developing Distributed Energy Resource (DER) interconnection process and procedures for members and utility owned assets, as well as the fee schedules for members to attach DER to the system.
- Pole attachment agreements, fees and contracts for communication equipment attached to the utility owned poles
- Street lighting location, light fixture types, and control systems for the lights
- Equipment purchasing specifications, construction standards and adherence to those, including site audits
- Operational technologies including configuration, administration and management of protective relays and controls, capacitor controls, SCADA devices and associated communication equipment both in and outside of substations. Some utilities also task the engineering department with operation and maintenance of the SCADA Master.

The utility industry has recently embraced the term "operational technology" (OT), which is different but often interwoven with "information technology" (IT). By the definition found on Gartner IT Glossary, (https://www.gartner.com/it-glossary/operational-technology-ot/) operational technology is "hardware and software that detects or causes a change through the direct monitoring and/or control of physical devices, processes and events in the enterprise." SCADA systems, meters, OMS and associated systems are all forms of OT, and acknowledging the role that planning and engineering plays in what can often be seen as an IT system is necessary. Required skillsets needed for OT systems overlap but are still different from those required for traditional IT functions. "While the technology is familiar to operators and engineers in these sectors, there is limited understanding outside of people working in or with these specialized environments. In contrast, Information Technology (IT), managed by CIOs and IT departments, is the application of computers to process, transmit and store data, typically in a business or enterprise environment." - Derek R. Harp Bengt Gregory-Brown from *IT-OT-Convergence: Bridging the Divide* published on NexDefense https://ics.sans.org/media/IT-OT-Convergence-NexDefense-Whitepaper.pdf

Planning and Engineering departments fill a wide range of functions and roles at distribution utilities. Looking forward, it is reasonable to assume that the changing emphasis on distributed energy resources on the grid will impact these departments and require changes to both the analytical tools used, and the "why and how" employees within these departments think about solving problems without necessarily upgrading the grid in traditional ways.

As the traditional distribution grid and its associated electrical model evolves, major changes will need to occur in conventional planning and engineering department focal points due to:

- Evolution from a centralized source-to-load, one-way power flow model to a more dynamic, distributed, two-way power flow model
- Increasing numbers of two-way, high-speed communication "IoT"-enabled devices attached to equipment on the distribution system and behind the meter, including DERs and EVs
- Massive amounts of granular data available from these devices and the associated data analytics required to take advantage of that data

This includes equipment within the substation (traditional SCADA), line reclosers, voltage regulators, capacitors, line sensors for temperature, fault indication, voltage, etc., and in the largest number, advanced or "smart" meters. This can also start to include IoT devices on the other side of the meter such as smart inverters, electric vehicles, and home automation systems including smart thermostats, load controllers, and possibly even in the near future smart home breaker panels. This inherently changes the entire way utilities will plan and design the distribution system, including training our employees to ensure safety first for workers and members. New technologies are emerging that challenge traditional planning and design processes and solutions.

Outside of the utility's power purchase, the construction work plan (usually spanning 3-5 years) is typically the next largest expenditure at utilities. These investments can be in the planning stage for at least a year prior to build, and the average life expectancy on large capital improvements is measured in decades, and not years. Identifying the need to future-proof the investments today for unknown changes coming in 10 years is paramount. A shift in traditional methods and thinking needs to occur so that decisions are made that could have significant savings for the utility in the future.

Examples of this "future proofing" are:

- Adding on the 7-pin control capability to an LED streetlight program (by default, the standard streetlight specifications exclude the required 7-pin connection for a future control module).
- Adding single-phase operation (to three-phase devices/systems). As DER increases and more solar comes into the system, this could be a paramount and required capability. As line equipment is purchased such as recloser or capacitor controls, the capability to have single-phase control on a three-phase device could allow for future flexibility without additional changes to the field equipment.
- Planning an AMI system for 1-minute data reads even though 15 minutes is the current industry standard.
- Incorporating the control channels for SCADA and 15kV equipment in the AMI communications network design process.

- Including the "Z" (height or depth) component in a full system inventory when collecting data for X and Y to allow for three-dimensional augmented reality as that technology comes into the industry.
- Looking today at how drones could be used at the utility for field inspections, from staking to storm response. These new tools will require a systematic program and trained employees. Start investigating now and learn about the right way to implement drones into the utility from vendors or NRECA directly before purchasing. Insurance implications and FAA oversight will require a well thought out program. Look at what software is already in house that could incorporate that data.

The concept of "what do we NEED today" versus "what do we WANT for tomorrow" has to be balanced and decisions made that accommodate flexibility, recognizing that choices may not always be the least expensive option at the time the decision is made.

Part of the challenge in looking at how to modify the future look of planning and designing is based on the cooperative's members, the current power supply, and outside influencers that will impact decisions that members make that directly impact the distribution grid. As utilities see more and more consumer driven choices, such as EV and DER, come into their system, the grid will have to change. Planning and Engineering departments have to work much more closely with member services and key accounts than ever before to understand membership trends in their service territory.

A recent example of changing planning and design from the IOUs is the Brooklyn Queens Demand Management Program. In 2014, Con Edison identified a need for a new substation, upgrades to a switching facility including installation of a fifth transformer, and a new sub-transmission feeder to connect the two facilities. A non-traditional approach, using utility and customer demand side management was approved in place of this, and in 2017 the final report stated the project provided an "opportunity for non-traditional solutions to not only defer investments but also to potentially allow solutions to scale and save more money than initially anticipated" and "demonstrates the ability of non-traditional solutions to provide additional flexibility, which can avoid over-investment." The large capital system upgrades are not expected to be needed until at least 2026, if even then. Cooperatives have long been leaders in non-traditional approaches being some of the first to develop water heater demand response programs, and time-of-use pricing. Continuing to look for better, cheaper, more efficient alternatives will be a priority as cooperatives look to the future.

https://info.aee.net/hubfs/NY%20BQDM%20Final.pdf;
http://www.ncsl.org/Portals/1/Documents/energy/webinar_LSchwartz_9_2017_31633.pdf
Slide 14

There are potential disruptors to the engineering and planning department's core functions. Members could have the option to buy and sell electricity from their own solar installations to each other over the distribution lines, increased environmental and other regulations could limit expansion of the lines or substation installations, or require more wind or solar for generation than other power sources. This means thinking creatively to find solutions.

Three key points to consider:

- Emerging technologies may shift traditional responsibilities from one department to another, or increase the need for cross-functional teams to spec out system requirements.
- Increased need for a digital model of the electrical grid, with minimal lead-time in incorporating field changes into the model, and few, if not zero errors for real-time operation.
- Planning and engineering departments may need to be allowed to fail first before finding the right long-term solution. Not every problem in the world of DSO has a current solution.

Shift of Traditional Responsibilities

Digital relays and SCADA systems were developed in the 1980s and had a relatively fast adoption rate that forced engineering departments into the computer era. It was not uncommon in the 80-90s for engineering departments to also be tasked with what is now considered an IT function. The foundation for SCADA systems is the communications from the office out to the field devices. This led to either inclusion of the communications system within engineering, or pushed it out to the IT department depending on the method of communication used. Engineering typically is still responsible for the internal substation communications networks, licensed radios or even dedicated wired circuits such as pilot wire protection schemes. This has required the utility engineer to also now understand operational technologies and communications concepts such as serial communications protocols, radios, Ethernet, and therefore cybersecurity standards. "While a relay engineer typically is not directly involved in the design of the utility communications network, the ability to explain how and why critical pilot relaying channel requirements may differ from other data communication needs could go a long way towards obtaining reliable communications services for protective relaying." - Solveig Ward and William Higginbotham, Network Errors and Their Influence on Current Differential Relaying, https://www.eiseverywhere.com/file_uploads/8cadfdb1f480bd98178c118361792189_war_pap.pdf

One point worth noting is relay engineers often have to re-design or implement a completely different communications system instead of utilizing an existing network owned by the utility. This occurs because the need for that department to be a part of that process was not identified during the design process of the communications system.

As meters become operational devices, and provide more than once a month billing data points, the engineering department will need to be involved in metering as the bulk of the data is needed for the real-time advanced distribution management systems (ADMS), and after-the-fact analysis to help balance and manage the grid, among other studies. The smart meter must continue to supply the billing data, but that is a small fraction of the data availability that is possible. Metering and billing departments will need to work with engineering now that it is a major stakeholder, if

not possibly the lead department, in managing the metering systems. In addition to smart meters, utilities are installing line sensors, which may duplicate some of the engineering data already available from AMI systems.

Need for a Digital Model

Planning and engineering departments rely heavily on digital models within their software analysis tools. Historically, these were hand-drawn models and typically included only the three-phase system. Some models now go down to the residential transformer, and a few will also model secondary down to the member's meter. This model may or may not be linked to the GIS system and it is not uncommon for the GIS map to be isolated from other systems as well. The increasing use of OMS systems and ERPs is changing this. In some cases, engineering analysis tools are still isolated from these other systems and even hand-drawn models. Ideally, modern systems will establish the GIS model as the data center with integrations to other systems such as AMI and ensure the model is regularly or even significantly updated so that the most accurate models are utilized for all utility functions.

As internal customer requirements for the model of the system and real-time power flow become available to crews in the field, a change in attitudes about isolated systems will be required. The GIS model typically has the most accurate data, down to the exact X, Y coordinate of a meter and all electrical characteristics of the system. This system should become the central hub for all related systems to draw from, and as technology allows for real-time integration, it should be considered.

Examples of integration to the GIS system include:

- Outage management systems
    - An accurate GIS system is foundational for an OMS to run. If there is not an accurate map available to connect substations to meters, an OMS with current technology will not operate reliably or efficiently.
- Advanced distribution management systems (ADMS) including Fault Location Isolation, Sectionalization and Restoration (FLISR)
    - Few SCADA systems have been converted into ADMS but this is changing rapidly. The basis for ADMS and real-time, automated control (machine driven) of the distribution grid is an accurate electrical model. This is slightly different from OMS that only needs connectivity. ADMS will require up to date impedance models down to the meter, and in the near future possibly even control of the smart meter. If utilities have not considered looking at moving the map/model into the SCADA system, they should start now they will likely be required.
- Mobile map viewers with real-time data from OMS, ADMS, CIS and Smart Meters
    - Increasingly, field workers want to see real-time information out in the field, including member information, driving directions, work order assignments, etc. As mobile devices are pushed to the field, the IT department is typically involved, but

the systems and data running on these devices is typically from the engineering department. This requires a close collaboration between IT and engineering to ensure the end user experience (i.e., field workers) needs are met. A balance between security and usability, with continuous testing for the experience is needed. An additional security measure employed by some utilities is utilizing Mobile Device Management software to remotely manage apps on the devices, push out documents and even restrict what websites are allowed to be accessed on a device.

- Staking packages for pushing data into the GIS in project-based environments
    - The way data moves into a GIS system can vary by utility. Some utilities have connected and integrated staking packages, while others still hand draw finalized projects into the GIS. If a GIS system can accommodate project-based versions, either method can work well if the correct processes and procedures are followed, however, an integrated staking package means faster inclusion of energized projects back into the GIS. As GIS should be the "home" of this data for other systems, if the delay to get projects and changes posted into GIS is long, the other systems will also be significantly behind the actual electrical grid configuration.
- Metering systems
    - Data from the GIS for normal substation/feeder assignments and X, Y data of the meters should be integrated into the CIS and/or AMI systems. If the meter department is hand typing X, Y coordinates for meters into their metering system, the likelihood of errors is high.
    - Data from the metering system should be made available to the GIS or other systems for meter status, low voltage alerts, load data, etc. Metering system data, if being used in OMS, should also have real-time substation/feeder data from the ADMS based on current electrical system configuration (i.e. changes in normal opens and other switching operations that change the "normal" system configuration).
- ERP / CIS / Financial / Work Order systems
    - This bucket of software is meant to include any and all modules that incorporate the GIS data into other departments of the utility. Some cooperatives have an ERP where the GIS is incorporated and can be used inherently by the work order system, financials and CIS. Other utilities may have stand-alone systems that all need to be closely integrated.
- Data Analysis packages
    - Some GIS systems such as ESRI are also an analytical tool. Others may need to have their data pushed into a different data analysis package in order to utilize the

GIS data against other systems for analysis. Combining different data sets can be challenging, but also can be a great benefit.

- Drones
    - As these devices become prevalent in the industry, the data captured by a drone will be integral to the development and maintenance of the GIS system. Cooperatives will need to figure out how to utilize and store this new type of data derived from drone inspections.
- DER/EV and other non-traditional devices
    - It is paramount if the GIS is being pushed out to field crews, that the GIS shows and allows for search capabilities to locate all non-traditional loads and generation sources such as solar and EV installations and EV.

A common utility mindset, especially at small utilities, is there is no time or desire to be part of pilot projects, R&D or a beta site. As technology changes accelerate, there is more need for trial and error to find the right fit for different solutions. Examples of this are piloting different load controllers for months before selecting the final solution for full deployment. This could also mean building out contracts with vendors to "try before you buy" software packages, paying for services to implement and being fully prepared to walk away if the solution does not meet the needs. Another option may be to try offering services to members or other cooperatives, such as solar installations, EV charging installations, or even offering engineering services to other cooperatives. These could all be within a distribution utility's core competencies, and open doors for other sources of revenue, and still allow for learning and growth experiences for employees. Flexibility in trying new ideas, and acknowledging that some may fail before you succeed, will be necessary in the future.

As we roll into the future of planning and engineering at a distribution cooperative, employees will continue to be a primary asset of the utility. The utility of the future will have the ability to "attract, hire and retain a new generation of worker that has the skillset for a cross-disciplinary power grid that incorporates the power engineering, cybersecurity, data analytics and communication networks" states Mark John in his post, The 6 D's Changing the Electric Utility Industry, published March 28, 2019 on T&D World. (https://www.tdworld.com/utility-business/6-d-s-changing-electric-utility-industry). This will be the way cooperatives continue to succeed. Creativity should be encouraged, and cross-departmental opportunities to discuss and brainstorm for solutions to problems should be encouraged. Examples of how to promote creativity, and collaborate on non-traditional solutions include:

- Allowing for job shadowing between functional groups to allow everyone to understand where data comes from and how it is used.
- Trial and error of different ideas and approaches - this could mean installing smart lights or Alexa devices around the office to see how members might be using new technology at home, or how to augment the work environment to promote efficiencies.

Opportunities to defer installing networked clocks within a building, or even intercom solutions may be found from non-traditional methods with trial and error mentality.

- Purchasing the next fleet vehicle as a full EV, and installing a smart charger, or even a solar installation and batteries in a yard with a smart inverter and EV charger, to gain experience. Some utilities are allowing members to rent out the EV for a day or more to see if it would work for them.
- Collaborating with local schools or colleges to explore upcoming technology and generate excitement in looking at new ideas within the utility that long-term employees may miss.
- Allowing employees to actively participate in industry groups such as REMDC, software vendor annual meetings, or NRECA conferences such as TechAdvantage—having a network to reach out to when new ideas are thought of, or to stay in tune with what other utilities are trying—what worked and what didn't—is paramount for continuing to stay relevant in an industry that is undergoing sweeping changes.

For planning and engineering employees that embrace challenges the future holds, exciting changes to the traditional methods and tools are coming. These employees can help shape how these changes impact their utilities now. They will be forced to "think outside the box" and look for solutions in areas beyond the substation yard and outside their distribution lines. The old-school theories and concepts will still hold, but the idea of a "normal" or "static" distribution grid will be a thing of the past. Re-training employees to think differently about the dynamic state of the grid, and truly integrate analysis and real-time operational systems into the rest of the business will be required.

Information Technology

The growth of information technology (IT) has accelerated perhaps faster than any other area of the cooperative business in recent years. For most electric cooperatives, much of what accounted for IT activity and investment 10-15 years ago was a server-based customer information/general accounting system and a personal computer based local network. From both internal demand for new platforms and an exponential escalation of consumer expectations for member-facing products, demands on electric cooperatives to purchase and implement hardware and train employees, consultants, and members on these systems has dramatically increased. We are in an age of around the clock social media, the Internet of Things and instant gratification, as well as constant information. IT will play a key role in EaaS, placing pressure on budgets, connectivity, and personnel.

Driving much of the growth of information technology systems was what the industry has become to accept as "big data". Digital AMR/AMI metering systems revolutionized the collection of usage data, first with daily and then hourly readings. Fifteen-minute data readings are quickly becoming a norm, with demand for even more granular data rapidly approaching. Housing this data is challenging, driving the advent of Meter Data Management systems, either standalone or integrated into a CIS platform. Suddenly, the integration of energy, demand, billing, outage, geospatial, and other customer data, such as smart thermostats and other home automation via the IoT, must be warehoused. To be of use internally or externally for member presentment online or via app, all of the platforms must be truly integrated. Obviously, this data must be backed up, and it must be protected. What began as 12 hourly reads has escalated into billions of data points.

Connectivity

It is impossible to adequately discuss information technology and the rise of data intensive systems and connectivity of platforms without fully discussing the availability of true "broadband" connectivity to cooperative facilities. While many agencies, including the U.S. Census Bureau, report high-speed internet availability (defined as 25mbps download/3 mbps upload, a standard only raised from 4 down/1 up in 2015) to greater than 80% of American households, rural areas obviously see much lower high-speed internet availability, if any. A 2018 Pew Foundation study found that about 50% of homes in rural areas had internet qualifying as high speed. It should not be overlooked that cooperative facilities are often located in places with the same internet availability challenges faced by their members.

While many rural cooperatives are actively working to bring broadband service to their service territories, either as middle-mile providers, service to the home retail providers, or both, many other cooperatives still struggle with accessing fiber sufficient for meeting the information technology platform needs of the utility. Many experts identify 50-100 Mbps as a minimum level of speed availability to support such system as VOIP, meter data backhaul, digital phone systems, or cloud access to certain platforms.

It should also be noted that many of the complementary technologies to EaaS, such as home automation, require high-speed internet service.

Cloud

Cloud computing has emerged as an alternative to tradition onsite server and storage platforms. While an all-encompassing term, the service models for cloud computing can be infrastructure as service (IaaS), platform as service (PaaS), or software as service (SaaS). Cloud platforms typically offer lower capital costs, lower IT operating costs, potentially including staffing needs, and the elimination of system upgrades or designed obsolescence. Cloud systems may offer enhanced reliability in disaster recover incidents, particularly due to redundant, offsite locations, but could prove a liability if damaged infrastructure prevents communication or if a data breach were to occur when data is stored in the cloud.

Security Issues

The continual growth of system platforms, data, member-facing applications and mobile devices within electric cooperatives enhance service, but they create more openings for cyber criminals. The very broad range of electric cooperative sizes and organizational structures make addressing best practices for all cooperative classes difficult. However, all have an equal responsibility to protect cooperative and member data, reliability and the cooperative's reputation.

Gone are the days where having a firewall and recently updated antivirus signatures is sufficient. A multilayered defense of physical security, firewalls, antivirus and malware software, password management, patch management, web and email filtering, system log monitoring and alerting, geoblocking filters (to block access both in and out of the network from hostile countries) and some form of network intrusion monitoring are the norm today. This approach has recently come to be known as "defense in depth". Further, social engineering and phishing emails have become the norm for hackers attempting to breach networks. Employee awareness training is as essential to the technology in keeping attacks from being successful.

The following considerations have direct bearing on the distribution cooperative, particularly in an EaaS environment, with ever-increasing data and system interfaces and intense public scrutiny on companies to secure customer data.

Regulatory Requirements

While NERC CIP-9 requirements ultimately affect electric cooperatives, distribution co-ops are largely shielded from direct responsibility by generation and transmission cooperatives or RTOs. For distribution co-ops, PCI-DSS may represent the greatest regulatory hurdle. While a cooperative's CIS provider may protect online/app transactions, equipment and software applications in telephony and adherence to the twelve PCI standards is still required to protect credit card data. Fortunately, these are all directly in alignment with accepted industry standards and requirements for a well-designed, multi-layered security approach.

In a world with increasing expectations for privacy and attentiveness to protecting consumer data, an escalation of regulatory requirements should be expected. Cooperatives should stay abreast of regulatory trends and remain prepared for adjustment to policy, budgets and employment trends.

Strategy and Security Frameworks

Regardless of size, the ability of a cooperative's staff to plan, assess and test cyber-security lies within the function of a security framework. Such a framework is purely voluntary. On a grand scale, the National Institute of Standards and Technology (NIST) Framework for Cybersecurity is exhaustive, cost prohibitive and likely overwhelming for even the largest cooperatives. The Center for Internet Security (CIS) 20 Controls is a more manageable framework. CIS vendors serving cooperatives offer self-assessment tools. Very small cooperatives with no dedicated IT staff will struggle to complete these assessments, perhaps even with assistance from consultants. However, NRECA's RC3 program provides assistance to small cooperative's with assessment tools, training, and other resources.

Creating a Culture of Security

Cultivating an environment where every employee understands and embraces their role in effective and resilient cybersecurity is challenging, but critical. A vast majority of cybersecurity breaches are caused by human error, perhaps 90% or more. The following should be incorporated into cybersecurity training for employees:

- Robust board, financial, and employee policies related to cybersecurity
- Initial training for new hires and thorough annual training for all employees
- Routine phishing and social engineering testing for all employees
- Escalating retraining and/or discipline for repeat failures

Penetration Testing

Beyond a requirement for PCI compliance, routine penetration testing offers validation and verification that the cooperative's cybersecurity measures are effective. Penetration testing, including "hammer testing" of security networks and telephony, testing of patch management policies, phishing testing, physical security and other vulnerabilities should be conducted at least annually.

Repercussions for Cybersecurity Failure

Recent studies, including IBM's 2018 Cost of a Data Breach Study, conclude that mitigation of a cybersecurity breach may cost $148 per account or more. Beyond direct financial costs, the public relations impact and loss of trust by a membership faced with a data breach could be lasting. A cybersecurity umbrella liability policy to protect the cooperative and cover some of the costs of mitigation are prudent. The creation of an Incident Response Plan to direct cooperative actions following a breach is recommended. Resources from Federated Rural Electric Insurance would be made available should a breach occur.

Staffing

Information Technology staffing would most certainly be impacted by an escalation of programming and platforms in an EaaS environment. Identifying, hiring and retaining the necessary personnel will place new challenges on human resources departments. Doubtless, the required integration of new platforms will require new and diverse skills, likely challenging the ability to attract highly valued IT employees to rural areas. Additionally, new member-facing platforms, website or app based, may require IT employees in “help desk” roles, new functions requiring both IT skills and customer service savvy.

Finally, support will be needed across department boundaries to support a growing list of technology related hardware and software options for cooperative members. In many cases at cooperatives, the IT staff is well suited to assist other departments with technology-related research, design, implementation and support issues.

Human Resources

Human Resources serves as a strategic business partner to leadership by providing guidance, coaching and direction regarding employee matters, organizational development and design, and positive employee relations. Human Resources is tasked with developing, promoting, and maintaining a human resource strategy that is aligned with the business strategy and corporate values of the cooperative. This department provides guidance and direction regarding human capital and talent management to maximize the cooperative's overall effectiveness, while providing both long and short-term information and recommendations for planning. Human Resources researches, designs, and develops plans and programs for recruitment, employee development, performance management, compensation, benefits, retirement, and total rewards. This iterative process is undertaken to attract, retain, engage and develop talent on a continuous basis.

According to a recent Gallup report, 21% of millennials have switched their job within the last year, this is three times the number of non-millennials. Many millennials are not engaged at work, and this statistic leads all other generations. In comparison, past generations of cooperative employees have made many sacrifices from family time to ensure that the cooperative is successful in its mission of providing exceptional service to the membership. Employee expectations are changing, in most cooperatives, currently it is not uncommon to have employees that have been with the cooperative for decades, this trend will most likely not continue, as millennials will make up 75% of the workforce in 2025.

Resources will need to be adaptive in order to compete and retain the talent of the future. Some suggestions to help keep employees engaged and to prevent top performers from leaving the organization:

- Reward innovation
- Utilize a change management specialist to help employees embrace change
- Design office space to encourage brainstorming and interaction for those who need it
- Increase hiring channels to encourage diversity
- Develop a pipeline of interns
- Use telecommuting when appropriate
- Flatten the organization to make sure everyone is heard
- Empower employees to make decisions
- Utilize cross training
- Continually evaluate wages and benefits to remain competitive
- Ongoing training and education

- Keep employees informed on issues pertaining to the organization and the industry
- Ensure employees have an open and transparent opportunity to provide input into the organization

Member Services and Key Accounts

Employees who serve in the Member Services department are the front-line communicators who respond to members over the phone, in-person, or via email. Member service representatives, in most cases, are the first cooperative employee that members interact with, so it is important they have a sound understanding of the cooperative and portray the cooperative culture.

To be successful, member services representatives (MSRs) should be empathetic, be able to think quickly and make decisions that align with company policies. Communicating complex information with a clear and accommodating manner will always be required. In many cases, members base their experience with the cooperative on the interaction they had with the member service employee. To ensure the members' experience is positive, it is imperative that member service employees have or can turn to a cooperative knowledge base. Therefore, it is important that training for member service employees is never ending and that MSR employees have an open line of communication with all departments.

Key Account representatives serve a similar role as member services, but are the individual point of contact and liaison for commercial and industrial (C&I) members with usage above a specific threshold or unique business circumstances. Key account representatives should understand the complex and unique needs of each of their accounts should be able to communicate on a multitude of issues that include reliability and economic impacts. In essence, key account representatives need to build and foster positive relationships with commercial and industrial accounts.

With shifting member service expectations, member services and key accounts will need different resources and skills than they did just a few years ago. For instance, email communication and the ability to write concisely and present correct information in written form is a different skillset than telephonic communication. MSRs should be able to use new technology such as chat functionality (written communication) and should be able to multitask and navigate different through different applications (CIS, MDM, outage system, payment system, call holding application, etc.) simultaneously.

New technologies and innovations are changing consumer retail exchanges. For example, Apple Pay, GooglePay and Venmo are new entrants into the market of mobile payment whereby consumers can send money and receive money via mobile application. Members who use these payment options with other companies may come to expect the cooperative to offer this type of payment.

In today's current cultural climate, more members are more environmentally cautious, and are seeking different generation resource options beyond the typical generation mix that have traditionally been offered by cooperative. This trend has challenged many cooperatives policies and knowledge. From a frontline perspective, MSRs are often caught in the crossfire. To combat this issue, member service employees need to be equipped with talking points and links to a cooperative's knowledge base. The materials used by MSRs should be customized to include specifics about interconnection process, size limitations, rate options, and any other policies that

are linked to installation of distributed generation. Recently, service companies have started to use mobile texting and electronic communication to notify and confirm appointments. With automated notifications, consumers are notified via text of upcoming appointments and given the option to confirm with a text response or cancel with a text message from the consumer to the company. These same proactive communications typically notify the consumer again within a short timeframe, before the technician arrives at consumer homes. This could be a valuable tool cooperatives may want to consider to improve scheduling between the cooperative and member.

As we look at the DSO of the future, member services will play key role in the success of the cooperative. As the cooperative begins to evolve into an energy as a service structure, member service employees will need to adapt their member approach to accommodate the sale of different types of services. As new services and programs are developed, member service employees will be charged with responsibility of promoting the sale these services to the membership.

Cooperatives should consider innovative ways to sell these products online through e-commerce websites and can offer LED lighting, smart Wi-Fi thermostats and energy efficiency items. Example: Energy United http://www.energyfederation.org/energyunited/lighting.html

Resources

Distribution cooperatives should coordinate with each other, their statewide, their G&T cooperatives or other associated groups when possible to leverage partnerships with vendors to provide complimentary services such as software and telecommunications. Cooperatives can also integrate new technologies to cater to wider population that includes members who are non-English speaking, or who are visually or hearing impaired.

Personnel in member services and key accounts should trained in the use of web-based applications for member self-service, smart phone cooperative apps and outage text functionality.

Tools and Technology

In order to assist members with technology shifts, cooperatives should consider implementing customer resource management tools that provide MSRs with answers to FAQs and to aid in sales, marketing and other important sales and service functions. CIS vendors that currently support the cooperative utility market will need to review and consider options for supporting such new requirements.

Training and Education

Training and education on new online platforms should be considered to help employees understand and articulate nuances of new services and technologies.

Operations

No matter the size of a cooperative, operations personnel typically construct, operate, and maintain the electric facilities. Employees are skilled in all tasks associated with constructing new services, replacing aging overhead and underground infrastructure such as poles, wire, transformers, responding to outages, trimming and cutting trees, as well as substation maintenance for cooperatives who also own and operative distribution substations. Employees should have a sound knowledge of RUS specifications, National Electric Safety Code, OSHA regulations and safe working practices.

Operations employees must be able to demonstrate physical stamina such as pole climbing, lifting heavy loads, and the skills necessary to operate large equipment. Improved bucket and derrick trucks, better safety gear, battery-operated tools including chain saws, pole saws and crimping tools have all been welcomed additions for operations crews.

Most cooperatives today have also adopted technology in the field. Information that was once available only in an office or on a printed map is now provided digitally to field crews to enhance productivity and safety. Use of computers or iPads for field crews provide updated maps and other information. Service orders, work orders, and consumer information related to collections and/or physical meter reading may also be routed via mobile work management systems.

New electronic devices in the field have improved reliability and safety features that allow faster job completion. Improvements in FR clothing, fall restraint devices and battery crimp tools have also helped to reduce injuries.

Industry Shifts that will Impact Cooperatives Operations and Safety

Developing technologies will further enhance operational awareness for line workers, providing operations crews more information in real time and improving their ability to work efficiently and safely. Other impacts may require more analysis of the current state of the electric grid and consideration of additional generation resources behind the meter.

Consumers Need for Increased Reliability

The integrated model of power flow is changing as more consumers expect and require greater reliability or even uninterrupted power. As noted in the “Need for Increased Reliability” section of this report, utilities and consumers want better reliability and resiliency from their electric cooperatives today.

Cooperatives continue to monitor and control substations and field devices. As communication systems improve, or are deployed for the first time, dispatchers and operations personnel will have more information and control of the grid, and some will operate automatically.

In systems with automatic switching schemes that “automatically” detect a fault within the system and restore as much of the system possible, operations personnel will need to know when the electric grid has been “switched” from its normal feed and may need to disable the

automation schemes in order to safely perform repairs. Additionally, visually opening switches at source and the back-fed source may be needed.

Move from Central Generation to Local Generation

Operation crews will also need to understand behind the meter generation and how it can affect restoration and maintenance. Many consumers have small generators, and most are noisy, alerting field crews to the potential for energy back feed. New generation such as solar or batteries have no sound, and field crews may not be aware of their use. Even though most will be connected properly and isolated during outages, adhering to restoration procedures will be a must to protect against the improper connections and equipment failure. Larger generation and micro grids will "island" during major outages. Operations personnel will need to know the locations of these power sources and may be required to properly isolate them prior to working on the distribution facilities.

Data and Information

In the past, operations personnel have relied on paper maps to navigate distribution systems. Today however, most cooperatives have moved to digitized maps that are available to field personnel on laptops or IPads. Going forward, operations crews will need real-time updates on system changes, SCADA information and the ability to view outage information in the field to make them more effective and efficient, as well as saving communication time between operations and dispatch. Crews will need to know how to access the information and use it to operate efficiently and safely. Today, some cooperatives use fault data from the SCADA system to help locate where a line has faulted, reducing the time crews use to drive the line to find a fault. Future systems will be able to relay this information to the field in real-time, allowing for even fast response times for outages.

Tools

There are many new tools that have helped operations personnel work better and safer. Improved fall restraint, battery operated tools and new electronic devices can alert crews to energized lines, help crews work safer and with less strains on the body. Going forward, cooperatives will need to continue to evaluate new tools and continue to invest in tools that make the job even safer and more efficient. Something as simple as changing from a manual crimping tool to a battery tool may cost more initially, but will lessen employee fatigue, and thus limit the possibility of future injuries and/or accidents.

Technology

Future operation crews will not only need to have a thorough understanding of line work, they will also need to understand the technologies that will be used to make their jobs more efficient and safer. They will be required to access data via computers or iPads. They will need to be able to use software systems and they will need to understand the electronic devices that are used in the field such as electronic reclosers and electronic regulator controls.

In addition, future technologies such as drones will one day assist operation crews in tasks that currently may require a bucket (such as aerial insulator inspection), or aid visual inspection of

downed power lines in inaccessible areas. Regardless of the technology, operations crews will need the aptitude and knowledge to use these systems.

Training and Wellness

Training has always been a major component of an effective, efficient, and most importantly, a safe operations department. While operations personnel have been well-trained, future training will need to expand to include new components including online or even virtual training. These new training platforms will allow individual training during times when other work may not be feasible. Additionally, training will be needed to educate the operations personnel on how to safely work on/around behind the meter generation.

Currently, operations personnel typically work outside and need to be able to lift, push, pull, and climb to construct and maintain electric facilities. Going forward, cooperatives will need to educate and facilitate wellness training to help the operation crews in maintaining a high level of physical fitness. A few examples of this are implementing daily or job site stretching or providing fitness equipment at a cooperative office.

Centralized Dispatching

Dispatchers can be in operations, engineering, or customer service, depending on what fits and works at each cooperative. Going forward, centralized dispatch centers can be used to monitor events such as outages, SCADA information, blinks, or even potential issues in a meter base from AMI data. This information will be used by central dispatch to not only respond to outages, but also to respond to the information proactively, allowing field personnel to be sent out to perform preventative maintenance to help prevent outages before they occur. In addition, dispatch personnel will be able to operate field equipment, at the direction of field crews, and use automation to perform switching.

Dispatchers may also need to dispatch behind the meter resources and oversee a DERMS system. Future real time load flows on the distribution system may require monitoring and reacting to changes in generation behind the meter in high saturation areas of DR. It is possible that in the DSO future those distribution system dispatchers will operate more like transmission system operators. There may be economic functions that are managed by a DERMS and will need to be under review and control by an individual 24x7.

Safety

Safety is the top priority at every cooperative. To ensure worker and public safety in the future, updated safety training related to behind the meter demand response will be required. Operations personnel will have to consider multiple sources when working on the electric grid, and they will have to be aware of any automatic switching that may have occurred prior to working on the distribution facilities. Personnel awareness of their environment and the effective use of visual opens and proper grounding techniques will continue to be critical. Additionally, promoting mental and physical wellness will continue to be major factors in a successful safety program, and play a primary role in ensuring that everyone returns home safely at the end of the day.

Power Supply

Power supply is an area significantly impacted by DERs and DSOs. Traditional power supply functions in the cooperative business model (supply chain for electric delivery) includes:

- Wholesale power supply planning, procurement/construction, operations, administration and transmission planning, construction and operations;
- Distribution power supply planning, work plans, procurement, operations and delivery.

The delineation between Wholesale and Distribution is typically defined at the power delivery Levels A and B1 where the transmission service provider delivers to the distribution system, which ultimately delivers and retails to Levels C and D, the consumer/business. In some situations, the wholesale power supplier may or may not be the transmission service provider.

For purposes of this section, reference to the wholesale power supplier is the G&T cooperative, while recognizing some distribution cooperatives do not have a G&T, and some already have partial requirements with their G&T. No matter how wholesale power is delivered to distribution cooperatives, transactions structured to provide all-requirements service or carve-outs in the long term may not provide the flexibilities needed to address the onset of DERs and the Prosumer.

For the purposes of understanding duties of Wholesale and Distribution, further definition of the terms Responsibility and Accountability is extrapolated.

- Responsibility is assumed, or an obligation exists. Responsibility is shared among entities. Responsibility is assumed before and after an assumed action.
- Accountability is imposed. Accountability is specific to an individual entity. Accountability occurs after an assumed action.

In general, the table below identifies parties to which each Wholesale and Distribution sector assumes responsibilities, accountabilities and high-level duties. This list of parties is meant to be comprehensive, while recognizing specific situations may only have a subset of parties.

	Responsibility to	**Accountability to**	**Duties**
Wholesale	• FERC • NERC • RTO/ISO/Control Area • PUC • RUS, Lenders	• Member-owner (distribution cooperative) • Typically, 60-70% of total consumer costs	• Power supply and transmission planning • Power generation, purchases, O&M • Transmission assets, purchases, O&M • System operations

			• Contract administration and billing
Distribution	• FERC • NERC • RTO/ISO/Control Area • PUC • RUS, Lenders	• Member-consumers • Typically, 30-40% of total member-consumer costs	• Distribution planning • Distribution system assets, O&M • Community relations and programming • Customer service, & billing

Industry Shifts and Impacts

Regulation (or deregulation or reregulation) of the wholesale power market, environmental concerns and technological advances are all factors causing disruption to every aspect of the traditional electric utility model. Terms now added to industry vocabulary include Rooftop Solar, Community Solar, Electric Vehicles, Internet of Things (IoT), Distributed Energy Resources (DERs), and Distribution System Operators (DSOs)—all terms relating to activities behind the wholesale meter and that enable consumers and distribution utilities to produce power without wholesaler assistance.

The Wholesale Power Markets

Congressional policies impacting the electric utility business model (including, but not limited to, Federal Power Act, Public Utility Act, Public Utility Holding Act, PURPA, EPACT92, FERC Orders 888 & 889, FERC Order 2000, EPACT05, CPP, MACT) have shaped the wholesale power markets and created today's competitive environments. The vertically integrated utility (generation, transmission and distribution) and monopolistic services are being challenged as competition in wholesale markets is proving to lower the price of electricity. What policies have not addressed is giving a capital-intensive industry with assets that were justified over 30-40-60-year timeframes the means to shed the assets and be able to compete as nimble non-utility players enter the market with no asset-baggage. Some would say utility status quo and denial that change was necessary in delivery structures have cost the industry valuable time in becoming more competitive.

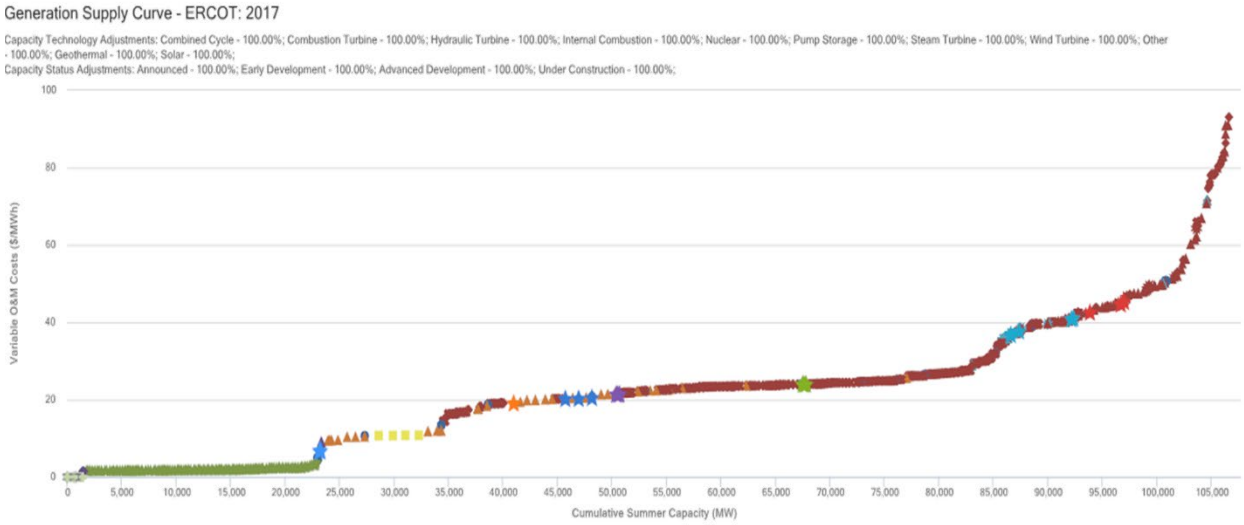
In response, most public utilities have formulated deregulated marketing arms that compete for wholesale load outside their traditional service territories, while maintaining their vertically integrated utility. In the case of cooperatives, some G&Ts have addressed their wholesale all-requirements power contracts and have added flexibility through partial requirements that allow distribution consumer/members to purchase all or a smaller percentage from the wholesale market (i.e., 100% future needs (OPC, NCEMC), 5% carve-out (ODEC)). While the wholesale

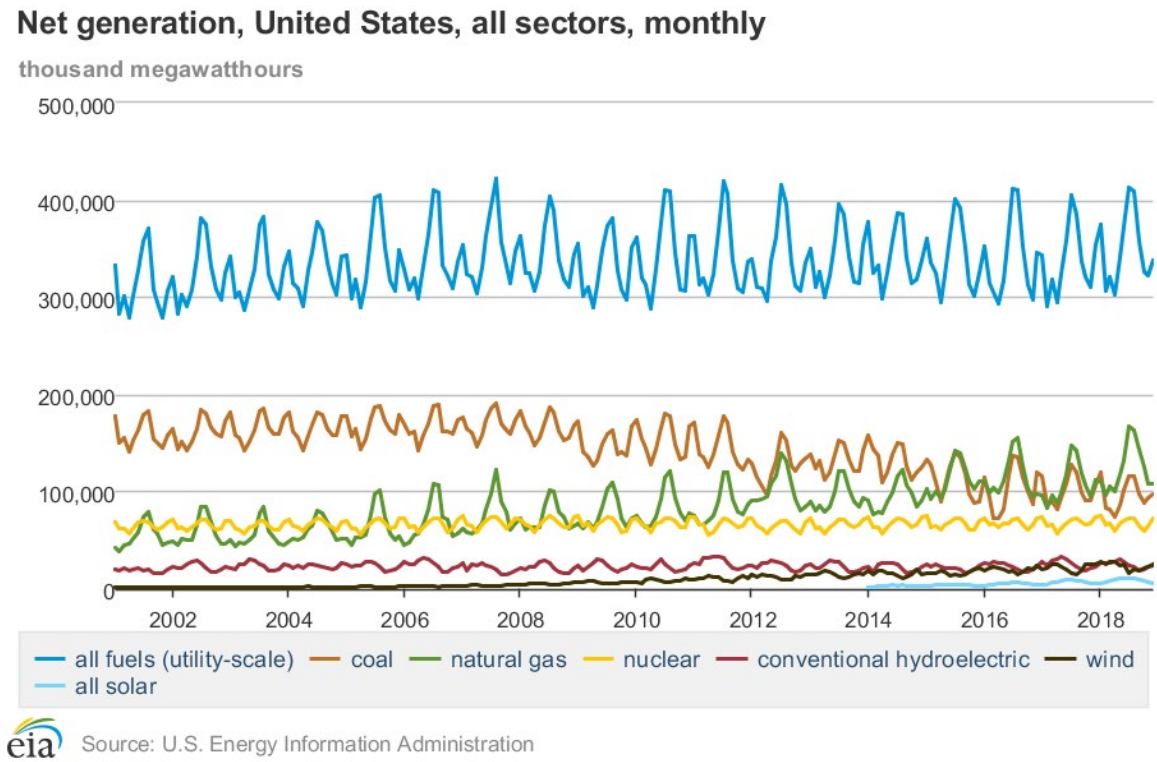
power markets are deregulated, it is argued that the wholesale arm of public and private utilities should provide flexibility as long as prior commitments are still kept whole.

Environmental Issues and New Technologies: Centralized Power Generation

The threat of global warning and climate change (whether perceived or real) has evolved worldwide and the electric utility industry, among others, has been targeted as a poster child for dirty emissions. At the same time, renewable energy has gone from being too expensive in some areas of the country to be considered as a way to attain 100% energy goals. As research and technologies have advanced, a scenario where a solar farm was more expensive than a coal plant has redefined the economic dispatch of RTOs, ISOs and control areas. Must-take energy from solar and wind projects and the economic benefits of U.S. oil and gas fracking have forced the economic stack from nuclear to coal, natural gas to oil (cheapest to expensive), to solar and wind, and nuclear to natural gas and to oil. Two facts to note: 1) **Exhibit A-1** shows the 2017 economic dispatch stack in ERCOT. The must-take wind and solar generation has pushed the traditional generation resources to operate less efficiently; 2) **Exhibit A-2** shows an EIA chart of the net generation by fuel source from 2002 to mid-2018. In 2015, the net generation from natural gas resources surpassed coal.

Exhibit A-1





As a result, coal plants are being mothballed because they cannot operate economically. Natural gas plants are driving the need for more gas pipeline capacity. Nuclear plants are unattractive after the recent Fukushima disaster and Westinghouse bankruptcy. And with reduced solar and wind, renewable generation systems are now serious contenders in the competitive generation resource mix. Finally, with the potential of affordable battery technology just around the corner, solar and wind resources may cost-effectively replace coal plants.

Distributed Generation

Distributed generation has been championed as a solution for commercial/industrial businesses who require back-up generation, ensuring consistent power and power quality levels in the event of electric outages. Research and technologies have 1) introduced clean technologies in the supply chain of electric generation, and 2) enabled the consumer to be in more control of their energy costs.

Today, the term is Distributed Energy Resources (DERs). Distribution cooperatives are in a position to become their system's Distributed System Operator (DSO), which is an expansion of today's energy management systems. If a cooperative today operates a load management system to reduce peak period usage and avoid wholesale power charges, it should view the DSO evolution as an expansion that can aid in the control of all DERs on its system to optimize peak period usage and reliability concerns.

The Home

Home usage affects utility power requirement studies (load forecasting) and thus, long-term resource planning. Residential usage patterns are now longer stereotypical for either Electric + Natural Gas or All Electric. The consumer use of IoT appliances changes the load profile of any single home, depending on how many appliances and how active the consumer is in managing residential appliances. Consistently changing residential usage patterns cause uncertainty in the long-term planning process for both wholesale generation and distribution utilities.

Additionally, as technology advancements have improved the energy efficiency of appliances and lighting, average residential usage from 2005-2015 has decreased throughout the country as shown in **Exhibit B**, developed by the EIA using census data.

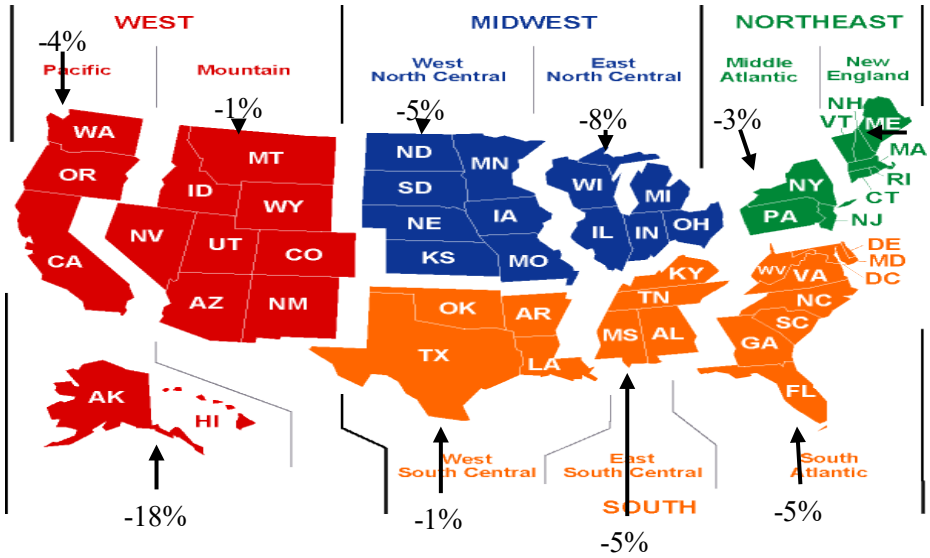


Exhibit B Source: Energy Information Agency

It is necessary for G&T and distribution cooperatives to understand why and how residential usage trends are shaping the need of change when wholesale power supply plans, load forecasts and distribution work plans are developed. Knowledge is power for the EaaS utility—where an inventory is taken of what DERs consumers/members have, collecting and interpreting data, developing DER programs that optimize power costs, system reliability and improvement plans and that model current of consumer usage trends is a "new" perspective a utility's management must consider.

Preparing for the Inevitable

What should electric cooperatives do to prepare for the DSO/EaaS future? Electric cooperatives were formed to deliver affordable electric service to Rural America. This mission does not have to change, however, the industry's perspective must change. Electric service is no longer limited to supplying electricity to the member-consumer, but rather enabling the member-consumer to use electricity as they wish, whether that is providing the delivery of electricity or providing programs that make DER technologies affordable.

In preparation for the developing impact of DERs behind the wholesale meter, as well as the retail meter, G&Ts and distribution cooperatives must have access to a changing/different set of resources, tools and technology, training and education. Those differences may vary in magnitude.

The following topics are not meant to be all-inclusive, because additional considerations will surface as DER/DSO environments mature.

Resources

For the purposes of this section, Resources are defined as Purpose, Structure, Capital (financial) and Human (staff).

Purpose

DERs address new consumer dynamics, and the Department of Energy's definition for Prosumer is the assumption: "A prosumer is someone who both produces and consumes energy—a shift made possible, in part, due to the rise of new connected technologies and the steady increase of more renewable power like solar and wind onto our electric grid," (https://www.energy.gov/eere/articles/consumer-vs-prosumer-whats-difference). As the consumer becomes a prosumer, the purpose of the distribution cooperative changes from the traditional electric utility to a facilitator of the prosumer; thus, the purpose aligns with EaaS. The distribution cooperative is no longer the single provider of electricity to the consumer. In addition, DER technologies will allow more economic and reliable means for the distribution cooperative to service member-consumers, both behind the wholesale meter and retail meter.

Since the G&T cooperative is owned by its member-owners, its purpose changes too— enabling member-owners so they can survive in today's highly competitive retail arena where maintaining a cost-competitive resource portfolio and providing services to the collective membership will be the new mandates. If a G&T's resources are not competitive, it is G&T's responsibility to determine how to address those issues cost-effectively. The key for accepted and effective G&T services is how the services assist the member-owners and how they are billed to the membership. A wholesale energy rate which is based on wholesale power may not be the appropriate approach to service charges. A more acceptable approach is following cost-causation pricing. Furthermore, adopting a competitive mindset will be key at the G&T, as well as developing an understanding of the willing buyer/willing seller relationship. In competitive markets, surviving enterprises deliver exceptional, useful services at affordable prices. Ultimately, the Prosumer will decide who will be relevant in energy services. Thus, developing a

competitive mindset should be the central and mutual focus of a G&T and distribution cooperative culture.

Structure

How do G&Ts and distribution cooperatives change with this new mission? First, in the prosumer world, the distribution cooperative will now advocate for member-consumers who generate their own power and deliver excess power back onto the grid. The directional flow of power generation and delivery will reverse in the future—from consumer to distribution, and then from distribution to generator and transmitter. Second, the distribution cooperative can implement efficient and economic technologies behind the wholesale meter to improve service reliability and costs to the Prosumer. Similar to the prosumer, the distribution cooperative can generate its own power and feed excess power back onto the grid. Technology is allowing for opportunities that enable prosumers and provide energy services still consistent to the original mission of electric cooperatives, making electricity affordable.

The wholesale power contract between G&Ts and member distribution cooperatives should reflect this new relationship, allowing distribution cooperatives the flexibility to generate power behind the wholesale and retail meters. The typical all-requirements wholesale power contract may not be flexible if it allows for no prosumer-generation of power. A wholesale power contract with a carve-out that allows member-owners to purchase from other sources has limited flexibility. If one member-owner executes a carve-out, and the G&T reduces its total costs by the same size of the carve-out, this structure could cause cost-shifting between member-owners of the G&T. A wholesale power contract that is a partial requirements contract allows continual recovery of a G&Ts existing resources. A structure that allows member-owners to purchase their incremental needs from other sources (including the G&T) is ideal, because it ensures the G&T cost recovery for existing resources and competes for future resources. Thus, the willing buyer/willing seller concept and competitive mindset are introduced. It is imperative for G&T's and their distribution cooperative owners find and implement useful solutions to address retail member's needs.

Second, the utility industry (electric and gas, in particular) must recognize that as the industry becomes more complex, decision-making also becomes more complex. Directors on boards at the distribution cooperative and the G&T must ensure they understand the new complexities in order to make reasonable decisions relating to contracts and policies. G&T and distribution cooperative leaders should work to ensure proper training and communication occurs with their directors.

Capital

With the growth of DERs, is the utility industry becoming less capital intensive? Probably overall, but at a slow rate because central power stations are still needed. Eventually, as DERs become more prevalent and residential usage continues to decrease, the need for central power stations

may lessen, resulting in the industry becoming less capital intensive. However, from the delivery aspect of the supply chain (the transmission and distribution systems), grid modernization is causing significant increases in utility investments. "Grid modernization refers to computer-based control and automation technology to bring current utility electricity delivery systems into the 21st century. The benefits of grid modernization include improvements in efficiency, reliability, economics, and sustainability of the production and distribution of electricity all the way from the electricity's generation to the user's home and workplace," per the Hawaii State Energy Office (http://energy.hawaii.gov/renewable-energy/grid-modernization). Although these investments do not compare in monetary size to central power stations; nevertheless, they are a fast growing cost component to the delivery piece of the supply chain.

Cooperatives are exploring and entering into the broadband/fiber space as high-speed communications networks are essential for efficient utility operations and member-consumers. An important component to effective DER programs is high-speed communication. This new business for cooperatives is capital intensive, yet enhances rural Americans' quality of life. From a lender's perspective, evaluating the cooperative's feasibility study and business plan centers around execution risk. This risk is determined from a demand study, competitive analysis, management expertise, budgeting/forecasting capability and technology.

Human Capital

As the industry changes, cooperative's staff will change, as well. The skill sets that will be needed at the management level will depend on the technologies the cooperative chooses to implement. In general, knowledge in the areas of information technology, marketing, public relations, data analytics and problem-solving is changing with the environment. In addition, skills such as leadership, management and communication are increasingly emphasized as staffs are challenged differently. The realm of required knowledge is increasing, and a new generation of workers is entering the workforce.

Increased use of adjunct staff, either through contractors and/or consultants assists cooperatives in transition by jumpstarting knowledge and experience. Further, as more employees retire from full-time jobs, many are staying in the workforce as part-time consultants—representing experienced resources that may bear further consideration. Likewise, the new generation of workers entering the industry brings with it a new curiosity, fascination and acceptance of new technologies. Regardless, there are many different methods that G&T's can consider in working with their distribution cooperative members to deal with the contractual issues that might be present, or that could affect the end Prosumer's desires. All stakeholders should work together to come up with solutions that work for and are acceptable to the retail member.

Tools and Technology

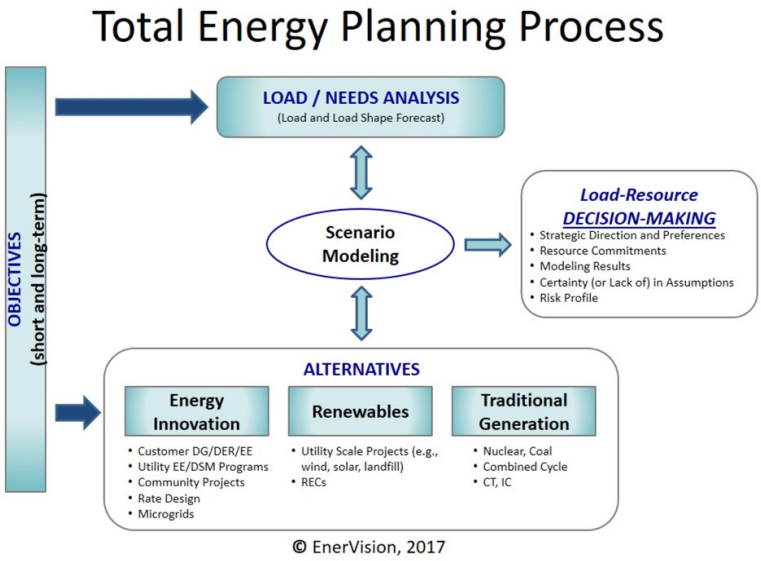
This section addresses the tools and technology that a shift in power supply may require at cooperatives.

Planning and Forecasting

Utilities have to plan and forecast, i.e., power requirements, resource plans, work plans, equity plans and financial forecasts. Traditional power supply planning has traditionally occurred at the G&T level in the past. In a few states, such as North Carolina and Washington, distribution cooperatives are currently required to provide an Integrated Resource Plan by Public Service Commissions. Whether or not regulatory bodies require the Integrated Resource Plan (IRP), it is a prudent tool. IRP are typically 20-year forecasts for how the utility plans to meet its load with power supply (resources). This plan typically includes the feasibility study for resource strategies, or justification for a specific additional resource technology. As the prosumer and DER evolves, Distribution IRPs (DIRP) are being investigated by regulatory bodies similar to those already implemented in North Carolina and Washington.

Exhibit C shows one example of how the IRP process could be updated for more current day planning.

Exhibit C



Planning models and forecasting tools range from complex (for example, using Monte Carlo simulation techniques) to less complex (for example, using Excel). To the extent that the utility requires granularity in data and precision, one must also realize that 20-year planning/forecasting is almost always wrong by the time it is completed. However, data granularity is available now as metering technologies are able to provide 5-15 minute data today. Modeling RTO/ISO markets and control areas can require data granularity, as well as simulation modeling techniques to predict future situations (i.e., generation forced outages, and congestion).

Formulating DER strategy is the first step to DER planning. Instead of implementing certain DER programs because of popularity or even at random, the distribution cooperative should produce a plan which contains cost/benefit analyses, implementation schedules and program goals. This justification demonstrates a methodical approach. **Exhibit D-1** illustrates an example of a DER planning process and **Exhibit D-2** illustrates an example outcome.

Exhibit D-1

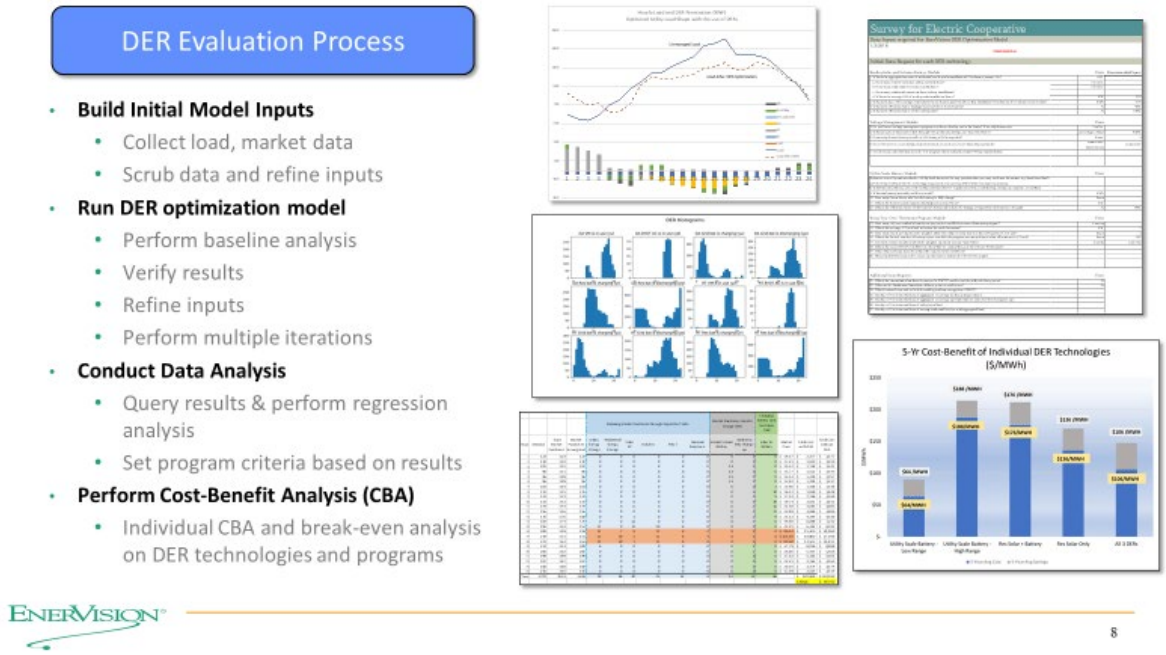
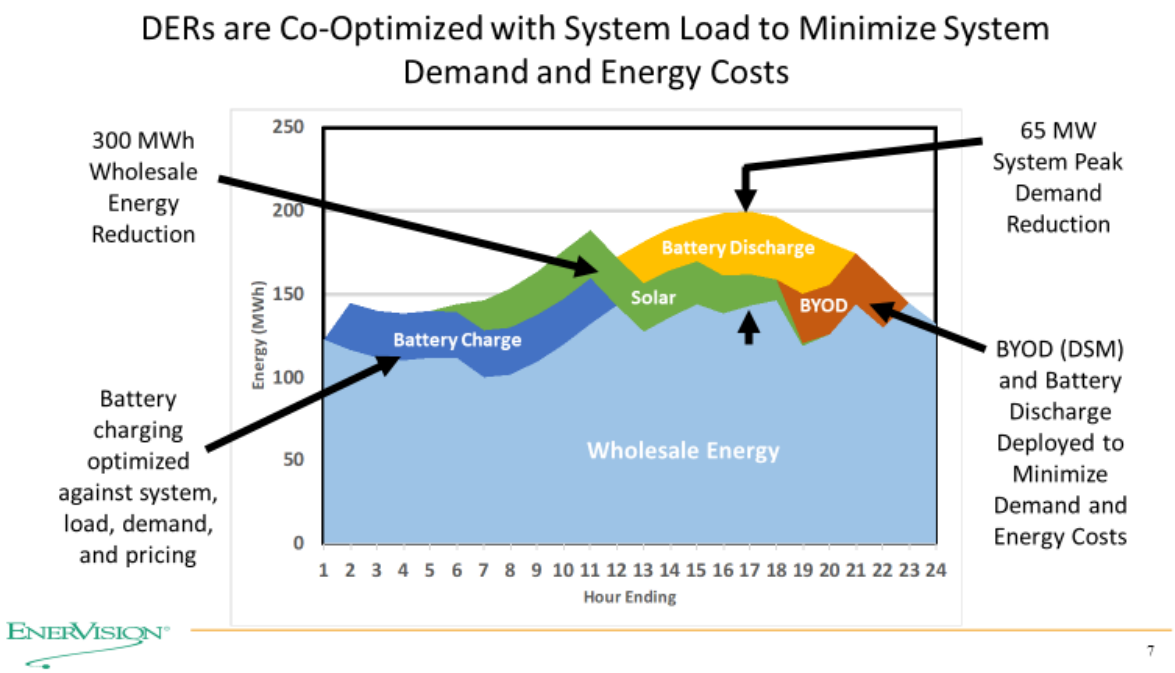


Exhibit D-2



Wholesale and Retail Ratemaking

Rates, whether wholesale or retail, are one area where the rubber meets the road—in other words, where the utility touches the consumer. In the cooperative industry, wholesale rates define the relationship between G&T and member-owners. Similarly, retail rates define the relationship between the distribution cooperative and member-consumers. Rates form the basis of member engagement and cooperative relationships.

Ratemaking begins with rate philosophy and strategy. This is especially important in the DER environment as the cooperative's rate strategy sets the stage for the cost of service study and rate classifications. The cost of service study is no longer taken from cookie-cutter templates. Since the "customer" class is no longer limited to one or two distinctions, defining the consumer classes is now subjective and links to the utility's rate philosophy and strategy. For example, to be an EaaS provider, a distribution cooperative is focused on enabling prosumers, incentivizing efficiency, and providing reliable service at affordable rates and that are fair and non-discriminatory. If the cooperative is rate-regulated, the strategy may be strictly devoted to a ratemaking philosophy where rates must be just, fair and non-discriminatory.

As the average residential electric usage decreases, distribution cooperatives are now focused on cost recovery through fixed charges or demand charges, and eliminating fixed cost recovery through energy rates. If the distribution cooperative aims to enable the prosumer and thus delivers EaaS, residential rates change from the traditional general services rate structure to rate options for DERs. Programming for DERs includes not only the program details and marketing, but also DER rates. Examples include electric vehicle (EV) charging rates enabling the member-consumer to charge their EV during non-peak times and Bring Your Own Thermostat (BYOT) rates that provide incentives to the member-consumer in exchange for turning thermostat control over to the distribution cooperative.

Ratemaking for large commercial/industrial customers is another challenge that brings in another layer of complexity. Industrial processes, power quality needs and desires for renewables and access to power markets require challenges to distribution cooperatives who serve these loads. From the ratemaking perspective, these customers may require real-time pricing (RTP) signals, or other time of use structures such as solar rates, market rates, etc.

Further, for the G&T, ratemaking creates winners and losers within the membership. It's imperative that the G&T rates provide signals appropriate for the member-owners to extend to member-consumers in the DER/DSO environment. As member-owners manage their resources under a G&T's wholesale rate, any peak reduction of the billing determinant achieved for one, potentially results in cost shift for another, unless the G&T reduces its overall costs proportionately. If the G&T does not reduce costs proportionately, it creates a rush to be first environment among members; and as the rate differential among member-owners becomes evident, polarization and non-cooperation grows among member-owners. A number of G&Ts have begun to look at, and potentially review, rate structures to allow flexibility while also addressing cost shifting issues between distribution members. This action will be necessary; the

G&T function has great value but will this structure will be stressed if the relationship doesn't shift to account for the new realities that are becoming evident.

DERMS

As DERs become more prevalent in a distribution cooperative's system, the cooperative can convert its energy management system/dispatch (EMS) to a Distributed Energy Resource Management System (DERMS). From OATI: "…utilities need a new set of tools to manage the technical, operational, and economic ramifications of having a high penetration of interconnected DERs. Key within this tool set is the need to provide situational awareness and to account for and mitigate the impact of DERs on grid reliability. Further, these tools must be able to capture the economic values of DERs for distribution and bulk power systems and for retail customers." (https://www.oati.com/Solution/Smart-Energy/distributed-energy-resource-management):

The coordinated management of distributed and renewable generation, energy storage, and Demand Response (DR) resources can deliver significant value to the host utility, including:

- Enhancing system resiliency and reliability
- Shifting load away from high price periods
- Improving load factor through load shaping
- Minimizing system losses through phase balancing and improved power factor
- Managing voltage profiles
- Managing congestion and circuit overloads, which defers capital expenditures
- Supplying ancillary and other grid services to bulk power and electricity markets"

There will be value in implementing and operating a DERMS for the full portfolio to be modeled. This will require coordination and integration between distribution cooperatives and their G&Ts. In some cases, it might make business and economic sense for the G&T to implement and operate such systems. Close coordination with the distribution cooperative would definitely be required in this condition.

Training and Education

No one doubts that the traditional utility environment is changing and is being disrupted by new technologies that enable prosumer choice. The evolution of energy innovation is occurring. As the environment changes, it will inevitably affect cooperative staffs. Thus, the skills and knowledge bases are changing, and the learning curves are steep.

For distribution cooperative staffs, the world of power supply planning, use of algorithmic planning tools and economic analyses theories may be new. Marketing efforts must be redirected, because DER program promotion may be new, especially if the associated rates are new. Rate philosophies and strategies take on a new perspective. Competition for electric

service, participation in DER programs, and broadband/fiber services mandate a new competitive mindset for some.

For G&T staff, the essential goal should be understanding the changing competitive environment its member-owners are experiencing and also developing a competitive mindset; understanding and focusing on services for member-owners from a willing buyer-willing seller philosophy; and supporting the needs and desires of member-owners in this new DSO and DER world.

Most of all, the willingness to change the business model—the entire supply chain for electric delivery—from generation, transmission, distribution to prosumer is essential. It is believed the Prosumer will ultimately shape the course for who will be relevant in energy services. Distribution and G&T cooperatives both must understand the ultimate purpose—supporting the needs and desires of the retail member.

Procurement

Overview

The electric utility industry is becoming increasingly complex. Digitization and the proliferation of internet-connected devices throughout the utility system and behind-the-meter are fundamental forces driving this change and complexity. This will present electric cooperatives with new business risks as well as opportunities associated with procurement practices and supply chains.

Supply Chain Risks

Supply chains are being disrupted by new entrants and technologies. Potential risks include: cybersecurity challenges, procurement of new and untested technology, and the risk associated with untested vendors.

Cybersecurity

Electric cooperative infrastructure is becoming more internet-connected. This trend will likely continue as infrastructure is replaced, behind-the-meter resources are deployed and consumers adopt new smart home devices. In this emerging environment, cybersecurity is an increasing concern. For instance, a newly purchased software platform could arrive without robust cybersecurity defense or, worse, it could come with malicious code already embedded. A cyber threat also could be a vendor who remotely accesses your system to conduct maintenance or insert a software upgrade that can unwittingly allow an intruder in. These supply chain issues are key risks in the war against cyberattacks[42].

Because of the complexity of cybersecurity issues, co-ops will need to practice increased due-diligence. Procurement best practices should be established and enforced to combat cyber threats. Procurement decisions are currently done in multiple departments so interdepartmental coordination and cooperation will be increasingly important to mitigate risks.

Because of possible cyber concerns, cooperatives should work with well-known and trusted companies, reduce the number of vendors used, and vet vendors with a standard questionnaire. Cooperatives are not able to verify how vendors test and develop software for cybersecurity risks, so being able to screen a vendor's cybersecurity practices on the front end will be important.

Disruptive Technologies

Technologies in the electric utility industry are changing at a rapid pace. At the same time, consumer preferences are evolving to expect new products and services made possible by these technologies. Like a lot of new technologies, many in the utility sector are prohibitively expensive, putting co-ops and other utilities in a tough position. Procuring new technology can be expensive so there is a new business risk with which to contend.

[42] NRECA and the American Public Power Association (APPA), *Managing Cyber Supply Chain Risk—Best Practices for Small Entities (2018)*

Untested Vendors

Industries such as the solar and battery storage industries are both dynamic and new. Many vendors operate in these markets, from small businesses of less than 10 people to large companies such as General Electric, Tesla and AES. However, small and even large companies regularly go out of business or significantly change ownership. So, choosing vendors who will be around for the life of the asset and uphold warranty agreements can be difficult. Smaller vendors may have lower pricing, but they have more risk. Larger vendors may have higher prices but are more stable. The vetting process is an excellent risk management tool that can save the co-op money in the end.[43]

Supply Chain Opportunities

While there may be risks associated with cybersecurity, disruptive technologies and untested vendors, digitization also holds great promise to improve procurement and supply chain efficiencies, which can lead to lower overall costs. For instance, handheld scanners and Wi-Fi enabled inventory-management systems have replaced more cumbersome and less accurate paper ledgers and parts manifests. Electronic signatures can also improve procurement and supply chain operations through improved speed and reliability and the ability to sign remotely. Radio frequency identification device (RFID) has the potential to make inventory management more efficient and improve the supply chain process. RFID-based systems have the potential to perform functions more effectively than their predecessors.

Cooperative Principle #6: Cooperation Among Cooperatives

Electric cooperatives have long leveraged the co-op network to promote mutual learning, pool resources and create economies of scale to bring down costs for the co-op and the consumer-member. The following are examples of ways that co-ops can and have taken advantage of the co-op network:

- Bid selection: vendors can be screened by a co-op on the front end to minimize risks. Other electric co-ops, NRECA and the rest of the co-op network can be a powerful resource.
    - Ex: NRECA's SUNDA Program[44]: The SUNDA program created procurement best practices for utility-scale solar PV systems based on field experience.
- Strategic partnering for specific products: Co-ops can achieve increased buying power through economies of scale for new products and services.
    - Ex: NRECA National Discounts Program[45]

---

[43] *Community Solar Playbook,* https://www.cooperative.com/programs-services/bts/Pages/SUNDA/The-Community-Solar-Playbook.aspx 2016

[44] Cooperative Utility PV Manual https://www.cooperative.com/programs-services/bts/Documents/SUNDA/Project-Managers-PV-Quick-Start-Guide.pdf

[45] https://www.cooperative.com/discounts/Pages/default.aspx

- G&Ts and Statewide Associations
    - Ex: Today's Power[46]: A for-profit subsidiary created by Arkansas Electric Cooperatives. Today's Power can provide discounted rates for co-ops who wish to procure new technologies such as solar PV arrays, battery storage, or electric vehicles.
    - Ex: North Carolina EMC Ecobee smart thermostat program
    - Energy efficiency programs[47]: Co-op collaboration brings economies of scale, joint product procurement, shared services, peer learning, and centralized program management
    - NRTC: Nest Thermostat program, battery storage bulk purchases, etc.

[46] http://www.todayspower.com/
[47] https://www.cooperative.com/remagazine/articles/Pages/Practical-Partnerships.aspx

Safety

Safety is foundation for electric cooperatives across the country. From the first day on the job until the last day on the job and including time outside of work at the cooperative, every employee has to have the competencies to actively determine and mitigate hazards in their daily tasks, as well as those tasks that they may influence. Safety is managed at cooperatives in many ways, but at the root level, each employee and the cooperative leadership must be accountable for ensuring all employees stay safe. While industry shifts will always effect change in cooperatives incorporate safety as a top priority in their organizations, the linchpin in any succeeding safety culture resides with every employee. Looking forward, cooperatives must make sure employees have the training, tools and resources that contribute to safety.

The tools cooperatives currently use in safety are the following:

- Development of a cultural attitude that all injuries can be prevented
- When injuries do occur, root cause analysis is completed to identify all the things that contributed to an incident.
- When factors contributing to incidents are identified, methods must be reviewed and altered when necessary, and then widely communicated.
- Training and the development of sound work habits continue to provide a model to safe behavior.
- More than 80 years of experience in the industry's potential hazards provide a knowledge base essential in mitigating hazards.

Most of these activities in electric cooperatives fall to the management of the cooperative and are communicated to the employees through direct training activities that include specific and repeated safety communication that emphasizes awareness and fighting complacency. In addition to the management, cooperatives usually employ the following organizational resources to address safety:

- Specific safety professionals who monitor changing laws, regulations, and training requirements. These professional safety directors are resourced within the cooperative, at a statewide level, or as external safety consultants.
- Safety committees representing a cross-section of employee types help safety management throughout the organization.
- Safety programs developed by other support organizations such as statewide organizations or NRECA. NRECA has several examples of these with RESAP and other targeted improvement programs such as Commitment to Zero Contacts. This entire framework puts cooperatives in the best position to adapt to shifting industry trends and

to prepare for how those shifts will affect safety. However, it is important to consider the types of changes and challenges that these shifts will cause. The following are anticipated changes that can affect safety and mitigation measures.

- Increased availability and dependence on mobile technology will continue to increase distractions that can potentially heighten safety lapses while driving and performing fieldwork.
    - Continued focus will be required on continually raising awareness to this fact, and more scrutiny of this concern will be required of leadership teams.
- Focus on system reliability will increase for members and regulators. The bar will be raised even higher for co-ops, creating the following effects:
    - Higher levels of employee and organizational focus on speed and efficiency of restoration will tend to pull employees away from effective job planning and identification of hazards (fast brain – slow brain), increasing potential for injury. This challenge exists now, but slowing down restoration efforts for safety will be an even greater challenge in the future (i.e. NERC compliance).
    - More emphasis may be placed (or mandated) on building and converting OH lines to UG—this will require increased focus and training on UG safety work practices (UG operational experience is lacking in many co-ops today).
- Higher levels of local distributed generation will increase potential risk of back-feed when working on de-energized lines and equipment.
    - This will require that co-ops institute sound local policies and requirements for member-owned generation at all levels that allow for isolation from the grid when required.
    - Clear, proactive communications to members about the potential safety risks to cooperative employees will also be needed.
    - Current safety procedures will protect employees if religiously followed. Increased training and safety awareness of this evolving hazard will be needed.
    - Automated operation of DG throw-over switches that safely insulate DG facilities is also a must in lowering exposure hazard. Distributed System Operation (DSO) control will be important.
- The expanded need for centralized operations and control of distribution assets will call for clear and sound operating protocols, communications and training of all stakeholders.

    - Standardized procedures for granting, tracking and completing clearances and/or Lock Out-Tag Out (LOTO) procedures will be required.
    - Distribution System Operator (DSO) positions will be needed to better control and monitor system performance, and help satisfy the need for higher reliability standards.
    - Certification of DSO position may be required and/or mandated.
    - High-quality training will be required for DSO positions, as well as for field personnel.
    - DSO selection, screening, training, testing and monitoring mechanisms must be in place to ensure competency.
- Remote control, operations and monitoring of co-op and member devices will be required to better manage system loads and restore service. These requirements will mandate the need for the following:
    - Dependable communication systems with few or no dead spots.
    - Greater GIS accuracy and processes to ensure timely updates.
        - This will include accurate tracking of member assets beyond the meter.
    - Interoperability of systems to integrate vehicle locations (AVL) with other distribution operating systems, i.e., GIS, outage management, SCADA, etc.
    - Greater safety for field personnel (fewer field trips, proactive understanding of system status, improved knowledge during service restoration, etc.) should be achieved in this environment, but this will require filed personnel to possess a much greater understanding of technology and how systems interact. This will require training that is different from that offered today.
- Construction, maintenance and restoration of broadband facilities. Although risks are similar in some areas to line work, these facilities will create new work procedures and requirements that will require new training programs for co-op employees.
    - Future employee training and supervision in this environment will require newer and more modern approaches.
    - This area will also require a balance of knowledge for any utility worker who may be working in both the electric and communication spaces.
- Physical security will be an ever-increasing risk for co-ops.

    - This risk will require greater resource allocation to monitor and protect co-op assets and personnel (i.e. removal of grounds in substations and pad-mount equipment, protection from high-risk members, etc.).
    - Specialized training with regular facility assessment and follow-up to close security gaps, more safety personnel tasked with security responsibilities, new hires with specialized expertise, and continued investment in monitoring equipment and technology will be required.
- As cooperatives enter the Energy as a Service realm, the meter will transition from a clear demarcation point to one that is very fuzzy. Cooperative employees will be much more engaged behind the meter, which present the need for additional safety requirements employees historically have not been exposed to.
    - This will require training and resources on additional Codes (like NEC v. NESC), OSHA Standards (other than 1910.269), and hazard recognition in these areas.
    - For many cooperatives, this will require a much more integrated relationship with local government building inspectors, and an understanding of laws and regulations.
    - Employees will also need situational safety training. Working in member homes and businesses presents new safety risks, and employees will need tools and resources to deal with these new risks.

The following summary addresses the Business Unit focuses for Safety to correspond with industry shifts and their effects.

Safety Management

Due to the increase in safety knowledge required outside the traditional "utility" safety arena that most cooperative line workers have experience in, resourcing new training programs will cause an increase in the training budget for cooperatives.

Safety Professional Resources

Whether a cooperative has in-house safety professionals, utilizes safety professionals at a statewide organization or uses consulting companies for safety professionals, cooperatives will need to shift resources dedicated to Utility Safety (1910.269 type) coordinators to more broad and general safety backgrounds. Obviously, the need will still exist for safety professionals to have a utility background, but most cooperatives have a ready employee pool to draw from in this area. To balance this and meet the needs of the future, cooperatives should work on training or acquiring employee resources that have been immersed in a wide variety of safety backgrounds. Cooperatives should also plan for these human resources to cost more, since the training to get or stay current in these areas will be accelerated. An example would be more

involvement in safety conferences where topics not typically covered in Utility-based safety training are featured.

Training Resources

The fast pace of change that is expected in the future will require new and innovative ways to train employees quickly and efficiently. The pursuit of operational efficiency will continue to pressure training budgets, and time away from what is traditionally considered productive work. Cooperatives of the future will need to put resources into effectively managing and administering training. Traditional training processes will need to be examined. The use of technology to reduce training travel time, situational awareness (like Virtual Reality training) and tracking of training will be critical. The use of the data to help develop more targeted training based on the hazards being encountered will be needed. Virtual Reality training, computer-based sessions with completion tracking and compliance measurement, as well as employee expertise databases will be a necessity.

In summary , a 1978 quote from Elise Boulding, a sociologist of the time, said, “If one is mentally out of breath all the time from dealing with the present, there is no energy left for imagining the future.” While this applies to almost all the areas covered in this report, it is especially relevant to safety. Since so much of the burden of day-today safety gets appropriately placed on the employees and their supervisors, then all of the problems being addressed are “present” problems. In the new and fast-paced environment laid out in this document, two things would suffer in the arena of safety: the pace would not allow people to anticipate problems and hazards. This would prompt a more reactionary approach to safety, which will not achieve a long-term safety goal of Target zero. Secondly, by only having the resources to deal with present issues even when communicating and mitigating hazards broadly, there is not time to “institutionalize” these changes through documented work practices and safety manual changes. Reliance must then be placed on those who are told to pass it on and remember it while being bombarded with a multitude of tasks in this fast-paced environment. This leaves workers more susceptible to repeating safety incidents.

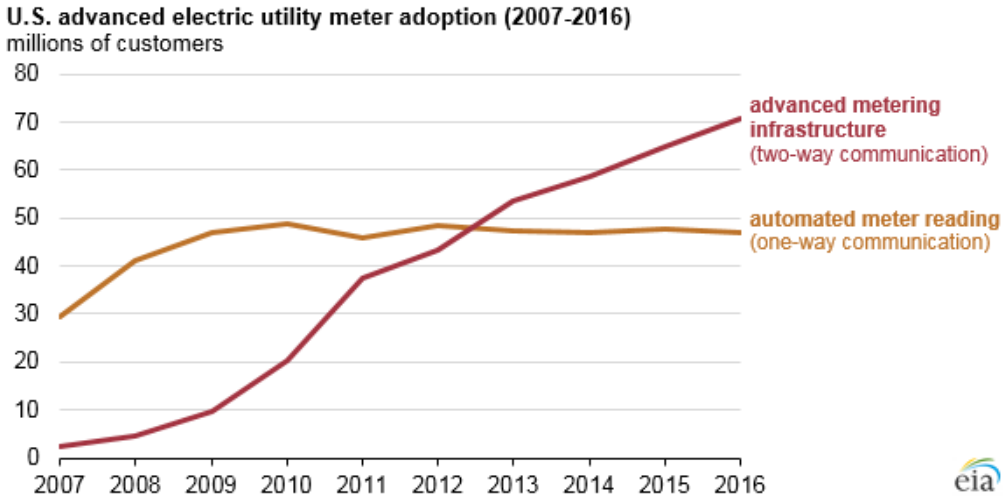
It is imperative for cooperative organizations to develop a safety culture, rather than a safety program. When safety is embedded in all employees’ thoughts, concerns, and work practices, it becomes a part of their daily routine, and thus a culture tethered in safety. With the significant amount of change that is coming to the industry, cooperatives need to be nimble and adjust their safety practices and invest what is necessary to develop a safety culture that will be lasting, no matter the environment.

Technical Services

One of the great futurists and authors of the 20th and 21st centuries, Arthur C. Clarke, published an essay in 1973 containing Clarke's Three Laws. The third of such, and most often quoted, states, "Any sufficiently advanced technology is indistinguishable from magic." Clarke had a fantastic gift for grasping and formulating conceptual ideas, but in the eleven years since he passed the rate technology has advanced would astonish even him. We are at the precipice of a technological revolution the likes of which we have not been seen since entering the Atomic Age. With almost daily advancements in nearly every branch of science and engineering, the development rate of new and better technologies has never been faster, and the line between science fact and science fiction has never been more blurred. Cooperatives must not stand idly by while the technology and equipment employed today become obsolete. The future is already here. Learning to adapt is imperative because cooperatives have the unique ability to not only improve the efficiency of their systems but also simultaneously improve the lives of the members and communities they serve. By accomplishing this goal, cooperatives can effectively implement, utilize, and understand the tools available today and make plans to become the (Distribution System Operator) DSO cooperatives of tomorrow. Because while it may be true that advanced technology seems like magic, it does not seem so to the magician.

Technical services have played an essential role in the cooperative structure from the very beginning. Although the purpose of technical services was small, in comparison to today, the metering of electric usage was most vital for the REA and the formation of rural electric cooperatives. Measurement of electrical usage has come a long way since Edison's electrolytic meter of 1881, which measured the change in weight of a strip of copper to find the electric usage. Electric metering would then be the first technical service. Advancements over the next century in the areas of metering, data acquisition, data communication, and power generation would bring the technical services of today.

This graph shows the change from AMR to AMI, whereby the end of 2016 smart meters with two-way communication covered 47% of the U.S., and by the end of 2017 they comprised 53%.



Source: U.S. Energy Information Administration, *Annual Electric Power Industry Report*

The transition to AMI metering added the ability to have two-way communication, power quality readings, power quality reporting, remote disconnects, and the ability to read metered usage on command in near real time. Although, the abilities of the meters have significantly increased they are only as good as the software that gathers and compiles their data. A DSO cooperative must be accessing and utilizing all of the currently available features and those features yet to come.

The future of the DSO cooperative starts with and depends on the ability to gather and utilize data. This is a product of a "Smart Grid" being that the difference between the grid of today and that of tomorrow is only the amount of data that is shared between devices and entities. This data acquisition will start with metering.

The future of metering will be more involved than a simple measurement of the power delivered to a location. It will be more complicated than the AMI metering that is being adopted currently. So, what does a future meter look like and where does it fit in with the internet of things (IoT) and decentralization of the electric generation system?

Metering of a home or business will not start on the outside, but rather on the inside. Individual devices and circuits will need to be able to communicate their power usage to the meter in real time. This is an integral part of what a DSO cooperative will need to function and provide Energy as a Service, and is a fundamental reason that Energy Innovation should be developed within the membership.

IEEE standard 1901 was published in 2010, and is the standard for the high-speed communication between devices over power lines. Expanding on this is IEEE standard 1905 that provides a communication protocol that is agnostic to underlying home networking technologies that are being built into nearly every device that is being produced today. The HomePlug Powerline Alliance certifies IEEE 1901 products, which, as of 2017, at least six computer chip producers were compliant. These standards are a crucial piece for how devices will communicate within a home area network. According to a Ford press kit from 2011, the HomePlug Green PHY specification has been adopted by Ford, General Motors, Porsche, Volkswagen, BMW, Audi, and Daimler as a connectivity standard for Plug-In Electric Vehicles.

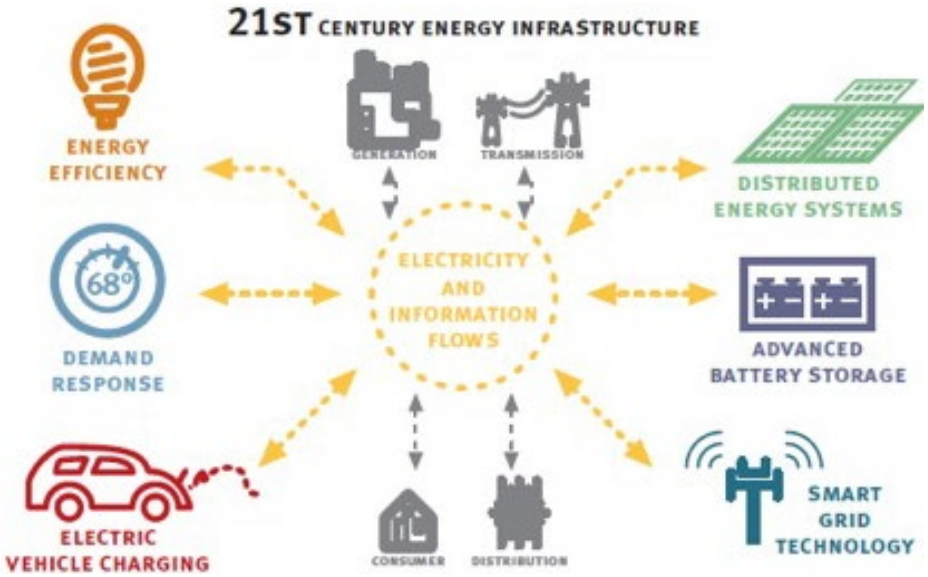
Since communication between devices within a home is advancing, there is a need for the utility meter to be able to communicate with these devices as well. For a DSO cooperative, the coordination and optimization of energy delivery hinge on the ability to have access to all relevant data, from when the HVAC systems are running to when a hairdryer is turned on. This will be necessary to monitor energy flow, maintain the stability of a flexible grid and remunerate for the energy transfer. With the ability to collect data from behind the meter, the DSO cooperative will be able to "see" the usage for individual devices. This data is critical to the DSO cooperative in being able to more accurately practice demand response, peak shaving, and other programs that will reduce the cost of electricity for the member. With this data, members will also be able to better monitor and manage their own usage. It is clear that IoT devices will likely also play a large role in providing data back to the cooperative.

With these new technologies, there come challenges that a DSO cooperative will have to address. With the additional data that is needed, members will need to trust cooperatives with their

sensitive information. Although today's sensitivity to data being shared is still an issue to many people, it is not nearly as much of a problem as it was even five years ago. This being said, while people may be more desensitized in the future, programs that encourage members to learn about what the DSO cooperative is using their data for, and how they are securing it, would be worthwhile.

The DSO cooperative could also consider other programs for implementation that would encourage members to practice energy innovation in their homes and around the community. These could be as simple as a discount program to change members' lightbulbs to more efficient styles. The programs could also be on a larger scale, such as community micro-grids and energy storage as a service. Micro-grids could be owned in part by members of the community and would add resiliency and capacity to the grid. Energy storage as a service could be part of the micro-grids, or in separate locations where there might be a need or want for a more resilient and efficient power supply.

This graphic gives an overview of how the "smart grid" will be connected. Increased energy efficiency, demand response, electric vehicle connections, and advanced battery storage will create additional capacity in the system while the distributed energy resources will be able to work together with the advanced battery storage, generation, transmission, member, and the DSO cooperative creating a more stable, secure and efficient electric grid.



"Smart Grid / Department of Energy," U.S. Department of Energy. Accessed at: http://energy.gov/oe/services/technology-development/smart-grid

Strategic Leadership

Strategic leadership should be provided at a cooperative through joint discussion and development between the cooperative's board of directors (board) and the General Manager/Chief Executive Officer (GM/CEO). With significant industry change coming, it is imperative that this coordination occur at electric cooperatives across the country. Related discussion and development should also be occurring between the electric distribution cooperatives and their associations—their Generation and Transmission Cooperative (G&T), their data cooperative, their statewide association, their financial support organizations and their national association and other related business partners. There is no need for any cooperative to 'go at it alone' when such resources are or can be made available to them.

Intuitively, strategic leadership starts with the GM/CEO. Many cooperatives across the county have GM/CEO's that are very adept in looking forward and preparing their cooperatives for what lies ahead. Many have developed both long and short-term plans to prepare for what they see coming in the specific areas and communities they serve. However, there are some cooperative GM/CEO's who need assistance in the development of strategic plans and have not been actively developing such plans. In the balance of those differences, some cooperative GM/CEO's have said they don't believe the industry is really changing and there really is no need to begin preparing for change—they feel changes are decades away and that the changes happening as discussed in the industry shifts section of this report will not really affect their cooperatives. This type of thinking could challenge the cooperative business model as these industry shifts further influence cooperative membership.

The GM/CEO can provide strategic leadership at a cooperative, but it will not go far without active discussion and consideration by the board of directors. Many boards are very involved in understanding the strategic direction that is being planned, developed and implemented at their cooperative. However, some boards are taking one of two other approaches with strategic planning and development. They are either allowing the GM/CEO to do whatever they think is best and staying in the background, or worse, some are actively directing the GM/CEO to keep the status quo. It is obvious that neither of these options are healthy for an organization in planning and preparing for its future service to its membership.

A large number of cooperatives are smaller and have limited amount of staff to support strategic planning and development. Some even use this as an excuse to not exercise strategic leadership. There is no need for ignoring strategic leadership. There are a many partners who have a high level of education and assistance resources smaller cooperatives can tap. There are also many cases across the country where certain associations could have taken a greater role in helping their cooperatives prepare for the industry shifts that are certainly on the horizon. There are also many good examples of cooperatives who are working with other cooperatives to plan and prepare for the future—the resources are there in many cases. Cooperative leaders should be working together to prepare for the future. Electric distribution cooperative members expect cooperatives to have strategic leadership. But more importantly, they deserve to have that level of attention applied to the business of their cooperative.

GM/CEO's have, in many instances, been developing executive and leadership teams at their cooperatives to better prepare for industry changes that are coming, while others have done little with their organizational structure. Those who are preparing today are charging their leadership teams with determining how best to work with cooperative resources to meet and hopefully exceed member expectations. It is doubtful the dated leadership and organizational structures at some cooperatives presently will serve the cooperative memberships' interests well when industry changes fully materialize. Cooperatives owe it to their members to consider leadership, staff, and organizational transitions that are purposed to meeting current and future service trends.

The cooperative business model is modeled and set to answer the challenges that are coming, but the GM/CEO, the board, and the leadership teams must work together to allow the business model to work.

The Seven Cooperative Principles guide the success and the way cooperatives respond to membership needs and wants, and the only way to achieve the goals and the ideals espoused through those guiding principles will be through effective, strategic leadership that is employed across the cooperative network.

Industry shifts that are coming will affect cooperatives in many ways. The first and most important step to determining the consequences of those changes is through strategic leadership implementation. These moves require cooperatives to really consider what they need to do to meet and exceed member expectations going forward. The fact these changes are coming will require more strategic planning that ever before. Cooperatives need to understand what their members perceive about these shifts and how they believe their cooperatives could likely provide solutions that for-profit interests that really aren't vested in the cooperative members' best interest. Simply put, without strategic planning and member input, how can cooperatives ensure they are meeting and exceeding member expectations? Cooperative resources are being stretched in many cases due to mounting industry changes. Not only are resources limited at many cooperatives, but the right kind of resources and leaders many not be present because a variety of industry swings are occurring simultaneously that require different skill sets. As one example shows, several industry shifts may necessitate a cooperative to provide a widening array of competitive services to members. How many true sales and marketing professionals exist at cooperatives? As another example, data analysis and the use of artificial intelligence in the business will require data experts. How many cooperatives currently have data experts? Several IOU's across the country have shared in conference venues that they have employed dozens of data experts to analyze and use better data in their decision- making processes. Only a handful of cooperatives across the country have taken this step.

Many industry shifts will challenge boards, GM/CEO's and leadership teams in response to intrusion of outside entrants into the cooperative industry, sector where they seek to garner member interest in a variety of services revolving around the retail electric services that may not be met currently by cooperatives. Many of the ideas that are being discussed by future competitors are beyond the understanding of some cooperatives and will lead to a competitive disadvantage over time. Cooperative boards and GM/CEOs should be paying attention to

cultivating director, GM/CEOs and leadership teams who have the capability of understanding the threats to the industry, and more specifically, to the cooperative business model. The coming changes will likely affect cooperatives in many ways related to strategic leadership; the most obvious is in the areas of talent recruitment and retention.

Vast changes will likely affect and/or challenge the way cooperatives have done business in the past. Cooperatives and cooperative support organizations will need to discuss new ways to work together to provide cooperative memberships the products and services they desire from their cooperative. In some ways, and in different areas across the country, members will expect their cooperative to have prepared for what is coming and to have developed solutions to changes are already occurring. The cooperative should be the energy expert, and their members should view them that way. However, many of the industry shifts occurring are placing doubt in member minds about whether the cooperative is the organization it has always said it has been--at least for those cooperatives who aggressively communicate with their members. For those that don't actively communicate, members are more likely to question whether their cooperative has the sophistication, expertise or desire to assist them in understand and dealing with industry options.

Certain industry may provide significant business and financial risk for the cooperatives. This concern is discussed more in-depth in various sections of this review, but strategic leadership is specifically charged with preserving the members' ideological investment in the cooperative. Ultimately, the board and the GM/CEO must address the changes that are coming, and they must work together with the leadership team at their cooperative, along with related business organizations, to determine solutions that make business sense, preserve the value equation for cooperative members, as well as meet future member expectations.

Implementing strategic leadership will require cooperatives to begin to think longer-term to identify trends and potential business risks. Planning for the future requires a different skill set than that previously required for operating the electric distribution system. Some cooperatives will likely not have employees with strategic planning skill sets, or who have an eye for what may occur in the future. Further, cooperatives will need strategic thinkers that understand technology and its potential impacts on the business. Technological advancements and their implementation should be weighed as a way to empower employees across the organization and generational lines to ensure cooperatives are considering multiple views when planning for the future. All generations will provide a different and meaningful perspective to strategic planning. Cooperatives should consider establishing strategy and risk management positions in order to ensure there are specific employees tasked with preparing for the future and managing risk for the cooperative. Larger cooperatives may even see the need to establish a Chief Strategy Office and/or Chief Risk Officer position. These positions should support the GM/CEO and staff vision in preparing for immense industry change.

This being said, it is important for cooperatives to have a strong succession management plan that includes, at a minimum, the staff and key cooperative managers. A key in cooperative future planning should include assurance that leadership retirements have been a part of succession planning, and that a plan is in place to replace the position with candidates who have a good understanding of potential future issues within the industry. Further, as

retirements occur, the GM/CEO should continually evaluate whether or not organizational structure needs adjustments due to industry changes. Retirements allow a good time for restructuring with minimal impact to the organization. NRECA and other organizations provide management training that should be considered by cooperatives who are preparing future leaders prior to the call for service. Cooperatives should also support internal training and mentoring programs. It is also recommended that cooperatives consider establishing an internship program to bring more input to strategic thinking and planning. Young and eager college students will generally be very excited to give input through their internship opportunity.

The cooperative's board is obviously an important part of the strategic leadership process. Directors should aspire to be well-educated and have a current understanding of industry trends that are occurring. Directors should be engaged in training programs and conferences offered through their G&T, statewide association and national associations. Directors should consider policy supporting director certifications. Further, the board should expect the GM/CEO to provide strategic leadership and hold the GM/CEO accountable for establishing long-term strategic planning goals, along with short terms goals that accomplish strategic plans. When the GM/CEO and board are working together in a strategic way, cooperative members' needs should be covered. At some cooperatives, one or more directors may not take the time or make the effort to stay up to date on industry trends. They may figure the business model has worked well over time and there is no need to apply strategic leadership to prepare for the future. While this sort of scenario may entail a small number of directors across the industry, it is incumbent on all directors to take a step back and evaluate the current state of the industry. Peer directors should assist in helping other board members understand industry changes. It is imperative that all directors are on board with the strategic leadership direction.

Obviously, directors are supposed to have a good understanding of their district membership desires. In many cases, this works very well for directors who are involved in their communities. Regardless, GM/CEO's should provide membership opportunities that allow members to see and hear cooperative objectives, and to provide input about those perspectives. This can be accomplished through community meetings, focus group meetings, town hall meetings (in-person or electronic) and through various survey methods. It is imperative that cooperatives remember their purpose and allow their member input about the cooperative's response to future industry trends and challenges. Strategic leadership will give members a view of the cooperative's future direction as determined by the cooperative's board, GM/CEO and staff, and provide venues for obtaining member input.

Many cooperatives in the industry are relatively small. Due to this fact, in order to keep rates comparatively low, they may not have the resources that may allow recruitment of employees that may be necessary in meeting the challenges in formidable industry change. First and foremost among those challenges is finding answers to changing member expectations. There are multiple opportunities that should be considered. Cooperatives, especially smaller ones, should establish either a service company or possible joint venture to create an operations center to provide the DSO function cost-effectively. This obviously allows cooperatives to have more resources to deal with new industry developments. Another option may exist in working with the

cooperative's G&T or statewide association. These support organizations are generally large enough that they can offer smaller cooperatives the services they otherwise may not be able to do on their own. A number of cooperative support organizations also offer services, such as hosting and leading strategic planning meetings, which can bring strategic leadership expertise to the cooperative who may not have such resources. The bottom line is: there are many options, therefore little excuse, for employing strategic leadership at cooperatives of all shapes and sizes.

Cooperative EaaS Examples

Cooperatives are Actively Being Energy Innovators

The review will include a final section detailing several examples of cooperatives implementing Energy Innovation programs that support the capability to meet and exceed member expectations. Program examples will include DER, Wholesale and Retail Market Options, and Energy as a Service offerings. All of these summaries should provide cooperatives who have future focus with concrete examples to consider. It will also highlight the ideal that cooperatives should work together, proving that the Seven Cooperative Principles still make up a roadmap all cooperatives should try to follow.

Examples of Energy Innovation at Cooperatives: United Cooperative Services EaaS Offering

As discussed throughout this study, EaaS seems to be a futuristic offering that has not yet been widely adopted by cooperatives. The reality is that many cooperatives today are already offering this type service model and don't realize it. An example of this is how many cooperatives bill for area lights.

United Cooperative Services currently has approximately 22,000 area lights that are billed monthly. Instead of a variable billing structure that is based on kWh sales, United determined it would bill members for area lights based on a fixed subscription structure. To determine the proper rates, United estimated the kWh usage for each light type (MV, HPS, and LED) and various wattages that are offered. The kWh estimate was based on manufacture standards, and internal testing. Also included in the rate is a monthly fixed amount for the light fixture, which is calculated by taking the total installed cost of the fixture and dividing it by the total life expectancy of the light.

To summarize, two components are used to determine the monthly fixed rate--the estimated monthly kWh usage and the fixed, installed cost of the light fixture that is spread over the light's life expectancy.

Cobb EMC –Retail Rate Options

Cobb EMC has a range of rate options for their members to choose from. This provides many benefits to the cooperative and the membership. First, it provides the optics that the member has choices, and allows the member to choose a rate option that best fits the member's lifestyle.

Cobb EMC's Smart Choice Rate is a great example of a rate option that provides the member the flexibility to reduce their monthly electric bill through innovation.

The Smart Choice Rate is a residential rate that includes a demand component. The member is billed based on what their Coincidental Peak (CP) was during Cobb's peak demand, which typically occurs during the hours of 2:00-7:00PM, during the months of June–September. To assist its members on this rate Cobb provides notification of when the expected peak will occur.

With this type of rate structure, members who have invested in DG, learning thermostats and other load management solutions will be able to reduce their load during the utilities demand, and ultimately reduce and control their monthly electric bill.

South River EMC - Butler Farms Microgrid

There are many cooperatives across the U.S. that are offering innovative solutions for meeting their members' needs. One example that stands out in terms of what cooperatives are doing with DERM's is South River EMC, and how they have collaborated with their G&T and their members to provide an innovative solution.

South River Electric Membership Corporation and its power supplier, North Carolina Electric Membership Corporation, collaborated with Butler Farms, a member of South River EMC and a sustainability-focused hog farm, to develop a local microgrid.

This microgrid is a joint partnership that utilizes existing generation resources owned by the farm of a 20 kW solar facility, 100 kW diesel generator, and 185 kW biogas generator, with a 250 kW battery system that is owned by NCEMC. This unique partnership was designed not only to benefit the member, Butler Farms, but also other South River Members in the local area.

During normal conditions, the microgrid will stay connected to South River EMC's distribution system to supplement and diversify traditional power resources. During outages, it can also operate in an island mode to power Butler Farms and surrounding homes.

This partnership is also a great example of how cooperatives can work with agribusiness members to develop solutions that are mutually beneficial, and that support both industries.

Conclusion

The future of the electric industry is uncertain. It is very possible that this future can be shaped by our actions today. Electric cooperatives have a proven business model, but it will take innovation, creativity and action to fold that model's best traits into meeting, and hopefully exceeding, member expectations. Cooperatives can control their future and continue to be the trusted energy resource members rely on. By adhering to the ideals espoused in the Seven Cooperative Principles, cooperatives can imagine and find solutions to any industry or consumer transitions that may develop in the future. By working together with cooperative members, the communities cooperatives serve, along with our cooperative partners, cooperatives can lead in developing the future of the industry for the benefit of our members. That is and has always been the electric cooperative mission. Change is occurring across many sectors that affect cooperatives and their memberships. Cooperatives must lead the charge in finding solutions to those changes. Others will find those solutions if cooperatives default on that enduring promise to their memberships. Implementing new Energy Innovation vision for the benefit of cooperative members is a simple and profound answer REMDC challenges cooperatives across the country to accept.

Acknowledgements

The DSO/EaaS sub-committee (committee) of the REMDC was created in June 2018. The committee first met in December 2018 and work has continued to completion thanks to the significant efforts of many parties over the span of the last year. Cooperative members of the committee include:

- Cameron Smallwood, CEO (United Cooperative Services, Burleson, Texas) - Committee Chair
- Amy Grice, Manager of Engineering (Peninsula Light Company, Gig Harbor, Washington)
- Blake Beavers, VP Power Supply (United Cooperative Services, Burleson, Texas)
- Damien Coleman, Manager of Engineering (Jackson Electric Cooperative, Edna, Texas)
- David Koogler, VP Member & External Relations (Rappahannock Electric Cooperative, Fredericksburg, Virginia)
- Greg Mullis, SVP Corporate Services (Tri-County EMC, Macon, Georgia)
- Greg Rogers, VP Engineering and Operations (Shenandoah Valley Electric Cooperative, Rockingham, Virginia)
- Jim Coleman, General Manager (Jackson Electric Cooperative, Edna, Texas)
- Jimmy Gray, VP Engineering & Operations (Central Alabama Electric Cooperative, Prattville, Alabama)
- Joyce Bodoh, Government Affairs & D.R. Administrator (Rappahannock Electric Cooperative, Fredericksburg, Virginia)
- Mark Stallions, CEO (Owen Electric Cooperative, Owenton, Kentucky)
- Marty Haught, COO (United Cooperative Services, Burleson, Texas)
- Ray Grinberg, CEO (Tri-County EMC, Macon, Georgia)
- Thomas Golden, CSO & VP Energy Services (EnergyUnited, Charlotte, North Carolina)
- Wayne Wilkins, CEO (EnergyUnited, Charlotte, North Carolina)

Special thanks to others assisting on the committee including:

- CFC (Greg Starheim, SVP Business & Industry Development)
- EnerVision (Elaine Johns, CEO)
- Milsoft (Steve Collier, VP Business Development)
- NCEMC (Mike Burnette, SVP & COO)
- NISC (David Bonnett, VP Product Management)
- NRECA (Jim Spiers, Jan Ahlen, Jim Horan, Tracey Steiner)
- SEDC (R.B. Sloan, CEO)

Special thanks to the staff of United Cooperative Services (Burleson, TX) for the development and final editing of this document.