


ELECTRIC COOPERATIVE TECHNOLOGY SOLUTIONS

A FLEXIBLE, STRATEGIC ROADMAP CREATED BY
THE COOPERATIVE RESEARCH NETWORK
FOR NRECA MEMBERS

October 2002



National Rural Electric
Cooperative Association

A Touchstone Energy Cooperative 



COOPERATIVE RESEARCH NETWORK
A Service of the National Rural Electric Cooperative Association

Acknowledgements

Electric Cooperative Technology Solutions was prepared under the direction of Tom Lovas, Chair, Policy, Planning, and Communications Task Force and Tony Ahern, Chair, Cooperative Research Committee. Significant contributions in editorial review and organizational advice were supplied by Shiela Medina, Bruce Giffin, Scott Drake, and Paul Dolloff. The roadmapping effort was led and coordinated by Steven Lindenberg, Executive Director of the Cooperative Research Network. Martin Lowery, Executive Vice President, External Affairs at NRECA was a steady guide through the entire process. The document was prepared by Ross Brindle, Julie Rash, and Charlie Smith of Energetics, Incorporated. A complete list of contributors can be found in Appendix B.

Introduction

Electric Cooperative Technology Solutions summarizes a comprehensive strategic planning process for the National Rural Electric Cooperative Association (NRECA) conducted by the Cooperative Research Network (CRN).

Individuals who hold management and senior staff positions at distribution cooperatives and at generation and transmission cooperatives, in consultation with CRN staff, NRECA staff, and partners such as the U.S. Department of Energy, EPRI, and TVA identified the issues and set the priorities for cooperative technology goals. Representatives from most of the organizations that constitute the Cooperative Business Network Council were also involved in the analysis and drafting process. A complete list of participants can be found in Appendix B.

This process—imagining, planning, evaluating, and implementing—is intended to be a malleable one. CRN members, remembering the constancy of change, will monitor our progress as we travel toward our destination and modify the Roadmap as necessary in the months and years ahead.

Individual co-ops will have different perspectives about where they want to arrive and when. These local decisions are embraced and encouraged in our planning and development of alternative solutions.

The Roadmap contemplates significant work in four knowledge development strategies:

- ◆ **Surveillance** activities to screen the incredible amount of technology information available, so that the portion which is relevant to cooperatives will be made easily accessible
- ◆ **Education** to help co-op staff understand how to select and/or reject technology from an ever-increasing array of options and to be trained to apply technology in their local situation
- ◆ **Investment** in investigations and demonstrations in areas as diverse as office automation, fuel purchases, and the changing business practices of successful cooperatives
- ◆ **Partnerships** with those who have the same technological needs and interests to effectively share expenses and knowledge

This work continues the process begun nearly thirty years ago, when the Cooperative Research Network was established in 1973 as the only research program dedicated to meeting the technological needs of electric cooperatives. It also continues the recent progress that the CRN has made in already meeting needs identified during this roadmapping process, as represented in their ongoing technology surveillance initiatives and expanding technology education courses.

Following the Executive Summary, the Roadmap discusses the participants' collective view of the issues affecting cooperatives now and in the future.

Then, it discusses the priorities for CRN work to be done under the individual goals of the vision for electric cooperatives: *affordability, reliability, responsiveness, sustainability, and quality of life.*

While the specific technology choices and applications will vary from cooperative to cooperative, technology offers the opportunity to achieve critical productivity improvements—in some cases, it’s the only remaining, real opportunity for productivity gains.

Technology also offers the opportunity to improve member service and satisfaction. Increasingly, members will measure cooperative services, as they measure all services, in terms of technological effectiveness and sophistication. Ours is, after all, a society increasingly intrigued by technology. Wise application of appropriate technology by capable staff can enable co-ops to thrive in this century. The Roadmap offers an outline

of how cooperatives will ensure their successes with technology in the years ahead. Cooperative Research Network members currently comprise more than a third of all electric cooperatives, and every member of NRECA is eligible to become a member of the CRN. Your participation is encouraged; we hope this strategic vision of our business will cause you to consider your commitment to your cooperative’s future.






Your comments on this process, on this presentation, and on our plans are important, and they, too, are most welcome.

Respectfully Yours,



Steven P. Lindenberg
Executive Director
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Executive Summary

Electric cooperatives have a history of achieving the unimaginable. In the 1930s, the technical and economic challenge of electrifying rural America did not seem daunting—it seemed impossible. Because of low population densities, many within the electricity industry doubted that extending distribution lines throughout rural America was feasible. Yet, through determination, innovation, and a spirit of adventure, that challenge was met. By combining forward-thinking policies such as the Rural Electrification Act with technological advances such as high-strength conductors, single-phase lines, and system-wide planning, rural electric cooperatives were born and the landscape of rural America was forever changed. Through hard work, dedication, and vision, the dream of rural electrification became reality.

Today, electric cooperatives, or co-ops, make up one-third of all electric utilities and own almost half of the distribution lines in the nation. Their story of unconditional success in the face of impossible odds is a stirring example of the power of communities coming together to achieve a common goal.

A New Frontier Emerges

In many ways, co-ops face a similar situation today as they did in the 1930s. The electricity industry is changing more rapidly than ever before. Technology is evolving at unprecedented rates, creating exciting new opportunities for co-ops to better serve their members. Co-ops are enjoying unparalleled growth in the electricity industry, almost

doubling average industry growth rates. Yet they also face both old and new challenges, such as electricity industry re-regulation, fluctuations in fuel prices, and changing demand patterns as suburbs grow and businesses appear and disappear virtually overnight. A new frontier full of great opportunities and serious challenges is emerging.

As co-ops embark on the 21st century, they are well equipped to meet these challenges and seize the opportunities before them. The fundamental principles upon which co-ops are built have served them well for almost 70 years and will continue to offer guidance and strength. Co-ops are vibrant businesses that share close relationships with their communities that are unmatched in the energy industry.

In the new energy enterprise, while the cooperative principles and a dedication to consumer service remain the foundation on which co-ops make decisions, technology will provide the key to enhancing co-ops' service and competitiveness in the market. Advances in automation and information technologies, distribution operations, marketing and energy services, and power supply technologies are empowering co-ops to do things they did not dream of doing just five years ago. Co-ops have proven themselves capable of pursuing innovative technology independently; however, by coming together, they can achieve even greater success.

In years past, the Federal government was the main sponsor of research and development in the United States, and

Co-ops need only look to their heritage to understand that what one cannot do alone, many can do together.

Cooperative Principles

All cooperative businesses adhere to these seven guiding principles:

1. Voluntary and Open Membership
2. Democratic Member Control
3. Members' Economic Participation
4. Autonomy and Independence
5. Education, Training, and Information
6. Cooperation Among Cooperatives
7. Concern for Community

Vision of Electric Cooperatives

*Electric cooperatives form the largest unified network of energy service providers in the nation through local consumer-owned, community-focused cooperative systems providing **affordable, reliable, responsive, and sustainable** energy services to enhance the **quality of life** of their members and communities.*

co-ops could depend on it to provide the technology they needed to continue to flourish. However, the federal government's role in research and development has been shrinking steadily over the past several decades. Today, co-ops must lean on each other to develop and apply the innovations needed to continue their tradition of exceptional value and consumer service.

Now is the time for co-ops to rekindle their spirit of cooperation to address the exciting technological challenges of the next decade and beyond. By banding together to manage technology development and implementation, co-ops can bring greater financial and technical resources to bear on *cooperative-specific* technical needs, while they share results and help one another manage their collective technology future. Ultimately, broad, national cooperation to address technological needs will bring innovations to co-ops faster, more economically, and with less risk, delivering benefits to their member-consumers. Electric co-ops have accomplished the unimaginable before, and they can do it again.

To paraphrase a popular saying, the best way for co-ops to prepare for the future is to invent it themselves. By coming together to address their most urgent technological needs, co-ops have an opportunity to invent the future they desire. A vision of that future is presented below.

Electric Cooperative Vision

“Electric cooperatives form the largest unified network of energy service providers in the nation through local consumer-owned, community-focused cooperative systems.” This vision was developed by the NRECA Board of Directors in 2000 as an effort to unify co-ops into a network designed to help all electric co-ops continue to offer superior consumer service. As part of the roadmapping process, co-op contributors to the Roadmap augmented this vision with five strategic goals aimed at keeping the

vision focused on their member-consumers. In the augmented vision, co-ops provide *affordable, reliable, responsive, sustainable* energy services that enhance the *quality of life* for their members and communities.


To assist in achieving the electric cooperative vision, the Cooperative Research Network (CRN), serving participating cooperatives nationwide, will provide information, tools, and services that enable co-ops to enhance the quality of life for consumers through technology and business innovation. This Roadmap, and CRN's implementation of its priorities, is focused on the application of technology to co-op businesses. Other groups within NRECA, such as Education, Training and Consulting; Energy Policy; and Government Relations; plus external groups such as the Electric Cooperative Business Network, are working on other facets of the Board's vision.


The five strategic goals establish the destinations of this Roadmap and elaborate the route to the Board Vision.

Vision Goals	
	Affordability
	Reliability
	Responsiveness
	Sustainability
	Quality of Life

\$ Affordability—Consumers expect their energy providers to offer services at a fair price for the value that they receive. For co-ops, that value includes energy services as well as consumer-focused services such as human interaction, local community development, and democratic participation.

G Reliability—All members depend on reliable power in their daily lives. Outages are not simply inconvenient. Even brief power outages are expensive in terms of lost productivity for commercial and industrial consumers. Outages can create safety risks for consumers who depend on electricity to power security systems, and prolonged outages can even be life-threatening in severely cold or hot weather. Maintaining high standards of reliability is central to the vision of cooperatives, and good consumer service simply cannot be achieved without reliability.

 **Responsiveness**—One of the greatest strengths of cooperatives, one that distinguishes them from other energy service providers, is their relationship with the member-consumers they serve. Cooperatives nurture close, trusting relationships by maintaining unmatched responsiveness to changing consumer needs for energy and other services.

 **Sustainability**—Part of the cooperative commitment to consumer service is protecting the environment in which co-ops operate and their members live. Cooperatives cannot simply provide affordable, reliable, and responsive energy services to their consumers; they must do so in an environmentally responsible, sustainable manner. By exploring diverse technological options, co-ops can continue to offer energy services while protecting both their local and the global environment.


 **Quality of Life**—The underlying goal of co-ops is to improve the quality of life of their members, a goal they achieve in two ways. Cooperatives provide affordable, reliable, responsive, sustainable energy services to power the televisions, computers, heating systems, and hundreds of other products consumers use to live more comfortable, satisfying lives. Co-ops also provide other services to the communities in which they operate by reinvesting significant resources into local community development projects.

Exhibit ES-1 presents an overview of the entire Roadmap. Co-ops ensure that they remain focused on achieving their vision by establishing goals and objectives that align with that vision. Key challenges that can limit technological progress are also shown in the Exhibit.

Operating as a unified network through the Cooperative Research Network to minimize risk to individual organizations, co-ops will strive to acquire knowledge and develop tools that deliver

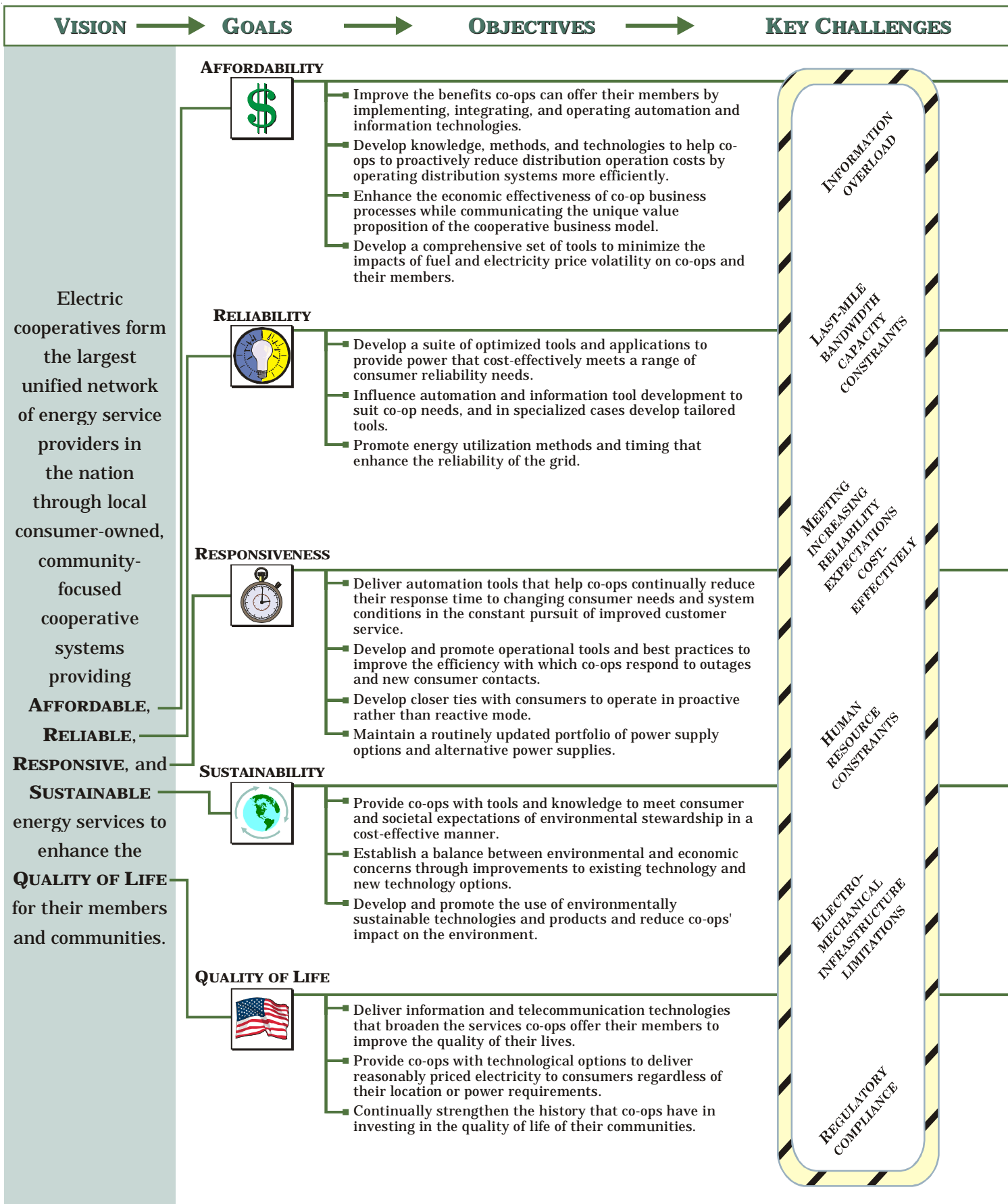
benefits to consumers. The Cooperative Research Network will use four knowledge development strategies to direct technology innovation.

Achieving the Vision: Technology Strategies

Separate chapters of this Roadmap list the technologies co-ops need to achieve their goals and objectives. These technological needs will be explored and delivered through four cross-cutting strategies that represent deliberate information and knowledge development methods for the co-op community.

- 1. Technology Surveillance**—By coming together in a unified technology network, co-ops can collectively sift through the massive amount of information available about new technologies and evaluate those that hold the most promise to improve the value of their consumer services, easing the burden on individual co-ops who would otherwise be forced to independently explore and learn.
- 2. Technology Education**—Identifying promising knowledge, tools, or technologies is only the first step in the overall technology strategy. The Cooperative Research Network will disseminate relevant information throughout the network to ensure that knowledge to their individual business settings. Through education programs, the CRN can help to ensure that co-ops have the knowledge they need to take advantage of new opportunities available through technological advances.
- 3. Technology Investment**—In some cases, co-ops may urgently need technology that does not exist or is unique to their segment of the electricity industry and is beyond the means of individual co-ops to address. In such instances, by pooling their resources, co-ops can create new knowledge and products to address those needs without any one co-op assuming great financial risk.

Exhibit ES-1. Overview of *Electric Cooperative Technology Solutions*



TECHNOLOGY STRATEGIES AND PRIORITIES

STRATEGIES:

Surveillance

Education

Investment

Partnerships

- Document the best practices of successful organizations [💰]
- Develop a database of technology solutions with a technology assessment guide [💰]

- Identify existing automation, information, and communication technologies and their range of costs [💰]
- Develop an application-specific cost-benefit assessment tool for co-ops to evaluate new ideas [💰]
- Study the fuel supply chain and costs, and develop tools to monitor fuel costs [💰]
- Maintain the balance between cost and revenue, despite need for high-cost generation technologies [💰]

- Lower material costs to improve affordability [💰]
- Integrate power supply planning with power marketing [💰]
- Develop user-friendly model that predicts the economic benefits of new technologies to co-ops [💰]

- Identify consumer products that will reduce the investment in system improvement projects and enhance system reliability [🌐]

- Develop low-cost methods to improve the reliability of electric service [💰🌐]
- Investigate power supply infrastructure limitations [🌐]
- Investigate new techniques to expand existing transmission facilities [🌐]
- Develop methods for integrating emerging technologies into the existing power system [🌐🌐]
- Research the impact of distributed generation on power system [🌐]
- Conduct analyses of emerging technologies and trends, and field test promising options [💰🌐🌐🌐🌐🌐]

- Expand CRN's MultiSpeak standards activities to include more automation, information, and communication technology activities [💰🌐]

- Develop technology tracking mechanism to keep co-ops abreast of changes in technology [💰🌐🌐🌐🌐🌐]

- Develop and implement utility training centers and distance learning with challenging certification requirements [💰🌐🌐🌐🌐🌐]
- Find and demonstrate examples of co-ops with leading automation, information, and communication systems [🌐🌐]

- Develop low-cost communication systems and communicate their value to co-ops [💰🌐🌐🌐]
- Explore innovative techniques to respond to outages faster [🌐]

- Develop and expand Internet-based services [🌐]

- Develop a portfolio of investments in new, clean energy sources [💰🌐]
- Follow carbon control technologies and associated opportunities to capture environmental credits [🌐]

- Establish partnerships with a range of power suppliers (e.g., wind, solar, renewables, DG, etc.) [💰🌐]
- Explore rural renewable potential [🌐]
- Minimize the influence of utility activities on wildlife and help to solve this collective issue [💰🌐]
- Support clean coal technology development [🌐🌐]

- Evaluate new technologies to determine which are suited or could be tailored to unique co-op needs [💰🌐🌐🌐🌐🌐]
- Understand how to introduce change management skills and promotional skills to co-ops [🌐]
- Study staffing and salary needs and constraints based on market conditions [🌐]

- Improve co-ops' knowledge about effective e-commerce [🌐]
- Develop method of recruiting and sharing the supply of technical employees among co-ops [💰🌐]
- Implement the automation and information technology education strategy [🌐]

- Develop Internet-based collaboration, learning, and training [🌐]

- Develop a "virtual co-op" model [💰🌐🌐🌐🌐🌐]

💰 Affordability 🌐 Reliability 🌐 Responsiveness
🌐 Sustainability 🇺🇸 Quality of Life

Denotes impact on other strategic goals.

4. Technology Partnerships—The financial and intellectual resources needed to reach all of this Roadmap’s goals will exceed the capabilities of co-ops. Some of the developments will be pursued through broad partnerships with organizations that have a stake in seeing electric co-ops succeed. Organizations such as the Electric Power Research Institute (EPRI), the U.S. Department of Energy (DOE), and the Tennessee Valley Authority (TVA) will apply their resources in partnership with the CRN on behalf of the unified co-op network to improve the cost-effectiveness of technology efforts.

These four strategies will be applied to deliver the technologies co-ops need over the next decade and beyond. Together, they combine to provide a valuable framework for technology exploration, development, and implementation. These four approaches will need to be applied across all five goals of affordability, reliability, responsiveness, sustainability, and quality of life.

The four-part technology strategy in Exhibit ES-1 is the Cooperative Research Network’s response to the goals and challenges, and will guide CRN efforts. The technology priorities shown on page *ix* describe a mix of near-, mid-, and long-term technological issues the CRN will work to address. By considering a range of time frames, the CRN can help to ensure they are not only helping co-ops achieve success next year, but also that they are laying the foundation for success in the more distant future. These priorities are aligned with the goals they are expected to help achieve and their corresponding technology strategy. Also noted are priorities which are expected to have impacts on multiple goals (small icons). Greater detail can be found in the subsequent chapters and in Appendix A.

Not since the 1930s has the need for careful technology planning been so crucial, nor the promise of achievement so great. Skillful technology application can empower co-ops to offer their members even greater value than they are able to deliver today. The time has come again for co-ops to draw upon their heritage of cooperation and gather the strength needed to excel as they embark on the 21st century.

1

Key Trends and Drivers

The electricity industry continuously evolves with the emergence of new technologies and energy supply options; growing consumer expectations; changing legislation and regulation, altering the markets and the way energy suppliers do business; increasing global and environmental pressures; and an evolving cooperative structure. These trends and driving forces provide the backdrop against which cooperatives will operate in the industry of the coming decade.

Rapidly Changing Technology

Over the past two decades, technology has advanced at impressive rates due to the development of computers and smart chips. New technology emerges on a continuous basis, altering the way cooperatives do their daily business, the

environment in which they operate, and the way they will do business in the future.

Technology Development and Investment

Financial commitment to the development and application of new technologies varies across the cooperative community. Currently, decisions and investments in new technologies for co-ops are largely performed on an individual co-op basis; collaborative approaches to selecting new technologies for the entire co-op community are limited. As compatibility issues arise, the lack of standardization, a collaborative approach, and commitment among co-ops may limit co-ops' ability to keep pace with technology changes.

Technology is evolving beyond the capabilities of the equipment currently in use. At some cooperatives, limitations in or lack of equipment infrastructure limit the cooperative's ability to implement new technology. Particularly, the lack communications bandwidth capacity can limit the use of technologies that require that capacity, such as some automation technologies.

The amount of new technology available in the electricity industry is staggering. With the sheer volume of information available, cooperatives, like many businesses in other industries, are suffering from information overload. Individual cooperatives find it impossible to keep current on all of the latest developments in the industry and are often unable to assess which technologies would be most beneficial to their consumers.

Most Critical Trends and Drivers

- ◆ Growing importance of asset & risk management
- ◆ Increasing complexity and expense of technology
- ◆ Increasing pressure from more stringent air and water quality regulations
- ◆ Growing expectations for power quality and reliability
- ◆ Increasing interest in distributed generation
- ◆ Growing cooperation among co-ops
- ◆ Continuing changes in fuel prices and availability

While the range of automation systems being provided today by vendors is broad, systems tailored to cooperatives' unique needs are limited. Technologies such as low-cost automation equipment, communications protocol translators, and artificial intelligence systems are being developed routinely. However, these technologies are not cost-efficient for cooperatives because they normally require the purchase of large systems that are not developed specifically with cooperatives in mind.

Economics

Co-ops have ready access to capital for technology investments, giving them a financial advantage. Co-ops have made investments in new generation, upgrading distribution, and offering consumer and community services. Much of this was made possible because of access to capital resources through the Rural Utilities Service (RUS), National Rural Utilities Cooperative Finance Corporation (CFC), and Co-Bank, often giving co-ops a financial advantage. As small economic units, though, co-ops are greatly affected by technology investments that may not always benefit their organizations as desired.

Distribution Technology

Co-op distribution systems are better maintained than the industry standard. Distribution lines that efficiently supply power to consumers are distribution co-ops' most valuable physical assets. The RUS requires co-ops to fulfill maintenance requirements as part of their loan agreements, providing co-ops with incentive to maintain their distribution systems. As a result, the co-op distribution system is in a better state of repair than other parts of the national system, allowing them the opportunity to offer superior value to their members.

Increasing Consumer Demands

Consumer demands for improved service and low prices are on the rise. Consumer growth and expanded use of computers, micro-electronics, and automation technology has raised the power quality and reliability needs of residential and commercial consumers, in some areas stretching the service capabilities of many utilities.

Quality and Reliability

The digital economy will depend on reliable electricity. As society moves further into the digital era, technological advances in business, health care, communications, consumer products, and other areas of the economy will depend on reliable electricity as a power source. The current electric power grid provides 99.9 percent power reliability. Many businesses, particularly in communications and banking, are demanding 99.9999 percent reliability (referred to as "six nines"), or about 30 seconds of downtime per year. As demands increase, the market will continuously challenge utilities to run ahead of consumer expectations.

Rising quality and reliability demands are driving interest in distributed generation. Reciprocating engines, photovoltaics, batteries, fuel cells, and microturbines may be capable of meeting rising quality and reliability demands as they become economically justifiable. On-site generation poses technical and business challenges to traditional systems based on a central plant and radial distribution configuration.

Sales and Consumer Growth

Energy sales and consumer numbers are growing at much faster rates for some co-ops than the industry average. In growing co-ops the challenge of meeting expanding demand requires creative and diligent staff commitment. In many locales, electricity rates for co-op consumers have been decreasing in real terms. High consumer

growth rates give co-ops an opportunity to maintain low rates and offer better value to their members, if they make the correct investments.

Internet-Based Services

Increasingly, consumers desire Internet-based services. More and more customer-based businesses are using the Internet in their interactions with customers. As a result, many co-op members expect their utilities to provide Internet-based services.

Uncertainty in Energy Markets

For many years, utilities enjoyed the benefits of a regulated, status quo wholesale energy market. With recent regulation changes, however, energy markets are evolving and co-ops are grappling with new issues, including wild fluctuations in energy and fuel prices. These changes are making the industry's future structure uncertain.

Industry Restructuring

Regulatory bodies, such as FERC, EPA, OSHA, state environmental regulators, and public utility commissions influence how co-ops operate. These entities can determine the level of co-ops' success. Interaction with regulatory bodies will be a requirement to influence the regulations they choose to implement.

Adaptability is becoming more important as the energy industry restructures. As technological and legislative trends continue to alter the industry, adaptability will play a greater role in planning and risk management of business strategies. Knowledge of the current situation and potential future opportunities are required for an organization to be adaptable.

Regional Transmission Organization (RTO) and Independent System Operator (ISO) concepts are being reviewed and redefined. The future ownership and operation of transmission lines is unclear; however, RTOs may

have a great influence on control and development. Co-ops will need to track and analyze this industry sector to obtain maximum value for members.

New technologies are enhancing connectivity to the consumer, but industry restructuring is opening the doors for increased competition. Growing use of the Internet is improving accessibility to consumers, opening the door for co-ops to reach new potential members. At the same time, however, the improved accessibility is enabling competitors to reach co-op consumers. As this trend continues, understanding and using consumer communication tools will become increasingly important.

Legislation

The actions of state and federal legislative bodies routinely determine the operational parameters of cooperatives. Legislation on issues such as the environment, energy policy, tax law, and agriculture dictates how co-ops can operate. Electric utilities may be required to meet renewable portfolio standards in the future, which will imply new and increased application of demand-side management (DSM) and renewable energy technologies. The actions co-ops take to interact with legislators (to provide them with research knowledge on the policies they are planning to implement, for example) will determine which policies are put into law.

Electricity and Fuel Trends

The price and availability of electricity and fuel, which significantly impact co-ops' bottom lines, are difficult to predict. Energy prices rise and fall with the price of oil, which has fluctuated since the 1970s. Most co-ops purchase a large fraction of their electricity on the wholesale market, the price of which fluctuates as a result of fuel availability, transmission constraints, weather occurrences, and other factors. To counteract the effects of these trends, hedging techniques such as portfolio

management and diversification are providing ways to keep electricity rates more consistent.

Conservation Trends

Demand-side management (DSM) has recently experienced renewed interest. As shortages of electricity have developed in some areas of the country, political incentives have increased interest in DSM programs, which require technology and labor to develop and implement. This trend puts pressure on co-ops to maintain and even expand their highly developed DSM programs.

Global and Environmental Pressures

Global pressure to reduce greenhouse gas emissions while shifting toward sustainable energy production and renewable fuels is increasing. As the pressures increase, politics will drive the response to these pressures and the subsequent policy changes.

Fuels

New, alternative fuels produced in rural America are offering affordable, clean power. Rural America, where most co-ops are located, is home to alternative energy resources such as wind, biomass, and solar power. Recently, these sources have been encouraged and supported, primarily because of their environmental benefits and decreased cost, offering an alternative fuel choice to co-ops.

Air Quality

Pressure is growing on the United States to curb carbon dioxide emissions, particularly from coal-fired power plants. Increased air quality restrictions can be expected over the next few years, possibly including a carbon trading program. Because the co-op community is more highly dependent on coal than other utility sectors, it may be disproportionately affected by greenhouse gas regulations.

Control of multiple pollutants may also become more regulated, restricting combustion-based energy production. NO_x, SO_x, mercury, heavy metals, and particulate emissions can travel long distances and affect air quality many states away from the source. Regulators are likely to implement more stringent limits, possibly combined with trading programs, to protect air quality.

Land and Water

Society continues to demand more responsibility from the land- and water-intensive energy industries. Mercury, water pollutants, heat discharges, and other waste products are under renewed scrutiny as possible hazards to human and environmental health. The electricity industry is likely to experience stricter regulations and greater enforcement, particularly for coal-fired plants. Also, competing demands for water resources may limit the electricity industry's ability to locate future large power plants on existing waterways.

Economic Globalization

Globalization continues to impact the energy industry. International companies are entering some domestic markets, just as U.S. companies are growing overseas. These companies, bringing in different cultures and unforeseen practices, will affect how business is conducted in the markets they enter.

Cooperative Structure

With advances in technology and changes to markets and legislation, the structure of the cooperative community is evolving. The relationship between the various types of cooperatives and cooperatives to the electricity industry as a whole will continue to change.

Cooperative Relationship

As technologies and markets evolve, the relationship between G&T and distribution co-ops also evolves.

G&T co-ops are looking for different energy supplies while distribution co-ops are seeking more flexibility in responding to consumer demands.

Organizational Structure

As utility industry leaders face increasing demands, they will need better understanding of complex technology issues. In the future, new technologies with unforeseeable benefits will continue to change the industry at a rapid pace. This constant change will force co-op decision-makers to routinely face complex, difficult issues affecting political and business decisions.

Human Resources

Technology is advancing at a pace beyond some cooperative personnel's ability to keep up.

As technology rapidly evolves, individual cooperatives often find their staff inadequately trained to operate distribution systems at peak efficiency, or to evaluate and implement new technologies.

Technical staff is in great demand in all industries across the country.

Utilities need top-notch technical staff to help them take advantage of constant advances in technology. However, such employees are in high demand, making it difficult for utilities to attract and keep them. Furthermore, co-ops in predominantly rural locations face an additional recruiting challenge.

2

Electric Cooperative Vision and Strategic Goals

To adapt to the new frontiers opening in the electricity industry today, electric cooperatives must draw upon the determination and spirit of adventure that led them when rural electrification was a new, exciting concept. To aid in this effort, the NRECA Board of Directors has envisioned electric cooperatives as forming the largest unified network of energy service providers in the nation through local consumer-owned, community-focused cooperative systems. This vision describes a flourishing sector of the electricity industry that is supplying consumers with the energy services they need to maintain a high quality of life. Co-op contributors to the Roadmap process augmented this vision with five **strategic goals** aimed at keeping the vision focused on their member-consumers. In the augmented vision, co-ops provide **affordable, reliable, responsive, and sustainable** energy services to enhance the **quality of life** for their members and communities. These goals

*Electric cooperatives form the largest unified network of energy service providers in the nation through local consumer-owned, community-focused cooperative systems providing **affordable, reliable, responsive, and sustainable** energy services to enhance the **quality of life** for their members and communities.*

are represented throughout this Roadmap by the icons on the right of this page.

To accompany the electric cooperative vision, the Cooperative Research Network, serving participating cooperatives nationwide, will provide information, tools, and other services that enable co-ops to enhance the quality of life for consumers through technology and business innovation. It will empower co-ops to respond to consumer demands more quickly and with greater agility than other power suppliers, in accordance with a deep commitment to consumer service. The CRN will also enable co-ops to provide their consumers with sustainable energy services that are environmentally responsible.

Strategic Goals and Objectives

The following paragraphs present a set of goals and supporting objectives towards which the cooperative community can strive in its effort to achieve the vision. Using these strategic goals, the CRN can focus the overall technology strategy for cooperatives squarely on the vision and help to ensure that co-ops take full advantage of technology in the years ahead.

Affordability

Consumers expect their energy providers to offer services at a fair price for the value that they receive. For co-ops, that value includes energy services as well as consumer-focused services, such as human interaction, local community development, and

Vision Goals

-  Affordability
-  Reliability
-  Responsiveness
-  Sustainability
-  Quality of Life

democratic participation. To ensure that co-ops can continue to offer member-consumers the highest value possible, the CRN will explore advanced technology and business solutions.

The Cooperative Research Network will work to improve the benefits of implementing, integrating, and operating automation and information technologies, which will enable co-ops to invest in and implement technologies that increase efficiencies and provide better service. The CRN will also develop knowledge, methods, and technologies that trim distribution operation costs so that distribution systems run more efficiently and co-ops continue to lead the distribution market.

Affordability Objectives



- ◆ Improve the benefits co-ops can offer their members by implementing, integrating, and operating automation and information technologies.
- ◆ Develop knowledge, methods, and technologies to help co-ops to proactively reduce distribution operation costs by operating distribution systems more efficiently.
- ◆ Enhance the economic effectiveness of co-op business processes while communicating the unique value proposition of the cooperative business model.
- ◆ Develop a comprehensive set of tools to minimize the impacts of fuel and electricity price volatility on co-ops and their members.

Through the technology provided by the CRN, cooperatives can seek to improve the effectiveness of their business processes, enhancing the value that they offer their member-consumers. Concurrently, the CRN will help co-ops communicate the unique value of the co-op business model to new consumers to

convince them that co-ops offer a valuable overall energy service. The CRN will also develop and help co-ops implement a comprehensive set of tools that can minimize the impacts of price volatility, allowing them to offer consumers steady, affordable rates. These tools will include, among others, hardware, demand-side programs, marketing strategies, hedging techniques, and notification programs for instituting conservation measures.

Reliability

All consumers depend on a nearly uninterrupted supply of high-quality power in their daily lives.

Even brief power outages are expensive in terms of lost productivity for commercial and industrial customers. In today's energy market reliability is not only continuous service, but delivery of high-quality power with predictable characteristics. Outages or inconsistent service can create safety risks for customers who depend on electricity to power security systems or production controls, and prolonged outages can even be life-threatening in severely cold or hot weather. Maintaining the highest standards of reliability is central to the vision of cooperatives, and good consumer service simply cannot be achieved without reliability.

Reliability Objectives



- ◆ Develop a suite of optimized tools and applications to provide power that cost-effectively meets a range of consumer reliability needs.
- ◆ Influence automation and information tool development to suit co-op needs, and in specialized cases develop tailored tools.
- ◆ Promote energy utilization methods and timing that enhance the reliability of the grid.

To ensure that reliability is maintained, the CRN will work to influence technology development and application suiting co-op needs and, in some specialized cases, develop tailored tools. The CRN will also work to enable co-ops to continually improve distribution reliability across the board so they can meet reliability expectations for all of their consumers, regardless of their power needs. Additionally, the CRN will promote energy utilization techniques that can reduce the strain on the grid and enhance its overall reliability, such as peak shaving and demand-side management.

Responsiveness

Empathetic and timely service is a strength of cooperatives, one that distinguishes them from other energy service providers. Cooperatives nurture close, trusting relationships by maintaining unmatched responsiveness to changing owners' needs. To maintain this competitive advantage, the CRN will explore service options that enable co-ops to remain poised to meet new consumer demands.

Responsiveness Objectives



- ◆ Deliver automation tools that help co-ops continually reduce their response time to changing consumer needs and system conditions in the constant pursuit of improved customer service.
- ◆ Develop and promote operational tools and best practices to improve the efficiency with which co-ops respond to outages and new consumer contacts.
- ◆ Develop closer ties with consumers to operate in proactive rather than reactive mode.
- ◆ Maintain a routinely updated portfolio of power supply options and alternative power supplies.

In the constant pursuit of improved customer service, the CRN will investigate automation and communication tools that enable co-ops to continually reduce the time needed to respond to changing consumer needs. The CRN will also develop and promote operational tools and best practices that improve the efficiency with which co-ops respond to outages and the support of consumers, reducing the duration of outages and also the time needed to bring power to new consumers.

The CRN will promote closer ties between co-ops and their member-consumers so that co-ops can anticipate rather than react to changing consumer needs, enabling them to operate in a proactive, rather than reactive, mode. To improve response times to requests for power and provide a wider range of services to consumers seeking power alternatives (e.g., ultra-high reliability, “green” power, etc.), the CRN will develop and maintain a portfolio of power supply options.

Sustainability

The cooperative commitment to consumer service includes protecting the environment in which co-ops operate and their consumers live. Cooperatives cannot simply provide affordable, reliable, and responsive energy services to their consumers; they must do so in an environmentally responsible, sustainable manner. Towards that end, the CRN will provide co-ops with diverse technological options for offering energy services in the most environmentally responsible manner available in the industry. In this way, co-ops can protect both their local and the global environment.

The Cooperative Research Network will provide co-ops with techniques and knowledge that will help them meet consumer and societal expectations regarding environmental stewardship in a cost-effective manner. The CRN will work to develop technologies that carry environmental and economic benefits

such as monitoring capabilities, problem identification and automatic mapping to reduce drive time, and maximization of energy efficiency by matching power demand with supply.

Sustainability Objectives



- ◆ Provide co-ops with tools and knowledge to meet consumer and societal expectations of environmental stewardship in a cost-effective manner.
- ◆ Establish a balance between environmental and economic concerns through improvements to existing technology and new technology options.
- ◆ Develop and promote the use of environmentally sustainable technologies and products and reduce co-ops' impact on the environment.

The Cooperative Research Network will also develop and promote the use of environmentally sustainable technologies by both co-ops and their consumers. By combining improvements to existing technology with new technology options, the CRN will work to establish a balance between economic and environmental concerns. The CRN will provide co-ops with a portfolio of options for remaining environmentally sustainable, from enhanced operations and maintenance practices to environmental compliance tools and alternative power sources such as wind, solar, biomass, and distributed generation.

Quality of Life

Co-ops support both individual comfort and family stability while helping to expand opportunities and economic growth in local communities. The underlying goal of co-ops is to improve the quality of life of their consumers, a goal they achieve in two ways. First, cooperatives provide

Quality of Life Objectives



- ◆ Deliver information and telecommunication technologies that broaden the services co-ops offer their members to improve the quality of their lives.
- ◆ Provide co-ops with technological options to deliver reasonably priced electricity to consumers regardless of their location or power requirements.
- ◆ Continually strengthen the history that co-ops have in investing in the quality of life of their communities.

affordable, reliable, responsive, and sustainable energy services to power the televisions, computers, heating systems, and hundreds of other products consumers use to live more comfortable, satisfying lives. Co-ops also provide other services to the communities in which they operate by continuing to reinvest significant resources into local community development projects.

The CRN will help co-ops to continue this tradition by providing automation and information technologies that broaden the services co-ops can offer their consumers. It will also provide technological options that enable co-ops to offer reasonably priced electricity to consumers at any location and for any power requirements, thus eliminating geographic boundaries on power quality and affordability. By continuing to serve and invest in their local communities, financially and otherwise, co-ops will sustain their roles as valued neighbors in rural America.

Key Challenges

For co-ops to achieve their goals and objectives, they must collectively address several challenges. Some of the most pressing challenges are discussed below.

- 1. Information overload**—Due in large part to the rapid pace of technology change described in Chapter 1, many co-ops are inundated with information about new technologies. Because of the many demands placed upon typically small co-op staffs, many co-ops cannot sift through the available information to find the few items relevant to their particular operations or capital infrastructure. As a result, some co-ops do not take advantage of technological breakthroughs, information about operating “best practices”, or new business solutions that could benefit their consumers.
- 2. Last-mile bandwidth capacity constraints**—Because many rural areas are not served by broadband communications technology, many rural co-ops are limited in both the technologies they can implement and the services they offer their members. Some rural co-ops cannot implement certain automation, information, and communication systems because these systems require broadband communications to send and receive large amounts of data, a function that can not always be accommodated via telephone lines.
- 3. Meeting increasing reliability expectations cost-effectively**—Consumers across America are demanding more reliable and high-quality power. Residential and commercial consumers alike depend on electricity to power electronic devices of all types, from personal computers to microchips in appliances and other electronics that require uninterruptible power to provide uninterruptible service.

Some industrial consumers need ultra-high power quality to maintain production rates or efficiencies. Meeting these reliability demands without substantial cost increases is a key challenge that co-ops can turn to technology to address.

- 4. Human resource constraints**—Co-ops are predominantly small businesses, and as such they generally have small technical staffs. Because many co-ops are in rural areas where population densities are lower, technical staff is in particularly high demand. As co-ops work with the CRN to apply new technologies to their organizations, they will be challenged to ensure they get the most from their technical staff and recruit and keep new staff.
- 5. Electromechanical infrastructure limitations**—As co-ops continue to grow at impressive rates, compared with electricity industry averages, the limits of their electromechanical infrastructure will be stretched. Co-ops will have to carefully assess their infrastructure to identify bottlenecks or other areas where their systems may limit marketing efforts or growth opportunities. Automation of appropriate and financially justified equipment and processes will help solve many of these problems.
- 6. Regulatory compliance**—All utilities must comply with a variety of federal and state regulations concerning transmission rights, air and water emissions, other wastes, and health and safety. These regulations are subject to change, sometimes with little warning. Keeping up to date with changes in regulations and complying with all appropriate regulations is difficult for co-ops. As regulations continue to evolve, this challenge will not diminish over the next decade.

Achieving the Goals: Technology Strategies

Operating as a unified network to minimize risk to individual organizations, the Cooperative Research Network will strive to acquire knowledge and develop tools that enable co-ops to address the challenges and achieve the goals detailed earlier. The CRN will help cooperatives achieve technology innovation through the strategies that it will pursue. These strategies will combine to form a logical progression of exploration and knowledge development.

Four technology strategies establish the approach the Cooperative Research Network will pursue to bring solutions to co-ops:

1. Technology Surveillance
2. Technology Education
3. Technology Investment
4. Technology Partnership

Technology Surveillance

With the rapid change occurring within the electricity industry, the opportunities and challenges offered by new technologies can overwhelm an individual co-op. To keep co-ops abreast of new technologies and business applications that are valuable and appropriate to their needs, the Cooperative Research Network will continually sift through the mass of information and evaluate those technologies that hold promise for improving the value co-ops offer their consumers. In this way, the CRN will ease the burden on individual co-ops and help to advance the co-op community as a whole.

This strategy will also be the first response to co-op questions and problems. Other organizations may have already developed solutions that work for co-ops. The least costly and most efficient strategy for the CRN to employ is to quickly find existing knowledge and products. The CRN has already begun to implement this strategy. CRN members

now have access to technology surveillance information through an on-line magazine.

Technology Education

When new ideas or technologies emerge that the CRN identifies as promising, it will disseminate the information throughout the CRN member community. Through education initiatives, the CRN will help to ensure that co-ops are aware of technological advances and how these advances can apply to their particular business needs. These efforts will ensure technical and business expertise will be available and applicable to CRN members. In support of this strategy, the CRN has developed specialized training with the assistance of the NRECA Education, Training, and Consulting Department and hosts an online Learning Center at the CRN web site.

Technology Investment

Because of the nature of their part of the electricity market, cooperatives may sometimes have a technological need that is unique to their segment of the industry. At the same time, individual co-ops may not have the means to address all of their technology needs as a single organization. In such instances, co-ops can pool their resources, through CRN, to develop technologies that address the knowledge gaps and product needs of their niche of the energy industry. Doing so can provide solutions without any one co-op assuming great individual expense or risk. Many commercial vendors and other research organizations could be interested in joining co-ops in these investments. The CRN will work for member co-ops to facilitate such investments.

Technology Partnership

Just as co-ops can work together in tightly-knit partnerships to strengthen their technology position, the cooperative community as a whole, through the CRN, can partner with outside organizations that have a stake in seeing electric co-ops succeed—organizations such as EPRI, DOE, TVA, E Source, NEETRAC

and U.S. Department of Defense have all participated in CRN studies. By partnering with these organizations, the cooperative community could leverage the financial and intellectual resources needed to improve the cost-effectiveness of its technology efforts. The CRN has already begun this process by signing formal Memoranda of Understanding with the TVA and the DOE.

A broad range of technological and business needs are shown in Appendix A, with the highest-priority needs shown in **bold** type (priorities). Technology solutions that address these needs will allow co-ops to work towards the goals and objectives described earlier in this Chapter. In the Appendix, the five goal icons (affordability , reliability , responsiveness , sustainability , and quality of life ) are used to indicate the goals towards which each needed technology is expected to enable progress. The table is organized by technology strategy (surveillance, education, investment, and partnership) and by the time frame in which these activities must produce results to support co-op operations.

While the Appendix is organized according to technology strategy, distinctions among them are not rigid. Rather, the four strategies form a continuum of technological development approaches through which the CRN will work to provide solutions.

Each of the subsequent five chapters presents an overview of the activities most relevant to the five goals, including an additional description of the most relevant priorities.

The Future

Electric cooperatives will achieve their vision through technology and business innovation. The goals of the Roadmap will be addressed over years by making investments in numerous projects that will resolve priority problems and gaps in co-op knowledge. The CRN staff will use the progression of strategies to explore available resources and minimize expenses while delivering capable answers to co-op problems. Resources required for developing needed innovations are significant; therefore, maximizing the returns from technology investments demands the application of our strategic approach. By pursuing advances through a unified, organized approach, co-ops can fortify their strengths and address their weaknesses, positioning themselves for continued success in the changing energy industry.

The Roadmapping and Priority-Setting Process

In December 2000, approximately 25 representatives of co-ops from across the nation gathered to develop a vision and strategic goals for electric cooperatives. Starting with a vision from the NRECA's Board of Directors, the planning group developed the vision and supporting goals described in Chapter 2 of this Roadmap. These results formed the basis for a Roadmapping Workshop in February 2001, at which representatives of approximately 50 co-ops identified key challenges that co-ops must address to reach the goals and the technologies needed to do so.

Four CRN task forces then worked to develop objectives for the CRN to pursue in support of the goals of affordability, reliability, responsiveness, sustainability and quality of life while the results of the Workshops were used by the CRN to create this Roadmap. The complete results of the Workshop are represented in Appendix A. Workshop participants deemed several technological needs as priorities by voting on those ideas most critical to achieving the vision (priorities are shown in **bold** type in the Appendix). These priorities were then reviewed extensively within the NRECA and the electric cooperative community. Those individuals who have contributed to the Roadmap either by participating in one of the working sessions or by reviewing the draft Roadmap are listed in Appendix B.

3

Technological Needs: Affordability

Electric cooperatives have always had a goal of delivering electric service at affordable prices. Balancing wholesale costs in a restructured market is just the beginning of the hard work required to accomplish this effort in the future. New service connections, expanded member expectations, and increased consumer awareness will continually raise the question of rates for co-ops.

To resolve the objectives established by co-op managers and staff, CRN will have to explore and solve the priority needs listed in this chapter. Doing so will require implementation of the technology investigation strategy to address co-op business, technology, and knowledge requirements. Using technology surveillance, education, investment, and partnerships the CRN will identify, apply, and develop technology that will enable co-ops to offer more affordable energy services to their members.

The roadmapping process described on page 14 provides insight into how technological needs and priorities were selected. The technological needs most relevant to affordability are described in this Chapter. These priorities are expected to enable gains toward the affordability goal, but may also have secondary benefits in other areas, as shown by the corresponding icons next to their descriptions. Also, while this Chapter is organized according to technology strategy (surveillance, education, investment, and partnership), distinctions among these four areas are


not rigid. Rather, the four strategies form a continuum of technological effort to be pursued by the CRN.

Technology Surveillance

Technology surveillance activities are needed to find information, methods, and technologies which can help co-ops reduce costs, improve efficiencies, and ultimately offer consumers more affordable power. Most of the technology surveillance activities relevant to affordability identified in Appendix A will result in near-term results.

Evaluating both currently available technologies and new, emerging technologies as they enter the market will allow co-ops to determine which would most benefit them when applied to their operations. Such evaluations should include cost and benefit analyses, helping co-ops understand how they can best apply these technologies to offer affordable energy services. Technology surveillance that helps co-ops identify opportunities at other organizations in the electricity and other industries is also part of the overall technology agenda. Several additional surveillance needs that pertain to the affordability objectives can be found in Appendix A.

Priorities

 Document the best practices of successful organizations.

Co-ops can learn ways to improve their operations by looking to successful organizations both within the electricity industry and in other industries. By documenting the best practices

Consumers expect their energy providers to offer services at a fair price for the value that they receive.

of successful organizations, co-ops can discover ways to cut costs or otherwise influence affordability. Such information could then be disseminated among co-ops to replicate it where possible. Quantitative studies that tabulate performance standards and methodology will help co-ops analyze these best practices and tailor them to their unique operations.

P R I O R I T Y **3** **Develop a database of technology solutions with a technology assessment guide.** A database that includes technology “screens” is needed to help co-ops sift through the massive amounts of information available today regarding technology. Combining this database with a user-friendly model that predicts the economic benefits of a new technology will help co-ops make informed investment decisions about technology. Understanding the economic benefit of new technologies before committing funds is critical to avoiding investment mistakes that could otherwise limit a co-op’s ability to offer affordable services to its members.

Technology Education

Both in-house and Internet-based training are key parts of education efforts aimed at helping co-ops improve the affordability of their services. Co-ops need training that encompasses a variety of topics, including cooperative-specific risk analysis and regulatory specialist training. A study to assess the value of training is also needed to convince co-ops that an investment in training will result in tangible benefits. Several other activities are needed to educate co-ops about how to best manage risk. Appendix A presents the complete list of technology education efforts that will impact affordability.

Priorities

P R I O R I T Y **3** **Identify existing automation, information, and communication technologies and their range of costs.** Many solutions that are available today have the potential to improve co-op operations in the right business applications. Understand-

ing the costs, proper applications, and benefits of automation, information, and communication systems available today will reveal some near-term opportunities to reduce costs or otherwise affect affordability.

P R I O R I T Y **3** **Develop an application-specific cost-benefit assessment tool for co-ops to evaluate new ideas.**

Assisting co-ops in developing business plans that account for the costs and benefits of technology investments will allow them to allocate resources to take advantage of promising opportunities that arise with technology advances. For co-ops to trust its results, this tool must be validated with real data in real applications and continually updated to reflect the most current advances. It should also account for indirect costs and benefits, such as sustainability or quality of life improvements.

P R I O R I T Y **3** **Study the fuel supply chain and costs, and develop tools to monitor fuel costs.**

The knowledge gained from such a study would allow cooperatives to better understand how changes in fuel prices along the supply chain affect production costs. Using that knowledge, the CRN can help co-ops develop appropriate steps to minimize or avoid production cost fluctuations, such as fuel switching or the increased use of distributed generation, thereby minimizing the impact of price fluctuations on consumers.

P R I O R I T Y **3** **Maintain the balance between cost and revenue, despite need for high-cost generation technologies.**

Environmental legislation is leading co-ops to invest in new, more costly generation technologies such as peaking turbines, emission controls, wind and solar. Today, these technologies are more expensive than traditional options and require more revenue to support. Co-ops need to explore ways to maintain the cost/revenue balance while exploring new generation technologies that can meet strict environmental requirements.

Technology Investment

Many investments in the near-, mid-, and long-term time frames are needed to improve the affordability of co-op services, emerging technologies and the cost-efficiencies of co-op operations. In the near term, studies to better understand co-op technology options and markets are needed for co-ops to fully capitalize on emerging opportunities. Investments are also needed to support surveillance and education efforts described above. Over the mid- and long-term time frames, investments to develop and demonstrate lower cost telecommunication and broadband capabilities, spectrum sharing technologies, and advanced automation, information, and communication systems are needed to make these technologies viable for co-ops. Other investments are needed to develop tools that will facilitate cooperation among co-ops.

Priorities

P R I O R I T Y **Lower material costs to improve affordability.** Developing materials that can be used throughout the distribution system while reducing costs can help co-ops meet the affordability goal. Materials research is prevalent in various industries across the United States; co-ops can look to other industries for materials that have potential to benefit them. Other strategies to lower material costs also hold promise, such as bulk purchasing and materials management techniques.

P R I O R I T Y **Integrate power supply planning with power marketing.** In order to market power to all potential consumers, co-ops need to ensure adequate power supply is in place to serve those consumers. Co-ops need to integrate power supply planning with power marketing to ensure they are able to serve all of their consumers while maximizing the use of their power supply. Such integration is particularly important for co-ops to understand whether they can provide affordable power to new potential consumers with specified loads (particularly industrial consumers).

Likewise, co-ops need to consider their marketing approach when planning power supply expansions to ensure those expansions are appropriate in size and scope.

P R I O R I T Y **Develop user-friendly model that predicts the economic benefits of new technologies to co-ops.** Such a model can help to advise co-ops of the potential return-on-investment new technologies may offer, giving those co-ops the tools they need to make informed technology investment decisions. By emphasizing user friendliness, the CRN will ensure the model can be used by all co-ops interested in assessing technologies.

Technology Partnerships

Partnerships among co-ops and with other organizations can help to accelerate technological progress by bringing greater technical and financial resources to bear on co-op needs. Conducting joint technology development and demonstration projects can help create economies of scale and allow the results to be shared within the co-op community. Partnerships with automation, information, communications, and other equipment suppliers are needed to help those suppliers tailor their products and services to co-op needs. Exploring partnerships among co-ops to consider joint ownership of new technologies (e.g., South Dakota wind co-op) may help co-ops implement promising technologies sooner and at a lower cost and risk for individual co-ops. In the long term, a broad-based partnership to help develop large-scale (100 MW) fuel cells may offer co-ops new power supply possibilities.

While no priorities are listed under Partnerships in this chapter, many of the other priorities will likely involve partnership elements. Also, several of the Partnership priorities described in later chapters will also help co-ops improve affordability.

4

Technological Needs: Reliability

As consumers demand more reliable power and become less tolerant of interruptions in service, technology advances can help co-ops meet these demands. The Cooperative Research Network and its member co-ops will pursue effective business application of technology collaboratively to realize their reliability goal and objectives.

The technological needs most relevant to reliability are described in this Chapter. The priorities described in this Chapter are expected to enable gains toward the reliability goal, but may also have secondary benefits in other areas, as shown by the corresponding icons next to their descriptions. Page 14 presents the process used to establish these priorities. As in Chapter 3, distinctions among the four strategies are not rigid.

Technology Surveillance

Technology surveillance is needed to discover techniques and technologies that have potential to improve the reliability of co-op power supply and distribution systems. Many of the surveillance activities in the reliability area will also help co-ops realize their other goals and objectives, as shown by the icons in Appendix A.

Surveillance into automation and information technologies and communication protocols will lead co-ops to discover existing technologies or techniques that co-ops can apply to improve their power quality and reliability in the near term. Establishing a baseline for

the performance of new technologies is needed to help co-ops understand, in quantitative terms, how these technologies help improve or, in some cases, threaten reliability.

Other, more specific surveillance activities are also needed. Viable alternative fuel supplies for distributed generation technologies are needed to open up new power supply options for co-ops seeking to improve the reliability of their electric service. Understanding the results and effects of various state electricity industry restructuring processes, exploring the problems and opportunities of demand side management, and developing new supply options can all help to minimize potential reliability problems for co-ops. Identifying technologies that can reduce risk to the power system from exposure to nature will help co-ops reduce the ongoing reliability threat that nature creates. Identifying consumer products or practices that can reduce reliability demands may allow co-ops to ease the burden on their systems and meet reliability demands without large capital investments.

Priorities

Identify consumer products that will reduce the investment in system improvement projects and enhance system reliability.

Consumer-side technologies or practices that can ease system reliability requirements may provide co-ops with an alternative approach to meeting their reliability goal and objectives. By promoting such technologies and practices, co-ops can potentially avoid large

All consumers depend on a nearly uninterrupted supply of high-quality power in their daily lives.

investments that may otherwise be required to modify power system infrastructure to achieve the reliability goals. Ideally, such consumer products and practices will also offer consumers advantages such as improved energy efficiency.

Technology Education

Technology education efforts are needed to help co-ops learn how to apply new and emerging technologies that can improve reliability for their operations. Providing tools that can help co-ops review technology options and training co-op staff to understand and use technology that can help to improve reliability are key components of this education effort.

A guide to help co-ops implement distributed generation is needed to help co-ops assess if and where DG should be used in the context of their unique power systems. Such a guide should evaluate DG at sizes on the order of 0.01 to 10 MW. Understanding Independent System Operators, RTO and NUGs while educating co-ops about evolving generation and transmission infrastructure constraints will help co-ops plan to avoid potential reliability pitfalls. Field tests for promising technologies, particularly power quality devices, are needed to help co-ops understand how they can apply technology to improve reliability, and the magnitude of improvements they can expect from doing so. Demonstrating advanced automation, information, and communication systems and publicizing examples of co-ops enjoying success using such systems can help to encourage more co-ops to implement.

While there are no specific education priorities that primarily affect reliability, other priorities overlap with this area.

Technology Investment

Appendix A shows a wide range of technology investments across all time frames that are needed to help co-ops improve reliability. Many of these

investments will also impact several other goals and objectives, as shown by the corresponding icons.

In the near-term, identifying infrastructure improvements needed to enhance reliability is the first step to resolving them. Investments in technology evaluations and field tests are needed to help co-ops better estimate the benefits of new technologies. New techniques to expand existing transmission facilities can help reduce or remove transmission bottlenecks and improve overall reliability.

In the mid-term, investments to develop technologies and systems that allow co-ops to more seamlessly tie their distribution systems together, as well as explore closer ties with G&T co-ops and other distribution co-ops, may open new operational possibilities for co-ops seeking high reliability. In the long term, investments are needed to develop new methods for integrating new technologies into existing power systems without compromising reliability, and for technology demonstrations.

Priorities

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Develop low-cost methods to improve the reliability of electric service.

Reliability demands are increasing within the electricity market. Meeting these demands at a price consumers are willing to pay is a priority for co-ops. Understanding the range of consumer reliability needs and what those consumers are willing to pay to achieve their desires is the first step. Using that knowledge, co-ops can then develop and implement improvements in electric service reliability that do not lead to cost increases that render those services unaffordable.

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Investigate power supply infrastructure limitations.

Identifying critical transmission and fuel supply chain bottlenecks can inform co-ops where they should direct efforts to address potential shortages.

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Investigate new techniques to expand existing transmission facilities. The transmission business is changing as RTOs evolve across regions and demand grows.

Expanding the existing infrastructure will allow co-ops to gain access to more consumers, widening their potential market.

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Develop methods for integrating emerging technologies into the existing power system. Because capital infrastructure in the electric-

ity industry typically has a long lifetime, integrating new technologies (both power technologies such as distributed generation and enabling technologies such as automation or communication systems) into the existing power system infrastructure is critical. This integration must be done in the most efficient and appropriate manner possible without disrupting power reliability, allowing co-ops to be responsive to evolving technology while continuing to meet reliability requirements.

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Research the impact of distributed generation on power system. Incorporating new distributed generation technologies into

the power system is one of the major technical challenges of the next 10 years. DG technologies hold promise to improve power quality and reliability, and are particularly promising for co-ops as they are well-suited to rural applications. Research to understand and address the significant challenges co-ops face in integrating DG equipment into existing systems will help reduce risk to co-ops seeking to take advantage of their benefits.

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Conduct analyses of emerging technologies and trends, and field test promising options. As

new technology emerges in the marketplace, ongoing analyses will help co-ops keep pace. The most promising options need to be field tested in real-world environments to prove their

reliability and benefits. Field tests will help co-ops gain confidence in new technology and overcome some of the barriers to technology implementation.

Technology Partnerships

For the reliability goal and objectives to be fully realized, technology partnerships that engage relevant organizations in technology development and application are critical. Almost all of the partnerships shown in Appendix A will impact reliability in addition to one or more other goals, indicating the valuable role these partnerships play in the CRN's overall technology strategy. The MultiSpeak partnership, a partnership with automation, information, and telecommunication technology vendors, has particular relevance to reliability. By working with these vendors, co-ops can ensure their unique operating and infrastructure conditions are considered during technology development. Expanding the CRN standards to include more of these vendors' products and services is needed to create a more standardized environment that can facilitate their application in co-op businesses.

Priorities

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Expand CRN's MultiSpeak standards activities to include more automation, information, and communication technology

activities. Current CRN standards activities do not include developing standards for all automation, information, and communication protocols and systems. Additionally, some technology vendors lack incentive to cooperate and standardize their systems, making overall compatibility a serious challenge. Working to develop standards will facilitate the incorporation of these systems into co-op operations, allowing co-ops to take advantage of their reliability benefits.

5

Technological Needs: Responsiveness

For co-ops to be more responsive to their members' changing needs, they need knowledge, tools, and technologies to enable them to react swiftly and confidently. The technological needs most relevant to responsiveness are described in this Chapter. Page 14 presents the process used to identify the priorities in this Chapter. These priorities are expected to enable gains toward the responsiveness goal, but may also have secondary benefits in other areas, as shown by the corresponding icons next to their descriptions.

Technology Surveillance

Most technology surveillance activities that will help co-ops improve their responsiveness to changing consumer needs will also have impacts on other goals and, thus, are discussed in other chapters. One activity specifically needed to improve responsiveness is surveillance regarding new telecommunications applications. Telecommunication devices hold promise for co-ops to develop closer ties across their systems and to their consumers, helping them respond more quickly to consumer demands.

Priorities

Develop a technology tracking mechanism to keep co-ops abreast of changes in technology. Such a mechanism will allow co-ops to make informed technology decisions and be responsive to technology breakthroughs as they emerge. The technology surveillance strategic approach will facilitate this objective.

Technology Education

Most technology education efforts to improve co-op responsiveness also impact reliability, indicating the close ties between these two goals. Educating co-ops about automation, information, and communication systems can help co-ops properly apply and use these systems to achieve higher responsiveness. In the near term, demonstrating successful commercialization of such systems (e.g., Turtle Meters) can convince co-ops that these systems are ready for deployment.


Utility training centers can help co-ops achieve all five goals and their supporting objectives. By developing programs that focus on training co-op staff about new technologies, the CRN can help co-ops understand how to apply advanced technology as it emerges. Co-ops with such training will be able to use new technology to respond quickly to consumer demand.

Priorities

Develop and implement utility training centers and distance learning with challenging certification requirements. A training curriculum designed to keep personnel up to date on technology will equip co-ops with the expertise they need to make informed investment and operational decisions. Tools such as seminars, guidebooks, and interactive web schools should all be packaged together for a complete training program. To complement and confirm the training, a challenging certification

Empathetic and timely service is a strength of cooperatives, one that distinguishes them from other energy service providers.

program can be used for engineers and operators to ensure staff is up to date on the most recent advances.


P R I O R I T Y  **Find and demonstrate examples of co-ops with leading automation, information, and communication systems.** Across the nation, some co-ops have made careful investments in automation, information, and communication systems that are now paying off in the form of improved service to consumers, increased operating efficiency, and enhanced reliability. Documenting these successes will provide examples for other co-ops to replicate. While testing and demonstration projects create confidence in new technologies, a co-op enjoying success is the most convincing demonstration.


Technology Investment

Investments that improve responsiveness are needed for co-ops to continue to offer unparalleled consumer service. Exploring alternatives for energy transmission and distribution to new facilities can help co-ops respond quickly to requests for power from new consumers. Developing a community plan for supporting broadband services for consumers will allow co-ops to offer more than just power. This business plan is needed to help co-ops respond to growing demand for broadband service across the nation. Investments in developing market-based pricing schemes may be needed to help co-ops respond faster to changes in market conditions.

In the mid-term, conducting research into media-efficient communications technologies will help co-ops implement advanced automation and communication systems. These systems send and receive large amounts of data, which many co-ops cannot accommodate today due to the lack of broadband communications. More efficient communications techniques may alleviate this constraint.

Priorities

P R I O R I T Y  **Develop low-cost communication systems and communicate their value to co-ops.** Systems such as supervisory control and data acquisition (SCADA) systems are used by many co-ops to operate their distribution systems. While the hardware costs are not prohibitive for most co-ops, the ongoing communication costs of these systems are high, discouraging many co-ops from taking advantage of the benefits they offer. Systems that are more affordable will allow co-ops to implement them where appropriate and enhance their responsiveness to changes in the power system. Additionally, communicating the value of those systems to co-ops will help them understand their value proposition and how they are best applied.

P R I O R I T Y  **Explore innovative techniques to respond to outages faster.** Many consumers measure responsiveness in terms of power restoration during outages. By exploring techniques to minimize the time between when an outage begins and when the lights come back on, co-ops can improve their service to consumers. By combining these techniques with outage prevention techniques described in Chapter 4, co-ops can work to achieve their goal of responding to outages quickly and efficiently.

Technology Partnerships

Partnerships to establish a program for understanding, developing, and marketing distributed generation to co-op consumers can combine with research described elsewhere in this Roadmap to allow co-ops to appropriately integrate DG technologies into co-op systems. Because DG holds promise to help co-ops achieve all of their goals, including responsiveness, such a partnership is particularly important. Partnerships to develop Internet-based services are a top-

priority activity needed to improve responsiveness; this priority is discussed below.

Priorities

**P
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Y** **Develop and expand Internet-based services.** Internet-based services have enormous potential across the board, and particularly for enhancing marketing and energy service capabilities. Developing Internet-based marketing approaches allows co-

ops to access millions of potential consumers through a medium they already use. Using the Internet to provide energy and other services may help co-ops provide better consumer satisfaction. Such capabilities may also be used to provide industrial consumers with real-time energy data for use in process control or other plant operations, adding to the value co-ops offer their members.

6

Technological Needs: Sustainability



To meet consumer and societal expectations regarding environmental stewardship in the years ahead, cooperatives will need to provide their services in an environmentally sustainable manner.

The technological needs most relevant to sustainability are described in this Chapter. Page 14 presents the process used to identify the priorities in this Chapter. These priorities are expected to enable gains toward the sustainability goal, but may also have secondary benefits in other areas, as shown by the corresponding icons next to their descriptions.

Technology Surveillance

Technology surveillance is needed to identify techniques and technologies that can potentially reduce the impact of electric cooperatives on the environment. This process could help to identify and track emerging environmental issues and actions taken in some leading jurisdictions. By identifying new techniques and technologies being used by other providers in the industry, co-ops can identify those that best suit their operations and that have the most potential for improving their environmental performance. All of the technology surveillance activities identified in Appendix A are expected to deliver results that will benefit co-ops in the near term.

Technology Education

Educating cooperatives on the steady flow of emerging technologies and regulations enacted to reduce environmental impact is crucial for co-ops to achieve their goals and objectives for sustainability. For example, developing a white paper on NOx emission allowances will help educate co-ops about regulations with which they must comply. Enabling sharing of information and knowledge quickly and effectively will help co-op staff to be aware of the success and failures of other co-ops and energy providers.

Technology Investment

Identifying and investing in cost-effective environmental technologies will help co-ops protect and preserve the environments in which they operate without prohibitive cost increases. Establishing environmental R&D targets will help focus research to achieve environmental objectives through technology. Exploring new ways to manage co-op waste can help reduce overall environmental impact and, potentially, turn wastes into useful byproducts.

Priorities

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The cooperative commitment to consumer service includes protecting the environment in which co-ops operate and their consumers live.


and raise rural economic development. CRN will take an active role in these development efforts to ensure the technologies developed are well-suited to co-op operations.

P R I O R I T Y  **Follow carbon control technologies and associated opportunities to capture environmental credits.** Many observers of the global climate debate have been arguing for early adaptation and sequestration in rural areas of the United States. Because these activities would be taking place in the service territories of co-ops this could mean new energy requirements, business operations, and community or economic development. Co-ops should make a strategic investment in understanding the opportunities and challenges that could influence their business and communities; such understanding could lead to new co-op opportunities.


Technology Partnerships


Numerous partnership activities that affect co-op operations in the near, mid, and long terms can help co-ops achieve their sustainability goals. Establishing a portfolio of R&D investments in new power supplies such as wind, solar, renewables, DG, and hybrid technologies will be particularly important in this effort. Cooperatives may wish to establish environmental targets to accelerate and focus research and development efforts. In the long term, partnerships to scale up fuel cell to the order of 100 MW will help bring this promising technology to co-ops seeking alternative power supply options.


Priorities

P R I O R I T Y  **Establish partnerships with a range of power suppliers (e.g., wind, solar, renewables, DG, etc.)** Co-ops are coal-intensive in their generation fuel mix, compared to the electricity industry as a whole. Non-coal based power supply, such as wind, biomass, and distributed generation technologies, such as microturbines and

fuel cells can be explored in a portfolio approach to technology development. By partnering with a range of power suppliers, co-ops can broaden their options to better serve their members.

P R I O R I T Y  **Explore rural renewable potential.** Electric co-ops are uniquely concentrated in rural America. These rural regions are rich in biomass, a potential fuel source that promises to offer environmental and, in some cases, cost benefits over conventional fuels. Capitalizing on this natural synergy can potentially have enormous implications for rural America and the co-ops it supports.

P R I O R I T Y  **Minimize the influence of utility facilities on wildlife and help to solve this collective issue.** Many co-ops operate lines and plants in rural and sensitive environments. Natural resources can be influenced by these operations; for example, right-of-way clearing, line locations, plant operations and water supply issues. This particular effort should be coordinated with other organizations to assure that all experiences are captured and that risks are shared through partnering.

P R I O R I T Y  **Support clean coal technology development.** Coal is an important long-term energy supply for co-ops. Developing ways to use this resource, while also protecting the environment, is a priority. NRECA is working with DOE, EPRI, and the Coal Utilization Research Council to create a roadmap for clean coal technology development. Only by working with other organizations and leveraging resources can the large investments required to develop clean coal technologies be assembled. NRECA's participation in this important work will ensure that co-ops' unique needs are considered during the early stages of technology development.

7

Technological Needs: Quality of Life

To continue to improve the quality of life in local communities across America, the CRN and its partners will seek to implement a portfolio of activities. The technological needs most relevant to quality of life are described in this Chapter. Page 14 presents the process used to identify the priorities in this Chapter. These priorities are expected to enable gains toward the quality of life goal, but may also have secondary benefits in other areas, as shown by the corresponding icons next to their descriptions.

Technology Surveillance

Technology surveillance will enable co-ops to find new techniques and technologies that will improve the services they provide and enhance the quality of life of their consumers. Co-ops need to understand how to introduce change management and promotional skills to co-op staff. Co-ops would also benefit from studying staffing and salary needs and constraints based on market conditions. Establishing a “think tank” to generate new ideas and technologies that may be uniquely suited to co-ops may lead to a continuous stream of innovative ideas for improving quality of life for co-op consumers. Research is also needed to help determine which co-op business disciplines could benefit from co-ops acting together as larger co-op networks.


Priorities

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 **Evaluate new technologies to determine which are suited or could be tailored to unique co-op needs.** As new technologies enter the market and become ready for co-op application, technology evaluations help to determine the most promising applications and how these technologies can be tailored to suit co-op needs. Helping co-ops better understand the benefits of new technologies will greatly enhance their ability to make informed investment decisions that can quickly benefit their consumers.


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Understand how to introduce change management skills and promotional skills to co-ops.

 The sweeping changes occurring in the electricity industry mean the cooperative culture should adapt in turn. However, the range of cooperative cultures is broad and unique within the electricity industry, and it must be understood and treated as such. Research into a variety of corporate cultures and how they can be managed and altered to face emerging challenges will help give insight into steps that can be taken to help co-ops adapt and grow to meet the emerging challenges in the electricity industry.

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Study staffing and salary needs and constraints based on market conditions.

 research to better characterize the human resources gaps among co-ops and the corresponding salary requirements to fill those gaps will help co-ops better understand the actions and resources

Co-ops support both individual comfort and family stability while helping to expand opportunities and economic growth in local communities.

needed to address their staffing issues. Such information likely exists; this study may entail more data gathering and education, and should include cooperative-specific data, other electricity industry data, and local marketplace data for staff availability and salary trends.

Technology Education

Knowledge and application of effective e-commerce practices will bring co-ops closer to their consumers and expand the range of services they can provide. To effectively implement automation and information technology advances, co-ops will need a tailored education strategy targeted at board members, managers, employees, and consumers alike that emphasizes value, not cost. Co-ops also need to assess new venture businesses and examine training programs that other companies and industries have used to transition from a monopoly to a competitive market strategy to assist those co-ops that face such a transition.

Priorities

PRIORITY **Improve co-ops' knowledge about effective e-commerce.**

Taking full advantage of e-commerce tools and techniques available today can enable co-ops to offer more value and a wider range of services to consumers. Many e-commerce tools already exist; educating co-ops about how these tools can be used to improve efficiency will help spread their benefits among CRN member co-ops.

PRIORITY **Develop method of recruiting and sharing the supply of technical employees among co-ops.** Individual co-ops, particularly smaller ones, may not need a full-time technical staff member, but may benefit from having part-time technical staff on hand. In such cases, it is not cost-effective to pay a full-time salary. Yet, technical staff often command high salaries and are in great demand, so securing part-time staff is difficult. Developing new techniques to help

recruit technical personnel will help address co-ops' difficulties in this area. In addition, as co-ops move towards the unified network concept, techniques that facilitate sharing the technical expertise resident within that network will help address cases where full-time staff is not required or cannot be secured.

PRIORITY **Implement the automation and information technology education strategy.** Such a strategy can help co-ops assess and operate automation, information, and communication systems more effectively. One key part of the education strategy is to emphasize making decisions on value rather than simply cost, which may help to overcome reluctance to deploy such technologies. All levels of co-op personnel could participate in the training program, including Board members, directors, co-op members, and employees, raising the overall knowledge level of participating co-ops.

Technology Investment

A range of investments in all time frames will help to provide co-ops with the appropriate technology to continue to improve the quality of life of their consumers. Surveys and focus groups may help cooperatives determine which services consumers will most appreciate and in what technologies they should therefore invest. The Internet may provide a tool that cooperatives can use for information-sharing and collaboration on research and investment in new technologies.

In the mid term, the development of artificial intelligence tools to support employees may improve cooperatives' overall services. In the long term, co-ops will need to continue the pursuit of "perfect power."

Priorities

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Develop Internet-based collaboration, learning, and training.

Internet-based tools will allow cooperatives to function more cohesively, disseminating knowledge of technologies and best practices quickly and efficiently. These tools can be used to provide all cooperatives with the ability to efficiently and effectively train staff.

Technology Partnerships

Cooperatives can develop partnerships to continue to improve their services and the quality of life of their consumers. Working together, co-ops can research, develop, and invest in technologies much more effectively than as individual organizations. Only by working together can cooperatives realize such broad-ranging changes as the transformation of

the industry to new, cleaner fuels. Many Cooperative Business Network members have important contributions to make in this area of study. Several federal and state government organizations have a role to play in supporting the implementation of new services. Co-ops need to continue the development of the long-standing relationships they have used in this area of service.

Priorities

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Develop a “virtual co-op”

model. Developing a model, or “virtual co-op,” that shows how technologies and tools can be used to efficiently run individual co-ops, or groups of co-ops working together, can enable co-ops to take advantage of opportunities where cooperation among co-ops is mutually beneficial.

8

Implementation

Implementing the wide range of activities and delivering on the prioritized issues described in this Roadmap will be no small task. The CRN, as the only research program dedicated to meeting the technological needs of electric cooperatives, is prepared to take up that challenge. By facilitating the creation of this Roadmap, the CRN has helped co-ops take an important step by identifying a common vision, goals that support that vision, and technological priorities that can help to achieve those goals. By collectively pooling the resources of members, CRN can enable the cooperative network to leverage individual, independent investments from co-ops nationwide in the creation of technological and business solutions that respond to the priorities outlined in the Roadmap.

The CRN is a flexible research program that allows members to participate in one or more of four “technology units” based on their business strategies and consumers’ needs:

- ◆ **Automation, Telecommunications, and Information Technology** identifies and evaluates automation and system telecommunications technologies which can help cooperatives serve members at reduced costs.
- ◆ **Distribution Operations** aims to demonstrate a capability to increase efficiency and reduce the costs of operating a distribution system through practical guidance on technology and operations methods.

- ◆ **Marketing and Energy Services** studies end-use products and services to manage demand, increase energy sales, provide new service options, and boost consumer satisfaction.
- ◆ **Power Supply** explores ways to generate, transmit, and supply power, which will improve load retention and, ultimately, consumer service.

In addition, a fifth, non-budgeted committee—the Policy, Planning, and Communications Committee (PP&C)—is responsible for promoting revisions and updates of the Roadmap as changes in cooperative technologies are met and new ones emerge.



The key decisions on research project selection and funding, as well as policies related to funding of the program, are guided by CRN member input and direction obtained through the CRN advisory structure. Staff from member cooperatives across the country select projects and define technology and business priorities that support the Roadmap's vision. This constant review and adjustment for current consumer demands and government requirements assures timely response to issues.

Members may join any or all of the four technology units within the CRN. From the membership dues, funds are allocated to research projects selected by a governing Task Force of member representatives. Projects are selected based on prioritized co-op needs (such as those in this Roadmap) from proposals submitted by members. The selection process occurs on a semi-annual basis, ensuring that the current needs of the members are always at the forefront of the research schedule. The results of the selected projects are shared with all of the members participating in that particular technology unit and are readily available to members through seminars, demonstrations, briefs, reports, and on the CRN web site.

Using the Roadmap

The CRN will use the Roadmap as its title suggests – the Roadmap is a strategic tool that will help co-ops get from where they are today to where they want to be in the future. *Electric Cooperative Technology Solutions* will help guide the CRN's four Task Forces as they make investments into research, development, demonstration, and business evaluation projects that respond to the priorities. The Roadmap is not a prescriptive guide that tells the Task Forces what projects to fund. Rather, it offers multiple pathways to achieving strategically important goals and realizing the cooperative vision and leaves investment decisions up to Task Force members.

In fact, the CRN has already begun to implement the priorities in this Roadmap. In 2001, the CRN allocated \$250,000 to fund the CRN Project 01-45, *CRN Technology Surveillance*. Under this project, the CRN has developed a web magazine devoted to delivering timely, pertinent information to co-ops about the latest technology innovations and business applications. This online resource, which is now available, will help co-ops sift through the mountains of information available about technology options on the market and provide them with relevant information they can use to deliver added benefits to their consumers.

Partnerships – A Key Pathway to Success

In addition to acting as a network through which co-ops can collaboratively and independently invest in technology projects, the CRN actively pursues collaborative relationships with other organizations interested in developing

Recent CRN Partnerships

In 2001, the CRN formed two new technology partnerships with E Source and the National Electric Energy Testing, Research & Applications Center (NEETRAC). E Source is one of the nation's premier retail and end-use research organizations. Via this alliance, CRN members now have access to important E Source reports. NEETRAC is a world-class testing laboratory associated with the Georgia Institute of Technology. Because of the CRN's relationship with NEETRAC, CRN members can now have access to the reports of NEETRAC and receive discounts on NEETRAC testing services. These two recent partnerships bring even more value to CRN members by broadening the products, services, and knowledge available to member co-ops.

technology that can secure business success for electric cooperatives. The CRN has signed formal Memoranda of Understanding with organizations such as the U.S. Department of Energy (DOE) and the Tennessee Valley Authority (TVA), and maintains a close relationship with the Electric Power Research Institute (EPRI). By working with other, often larger, organizations, the CRN can help leverage co-op investments with additional resources to bring a greater overall research capability to bear on member co-ops' business needs. The CRN will continue to actively seek out partner organizations to expand the network of resources available to implement the priorities in the Roadmap.

The Roadmap – a “Living Document”

The Roadmap is a living document, and will constantly be reevaluated to assure the route and the destinations are appropriate for electric co-ops. Like any traveler, co-ops must be able to adjust to changes in opportunity and obstruction. In the months and years to come co-op staff and others interested in the success

of co-ops will be asked for their requirements and advice. The destinations of *Electric Cooperative Technology Solutions* will be altered to respond to the changing views of the future. In this capacity, the priorities it suggests will be periodically reviewed in light of the most current developments in the energy industry and in technology.

Current plans call for routine consideration of the vision of co-ops and the general strategy they will use to reach that vision. The NRECA Board and co-op executives from across the nation will be involved in this process. As these broad strategic directions are reconsidered, the Roadmap will need to be evaluated. This will continue to be a routine requirement of CRN advisors from across the co-op network. At each Task Force meeting the current direction and route of the Roadmap and the technical priorities will be considered. At periodic intervals of two or three years the entire Roadmap will be reviewed and adjusted as the cooperative network desires.



Consolidated List of Technology Needs











































Technology Surveillance

Affordability
 Reliability
 Responsiveness
 Sustainability
 Quality of Life

Time Frame	Impact on Goals	Technology Needs (top priorities in bold)
2002		<ul style="list-style-type: none"> ▪ Document the best practices of successful organizations <ul style="list-style-type: none"> • Tabulate performance standards and methodology
		<ul style="list-style-type: none"> ▪ Develop a database of technology solutions with a technology assessment guide <ul style="list-style-type: none"> • Evaluate existing and new technologies for co-op G&T criteria • Technology surveillance tools
		<ul style="list-style-type: none"> ▪ Develop technology tracking mechanism to keep co-ops abreast of changes in technology
		<ul style="list-style-type: none"> ▪ Evaluate new technologies to determine which are suited or could be tailored to unique co-op needs <ul style="list-style-type: none"> • Evaluate new wood pole testing materials • Compare technologies that competitors are using and identify which are best for co-ops • Ensure R&D solutions are affordable
		<ul style="list-style-type: none"> ▪ Understand how to introduce change management skills and promotional skills to co-ops
		<ul style="list-style-type: none"> ▪ Study staffing and salary needs and constraints based on market conditions
		<ul style="list-style-type: none"> ▪ Identify information technology training needs for co-ops' staff
		<ul style="list-style-type: none"> ▪ Gather competitive intelligence regarding other industries and requirements of electric utilities
		<ul style="list-style-type: none"> ▪ Study existing communications channels
		<ul style="list-style-type: none"> ▪ Establish reliable baseline performance for new technologies and feed back to technology development
2004		<ul style="list-style-type: none"> ▪ Establish a cooperative "think tank" to generate new ideas and technologies
		<ul style="list-style-type: none"> ▪ Identify consumer products that will reduce the investment in system improvement projects and enhance system reliability
		<ul style="list-style-type: none"> ▪ Investigate alternative fuel supplies for DG
		<ul style="list-style-type: none"> ▪ Generate support for and collect regular reports on various technology projects other utilities are pursuing
		<ul style="list-style-type: none"> ▪ Explore technology to reduce risk exposure to elements of nature
		<ul style="list-style-type: none"> ▪ Evaluate interface protocols of existing systems
2007		<ul style="list-style-type: none"> ▪ Explore new telecommunications applications
		<ul style="list-style-type: none"> ▪ Investigate which business disciplines lend themselves to the larger co-op networks
2012		<ul style="list-style-type: none"> ▪ Investigate incentives for capital investment
		<ul style="list-style-type: none"> ▪ Explore co-op approaches to participate in hydrogen fuel economy


















































































Technology Education

 Affordability
  Reliability
  Responsiveness
  Sustainability
  Quality of Life

Time Frame	Impact on Goals	Technology Needs (top priorities in bold)	
2002		<ul style="list-style-type: none"> ▪ Identify existing automation, information, and communication technologies and their range of costs 	
		<ul style="list-style-type: none"> ▪ Develop an application-specific cost-benefit assessment tool for co-ops to evaluate new ideas <ul style="list-style-type: none"> • Business plan template • Unbundled costs and benefits • Screening tool for selection of options • Calibrate with real data 	
		<ul style="list-style-type: none"> ▪ Study the fuel supply chain and costs, and develop tools to monitor fuel costs <ul style="list-style-type: none"> • Develop tools to monitor fuel costs • Develop white paper on future power costs as function of fuel costs 	
	 	<ul style="list-style-type: none"> ▪ Maintain the balance between cost and revenue, despite need for high-cost generation technologies 	
		<ul style="list-style-type: none"> ▪ Improve co-ops' knowledge about effective e-commerce 	
	 	<ul style="list-style-type: none"> ▪ Develop method of recruiting and sharing the supply of technical employees among co-ops 	
	 	<ul style="list-style-type: none"> ▪ Implement the automation and information technology education strategy <ul style="list-style-type: none"> • Emphasize value, not cost • Overcome reluctance to first use • Target Board, directors, members, and employees 	
		<ul style="list-style-type: none"> ▪ Reevaluate CAES in light of volatile gas prices 	
		<ul style="list-style-type: none"> ▪ Develop risk characterization and mitigation information for cooperatives <ul style="list-style-type: none"> • Investigate co-op risk bank financing tool • Develop software assessment programs targeted to co-op-specific risks 	
		<ul style="list-style-type: none"> ▪ Improve in-house training 	
		<ul style="list-style-type: none"> ▪ Develop cost-effective distance learning programs 	
		<ul style="list-style-type: none"> ▪ Develop and utilize Internet-based training 	
		<ul style="list-style-type: none"> ▪ Document the strategic value of information technologies to businesses 	
		<ul style="list-style-type: none"> ▪ Demonstration projects/programs to prove the value of training 	
	 	<ul style="list-style-type: none"> ▪ Develop white paper on NOx emission allowances 	
	  	<ul style="list-style-type: none"> ▪ Develop template or guide for integration of distributed generation into the power supply system <ul style="list-style-type: none"> • At sizes on order of 0.01 to 10 MW 	
	 	<ul style="list-style-type: none"> ▪ Conduct demonstration and implementation of a range of power quality devices 	
		<ul style="list-style-type: none"> ▪ Develop common information format for consumer power cost information 	
		<ul style="list-style-type: none"> ▪ Examine training programs other companies and industries have used to transition from a monopoly to a competitive scheme 	
		<ul style="list-style-type: none"> ▪ Create automation and information technology CRN School <ul style="list-style-type: none"> • Use proven education tools • Develop curriculum for information technology business planning 	
2004	    	<ul style="list-style-type: none"> ▪ Develop and implement utility training centers and distance learning with challenging certification requirements <ul style="list-style-type: none"> • Develop training curriculum to bring and keep co-op personnel up-to-date on technology • Develop course on how to network with training on web browsing, along with resources and contacts • Training seminars, guidebooks, interactive web schools • Develop certification program for engineers, operators, power quality, metering, and information technology • Technician training on microprocessor-based equipment used by utilities 	
	 	<ul style="list-style-type: none"> ▪ Find and demonstrate examples of co-ops with leading automation, information, and communication systems 	
	  	<ul style="list-style-type: none"> ▪ Demonstrate advanced automation, information, and communications system <ul style="list-style-type: none"> • Prove capabilities and establish cost 	
		<ul style="list-style-type: none"> ▪ Develop education and training programs on cooperative-specific risk analysis 	
		<ul style="list-style-type: none"> ▪ Develop "regulatory specialist" training 	
		<ul style="list-style-type: none"> ▪ Publish transmission constraints study 	
		<ul style="list-style-type: none"> ▪ Demonstrate successful commercialization of automation and information technology such as Turtle Meters 	
		<ul style="list-style-type: none"> ▪ Assessments of new venture businesses 	
	2012 2007		






































Technology Investment

 Affordability
  Reliability
  Responsiveness
  Sustainability
  Quality of Life

Time Frame	Impact on Goals	Technology Needs (top priorities in bold)
2002	                                             	<ul style="list-style-type: none"> ▪ Investigate power supply infrastructure limitations ▪ Investigate new techniques to expand existing transmission facilities ▪ Conduct analyses of emerging technologies and trends, and field test promising options <ul style="list-style-type: none"> • Determine technology supply leaders ▪ Develop low-cost communication systems and communicate their value to co-ops ▪ Explore innovative techniques to respond to outages faster ▪ Develop a portfolio of investments in new, clean energy sources <ul style="list-style-type: none"> • Wind, solar, PV, renewables, DG, etc. • Develop hybrid technologies ▪ Develop Internet-based collaboration, learning, and training <ul style="list-style-type: none"> • Promote cooperation among co-ops with shared database • Web-based clearinghouse ▪ Develop user-friendly model that predicts the economic benefits of new technologies to co-ops <ul style="list-style-type: none"> • Develop standard scenario ROI information for various known technologies ▪ Investigate fuel and energy shortage alternatives ▪ Evaluate deregulated market ▪ Research fuel cells for use by consumers ▪ Explore waste management options, turn waste into a product ▪ Develop method to determine when and how to replace aging distribution system ▪ Investigate transmission infrastructure limitations ▪ Allocate more resources to CRN projects ▪ Take advantage of Internet for automation, metering, and pooling regional technical services ▪ Identify promising technologies for field testing ▪ Develop a business plan outline to market broadband services to consumers ▪ Assess member automation and information technology expectations ▪ Conduct survey/focus group on consumer preferences and valuation
2004	                         	<ul style="list-style-type: none"> ▪ Lower material costs to improve affordability ▪ Integrate power supply planning with power marketing ▪ Develop low-cost methods to improve the reliability of electric service ▪ Research the impact of distributed generation on power system <ul style="list-style-type: none"> • Reliability, performance, net metering, etc. ▪ Follow carbon control technologies and associated opportunities to capture environmental credits ▪ Establish a framework for "virtual mergers" to gain economies of scale without losing individual identities ▪ Develop and test spectrum sharing technologies ▪ Develop low-cost broadband communication channels for co-ops ▪ Develop lower cost telecom unit for low data flow communications ▪ Develop lower cost automation equipment ▪ Develop and implement neural networks ▪ Conduct plant site mapping ▪ Demonstrate standardized interconnection to publicize virtues of working together ▪ Develop cost-effective environmental technologies ▪ Develop tool that models G&T infrastructure and constraints ▪ Identify most-needed infrastructure improvements <ul style="list-style-type: none"> • Prepare white paper on technical infrastructure, availability, and needs ▪ Conduct research in media-efficient communications technologies ▪ Develop artificial intelligence systems to support employees
2007	    	<ul style="list-style-type: none"> ▪ Develop methods for integrating emerging technologies into the existing power system ▪ Develop cost-effective environmental technologies ▪ Continue pursuit of "perfect power"
2012	   	<ul style="list-style-type: none"> ▪ Develop methods for integrating emerging technologies into the existing power system ▪ Develop cost-effective environmental technologies ▪ Continue pursuit of "perfect power"

Technology Partnerships

 Affordability
  Reliability
  Responsiveness
  Sustainability
  Quality of Life

Time Frame	Impact on Goals	Technology Needs (top priorities in bold)
2002	                  	<ul style="list-style-type: none"> ▪ Expand CRN's MultiSpeak standards activities to include more automation, information, and communication technology activities <ul style="list-style-type: none"> • Evaluate member needs • Get vendor commitment ▪ Develop and expand Internet-based services ▪ Establish partnerships with a range of power suppliers (e.g., wind, solar, renewables, DG, etc.) ▪ Support clean coal technology development ▪ Develop uniform processes for resolving siting issues <ul style="list-style-type: none"> • Develop information to assess regulatory barriers and time frames for new technologies ▪ Research joint cooperative ownership of new technology (e.g., SD Wind co-op) ▪ Identify key automation and information technology areas and develop links to appropriate vendors ▪ Conduct field tests for promising technologies ▪ Establish environmental R&D targets
2004	         	<ul style="list-style-type: none"> ▪ Explore rural renewable potential ▪ Minimize the influence of utility facilities on wildlife and help to solve this collective issue ▪ Develop a "virtual co-op" model ▪ Conduct more joint projects to mitigate economy of scale problem ▪ Partner with AT&IT companies to develop and implement new automation, telecommunication, and information technologies for co-ops ▪ Develop communications protocol translators ▪ Establish program for the development and marketing of DG
2007		<ul style="list-style-type: none"> ▪ Scale up fuel cells to 100 MW
2012	      	<ul style="list-style-type: none"> ▪ Conduct new technology demonstration projects



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