CLEANENERGYWORKS

Grid Readiness in Rural Electric Cooperatives for Medium and Heavy Duty Vehicle Electrification

Recommendations for Improving Grid Planning to Manage Load Growth

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In partnership with: Environmental Defense Fund

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List of Acronyms

AI	Artificial Intelligence
CoBank	Cooperative Bank
Co-ops	Rural Electric Cooperatives
CFC	Cooperative Finance Corporation
DOE	Department of Energy
DER	Distributive Energy Resource
EPRI	Electric Power Research Institute
ICCT	International Council on Clean Transportation
IOU	Investor-Owned Utilities
G&T	Generation and Transmission
MHDV	Medium and Heavy Duty Vehicles
NREL	National Renewable Energy Laboratory
NRECA	National Rural Electric Cooperative Association
USDA	United States Department of Agriculture
VGI	Vehicle-to-Grid Integration
V1G	Unidirectional Vehicle-to-Grid
V2G	Bidirectional Vehicle-to-Grid

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Disclaimer

While preparing the report, authors relied on both a comprehensive review of the existing literature and insights gathered from interviews. Parts of this report are based on information obtained directly from interviews and stakeholder discussions, particularly in areas where no publicly available sources exist.

About Clean Energy Works

Clean Energy Works accelerates inclusive investments that open the clean energy economy to all. We envision a world with a 100% clean energy economy that provides opportunities and benefits to everyone, regardless of race, income, or social status. Our team builds bridges between community champions, leading utility executives, and policymakers to create bright spots of innovation in clean energy.

Racial and social equity are at the heart of our mission. We understand the undeniable impact that unequal access to clean energy can have on the most vulnerable members of society. Clean Energy Works is committed to centering and supporting communities experiencing divestment and communities of color to take the lead in transitioning to a clean energy economy. To learn more, visit www.cleanenergyworks.org.

1.0 Executive Summary

Rural electric cooperatives (co-ops) are on the frontlines of a major transformation as rapid load growth, driven by building and transportation electrification, data centers, and other emerging technologies, challenges their aging infrastructure. The electrification of medium and heavy-duty vehicles (MHDV) in particular presents both a challenge and a major opportunity for rural electric co-operatives to modernize and strengthen vital systems. Drawing on stakeholder interviews, this report outlines the need for new grid planning approaches to ensure that rural electric cooperatives are prepared to meet the rising demand cost-effectively and equitably. It identifies key barriers including capital constraints, limited capacity for technical analysis, and regulatory uncertainties, and it provides strategic, actionable recommendations to overcome them.

Recommendations focus on:

- Working closely with capital providers
- Using new data, modeling, and projection tools
- Strategically selecting sites for charging infrastructure in rural electric cooperatives territory
- Proactively engaging with fleet owners to understand their electrification plans and impact on the grid
- Integrating with distributed energy resources plans

Despite persistent constraints, rural electric cooperatives are uniquely positioned to lead in a just energy transition and better grid planning. Rural electric cooperatives have flexibility to innovate and adapt wherever there are healthy governance structures, community ties, engagement with financial partners, and access to low-cost capital. With the right tools and support, rural electric cooperatives can turn MHDV electrification into a catalyst for resilience, affordability, and community benefit, honoring their seven cooperative principles[1].

2.0 Introduction

For decades, most rural electric cooperatives (co-ops) have experienced relatively flat load growth[2]. A small percentage of rural electric cooperatives, especially surrounding urban centers, have grown as farmland has been converted to housing and urban development through sprawl. However, the conditions for this growth trend are changing, and they vary depending on the location of each rural electric cooperative due to the rise of artificial intelligence, expansion of data centers[3], manufacturing (particularly semiconductors), and the electrification of transportation and buildings. Upgrading transmission and distribution lines requires substantial capital investment[4] and long lead times, which are not currently keeping pace with demand. At a recent convention of rural electric cooperatives, surging demand growth was the topic of numerous sessions that drew standing-room only crowds. It certainly has the attention of industry leaders.

This rapid load growth is impacting both rural electric cooperatives and investor-owned utilities (IOU). It brings significant challenges to grids that were built decades ago and were not designed to handle the pace of today's rising demand[5] and large-scale electrification. These topics have been widely explored in the IOU space, with many resources developed to support their transition. In contrast, rural electric cooperatives have had fewer opportunities for similar engagement and tailored support.

Given the cost- and time-intensive nature of grid upgrades, a proactive approach is needed. It should include accurate load forecasting and infrastructure development to ensure the grid is prepared to handle increasing demand efficiently and cost-effectively.

While many sectors are driving increased electricity demand, transportation electrification presents a unique opportunity. Electric vehicles (EVs) can enhance grid resilience[6] and reliability by providing flexible loads and serving as mobile storage through V1G (unidirectional) and V2G (bidirectional) vehicle-grid services. V1G services, such as managed charging, enable grid operators to shift EV charging to off-peak times, reducing strain on the grid and lowering energy costs. With V2G, large battery capacities, such as electric school buses and delivery trucks plugged into bidirectional charging equipment, can supply power during peak demand, helping rural electric cooperatives potentially delay or avoid costly upgrades.

This report is informed by interviews with experts in the field and a review of relevant literature. It builds on the insights of Environmental Defense Fund's report *Building the Grid to Need: Best Practices for Proactively Developing Distribution Grid to Support Truck and Bus Electrification*[7], contributing to the ongoing conversation around proactive grid planning with a specific focus on rural electric cooperatives.

The report begins with a brief overview of rural electric cooperatives with unique characteristics and leadership, then focuses on the challenges and opportunities they face in grid modernization, specifically on MHDV electrification. The report closes with targeted recommendations to support better planning in the transition to electric fleets in rural electric cooperatives' service territories.

3.0 A Brief Overview of Rural Electric Cooperatives

Rural communities are often geographically dispersed, requiring long transmission and distribution lines that not only increase infrastructure costs but also lead to higher transmission and distribution losses due to increased distances. As a result, in the first 50 years of electrification, IOUs were reluctant to expand their service in rural areas. Rural communities took matters into their own hands and began establishing rural electric cooperatives to generate and distribute electricity to their area.

The Rural Electrification Administration drafted and formalized the Electric Cooperative Corporation Act in 1937[8], providing a model law that states could adopt to facilitate the formation and operation of not-for-profit, consumer-owned rural electric cooperatives. These member-owned co-ops emerged as a solution to rural electrification, ensuring that rural communities could access affordable and reliable electricity. Rural electric cooperatives are each governed by a board of directors elected by their members, and operate on a one-member, one-vote principle, where every vote counts equally.

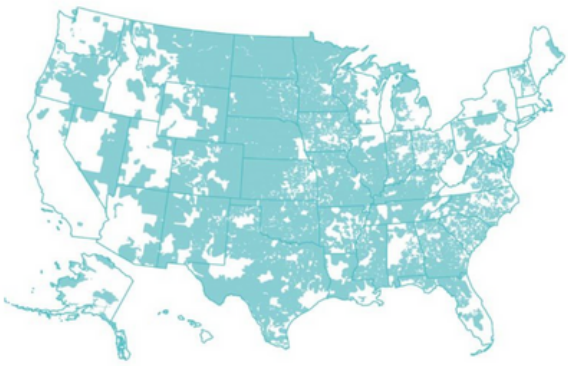
Figure 1 Rural Electric Cooperatives Governance Structure from UW Madison

3.1 Rural Electric Cooperative Service Areas

According to the National Rural Electric Cooperative Association (NRECA), rural electric cooperatives serve 42 million people and power 56% of the nation's landmass[9]. These rural electric cooperatives provide electricity to over 22 million businesses, homes, schools, and farms across 48 states, and return more than $1 billion annually to their member-owners as not-for-profit organizations.

Rural electric cooperatives serve millions of low-income households and regions that have experienced persistent poverty[10] over decades, with one in four members earning an annual income below $35,000[11]. As both customers and owners, co-op members report the highest satisfaction scores of any utility customer group[12].

Figure 2 : Maps of Service Areas from NRECA



3.2 Types of Rural Electric Cooperatives

There are two types of rural electric cooperatives:

- **Generation and Transmission Cooperatives (G&T):** There are 64 Generation and Transmission (G&T)[13] cooperatives in the U.S. These rural electric cooperatives supply wholesale power to distribution electric co-ops through their own generation facilities.
- **Distribution Cooperatives:** There are 832[14] distribution co-ops across the U.S. These co-ops purchase electricity from the Generation & Transmission cooperatives, federal power marketing administrations, or other power suppliers and deliver it directly to end users.

3.3 Governance of Rural Electric Cooperatives

Rural electric cooperatives are governed by their boards of directors, who are elected by the co-op member-owners. All electricity customers of the co-ops are members and have voting rights. The board typically consists of members who reside within the co-op's service territory. They are responsible for setting the strategic direction and long-term goals of the organization. They also ensure that the rural electric cooperative's operations align with its mission to provide reliable, affordable, and sustainable energy to its members.

The board of directors is typically elected at annual meetings and has four main responsibilities:

- **Set strategic direction and long-term goals:** The board is responsible for setting the rural electric cooperative's overall vision and ensuring it aligns with the needs of its members.
- **Approve rates, budgets, and major expenditures:** The board also approves the rural electric cooperative's annual budgets and any major capital expenditures, ensuring financial stability and long-term sustainability.

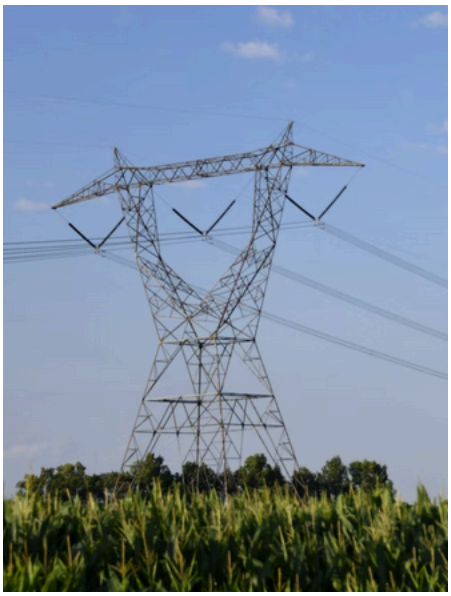
- **Hire and oversee the General Manager or Chief Executive Officer (CEO):** The board hires the General Manager or CEO, who is responsible for running the day-to-day operations of the rural electric cooperative. This individual plays a critical role in implementing the board's strategic vision, managing staff, and ensuring the smooth operation of the rural electric cooperative.
- **Ensure compliance with legal and regulatory requirements:** The board ensures that the rural electric cooperative complies with all relevant local, state, and federal regulations. This includes regulatory oversight related to electricity rates, environmental standards, and safety.

In some states, rural electric cooperatives are subject to regulations by state authorities. According to NRECA, electric cooperatives in 23 states are subject to regulation by state public utility commissions[15].

3.4 Meeting the Seven Cooperative Principles

Rural electric cooperatives are guided to meet the energy needs of its member owners under their **Seven Cooperative Principles**[16]:

1. Open and voluntary 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.



These principles were established to offer an alternative model of bringing energy that centers the decision-making of member-owners to rural communities. Their unique needs, priorities, and past impacts are not always taken into consideration equally, and intentionality is essential in taking a holistic approach to overall planning, investments, program design, and final delivery of services.

4.0 Leadership of Rural Electric Cooperatives in Promoting Clean Energy Initiatives

Co-ops are already leading on clean energy initiatives, guided by their principles and benefiting from competitive advantages that set them apart from IOUs. Those advantages include local governance that avoid lengthy regulatory processes with regulatory bodies or commissions, as well as access to low-cost capital. Some examples of co-ops piloting new governance in clean energy include:

- **Kit Carson Electric Cooperative (NM):** Kit Carson Electric Co-Op achieved its goal of providing 100% of its daytime power with solar energy, marking a significant milestone in its commitment to renewable energy. The Community Solar project was planned with input from local stakeholders to ensure it aligned with community values and environmental considerations[17].
- **Great River Energy (MN):** Great River Energy, a generation and transmission co-op, partners with member co-ops to co-develop programs on distributive energy resource (DER) integration, electric transportation, and cybersecurity. Their cooperative planning council is made up of representatives from each member co-op to align on major investments and strategic initiatives[18].

4.1 Pioneers of Inclusive Utility Investment

Rural electric cooperatives have also been pioneers of an innovative and equitable financial solution for customer-sited clean energy upgrades known as inclusive utility investment.

Inclusive utility investment is a financial solution for distributed clean energy upgrades (including energy efficiency) via a tariff for site-specific utility investment and cost recovery, approved by the utility's regulatory authority and designed to ensure net annual cost savings for participants[19].

This financial mechanism utilizes a tariff for site-specific utility investments and cost recovery, which is approved by the utility's board in the case of rural electric cooperatives. In this type of investment, a rural electric cooperative provides capital to pay for energy efficiency or other clean energy upgrades to a member-owner's home, farm, or business and recovers its costs through a charge on the customer utility bill at the location[20]. This charge is calculated based on the participant's estimated cost-savings and may account for benefits to the grid from these upgrades (e.g. demand response programs). Some examples that demonstrate the power of inclusive utility investment include:

- **Roanoke Electric Cooperative (NC):** The rural electric cooperative launched Upgrade To $ave in 2015 and has enrolled more than 10% of its residential members. The energy efficiency upgrades reduced electricity consumption and delivered positive value to both the utility and its member-owners, primarily by lowering wholesale peak demand charges[21].
- **Ouachita Electric Cooperative (AK):** Launched in 2016, HELP PAYS® has supported upgrades including efficient lighting, new heating and air conditioning systems, insulation projects, and solar panels. During the first five years, Ouachita upgraded 6% of its members across the residential and commercial sectors, yielding more than $3 million in site-specific investments[22].

- **Midwest Energy (KS):** One of the long-running and successful programs, Midwest Energy's How$mart program started in 2007, also based on the Pay As You Save. system, and it has invested more than $10M in more than 1,700 upgrades[23].

Inclusive utility investment can also be extended in rural areas to support EV chargers given the opportunity to aggregate the flexibility resources they offer for grid benefit. In Michigan, the Public Service Commission has approved a tariff for inclusive utility investments for batteries onboard electric MHDV (eFleet Battery Support). This can support DTE Energy in providing battery systems for electric buses and commercial trucks, establishing a precedent for investor-owned utilities[24]. This program is still being implemented and results have not been reported publicly yet.

5.0 Capital Access for Rural Electric Cooperatives

Rural electric cooperatives have access to low-cost capital from a few sources, which lowers financial barriers and allows co-ops to invest in grid infrastructure and expand service to rural communities. This access to affordable capital helps rural electric cooperatives meet their needs at a lower cost, which improves service reliability.

In addition to providing capital, some banks often provide technical assistance and conduct or assist with load forecasting for co-ops.

Major capital sources include the U.S. Department of Agriculture (USDA), the Confederation of Cooperatives, the Cooperative Bank (CoBank), the National Rural Utilities Cooperative Finance Corporation (CFC), and the Farm Credit Bank. More detailed information as follows:

- **U.S. Department of Agriculture:** USDA loans are the largest capital source for rural electric cooperatives. Through USDA, rural electric cooperatives have access to multiple programs, such as:
    - **Electric Loan Program at Rural Utility Service (RUS):** Offers long-term, low interest loans for rural electric infrastructure build out, including grid modernization, transmission, and distribution upgrades[25].
    - **Rural Energy for America Program (REAP)**: Provides grants and loans for renewable energy and energy efficiency improvements, supporting rural electric cooperatives to invest in climate and eco-friendly energy sources[26].
    - **High Energy Cost Grants**: This grant opportunity assists energy providers and other eligible entities in lowering energy costs for families and individuals in communities with extremely[27] high per-household energy costs[28].

- **Empowering Rural America (New ERA) and Powering Affordable Clean Energy (PACE)**: While paused at the time of this writing, these two funding programs were established in the Inflation Reduction Act to help rural electric cooperatives finance clean and renewable energy projects. The programs represent a combined $10.7 billion in funding to leverage four times more money to accelerate the rural clean energy transition. These programs are designed to support the expansion of clean energy generation but do not extend to initiatives focused on end-use electrification, such as electric vehicle deployment[29].

- **Cooperative Finance Corporation (CFC)**: CFC is a key lender and focuses solely on rural electric cooperatives. A member-owned financial institution that provides loans solely for rural electric cooperatives. It offers flexible, long-term financing for system expansion and enhancing grid resilience.
- **CoBank**: CoBank is another key lender to co-ops and serves a diverse set of co-ops (including farming cooperatives). It is a national cooperative bank[30] that offers capital for rural electric cooperatives to invest in transmission and distribution infrastructure, technology upgrades, and working capital[31].
- **Farm Credit Bank**: Offers lending and other financial support (including low capital loans) to farm-owned co-ops[32] and rural electric cooperatives.

6.0 Challenges and Opportunities for Medium and Heavy Duty Vehicle Transportation Electrification in Rural America

MHDVs include larger commercial vehicles such as delivery trucks, buses, and freight haulers. Electrifying MHDVs can significantly reduce emissions, improve air quality, especially in frontline communities and lower fuel and maintenance costs for fleet operators. As these vehicles consume more fuel than passenger cars, their electrification offers greater environmental and economic benefits. While rural electric cooperatives and other utilities face shared challenges in electrifying MHDVs, they also have unique strategic opportunities to explore.

6.1 Challenges

MHDV electrification is still in its early stages, particularly in rural America, where adoption rates remain very low despite the significant cost-saving and socioeconomic benefits of electric vehicles. Several key challenges limit the widespread transition to electric MHDVs, including:

- **High upfront cost:** Zero-emission MHDVs still come with a high price tag due to large battery sizes. In 2022, Class 8 electric trucks cost $279,000, nearly double the cost of a $150,000 diesel truck[33]. This makes the transition especially difficult for small rural fleet owners with limited financial resources. However, the cost of MHDVs is decreasing as battery technology advances, suggesting that the current high upfront costs are not expected to remain a long-term barrier[34].
- **Lack of charging infrastructure:** Many rural communities face unreliable electricity supply, raising concerns about the feasibility of fleet electrification. In addition, limited charging options create uncertainty, discouraging drivers from switching to electric[35].
- **Vehicle performance must meet real-world rural needs:** Rural routes often involve long distances, rugged terrain, and varying driving speeds, all of which can affect battery life and reliability[36]. The limited availability of vehicle models suited for various operational requirements adds to the challenge.
- **Limited public confidence:** Rural drivers are more likely to experience range anxiety due to limited charging infrastructure. This uncertainty slows both adoption and the development of supportive infrastructure.
- **Insufficient ratepayer funds available:** It is uncommon for rural electric cooperatives to have authorization from their governing boards to use their ratepayer funding for customer-side EV incentives. Clean Energy Works along with the World Resources Institute published a resource listing utilities (IOUs, co-ops, and municipal utilities) that offer make-ready and rebates for light and MHDV[37]. Only 62 out of the 832 rural electric cooperatives (7%), offered some kind of EV incentive, unlike IOUs where about 40% offered some form of incentives (data from 2023). In contrast with IOUs, rural electric cooperatives have a smaller amount of ratepayers or customer base to recover all the cost for EV charging or incentives for member-owners.

6.2 Opportunities

Advancements in battery technology are reducing the high upfront costs of MHDVs[38], accelerating their adoption. Despite challenges, rural electric cooperatives' unique strengths position them to lead the electric transportation transition.

- **Greater regulatory flexibility:** Because rural electric cooperatives are not typically regulated by state public utility commissions (PUCs), they have more autonomy to design, approve, and implement innovative programs without the lengthy regulatory proceedings that often affect IOUs. This allows rural electric cooperatives to act more nimbly in piloting and scaling EV programs that meet the needs of their local communities.
- **Not-for-profit, member-owned model:** Rural electric cooperatives operate with a mission to serve their member-owners rather than external shareholders. This allows them to prioritize community benefit, long-term affordability, and local economic development when designing EV programs, rather than focusing solely on profit maximization.
- **Favorable rate structures:** Compared to customers in IOU service territories, those served by rural electric cooperatives typically pay lower electricity rates. This cost advantage can make operating electric vehicles more affordable in rural areas, where lower electricity prices help reduce overall operating costs[39].
- **Governance structure:** Rural electric cooperatives are well-positioned to lead transportation electrification because of their member-owned structure and deep local ties. Their close relationships with members allow them to tailor solutions to community needs, build trust, and coordinate directly with schools, businesses, and residents. Unlike IOUs, co-ops prioritize local benefits, making them agile partners in deploying charging infrastructure and grid upgrades that support electrification.
- **Deep community ties:** Co-ops are deeply embedded in their communities and often have longstanding relationships with local businesses, governments, and fleet operators. This local trust can be leveraged to build momentum for EV adoption.

7.0 Grid Planning for New Load

Grid planning is the process of anticipating future energy needs, like the growth of electric vehicles or building electrification, and upgrading or expanding the electric grid in advance, rather than reacting after the load growth arises. Improving grid planning can be a cost-effective strategy for utilities, IOUs, and rural electric cooperatives, enabling them to anticipate future electricity demand and manage infrastructure upgrades efficiently. By planning ahead, co-ops can distribute costs over time, avoid expensive emergency upgrades, and capitalize on economies of scale.

Rural electric cooperatives can improve grid planning by becoming more data-driven, identifying where new loads are emerging, and incorporating EVs and distributed energy resources (DERs) into their planning. Building strong partnerships with stakeholders, including other cooperatives, fleets, state energy departments, and agencies, will enhance visibility into future demand and resource needs. By leveraging these collaborations and securing additional funding and technical resources, cooperatives can better anticipate grid impacts, integrate distributed resources, and ensure reliable, forward-looking system planning.

Furthermore, the new load from EVs can offer an advantage for rural electric cooperatives, as it is highly flexible, and charging can be scheduled during off-peak hours or times when electricity is more abundant and affordable, avoiding periods of high demand or limited supply[40].

7.1 Barriers for Grid Planning for Transportation Electrification

While grid planning is an essential part of operations for rural electric cooperatives, planning for transport electrification's grid upgrades presents its own barriers.

Some rural electric cooperatives lack in-house expertise for advanced grid planning tasks such as load forecasting, interconnection studies, and integration and potential of load flexibility with emerging technologies like managed charging, V2G, and DERs[41]. As a result, they often rely on external technical assistance to fill these gaps.

Additionally, rural areas often lack sufficient data on electric vehicle uptake, charging patterns, energy consumption, and fleet transition timelines. As a result, rural electric cooperatives struggle to make informed decisions about grid upgrades needed on the utility side to support capacity for future load growth.

For example, estimating how a 25% MHDV sales penetration in the service territory translates into actual grid load is complex and requires advanced modeling tools that co-ops may not have access to or staff capacity to apply. The absence of detailed data analysis makes it difficult to forecast load, identify infrastructure needs, secure funding, and ensure reliable service.

8.0 Recommendations for Improving Grid Planning for Medium and Heavy Duty Vehicle Electrification in Rural Co-ops

Five potential solutions to improve grid planning in rural electric cooperatives could be responsive to challenges faced and the opportunities presented by electrification of MHDV:

1. Work closely with capital providers
2. Use new data, modeling, and projection tools
3. Strategically select sites for charging infrastructure in rural electric cooperatives territory
4. Proactively engage with fleet owners to understand their electrification plans and impact on the grid
5. Integrate with distributed energy resources plans

1 Work Closely with Capital Providers

As mentioned in the first section, rural electric cooperatives typically access capital for grid assets through loans from the USDA, CoBank, and CFC, with the loans from USDA being the single largest source. For a new load that has yet to materialize, co-ops can work closer with their capital partners to work out some of the market and technology challenges:

- **Address the capital commitments ahead of demand**[42]**:** Rural electric cooperatives need to work closely and proactively with their banks and their technical assistance departments to include transportation electrification in their load forecasting. Given the terms governing loans for rural electric cooperatives by USDA, supported by the Rural Electrification Act, rural electric cooperatives can work directly with USDA or through CFC and CoBank to determine the best financial arrangement for these new infrastructure upgrades. A proactive engagement with capital providers will help plan the high-power charging needs of MHDV and invest timely in upgrading transformers, substations, and distribution networks in advance of materialized demand. Furthermore, rural electric cooperatives can demonstrate the value of additional data, rather than rely solely on historical load data for forecasting, to secure additional capital for comprehensive grid planning, particularly for transportation electrification.
- **Align the timing:** Rural electric cooperatives need to communicate with the federal government to align timelines. There is often a misalignment between grant timelines and on-the-ground project implementation schedules[43], which can create cash flow challenges. Rural electric cooperatives, in particular, may struggle with these timing gaps, as many federal programs operate on a reimbursement basis. This requires upfront capital that co-ops with limited reserves may find difficult to secure.

2 Use New Data, Modeling, and Projection Tools

Expanding access to more data and advanced modeling and projection tools is essential for supporting rural electric cooperatives as MHDV electrification grows. There are advanced tools available that help identify where new electricity demand is likely to arise, evaluate potential grid impacts, and determine the system upgrades needed. These tools support more informed planning and targeted infrastructure investments. They can be utilized by the rural electric cooperative's staff, generation and transmission (G&T) partners, capital providers, financial institutions, and software vendors to enhance coordination and decision-making.

Many rural electric cooperatives are members of NISC or Meridian Cooperative, two IT software providers that offer a broad range of analytical applications for supporting grid analysis. Both NISC or Meridian could develop integrations with open source resources and tools and support many rural coops at the same time.

The available tools have been developed by five sources: RMI, Electric Power Research Institute (EPRI), National Renewable Energy Laboratory (NREL), Lawrence Berkeley National Lab (LBNL), and International Council on Clean Transportation (ICCT). These tools offer deep-dive quantitative analyses that can help rural electric cooperatives forecast load growth and identify high-priority areas for charging infrastructure to strategically allocate resources.

Among the tools and resources available to support rural electric cooperatives in planning for transportation electrification are:

- **RMI's GridUp:** This publicly available planning tool was developed to support utilities and regulators in proactively preparing for EV adoption. It enables users to anticipate where and when increased energy and power demand from vehicle electrification is likely to occur, offering forecasts down to the census block group level.
- **EPRI's eRoadmap:** This tool provides utilities with quantitative forecasts of future electricity demand from EVs at detailed levels of geospatial granularity, and assessing the impacts of transportation electrification based on regional travel patterns.
- NREL offers modeling tools such as
    - **EVI-Pro and EVI-Pro HD:** Estimates the amount and type of EV charging infrastructure needed in a specific area to meet projected demand. Developed in partnership with the California Energy Commission, EVI-Pro uses detailed data on personal travel behavior, EV characteristics, and charging station features to generate its projections.
    - **EVI-RoadTrip:** Supports the design and analysis of high-resolution EV charging networks to guide infrastructure planning for long-distance travel. It allows planners, analysts, and decision-makers to assess EV energy use and charging needs along specific travel routes, from origin to destination. The tool also accounts for factors such as projected charging station locations and characteristics, potential impacts on the electric grid, and necessary infrastructure upgrades.
- LBNL's Energy Markets and Policy Department[44] offers a framework methodology for utilities to develop long term load forecasts that account for the impacts of building and transportation.
- ICCT has developed a study on near-term charging infrastructure needs[45], offering county-level insights that help cooperatives identify where high energy demand is likely to emerge.

3

Strategically Select Sites for Charging Infrastructure in Rural Electric Cooperatives Territory

For rural electric cooperatives, strategic site selection is critical to optimize limited resources and ensure infrastructure is placed where demand is most likely to emerge.

Building out charging infrastructure is both a time and cost-intensive activity. Further, the infrastructure development does not need to be done all at once; a phased charging infrastructure deployment can be cost-effective by minimizing upfront cost and enabling strategic, demand-driven expansion over time. This phased approach, where utilities construct infrastructure with built-in capacity for future expansion (such as designing a substation to accommodate additional transformers or feeders), can offer a more cost-effective solution by minimizing upfront investment while enabling scalable, long-term growth.

Rather than focusing solely on broad national trends, co-ops should closely evaluate local and regional signals that indicate near-term electrification opportunities within their own service territories. Several factors can help identify where the demand will be materialized. One effective strategy is to overlay the co-ops' service territories with the areas that have been already identified as priorities for electrification. These areas will require targeted infrastructure investments to accommodate the increased electricity load associated with MHDV adoption.

The International Council on Clean Transportation has published a study with areas with a high energy demand from MHDV Electrification[46]. This includes:

- **Major freight corridors:** The Department of Energy's National Zero-Emissions Freight Corridor Strategy[47] identifies key freight corridors that are electrifying, accounting for 85% of the charging needs for long-haul trucks by 2030. Rural electric cooperatives that intersect with key freight routes will be increasingly targeted for long-haul truck electrification by private fleets.
- **Largest industrial activity:** Co-op territories that serve industrial parks, manufacturing, or regional logistics hubs may see earlier transportation electrification as fleets begin to electrify their MHDV.
- **Private fleet deployment:** Private fleets often prioritize regions where projects can move quickly. Because not all co-ops are regulated by PUCs and can avoid lengthy rate case approvals, these regions may offer an attractive deployment environment.
- **Supportive policies:** States and localities that implement supportive policies such as OEM commitments, financial incentives for fleets, streamlined permitting processes, and infrastructure investment are more likely to experience accelerated adoption of electric MHDV fleets. Co-ops in states and localities that have adopted these supportive policies may see earlier electrification.

4

Proactively Engage with Fleet Owners to Understand Their Electrification Plans and Impact on the Grid

Major corporate fleets such as Walmart, Amazon, DHL, and others are committing to electrification, signaling that demand for electric (MHDVs) is materializing. Proactive engagement with fleet operators in their service territories enables co-ops to understand fleet owners' electrification timelines and infrastructure needs, helping to anticipate grid impacts. In addition, fleet owners can participate in co-op conferences, such as TechAdvantage, to support direct dialogue and collaboration.

Rural electric cooperatives proactively reach out to fleets to understand their electrification plans, allowing them to prepare in advance and request load letters early. Corporate fleets across the country have committed to electrifying their fleets, and co-ops can proactively anticipate this growth even if the demand is not material at the moment. Some of these commitments include:

- **Amazon**: As part of its climate pledge[48], Amazon plans to achieve carbon neutrality across its operations by 2040. To meet this goal, the company is focusing on decarbonizing its "last mile" logistics[49] by purchasing 100,000 electric delivery vehicles by 2030[50].
- **DHL Express:** The DHL sustainability roadmap outlines an investment of 7 billion euros to achieve its transport decarbonization targets and invest in carbon-neutral logistics by 2030. A notable portion of this investment is directed towards electrifying 60% of DHL's global fleet by 2030[51].
- **Walmart:** According to GreenBiz, Walmart aims to decarbonize all of its long-haul trucks by 2040, which includes 10,000 vehicles and 6,500 semi-trucks[52].

- **PepsiCo:** In 2022, PepsiCo received an initial batch of fully electric Tesla semi-trucks now in operation. These trucks are the first installment of a larger order intended for use across PepsiCo's snacks and beverage divisions. In addition, PepsiCo supports third-party partners to electrify their fleets by developing and sharing best practices.

Rural electric cooperatives could greatly benefit from marketing support as part of technical assistance, as many have limited staff capacity to proactively engage with fleets.

Strengthening marketing and member engagement teams through targeted training and resources can improve early engagement with fleet operators. In addition, understanding depot vs. enroute charging needs, fleet inventories, seasonal operations, and customer side flexibility such as managed charging or demand response will enable co-ops to identify optimal charging locations, and avoid costly upgrades.

5 Integrate with Distributed Energy Resources (DER) Plans

Rural electric cooperatives are uniquely positioned to integrate DERs, such as rooftop solar, behind-the-meter storage, and smart appliances, because of their community-centric approach, focus on optimizing services to member owners, and their non-profit model. As shown in a previous section, some co-ops are already supporting DER deployment to improve energy reliability, affordability, and sustainability for their communities. This practice could be enhanced by including a long-term DER roadmap and taking MHDV resources into consideration.

Particularly for MHDV, electric school buses offer a good opportunity to integrate as battery storage, given their predictable schedules, and available time in periods where schools are not running. Further, integrating MHDV charging with solar can strengthen microgrids, taking into account solar curves to maximize resource availability and minimize storage costs.

The interconnection of DER assets through virtual power plants (VPPs) is another innovation that co-ops can pioneer by integrating rooftop solar panels, smart appliances, smart thermostats, and battery storage systems, including batteries onboard electric vehicles. This approach can help make these upgrades more cost-effective for participating customers and deliver broader benefits across the energy system, including lower energy costs for all members and stronger grid reliability and resilience.

9.0 Conclusion

As rural electric cooperatives experience significant load growth driven by AI, data centers, and transportation electrification, a more proactive approach for grid planning is no longer optional. MHDV electrification represents both a critical challenge and a transformative opportunity for rural communities.

This report has shown that co-ops face distinct challenges in preparing for MHDV electrification, including limited capital, limited capacity for technical analysis, and infrastructure gaps. At the same time, they are well-positioned to respond because of their governance structure that is very distinct from IOUs. Their ability to access low cost capital, engage directly with member-owners, and act outside of lengthy regulatory processes gives them a strategic advantage.

Rural electric cooperatives can improve their grid planning approach: working closely with their financial institutions, their governing boards, and their members who are fleet owners and operators to forecast demand. They can leverage open-source modeling tools for informed decision-making, and design investments needed upstream and at the customer site, ensuring equitable access and lower costs. By combining investments in infrastructure for MHDV electrification, an ambitious DER plan, and implementing inclusive utility investment to access necessary clean energy upgrades, including EV chargers, co-ops can accelerate infrastructure deployment while keeping member affordability at the center.

Finally, planning for electric MHDVs requires shaping future load rather than just meeting it. Through thoughtful planning and member-centered investment, rural electric cooperatives can lead a just transition that delivers reliability and cost savings to the communities they serve.

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