ZETA

WHITE PAPER

The Next EV Market: Expanding Electrification in Rural America

Zero Emission Transportation Association

Contributing Authors: Leilani Gonzalez, Sofya Olenicheva, Eva Brungard, Rianna LeHane, Grayson Eady

August 2022

Contents

List of Figures

Executive Summary

As the electric vehicle (EV) industry becomes more widespread across the United States, communities have the opportunity to explore what it means to electrify their personal and transit vehicles. With new market penetration and model availability from the EV sector paired with the creation of a national EV charging program, rural communities are in a unique space to transform transportation planning in their area. Benefits such as lower maintenance and operating costs will serve individual drivers more in the long term. Additionally, given that there are multi-purpose use options for EVs, such as agricultural, construction, and outdoor recreation, which remain critical industries in rural communities. To ensure a smooth transition of these vehicles into rural communities, state and federal governments must remain coordinated with relevant stakeholders such as manufacturers, grid operators, and fleet owners.

Key Takeaways

- Despite accounting for 30% of vehicle miles traveled nationwide, **rural America has been largely overlooked in the deployment of electric vehicle charging infrastructure**; Most EV investments and policies to date target urban areas.

- Investments in EV infrastructure and building out rural grid capabilities will lay the foundation for a larger EV transition that will benefit rural communities in a variety of ways—by reducing the urban-rural divide, revitalizing the automotive sector, creating a new workforce of EV service technicians, and boosting opportunities for tourism in these regions.
    - EV charging stations are on track to outnumber gas stations throughout the U.S. However, it is the distribution of this charging network, not just its size, that limits rural electrification: more than 80% of these chargers are privately owned.
    - To deploy EVSE efficiently, stakeholders must distinguish between non-networked and networked chargers. Non-networked EVSE does not have Internet access and does not collect data or balance loads during peak usage.
    - Telecommunications deployment must occur in tandem with EVSE deployment; More than 22% of rural Americans lack broadband coverage, compared to only 1.5% in urban areas.

- **Every state is an "auto state,"** home to suppliers and manufacturers who produce parts for all vehicle power-trains. As the country rapidly shifts to EVs, building a domestic EV manufacturing capacity presents a prime opportunity for robust job growth in rural communities.
    - The International Energy Agency (IEA) estimates that 12 new jobs are created for every $1 million invested in charging infrastructure; by comparison, ICE vehicles manufacturing creates an average of 7.2 jobs per million invested.

- Individual rural drivers will also benefit substantially from EV-sector investments.
    - **Between 2019 and 2021,** the average rural household spent between 19 and 22.5% of their income on transportation.
    - Over a vehicle's lifetime, a rural EV owner can save an average of $4,600 on maintenance costs alone by transitioning away from driving a gas vehicle.

Glossary

AC	Alternating current
ATV	All-terrain vehicles
DCFC	Direct Current Fast Charger
DER	Distributed energy resource
eGallon	Electric gallon equivalent
EIA	U.S. Energy Information Administration
ESB	Electric school bus
EV	Electric vehicle
EVSE	Electric vehicle supply equipment
GDP	Gross domestic product
HP	Horsepower
ICCT	International Council on Clean Transportation
ICEV	Internal Combustion Engine
IEA	International Energy Agency
IIJA	Infrastructure Investments and Jobs Act
L2	Level 2
MMT	Million metric tons
MOU	Memorandum of understanding
MW	Megawatts
NASEO	National Association of State Energy Officials
NEVI	National Electric Vehicle Infrastructure Formula Program
NREL	National Renewable Energy Laboratory
OEM	Original equipment manufacturers
OTA	Over-the-air
REAP	Rural Energy for America Program
TCO	Total cost of ownership
TCU	Telematics control unit
UTV	Utility terrain vehicles
V2G	Vehicle-to-grid
V	Volt
VMT	Vehicle miles traveled

1. Introduction

Addressing the needs of underserved communities is integral to successful national electric vehicle (EV) deployment. One in five Americans live in rural areas, and according to the Congressional Research Service, 2.9 million—71%—of the nation's miles of public access roads are rural.[1] Despite accounting for 30% of vehicle miles traveled nationwide, to date rural America has been largely overlooked in the deployment of electric vehicle charging infrastructure.[2] While rural areas can vary widely in their geographic and demographic makeups, there is a significant opportunity to electrify rural residents' passenger vehicle fleet, where the dependency on personal vehicles is often much higher than it is in urban regions.

Despite this potential, most current EV investments and policies target urban areas. However, both private and public actors have begun to recognize the importance of investing in rural America. For EVs to effectively reduce transportation sector emissions, electrification must be available for all passenger vehicles, including those in rural communities.[3] Travel patterns, vehicle preferences, and accessibility in rural areas will play an important role in the EV transition.[4]

2. The Rural Landscape

What is rural?

Currently, there is not a widely accepted, standard definition of "rural." Rural communities are often associated with small towns, farms, and open spaces.[5] In a purely demographic sense, the Economic Research Service of the U.S. Department of Agriculture defines a rural area as one with a small population (under 2,500 people), distributed broadly across a large area relative to the number of residents.[6]

Socioeconomically, small population size and low population density often intersect with a range of vulnerabilities, including higher rates of poverty and unemployment, as well as access to relatively fewer educational opportunities, health care, and basic necessities.[7] When it comes to electrification, these factors, as well as the dependence on personal vehicles, occasionally outdated infrastructure, and other sociocultural elements, present unique—though not insurmountable—challenges to transitioning away from internal combustion engine (ICE) vehicles. At the same time, rural communities' vulnerability to economic disruptions makes the need for a revitalized workforce particularly salient.

2.1 The Current Economic Landscape in Rural Areas

Rural economies must be positioned at the center of transportation electrification. Although non-metropolitan areas in the United States are home to just 17% of U.S. businesses, rural regions provide invaluable industries that fuel the broader US economy, including agriculture, outdoor recreation, and natural resource development.[8] At the onset of COVID-19, rural America had not yet recovered from pre-2008 unemployment levels.[9] This economic insecurity was compounded by the economy-wide, pandemic-related shutdowns placing an even greater strain on rural households and industries.

Along with disparities in metro and non-metro infrastructure investment, rural Americans often experience disproportionate poverty levels and lower economic vitality. Non-metro areas are home to 46 million Americans—14% of the population—yet rural America's socioeconomic standing compared to urban regions reflects decades of underinvestment.[10] The United States Department of Agriculture's Economic Research Service reported that the 2020 average per capita income for rural Americans was $45,917, compared to $59,510 for Americans nationally. Furthermore, rural counties experience a disproportionate level of persistent poverty—15.2%, or 301 of 1,976 rural counties—compared to 4% of metro counties.[11] Overall, rural Americans experience higher levels of economic stress than those in urban areas.

2.2 Transportation

Though personal vehicles are the preferred choice of transportation in the U.S., rural residents are particularly car-dependent. Personal vehicles are necessary for rural communities—not just as transportation methods but also as multi-use tools for personal and professional use. For example, individuals may use their vehicle for recreation (hauling trailers or sporting equipment) or work (transporting agricultural or construction supplies and equipment). On average, rural residents drive longer distances and drive more frequently than urban and suburban dwellers.[12] Low population densities also mean limited opportunities to walk or bike to work, school, or shopping. Combined with often-underdeveloped public transportation systems, these factors make personal vehicle availability or ownership particularly vital for rural residents.

At the same time, vehicle access remains an issue in rural communities. A recent study found that there are 292 counties (out of 3,142 total nationwide) where at least 10% of households do not have access to a vehicle; 56% of those 292 counties are considered rural.[13] Furthermore, that same study found that residents in certain parts of these counties rely entirely on transit, deliveries, or neighbors to access basic necessities. Nationally, the majority of households without a car are in metropolitan areas, but more than one million rural households do not have access to a personal vehicle.[14] And when it comes to EV registration in rural areas, the majority of non-metro countries have fewer than five EVs registered per 10,000 people, whereas metro areas have between ten to a hundred.[15]

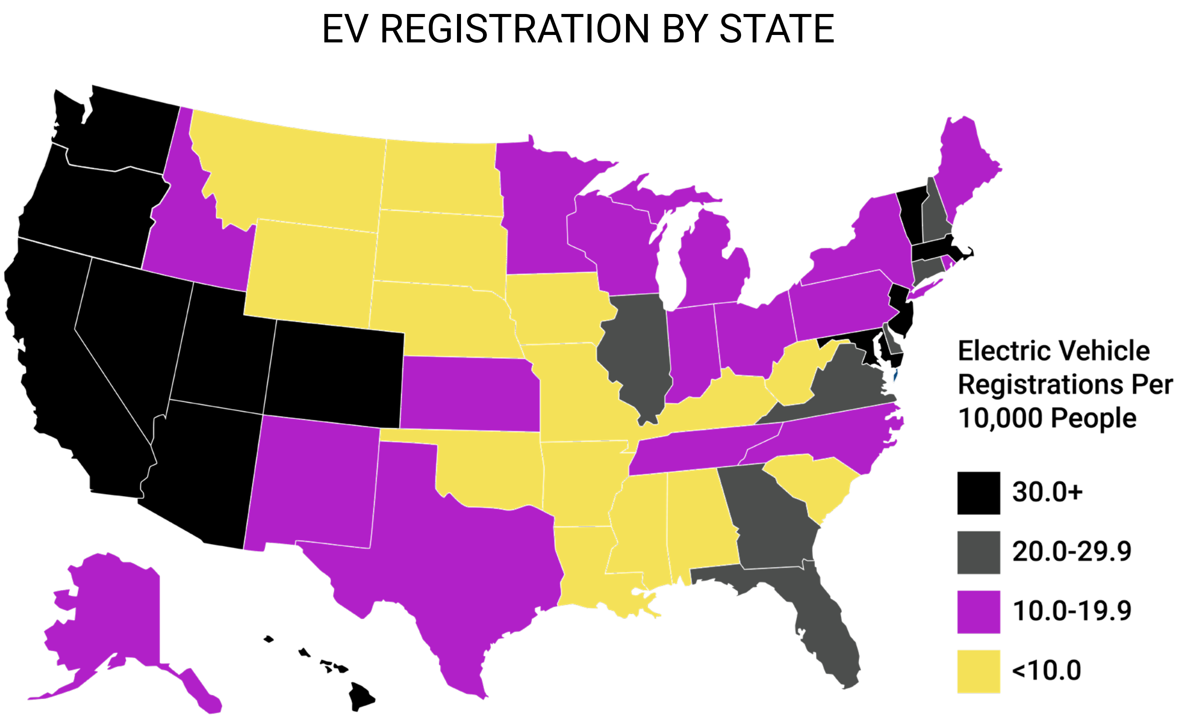

Figure 1: EV registration by state as of June 2021.[16]

This heavy reliance on passenger vehicles challenges and encourages transportation electrification. Car dependence in rural communities correlates with a high degree of single-family homes (as opposed to multi-unit dwellings), where individuals have greater potential access to at-home charging. High vehicle miles traveled (VMT) also leave rural residents highly sensitive to fuel prices; at the time of the publication of this paper, rising fuel costs made gas-powered cars 3–6 times more expensive than electric vehicles.[17] At the same time, a lack of updated infrastructure—including regular access to charging stations and grid-related resilience—currently limits the feasibility of transportation electrification in these areas.

2.3 Infrastructure

EV charging stations are on track to outnumber gas stations throughout the U.S.[18] However, it is the distribution of a national charging network, not just its size, that limits rural electrification: more than 80% of these chargers are privately owned.[19] Fewer than 46,000 stations are publicly available today, and slightly more than 5,500 of those are direct-current fast charging (DCFC).[20] Today, most public and private chargers are also concentrated in urban areas; even highway corridors experience limited electric vehicle charger availability, though specific provisions in the Infrastructure Investment and Jobs Act (IIJA) aim to remedy this issue. This topic is discussed more in Section 3.4.

2.4 Culture

Rural Americans hold a diversity of identities, cultures, and beliefs that may result in possible heistation toward widespread EV adoption. Even as the number of EV models increases and the price of available EV models decreases, cultural differences may create biases against EV technologies.

Public education efforts are a key factor in counteracting these assumptions. Often, consumers are unaware of financial incentives available to EV purchasers, without which acquiring a new model is challenging for families. Many people also believe that new EVs cost more than new ICE vehicles, though recent models and developments in battery technology are rapidly bringing about cost parity between the two. Additionally, two-thirds of Americans have never had the opportunity to drive or even sit in an EV, an experience that often correlates with marked improvements in sentiments toward the vehicle.[21]

Generations of shared values and experiences shape regional identities. Individuals living in rural communities are often more self-employed than in metropolitan areas.[22] Americans value personal freedom and autonomy,[23] and a spirit of "rugged individualism" that ties back to rapid westward expansion in the 18th century.[24] As a result, many rural Americans look for vehicles that represent this mentality and fit their unique needs—outdoor recreation, work, and personal use—such as Pickup trucks and SUVs.[25] Recent trends indicate that Americans who are in the market for a new vehicle have continued to shy away from the sedan or wagon models and are increasingly purchasing trucks and SUVs:[26] in the U.S., trucks, and SUVs outsell sedans three-to-one and account for nearly 75% of all new vehicle sales.[27] Until very recently, EVs of this size and type were not available on the market, leaving many rural residents feeling that their needs were unmet.

Finally, research suggests that residents of rural areas are closer-knit than others, with higher degrees of trust and more positive ratings of the community "as a place to live" than in urban and suburban environments.[28] These high ratings may correlate to high degrees of social cohesion, meaning that positive EV experiences among trusted community members hold the potential to shift opinions in a positive direction. Likewise, there is evidence to suggest future interest in clean transportation in rural communities: a 2019 poll of rural residents in the Northeast found high rates of dissatisfaction with the current state of the transportation network in their area, a sense of choicelessness about car dependence, and majority support for EV technology (including school buses, charger installation, and providing incentives to make EVs more affordable).[29] Findings like these demonstrate that, with greater awareness of the benefits, transportation electrification may be well-received by those who may have previously reported hesitations toward EVs.

3. Infrastructure Deployment

Rural communities are well-positioned to gain from an EV transition, meaning that support for electrification in rural areas is well-justified. However, a rapid, convenient, and sustainable transition to electrified transport cannot occur without robust planning and investments in EV supply equipment (EVSE).

Historically, electrification has come to rural communities much slower than in urban areas. This trend can be traced to 1936, when Congress passed the Rural Electrification Act. At that time, 90% of U.S. farms did not have access to electricity.[30] That same year, an equal percentage of urban households were electrified.[31] However, federal support for the expansion of electrification in rural regions has transformed the economic growth of rural America.[32] As the country transitions towards electric mobility, ensuring that rural America is equipped with the adequate, updated infrastructure to fulfill charging needs in residential, agricultural, and public contexts from the outset will be critical to fulfilling the promises of an electric transition.

3.1 EVSE Infrastructure Landscape

Electrifying transportation in rural America comes with a different set of infrastructure obstacles than introducing EVs to an urban environment. The electrification needs of rural regions are variable; as a result, rural charging expansion protocols should be flexible and guided by case-by-case specificity. Rural grid preparation requires coordination among utilities, grid operators, federal agencies, and state and local governments to upgrade the system—including targeted investments to extend distribution and transmission capacity to remote areas to allow for rural highway charging. Extending transmission to commercially-remote areas may pose unique challenges for utility companies, but robust investments are being made by both private electricity providers and federal funding.

Various models project that investments in EVSE are all-but-inevitable. Under a conservative estimate, the International Council on Clean Transportation (ICCT) projects at least 3.6 million EVs on U.S. roads by 2025. However, only about one-fourth of the public chargers needed to support this trend are currently in place,[33] and a majority of these chargers are concentrated in metro areas.[34] At the same time, non-metro areas contain major highway corridors with vast stretches of road that will need a charging network to serve distance travelers. For instance, 44% of rural passenger vehicle traffic reflects urban residents traversing between their homes and another destination. Similarly, 46% of freight truck vehicle miles traveled are driven within rural regions.[35]

Those statistics demonstrate that rural areas may be some of the first to experience EV traffic, justifying EVSE investments throughout these regions. However, EV adoption rates in these areas remain limited. As of September 2021, the ten most rural U.S. states average 2,123 EV registrations, reflecting some of the country's lowest EV adoption rates. These states average 7.4 EVs per charging station; however, this ratio will widen as vehicle deployment accelerates.[36] A recent ICCT study projected the necessary geographic variation in the U.S. charging needs based on expected EV adoption through 2030: the report provided evidence that the rate of charging expansion in the Midwest will need to accelerate to ensure a consistent rural charging network and demonstrated that parts of the rural West—the least EVSE-need dense region—would need one public charger every 100 square miles.[37] Preparing these rural areas for electrification via EVSE deployment in advance will ensure these communities are well-positioned to take advantage of the transition.

3.2 Electricity Generation

One of the benefits of the EV transition is its ability to reduce U.S. energy dependence on fossil fuels. Cleaner, more efficient energy generation is critical to reducing carbon emissions from transportation. By 2035, the United States is expected to have gained 325k more megawatts (MW) of electricity generation capacity than it had in 2000. U.S. utility companies recognize their role in supplying a greener grid to their service areas. Between 2005 and 2020, the power sector cut emissions by nearly half.[38] Likewise, direct power-sector CO_2 emissions in 2020 were 1,450 million metric tons (MMT), 52% lower than the 3,008 MMT in 2020 projected in the U.S. Energy Information Administration's (EIA) 2005 Annual Energy Outlook report.[39] In 2021, energy from solar photovoltaics accounted for 39% of new electricity generating capacity, followed by wind at 31% of new generation.[40] Furthermore, a recent Department of Energy study found that solar could account for 40% of U.S. electricity as soon as 2035.[41]

Electric vehicles are already more efficient than ICE vehicles in all fifty states, and continued expansions in new renewable energy generation will make them even cleaner.[42] Although half of the ten most rural states rely primarily on coal-fired plants, U.S. coal power capacity peaked in 2011 and has declined 30% since then.[43] Paired with reduced power-sector emissions, current low EV adoption rates create a significant opportunity for rural states to decarbonize by transitioning to EVs. Figure 2 below demonstrates the correlation between rural EV adoption and potential carbon savings.

State[44]	Number of EV Registrations	EVs Per Charging Port (2021)	Electricity Mix Majority[45]	Annual CO_2 Savings from Driving an EV[46] *(compared to 11,435 lbs emitted by an ICEV)*
> #1 Wyoming	707	4.18	73.89% Coal 19.52% Wind	3,994 fewer lbs
> #2 Montana	2,278	11.22	43.20% Coal 39.9% Hyrdo	6,954 fewer lbs
> #3 South Dakota	1,015	6.9	52.32% Wind 29.72% Hydro	10,135 fewer lbs
> #4 Alaska	1,113	13.74	41.03% Natural Gas 27.67% Hydro	7,100 fewer lbs
> #5 Vermont	7,061	8.5	50.13% Hydro 25.11% Biomass	11,435 fewer lbs
> #6 Mississippi	1,689	6.01	72.1% Natural Gas 17.13% Nuclear	7,369 fewer lbs
> #7 Maine	1,795	12.08	27.11% Hydro 24.7% Natural Gas	10,226 fewer lbs
> #8 North Dakota	656	4.9	57.16% Coal 34.08% Wind	5,653 fewer lbs
> #9 West Virginia	1,795	6.75	90.9% Coal 4.0% Natural Gas	2,299 fewer lbs
> #10 Arkansas	3,127	7.59	35.56% Coal 32.1% Natural Gas	6,473 fewer lbs

Figure 2: The state of EV deployment and potential carbon savings in America's 10 most rural states.
Rural ranking based on population density, i.e., Wyoming is the "most rural" and least population-dense state

3.3 Transmission, Interconnection, Distribution

Beyond using cleaner sources of energy, deploying the transmission and distribution infrastructure to geographically remote and often less densely populated areas is another key step towards effective rural electrification.

Home and business-based chargers are likely the primary way rural Americans will charge their vehicles within residential and more commercialized areas. Charging equipment for EVs is classified by the rate at which the battery is charged. Alternating Current (AC) Level 1 chargers provide charging through a 120 volt (V) AC plug, most commonly referred to as trickle chargers.[47] Level 2 chargers provide a faster charge and are the standard-installed charger in most homes, as well as longer dwell time commercial locations and DCFCs are a preferred option for shorter dwell time commercial locations. Figure 3 provides a detailed overview of each charger type.

EV CHARGING TYPES

Charger Type	Level 1	Level 2	DC Fast Charger
Voltage	120	240	480
Kilowatts	1.3	11.5	250
Time to Charge to 80% Battery	61.54 hours	6.96 hours	19.2 min

Figure 3: An overview of different charger types.

Charging at home is inexpensive and convenient in rural areas due to the predominance of single-family homes, where EV drivers can leave their car overnight and be confident it will be charged in the morning. Electric utility residential charging rates and innovative customer programs approved in several states can allow customers to save money by charging at off-peak times. For example, in 2021 Xcel Energy launched a smart charging pilot program in Colorado that helps customers save money by charging their EVs at times that are good for both the grid and customers.[48] However, it is important to note that electric vehicle fast-charging options should also exist close to existing fueling stations and convenience stores is critical to user-friendly rural public charging. These areas are convenient for drivers and are also often located within ten minutes of 93% of Americans.[49]

Upgrading the grid infrastructure of underprepared rural towns can come at a high cost to charging companies, utilities, and station hosts. In many cases, charging companies can install EVSE for Level 2 (L2) charging in municipalities without the need for electrical upgrades; however, installing DCFC sometimes requires additional utility-scale infrastructure improvements.[50] Securing and using government funds cost-effectively to maximize the profitability margin of rural charger installation for utility companies and charging installers is essential to rural EV deployment.

State governments, municipalities, utilities, utility regulatory commissions, and the private sector can also play a role in facilitating EV charging-friendly upgrades to the electrical grid by making these upgrades more accessible to rural communities. For example, California recently approved a new electric rule "that will ensure utilities provide 'utility-side make-ready' infrastructure to support EV charging at no cost to the typical customer. This will reduce the costs of installing charging stations for cars, trucks, and buses by about 25 percent, fundamentally improving the economics of electrifying the transportation sector."[51] In addition, adjustments to demand charges and microgrid options can provide an affordable way for commercial customers (such as charger operators),

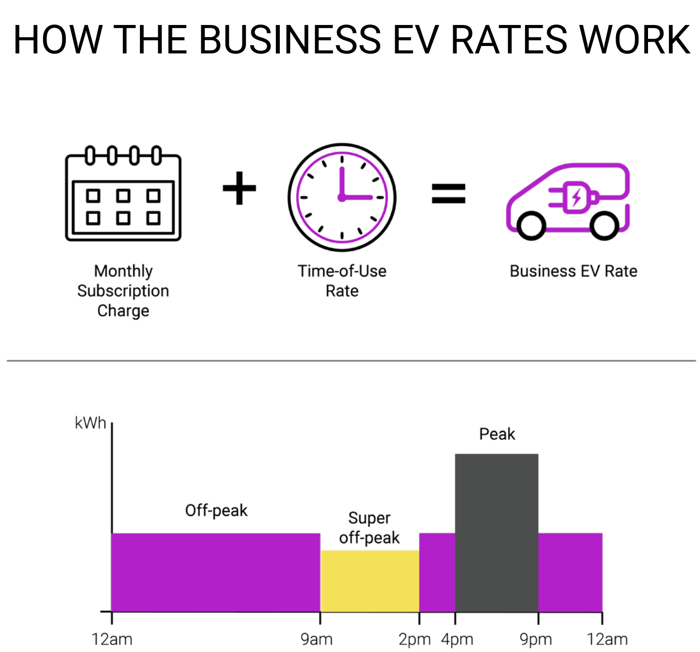

Figure 4: Business EV rates are calculated by combining time of use rates and fixed monthly subscription charges.

remote communities, and agricultural cooperatives to invest in their charging capacity.

3.3.1 Demand Charges and Rates Structures

Commercial customers and site hosts can attract more traffic to their chargers by providing fast, reliable charging options. DCFC is often the most convenient, as it provides a substantial charge in a short timeframe. However, operating DCFC is expensive–electricity distribution to site hosts accounts for a major portion of DCFC costs. These stations require significant power to operate and can cause usage spikes that push a site host above its peak energy load. Demand charges can account for 30% to 80% of the cost of electricity at these stations, making it particularly difficult for site hosts with limited EVSE usage to justify investing in DCFC.[52] Fortunately, L2 chargers supplemented by at-home charging can fulfill the majority of charging needs in rural America.

Given the policy benefits of widespread access to public charging, it is appropriate to consider creative rate design solutions to address the challenges presented to commercial customers and public charging station site hosts. Within each service area, investor-owned utilities can work with these station owners and other stakeholders to find appropriate solutions to propose to state regulatory commissions. Potential solutions to explore include waiving or reducing demand charges temporarily; implementing costs of service rates that don't assess demand charges (on a more permanent basis); integrating demand charges in subscription rates; or exploring discrete incentives that vary with station utilization. It is important to note that rural areas may also be served by municipal utilities or rural cooperatives. These entities operate under different governance structures and without the same regulation as investor-owned utilities; as such, they are under different procedural constraints to implement these solutions.[53]

There are several case studies of utilities exploring creative approaches such as these. In California, utility providers have tested a system of fixed-price, monthly subscriptions for energy costs. The subscription rate is tiered based on a customer's anticipated usage, and this structure seeks to eliminate hard-to-predict fluctuations in demand charges that are burdensome to DCFC hosts.[54] Another method seeks to implement demand charge "holidays" over the coming several years in an effort to incentivize early adopters.[55] Xcel Energy has multiple electric tariff options in Colorado designed for commercial EV charging contexts where demand charges can sometimes present a barrier to sites with lower utilization. One rate option eliminates the majority of demand charges and instead offers customers time-varying energy charges, a low distribution demand charge, and a critical peak price (CPP) energy charge applicable to just a small fraction of hours a year. Another similar rate option is also offered without the CPP component.

3.3.2 Microgrids in the Rural Context

Considering the high costs of running transmission to extremely remote geographic locations, investing in microgrid structures presents a way to reinforce grid resilience and electrify transportation in rural communities. The Department of Energy defines a microgrid as "a local energy grid with control capability, which means it can disconnect from the traditional grid and operate autonomously."[56] A "microgrid" takes a localized source of renewable energy generation capacity coupled with another distributed energy resource (DER), such as a battery storage system, with power capacities tailored to the needs of its specific remote location.[57] These self-contained electrical grids can continuously provide electricity while connected to the broader grid or operate completely independently. Microgrids, including generation and storage, are managed by the local microgrid controller and can provide unique grid services while offering resilience to the host. Microgrids can lower energy costs for rural consumers, increase the use of renewable energy, provide relief during grid outages, and eliminate high transmission and siting costs when connecting remote areas to larger grids.[58] Federal assistance and private-sector investment are critical throughout the U.S. to ensure successful microgrid operations.

Microgrids can also be particularly useful in an agricultural context, where they can facilitate a transition away from diesel-powered machinery. Electrifying agricultural equipment requires additional electricity capacity for on-farm buildings that are not typically connected to robust transmission systems. Therefore, farmers face major cost burdens with a lack of incentive for utilities to deliver additional load to these remote locations for the charging of heavy e-farm equipment.

Finally, stand-alone, solar-powered EV charging technology presents an exciting, sustainable opportunity to address rural charging needs. Currently employed throughout California, this system is characterized by mobile, grid-independent EV charging. This technology presents an opportunity for electrifying rural communities and national parks at lower costs compared to grid-expansive EVSE installation.

3.4 EVSE Deployment and Internet

The federal government's recent passage of the IIJA has substantially increased the opportunity for widespread EVSE deployment. IIJA mandates $5 billion in support of an accessible, connected national charging network titled the National Electric Vehicle Infrastructure (NEVI) Formula Program. As a result of the NEVI Formula Program's requirement, state agencies looking to deploy EVSE must connect it to a network that will facilitate data collection and reliable access to meet

EV CHARGING INFRASTRUCTURE BY STATE

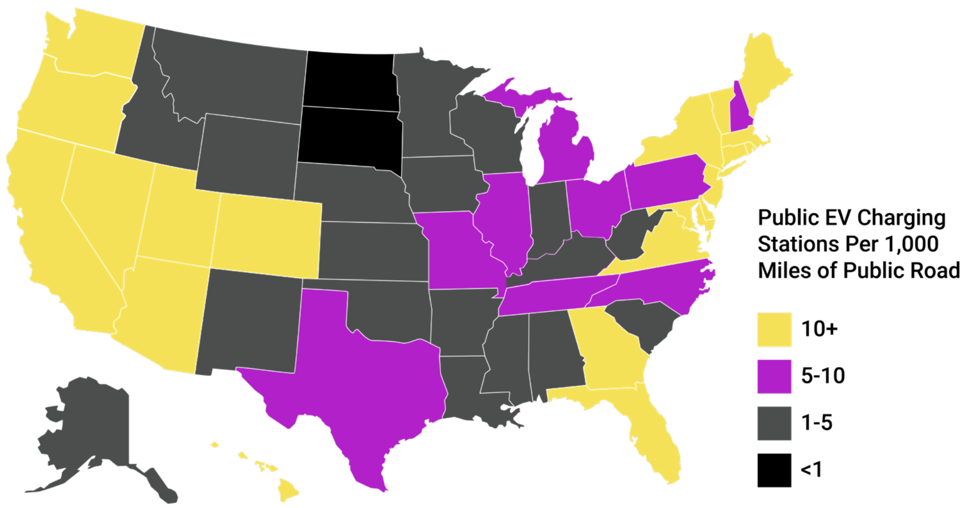

Figure 5: Proportion of EVSE infrastructure across the country.[59]

demand. Under these regulations, telecommunications connections will play a significant role in rural EVSE deployment. Figure 5 provides an overview of EVSE deployment throughout the country as it stands prior to enactment of the NEVI Formula Program.

3.4.1. Networked and Non-Networked Chargers

To deploy EVSE efficiently, stakeholders must distinguish between networked and non-networked chargers. Non-networked EVSE does not have Internet access and does not collect data or balance loads during peak usage. On the other hand, networked chargers vary in price and power but can provide data on energy consumption, usage, and uptime reporting.[60] As a result, high-speed internet connectivity is a key prerequisite for the rural EV transition. As we discover new opportunities for smarter, more efficient transportation, rural telecommunications investment will remain an essential part of interconnected transportation plans.

3.4.2. Broadband

Rural broadband deployment may impact EVSE deployment. Broadband enables access to high-speed communications and information technologies; it encompasses cable, telephone wire, fiber, satellite, mobile, and fixed wireless. It serves a variety of purposes ranging from voice communications, telework, distance education, public safety, transportation, and e-commerce.[61] Although not all EV chargers are the same, a networked charger will allow charger operators and drivers to initiate a charge, check its progress, finalize payment, and monitor energy use. Likewise, a networked charger can provide grid benefits through power-sharing by participating in demand-response programs. Often, networked chargers only require cell tower reception to be connected to the company's internal network.

More than 22% of rural Americans lack broadband coverage, compared to only 1.5% of urban residents.[62] As rural communities already experience a digital divide, telecommunications deployment must occur in tandem with EVSE deployment; otherwise, rural communities may experience additional challenges while transitioning to transportation electrification. The COVID-19 pandemic highlighted the digital divide through the difficulties of distance learning and telemedicine. Lack of telecommunication installation may only lead to further challenges as networked chargers are installed in spaces where these telecommunications capabilities have yet to be realized.

3.4.3. Over-the-Air Software Updates in EVSE

Over time, EVSE in urban and rural areas will need software updates to meet federal reliability standards and uptime reporting. Over-the-air (OTA) updates provide wireless delivery of new software, firmware, or other data to devices such as EVSE. Chargers must be equipped with a telematics control unit (TCU) with a mobile communication interface and memory to store data to facilitate OTA software updates.

4. Revitalizing Rural Economies

Investments in EV infrastructure and building out rural grid capabilities will lay the foundation for a larger electric vehicle transition that will benefit rural communities in a variety of ways—by reducing the urban-metropolitan divide, revitalizing the automotive sector, creating a new workforce of EV service technicians, and boosting opportunities for tourism in these regions.

4.1 Framing the Rural-Metropolitan Divide

While framing the United States in terms of the rural-metropolitan divide helps explain logistical e-mobility challenges unique to the specific conditions of different regions, it is important to remember these communities exist as part of a domestic EV manufacturing ecosystem. Rural Americans value the environment and exist in economies closely connected to natural resources. Narrow understandings of rural Americans overlook not only the needs of diverse rural communities but also the fact that metro and non-metro Americans value the environment similarly.[63] Rural and urban residents have a social and economic stake in expanding U.S. transportation electrification: the EV revolution brings tremendous investments to rural regions that have the potential to revitalize economies left behind.

4.2 EV Investment in Rural Areas

Historically, the Midwest's Manufacturing Belt, the Southeast, California, and Texas have been at the center of U.S. auto manufacturing.[64] Nonetheless, every state is an "auto state," home to suppliers and manufacturers who produce parts for all vehicle power trains.[65] As of 2020, auto manufacturing and sales contribute 3%, or $627 billion, to the national gross domestic product (GDP).[66]

4.2.1. Job Creation

Manufacturing is an important source of employment and economic growth in many rural communities. In 2015, transportation-sector manufacturing—especially auto-parts manufacturing—accounted for 12% of all rural manufacturing sector employment.[67] As the country rapidly shifts to EVs, building a domestic EV manufacturing capacity presents a prime opportunity for robust job growth in rural communities. Even as this technology is in its nascent stages, the EV sector added 6,000 jobs at an 8% growth rate in 2020, while the rest of the auto sector saw a 9% decline due to COVID-19.[68] Increasing consumer demand for EVs—a ZETA poll found that 71% of Americans are considering an electric vehicle for their next car—as well as government and private sector support for the industry can be counted on to supply rapid growth.[69] As a result, there exists the potential for tens of thousands of new jobs to power this emerging industry in communities big and small.

As this transition accelerates and new EV investments are announced at a near-weekly rate, stakeholders must ensure that rural communities are not left out. Several recent announcements for EV facilities have targeted rural areas. For example, Ford's $10 billion investment in rural Kentucky and Tennessee will create an estimated 10,000 new jobs.[70] Another prominent EV automaker, Rivian, has announced a factory in the city of Rutledge, Georgia. In a community of slightly more than 1,000 people, the Rivian factory will create up to 8,000 jobs by 2030.[71] An automotive facility situated in a rural area has a jobs multiplier of 2.1, which means that every job at the plant will create an additional 1.1 jobs in the larger community.[72]

Likewise, rural areas may have an advantage regarding site selection. Auto manufacturers often target rural areas, as these sometimes benefit from established manufacturing infrastructure, larger open building sites, and easy access to rail lines.[73] As a result, rural communities are well-positioned to receive billions in private industry investment as automakers build out the EV supply chain. These factors contributed to EV manufacturer Canoo's selection of Pryor, Oklahoma, as the site of their new U.S. manufacturing facility. The plant will create approximately 2,000 jobs and represents a $400 million investment in the community. While many rural towns have seen job losses in recent decades,[74] these new electric vehicle facilities can bring thousands of new jobs.

EV charging infrastructure buildout similarly promises to generate substantial job creation throughout the country. The International Energy Agency (IEA) estimates that 12 new jobs are created for every $1 million invested in charging infrastructure;[75] by comparison, ICE vehicle manufacturing creates an average of 7.2 jobs per million invested. At this rate, IIJA's $5 billion allocations through the NEVI program to build out a national EV charging corridor could create at least 60,000 direct jobs. Beyond installation, ongoing EVSE operations and maintenance will create thousands more jobs. This creates an entirely new occupation, that of an EVSE technician, that goes beyond the role of a traditional electrician. EVSE technicians are responsible for the ongoing maintenance and operations of chargers and are specially trained to handle electrical and parts malfunctions, software upgrades, cell signal issues, damages, and more.[76] This new career can open a door for rural Americans seeking to enter the clean-tech industry and ensure they are not left behind in the EV transition.

4.2.2 Workforce Training

One way to incentivize communities is to ensure that rural workers have the proper skills to build these new technologies. For example, President Biden's goal of building 500,000 charging stations—many in underserved and rural communities—presents a significant employment opportunity for these populations.

As a result, workforce development plans may include funding for programs that train locals' capability to both install and service EVSE. Training opportunities for positions that do not require trade licenses or several years of experience can reduce barriers to entry in this sector. ChargerHelp is one company removing these barriers through partnerships with workforce development agencies to train EVSE technicians across the country. Not only does training technicians create job opportunities for disadvantaged communities, but these technicians also play a key role in guaranteeing a reliable charging system that will boost Americans' confidence in their ability to have a smooth EV charging experience.

4.2.3 Community Benefits

Beyond the EV industry's opportunity to provide direct employment and facilitate investments in rural communities, installing charging stations throughout rural transportation corridors will increase rural areas' attractiveness to EV drivers. Locating charging stations in rural communities can attract more tourists, bringing in revenue for local businesses.[77] There is already evidence showing that EV-accessible routes and amenities are bringing tourism to rural communities: in West Virginia, every state park lodge attracted more visitors after installing free EV charging stations.[78] While charging, these visitors can explore the gift shop, dine at the park restaurant, or even stay overnight in the lodges. Michigan[79] and California[80] have taken similar steps by including EV charging stations throughout state parks.

Unlike fueling at a gas station, charging an EV can require travelers to pause at stops for longer periods, a practice known as dwell time. Co-locating chargers with other attractions, like food or shopping, can prompt drivers to increase their dwell time and combine charging with visits to stores, restaurants, and other community attractions. For businesses, increasing dwell time directly increases revenue. One charging manufacturer, ChargePoint, has partnered with major retailers to install charging stations to boost dwell time. One retailer reported an average of $1 spent in the store per additional minute of dwell time.[81] Likewise, a rural electric cooperative's decision to install EV charging stations throughout their downtown in rural Meeker, Colorado, turned the main street into a destination for EV drivers. In turn, this spurred economic development, reduced range anxiety and encouraged EV adoption.[82] This method of main street revitalization provides various community services by creating jobs, tourism opportunities, and community-building by developing a central gathering location.[83]

For many of the same reasons, EV infrastructure can also be particularly useful in national parks and on public lands. In the Intermountain West—the least charging-dense region in the U.S.—respondents to a 2021 National Association of State Energy Officials (NASEO) poll identified expansions within and around public parks, as well as “gateway” communities just outside these natural tourist attractions, as a priority for charging infrastructure installation.[84] The CORWest Project, part of an eight-state partnership between Arizona, Colorado, Idaho, Montana, New Mexico, Nevada, Utah, and Wyoming, focuses on electrifying these gateway communities. Led by the Utah Clean Cities Coalition in partnership with NASEO, this initiative works to remove the barriers to private sector investment in rural EVSE. Similarly, the California Energy Commission awarded $491,342 to the nonprofit Adopt a Charger under the Clean Transportation Program grant. As a result of the assistance, Adopt a Charger installed over sixty L2 charging stations in eighteen California State Parks.[85] Supplemented funding provided by private partnerships where charging manufacturers pay for public charger operation and maintenance; as a result, Adopt a Charger has been able to provide free charging in national parks.

5. Rural Use Cases

Rural populations often use vehicles differently than their urban and suburban counterparts. In rural areas, driving is the most important form of transportation because the drivers’ destinations tend to be located further apart. Vehicles are also used more cross-functionally given rural communities’ greater connection to industries such as agriculture and construction and their increased emphasis on outdoor recreation. As such, vehicles are seen as important tools for work and play. Until recently, these preferences would have made EVs subprime candidates for use in rural areas. However, improving technology and availability across models and vehicle classes have made EVs strong contenders in the rural market.

5.1 Agricultural and Industrial Applications

Industries such as agriculture and mining remain important and unique use-cases for vehicles in America. Agriculture employs over 15% of workers in the most rural communities in America, and the majority of mining employment is seen in non-metropolitan areas.[86] Thus, rural electrification will positively impact large segments of the rural workforce. Electrifying agricultural and mining equipment presents one way to maximize the benefits of this transition.

5.1.1 Agriculture

Electric pickup trucks like those explored in Section 5.2 are vital to agricultural electrification. Still, specifically, electric agricultural equipment will enable farmers in rural areas to complete a full day's work with zero emissions. For example, the upcoming Monarch MK-V electric tractor integrates seamlessly with current farm equipment for specialty operations and can run for upward of 10 hours on a single charge.[87] Along with zero emissions, electric tractors bring the benefits of low maintenance and little downtime, increasing productivity and reducing operating costs.[88] Currently, few models exceed 100 horsepower (HP), so smaller tractors are the most viable market entry point.[89] However, advancing battery technology and greater demand for zero-emission vehicles will likely lead to broader availability of electric farm equipment.

5.1.2 Mining

Electrifying mining equipment presents numerous operational and health benefits. Historically, diesel equipment has dominated the industry. In mines, temperature, noise levels, and ventilation are primary concerns for miners' health and productivity, concerns which are exacerbated by diesel engine use. Electric motors, however, are far more efficient, producing less heat than combustion engines.[90] They are also quieter and emit no pollutants that would need to be vented out of a mine.[91] In search of these benefits, original equipment manufacturers (OEMs) have begun introducing electric models. Caterpillar's new R1700 XE Load Haul Dump rivals the performance of the existing diesel R1700 without exhaust emissions or significant heat generation.[92] Electric mining options remain limited but are highly anticipated by industry professionals as demand for such equipment has seen recent expansion.[93]

5.2 Daily Use

Aside from industrial applications, EVs are already prime candidates for everyday vehicles. Ford recently launched an electric version of the best-selling vehicle in America,[94] the Ford F-150 Lightning,[95] signaling that every corner of the American passenger vehicle market is electrifying. Other pure EV manufacturers like Rivian have already brought highly capable electric pickup trucks and SUVs to market. The popularity of these vehicles provides insight into the preference of Americans for utility-forward vehicles. Like their gas-powered predecessors, EVs can perform across broad use cases while delivering unique utility well-suited for rural drivers.

5.2.1 Personal and Professional Use

Working rural drivers travel 38% longer distances than their urban counterparts.[96] However, modern EVs are more than capable of achieving the necessary range for a day of rural driving. The average daily drive in rural areas is 48.6 miles;[97] as of 2021, the median range of EV models sold in the US is 234 miles per charge.[98] At this range, an EV can drive the average rural daily drive for multiple days before needing to charge. With new electric vehicle models offering an ever-increasing range, EVs are becoming even more equipped to meet the rigorous range requirements of rural driving.

Given the popularity of utility vehicles in rural areas, the ability to tow and haul is critical for electric utility vehicle adoption. The Ford F-150 has a rated towing capacity between 8,200 and 14,000 lbs with a maximum payload between 1,400 and 3,325 lbs.[99] Its electric variant can tow up to 10,000 lbs with a payload capacity of up to 2,000 lbs, squarely competing with the gas-powered models. Other manufacturers of electric utility vehicles boast similar capabilities. For example, Rivian's R1T pickup truck can tow up to 11,000 lbs[100] while Tesla's planned Cybertruck is expected to tow up to 14,000 lbs.[101] Not dissimilar to the reduction in fuel efficiency seen when towing with an ICEV,[102] an EV's range diminishes when towing near-maximum capacity.[103] The availability of EVs capable of carrying substantial loads will propel EV demand in areas and industries where utility vehicles are necessary, further encouraging the development of public charging corridors.

Electric vehicles' utility applications extend beyond towing. EVs are also mobile battery packs, ready to power equipment for the job site or tailgate. For example, the Ford F-150 Lightning has 11 outlets, including one 240 VAC outlet; in sum, it can provide up to 9.6 kW of external power. New offerings from electric truck and utility vehicle manufacturers like Rivian,[104] Canoo,[105] Lordstown,[106] and GM[107] all include external access to power. Numerous electrical outlets mean that a contractor can use their truck as a workbench, running motorized saws and charging drill batteries without grid connectivity—or that campers can use campsite electric cooktops and lanterns with their trucks' power. EVs provide versatility that is otherwise unattainable without large gas generators.

5.2.2 Outdoor Recreation

Outdoor recreation activities—such as camping, biking, swimming, hiking, and off-roading—is a key economic driver in many rural communities. Recent U.S. data shows the outdoor recreation economy accounted for 1.8 percent ($374.3 billion) of the current GDP in 2020, and outdoor recreation has sustained record growth since the start of the COVID-19 pandemic. The electrification of recreational vehicles includes all-terrain vehicles (ATVs), utility terrain vehicles (UTVs), watercraft, and vehicles equipped to handle off-roading through all-wheel drive. Electric recreational vehicles provide high performance without producing emissions or excess noise. For example, Arcimoto manufactures electric 3-wheeled utility vehicles perfect for trail riding and adventuring.[108] Pure Watercraft sells electric outboard motor kits as well as small electric watercraft that are far more efficient than equivalent gas-powered systems.[109] Similarly, Taiga Motors makes electric jet skis and snowmobiles,[110] and companies like ECO Charger and DRR make electric ATVs,[111] all of which are a testament to the vast market for electric recreational vehicles.

The evolving EV charging landscape further promotes the adoption of electric recreational vehicles. The external power features of electric trucks mentioned in Section 5.2.1 will allow users to charge smaller recreational vehicles on the go, extending time on the trail or water. Additionally, installing EVSE at state and national park entrances will incentivize zero-emission vehicle drivers to visit and charge their vehicles throughout their stay. With robust charging infrastructure, electrified outdoor recreation becomes not only possible but preferable.

5.2.3 Electric School Buses

Electric school buses (ESBs) are well-positioned to outperform traditional diesel school buses, particularly in rural areas. Of the over 1,700 routes observed in a study of school bus operation, the National Renewable Energy Lab (NREL) found a maximum school bus route length of 127.36 miles.[112] The electric Proterra-powered Thomas Built Saf-T-Liner C2 Jouley, for example, offers a range of up to 138 miles, more than the length of the maximum route.[113] Likewise, the standard schedule of a school day is particularly conducive to electrification. School buses ferry students in the morning and afternoon but sit idle during the day, allowing them to charge and recover range from the morning pickup. The C2 Jouley can fully recharge in 3 hours with Proterra's 60 kW DC fleet charger,[114] allowing the same station to charge multiple buses during an 8-hour school day. Another example of bus electrification is GreenPower Motor Company's development of the "battery-electric automotive school transportation," or the BEAST. The BEAST's 194-kWh battery provides a range of up to 150 miles. This vehicle is also equipped with a Thermal Management System and anticorrosive E-coating, which can operate in the harshest climates, and has a turning radius of 37.7 +/- 1.6 ft—the best out of all school bus types in the industry. Additionally, Lion Electric will provide ESBs to school districts across the country, and more than 600 are already operating throughout North America. Lion Electric has seven purpose-built electric models, with their chassis, bus body and truck cabin, and proprietary battery system technology. It has five new models coming out by the end of this year.

Idle school buses can also serve as grid storage resources in the future. Vehicle-to-grid (V2G) technology, such as bidirectional charging, allows electricity to flow both into a vehicle's traction battery and back to the grid,[115] enabling utilities to supplement demand with the vehicle's battery during peak electricity demand.[116] In summer, when school buses are rarely in use, utilities may be able to store renewable energy in bus batteries, then use that stored energy to help supply the local area with electricity during peak demand or at night.[117] These idle buses could also serve as localized backup power for the school and nearby buildings in a power outage. Seamless integration into school operations, together with the added future potential for grid benefits, firmly makes a case for adopting electric school buses in rural areas.

6. Benefits of EVs

Rural communities stand poised to reap the greatest financial benefits of EVs. Transportation places a higher financial burden on rural families.[118] As more and more EV models come online, rural drivers have the potential to realize substantial cost savings across maintenance and fuel.

6.1 Total Cost of Ownership Savings

The higher daily distance traveled and the older average age of rural ICE vehicles generally means significantly more maintenance costs. Notably, the average maintenance costs for an EV are 50% lower than those for a comparable ICEV: EVs have significantly fewer components that require regular maintenance like engine oil, transmission fluid, and air filters. Over a vehicle's lifetime, a rural EV owner can save an average of $4,600 on maintenance costs alone by transitioning away from driving a gas vehicle.[119]

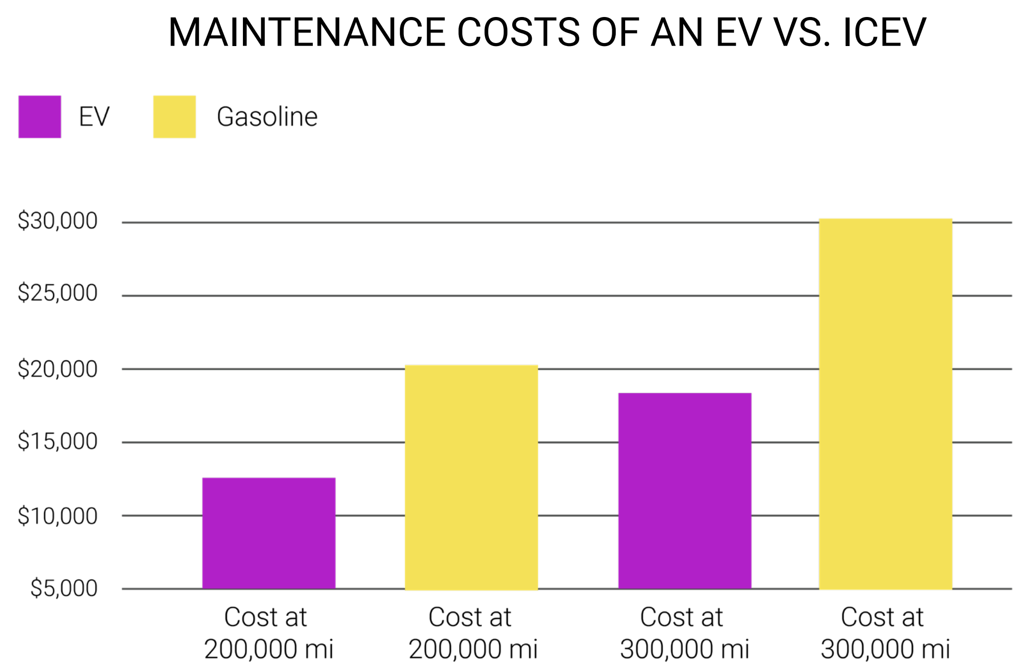

Figure 6: Average maintenance costs of an EV vs ICEV[120]

Maintenance costs contribute to a lower total cost of ownership (TCO) of an EV. Though a vehicle's TCO depends on several factors, such as the region, driver characteristics, electricity rates, and access to charging, EVs are consistently cheaper to own than gas-powered cars. Due to the higher cost of ICEV maintenance, greater VMT, and lower fuel efficiency, a rural driver can expect to save between $27,000 and $44,000 over a vehicle's lifetime by switching to an EV. These savings are magnified in rural areas (an urban driver can save about $22,000 to $31,000),[121] where drivers travel an average of 38% more miles than urban drivers. These differences are even greater for low-income rural drivers, who travel 59% farther.[122]

In particular, pickup truck owners can see the greatest maintenance savings. After seven years, an EV pickup truck saves $9,000, nearly double the savings for a light-duty vehicle at $4,700.[123] This is particularly salient for rural America, as the top vehicle models in recent years have all been pickup trucks.[124]

Approximately 93.7% of rural drivers own gasoline-powered vehicles, and the second-most common fuel source is diesel.[125] Initiating a shift to electric powertrains could see dramatic declines in fuel consumption and increases in household savings. In rural areas, the annual amount spent on fueling a vehicle is the second-highest transportation cost for households, the first being the initial purchase of a vehicle. Between 2019 and 2021, the average rural household spent between 19 and 22.5% of their income on transportation.[126] Likewise, the savings of fueling an electric vehicle are paid back at a greater rate of return mile-by-mile, meaning that higher-mileage vehicles would see the largest cost reductions. Lower fuel costs for EVs are especially beneficial to rural drivers, who drive an average of 10 miles more per day.[127] The additional mileage and inefficient vehicles result in rural drivers spending up to 44% more on gasoline than their urban counterparts.[128] As a result, the transition to EVs could have an enormous impact on reducing the energy burden in rural communities.

Using the EPA's electric gallon equivalent (eGallon), the cost to charge an EV at home is around $1.18 per eGallon.[129] The average U.S. gallon of gasoline is well over $4 per gallon, meaning an EV cuts fuel prices by nearly 75%. Over the course of a year, the cost of refueling an EV is around $546, compared to $1,255 per year when fuelling a gasoline car.[130] This estimate does not account for recent increases in gas prices.[131]

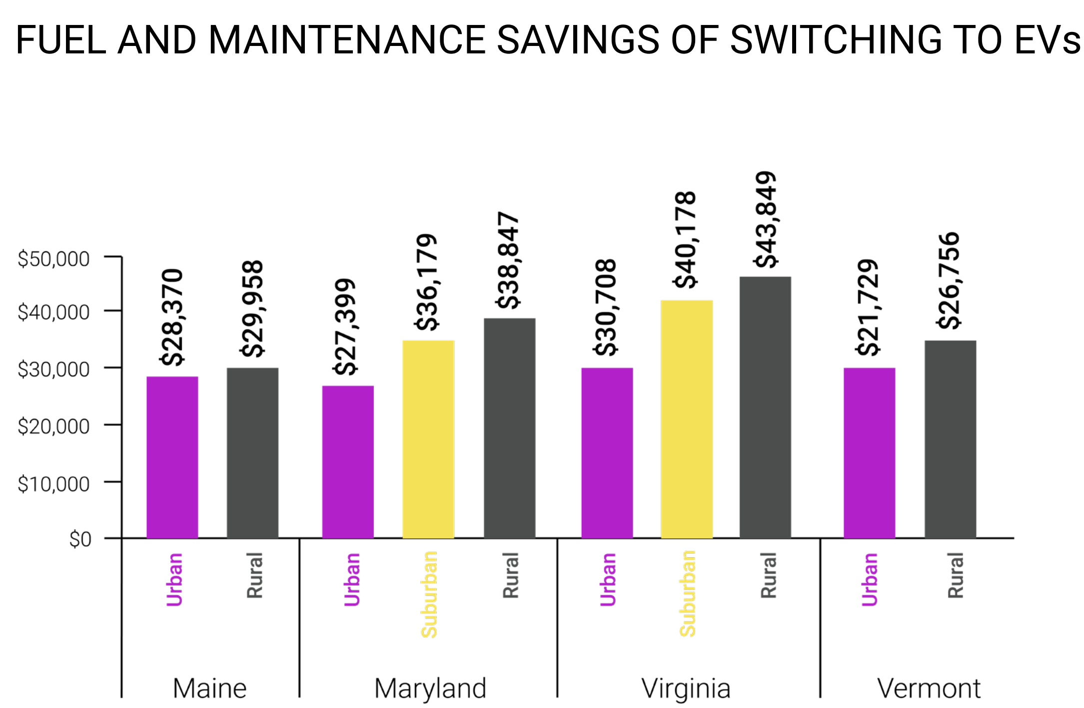

Figure 7: Lifetime fuel and maintenance savings from switching to an electric vehicle.[132]

Finally, many vehicles most commonly driven in rural areas are characterized by poor fuel efficiency, further driving up their operating costs. Many vehicles are more than ten years old and have fuel economies that are up to 1.6 miles per gallon lower than metro area vehicles. Pickup trucks, too, are generally inefficient vehicles.[133] Fortunately, EVs are 3.6 times more energy-efficient than a typical ICEV and even more efficient than a pickup truck.[134] As an example, rural pickup drivers in Maryland would save over $2,000 in annual fuel costs by driving an EV.[135] These savings would be greater in times of higher gas prices, as they were calculated using an average gas price of $2.72. Nonetheless, even under a low-gas price assumption, consumers would still save thousands by avoiding the pump: EVs have more efficient performance due to superior acceleration, smoother transitions, improved towing capacity, and regenerative braking.

The unique characteristics of rural communities equate to even better outcomes from switching to EVs. While an urban household would similarly see dramatic decreases in fuel costs, a rural household saves 43% more by switching to an EV.[136]

7. Recommendations

Federal and state governments have the opportunity to exercise substantial leadership in facilitating an active EV transition. Investing in this transition—prioritizing certain policies, opening up funding opportunities for the EV industry, and facilitating public-private partnerships—will set the tone for a new EV economy.

7.1 For the Federal Government

The federal government has several opportunities to support rural communities in their transition to transportation electrification. Rural transportation planning can advance through several funding mechanisms such as competitive grant programs, loans, and rebates. Targeted federal investments, like DOE's Electric Vehicle Community Partner Projects, will ensure that rural communities are at the forefront of this transition. The Partner Project awards funding for investments in EV manufacturing in rural areas like Appalachia and Tribal communities in the Midwest. Rural communities rely on the federal government and community stakeholder engagement to facilitate transit plans with varying population densities and the lack of central transportation planning organization.

To improve equity in workforce development, ZETA recommends DOE and DOT work with State Workforce Development Agencies to create new industry opportunities in addition to pre-existing training programs by individual charging equipment manufacturers. Plans may include funding for programs that bolster the training and capability of local workforces to install and service EV charging infrastructure. A variety of training programs allows flexibility to ensure employment is accessible for rural communities. Efforts should be targeted at removing barriers to entry for local workers, not creating new, restrictive requirements.

7.1.1 Upgrade the Rural Energy for America Program

Though agriculture may not be the primary—or only—source of income in rural communities, many are still reliant on this sector. Agriculture continues to play a central role in the broader U.S. economy, contributing over $1 trillion of the U.S. gross domestic product in 2020. America's farm products contributed $134.7 billion of this sum—about 0.6 percent of GDP.[137] At the same time, several regions are experiencing declining crop and livestock production due to extreme weather patterns.[138] Electric tractors and other farm equipment are currently being developed and implemented in limited-use applications or prototype settings. Electrifying farm equipment is projected to reduce air and noise pollution and holds the promise of extensive fuel cost savings for farmers. Federal policymakers should consider amending federal programs such as the Rural Energy for America Program (REAP) to expand the loan program to include EVSE installation in rural retail areas and agricultural sites.[139] Making rural EVSE deployment an allowable expense under REAP financing should allow other federal programs and incentives to be considered part of the grantee's cost-share. It should also support small business and on-farm vehicle electrification.

7.1.2 Invest in the Secondary EV Market

Federal policymakers must also make it easier for consumers to acquire EVs, and facilitating the growth of the used EV market offers a straightforward approach. As a rule, secondary sale vehicles are more affordable than new vehicles, and a much larger share of the U.S. population—nearly 74%—only buy used cars.[140] As more EVs enter the used-vehicle market, they will become more affordable for buyers further down the income scale.

However, to sell affordable used EVs, we must first sell new EVs; facilitating these sales will require support in the form of incentives and infrastructure. Income-based and first-adopter criticisms against EVs result from market realities: EVs are part of an ascendant market almost entirely made up of new car purchases, which on their own (whether ICE or EV) typically attract more affluent customers. Consumer incentives policies, such as expanding section 30D of the U.S. tax code and extending the credit availability period, will help deploy more electric vehicles into the market. These incentives will accelerate the rate at which EVs turn over into the secondary sales market, allowing for more affordable vehicles to all Americans.

7.1.3 Coordinate with Utility Providers

Coordination with utilities is a given necessity as we accelerate rural electrification. Federal policymakers and local stakeholders must work with utility providers to ensure streamlined permitting of EVSE projects. Relevant agencies, such as the Department of Interior, the Department of Energy, and the United States Forest Service, must improve interagency and intergovernmental coordination to address planning concerns before the project breaks ground. To effectively modernize the grid, the federal government must use tools such as the Interagency Pre-Application Process for grid transmission or create memorandums of understanding (MOUs) between project applicants, federal agencies, states, and Tribal governments.[141]

7.2 For State Governments

7.2.1 Remove Barriers to Direct-to-Consumer Sales

Direct-to-consumer sales present an additional pathway to increase transportation electrification. Until 1920, most vehicles were sold through a contract between manufacturers and wholesalers. As the demand for new vehicles slowed, dealerships were created to offer repairs, trade-ins, and warranties. Currently, servicing makes up over 35% of a dealer's profit.[142]

Though consumers' preference for e-commerce has boomed over the last few years,[143] 34 states—a majority—currently limit manufacturers' ability to sell direct-to-consumers and require a franchise agreement, and 17 states have total bans.[144] The direct sales restriction can take the form of a prohibition on direct vehicle sales or a prohibition on the ability of the manufacturer to operate a vehicle dealership. Direct-to-consumer sales bans create an artificial restriction on EV adoption by prohibiting automakers who do not use the dealer model to sell in their state. In turn, this decision limits consumer choice and disproportionately affects rural communities, as many of the states with direct-to-consumer sales bans have large rural populations.[145]

Similarly, a few states permit or do not expressly prohibit manufacturers from owning a dealership but might limit this ability if an existing franchise network is present in the state.[146] State lobbying efforts have created exemptions in four states for direct-to-consumer sales. Still, as more EVs come on the market and second-sale options increase, direct-to-consumer sales must also increase.

7.2.2 Prioritize Charging Build-out in Rural Communities with IIJA funds

The IIJA requires that EVSE installation is prioritized in rural and underserved communities. To meet the requirements and receive IIJA funding, state DOTs must demonstrate public engagement with stakeholders such as the general public, Tribal governments, labor organizations, and private industry while drafting their state plan. State DOTs should utilize IIJA's authority to provide operations and maintenance support for rural chargers that may have low utilization and are not economically viable in the short term. As the the NEVI program is finalized, state DOTs should ensure adequate charging infrastructure for MDHVs, such as site requirements for at least one pull-through parking spot that would allow trailers to park safely while charging.

8. Conclusion

Electric vehicles can cut drivers' fuel and maintenance costs, protect drivers from exposure to dangerous exhaust pollution, and serve as an asset for those who rely on their cars for professional, personal, and recreational use. Investing in the electric vehicle industry can create hundreds of thousands of jobs in manufacturing, charging service and installation, and critical minerals development. As heavy users of personal vehicles for personal and professional use and as the residents of communities with a historical connection to the automotive sector, rural communities stand to reap unique benefits from the transition to electrified transportation.

The private sector, local and state governments, and federal lawmakers must work with rural communities and consider their unique needs as they shape a prosperous, equitable, and sustainable EV transition. By targeting investments and policy solutions to these communities, prioritizing flexibility, and challenging themselves to think creatively, policymakers can ensure that they do not leave rural residents ill-equipped to transition away from ICE vehicle dependence.

References

1. "Rural Highways." CRS Reports. Congressional Research Service, July 5, 2018. https://crsreports.congress.gov/product/pdf/R/R45250/4.

2. Ibid.

3. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption

4. https://epm.ucdavis.edu/sites/g/files/dgvnsk296/files/inline-files/Preparing%20Rural%20America%20for%20the%20Electric%20Vehicle%20Revolution.pdf

5. https://www.ers.usda.gov/amber-waves/2008/june/defining-the-rural-in-rural-america

6. https://www.ers.usda.gov/topics/rural-economy-population/rural-classifications/what-is-rural.aspx#:~:text=According%20to%20the%20current%20delineation,not%20necessarily%20follow%20municipal%20boundaries.

7. https://www.apa.org/pi/aids/resources/exchange/2015/01/rural-communities#:~:text=Perhaps%20the%20most%20obvious%20characteristic,%2C%20%26%20Morris%2C%202005).

8. https://www.ers.usda.gov/topics/rural-economy-population/business-industry/

9. https://www.ers.usda.gov/topics/rural-economy-population/employment-education/rural-employment-and-unemployment/

10. https://www.ers.usda.gov/webdocs/publications/102576/eib-230.pdf?v=946.5

11. https://www.ers.usda.gov/webdocs/publications/102576/eib-230.pdf?v=946.5

12. https://nhts.ornl.gov/assets/2017_USTravelProfile.pdf

13. https://smartgrowthamerica.org/more-than-one-million-households-without-a-car-in-rural-america-need-better-transit/

14. Ibid

15. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption

16. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption#:~:text=Light%2Dduty%2C%20fully%2Delectric,light%2Dduty%20vehicles%20in%202021.

17. https://drive.google.com/file/d/1_d6OXxWpF6GzBjZiFP3oj0QqQTM1P5io/view

18. https://insideevs.com/news/567694/chargers-outnumber-gas-stations-soon/

19. https://afdc.energy.gov/stations/states

20. Ibid

21. https://8829857.fs1.hubspotusercontent-na1.net/hubfs/8829857/ZETA%20-%202022%20Feb%20Electric%20Vehicle%20Perception%20Index%20Memo.pdf

22. https://www.usnews.com/news/national-news/articles/2017-03-20/6-charts-that-illustrate-the-divide-between-rural-and-urban-america

23. https://brownpoliticalreview.org/2018/10/personal-space-american-individualism/

24. https://www.bu.edu/econ/files/2017/03/Frontier-Culture-The-Roots-and-Persistence-of-%E2%80%9CRugged-Individualism%E2%80%9D-in-the-United-States-2.pdf

25. https://legallysociable.com/2020/04/23/marketing-101-example-equating-pickup-trucks-to-the-american-way-of-life/

26. https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1013L5Z.pdf

27. https://www.forbes.com/wheels/news/light-trucks-now-outselling-cars/

28. https://www.pewresearch.org/social-trends/2007/02/22/americans-and-social-trust-who-where-and-why/

29. https://www.nature.org/content/dam/tnc/nature/en/documents/TNC_TCI_Survey_2019_Public.pdf

30. https://livingnewdeal.org/a-light-went-on-new-deal-rural-electrification-act/

31. Short- and Long-Run Impacts of Rural Electrification: Evidence from the Historical Rollout of the US Power Grid

32. Ibid.

33. Nicholas, Michael, Dale Hall, and Nic Lutsey. "Quantifying the Electric Vehicle Charging Infrastructure Gap across U.S. Markets." icct. International Council on Clean Transportation, November 24, 2021. https://theicct.org/publication/quantifying-the-electric-vehicle-charging-infrastructure-gap-across-u-s-markets/.

34. Rural Highways

35. https://www.bts.gov/rural

36. Charging Stations By State – EVAdoption

37. Charging up America: Assessing the growing need for US charging infrastructure through 2030

38. https://eta-publications.lbl.gov/sites/default/files/halfway_to_zero_report.pdf

39. https://eta-publications.lbl.gov/sites/default/files/halfway_to_zero_report.pdf

40. Renewables account for most new US electricity generating capacity in 2021 - Today in Energy

41. Solar Futures Study | Department of Energy

42. https://www.ucsusa.org/sites/default/files/2020-05/evs-cleaner-than-gasoline.pdf

43. So Much For Coal's Rebound - Plant Closures Come Roaring Back. It's Time To Unlock A Just Transition.

44. How Urban Or Rural Is Your State? And What Does That Mean For The 2020 Election? | FiveThirtyEight

45. Alternative Fuels Data Center: Emissions from Hybrid and Plug-In Electric Vehicles

46. Alternative Fuels Data Center: Emissions from Hybrid and Plug-In Electric Vehicles

47. https://afdc.energy.gov/fuels/electricity_infrastructure.html#level1

48. https://my.xcelenergy.com/s/state-selector?return=%2Fs%2Fabout%2Fnewsroom%2Fpress-release%2Fxcel-energy-announces-new-electric-vehicle-smart-charging-pilot-with-automakers-MCAMWGE6254FFLNEAWSFYXMYBQA4

49. https://www.convenience.org/getattachment/Research/Consumer-Insights/Time-to-Shop/White-Paper.pdf

50. https://www.evgo.com/blog/dcfc-cost-components-much-more-than-electricity/

51. https://betterenergy.org/blog/demand-charges-and-dcfc/

52. https://www.nrel.gov/docs/fy17osti/68963.pdf

53. ATE, "Rate Design for EV Fast Charging: Demand Charges."

54. https://www.pge.com/en_US/small-medium-business/energy-alternatives/clean-vehicles/ev-charge-network/electric-vehicle-rate-plans.page

55. UTILITY COSTS AND AFFORDABILITY OF THE GRID OF THE FUTURE

56. https://www.energy.gov/articles/how-microgrids-work

57. https://inl.gov/article/electric-vehicle-charging-first-of-a-kind-national-lab-project-will-simulate-fast-charging-station-microgrids/

58. https://repository.law.umich.edu/cgi/viewcontent.cgi?article=1013&context=mtlr

59. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption#:~:text=Light%2Dduty%2C%20fully%2Delectric,light%2Dduty%20vehicles%20in%202021.

60. https://www.naiop.org/Research-and-Publications/Magazine/2018/Fall-2018/Business-Trends/Networked-Electric-Vehicle-Charging-Stations

61. https://crsreports.congress.gov/product/pdf/RL/RL30719/101

62. https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2020-broadband-deployment-report

63. Understanding Rural Attitudes Toward the Environment and Conservation in America

64. https://www.americanprogress.org/article/electric-vehicles-win-american-workers/

65. https://www.americanautomakers.org/sites/default/files/State_Of_The_US_Automotive_Industry_2014.pdf

66. https://www.americanautomakers.org/sites/default/files/AAPC%20ECR%20Q3%202020.pdf

67. https://www.ers.usda.gov/webdocs/publications/84758/eib-177.pdf?v=0

68. https://www.energy.gov/articles/doe-finds-strong-opportunity-job-growth-energy-sector-post-pandemic

69. https://www.zeta2030.org/news/new-national-poll-shows-that-a-large-bipartisan-majority-of-voters-favor-policies-to-accelerate-electric-vehicle-adoption

References

70. https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/community-benefits

71. https://www.ajc.com/news/rivian-to-build-electric-vehicle-plant-in-georgia-sources/VGX3MGWVNBDSHEUFC32VHPON5Q/

72. Center For Automotive Research. (2010). "Contribution of the Auto Industry to the Economies of all Fifty States and the United States."

73. https://www.friedmanrealestate.com/whats-driving-todays-location-decisions-in-the-auto-industry/

74. https://www.ncsl.org/research/environment-and-natural-resources/jump-starting-rural-economies.aspx

75. https://www.iea.org/reports/sustainable-recovery/transport

76. ChargerHelp Guiding Standards 2022

77. https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/community-benefits

78. https://afdc.energy.gov/case/3009

79. https://www.michigan.gov/whitmer/news/press-releases/2022/05/26/whitmer-announces-partnership-to-install-electric-vehicle-chargers-in-michigan-state-parks

80. https://www.nrdc.org/experts/miles-muller/ca-approves-55m-ev-charging-parks-beaches-schools

81. https://www.chargepoint.com/files/casestudies/cs-retail.pdf

82. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption

83. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf

84. https://www.naseo.org/data/sites/1/documents/publications/EVWest_NeedsAssessment_Final.pdf

85. Electric Vehicle Chargers at California State Parks

86. https://www.americanprogress.org/article/redefining-rural-america/

87. https://www.monarchtractor.com/mkv.html

88. https://cleantechnica.com/2021/02/25/why-electric-tractors-are-so-great-charging-just-1000-down-is-so-important/

89. https://www.fcc-fac.ca/en/knowledge/electric-tractor-technology.html

90. https://www.fueleconomy.gov/feg/evtech.shtml

91. Ibid

92. https://www.oemoffhighway.com/trends/equipment-launches/mining/press-release/21747420/caterpillar-inc-new-caterpillar-mining-equipment-focuses-on-reducing-emissions-and-improving-productivity

93. https://www.newscientist.com/article/2290944-how-electrification-is-changing-mining/

94. https://www.forbes.com/wheels/news/best-selling-cars-suvs-pickups-2021/

95. https://insideevs.com/news/508818/top-features-ford-f150-lightning/

96. https://blog.ucsusa.org/cecilia-moura/5-ways-rural-drivers-benefit-from-electric-vehicles/#:~:text=Drivers%20in%20rural%20areas%20often,travel%2059%20percent%20more%20miles.

97. https://www.greencarreports.com/news/1071688_95-of-all-trips-could-be-made-in-electric-cars-says-study#:~:text=The%20average%20daily%20drive%20total,an%20average%20of%2048.6%20miles.

98. https://www.greencarreports.com/news/1134758_epa-finds-median-range-of-evs-dropped-in-2021

99. https://www.ford.com/cmslibs/content/dam/vdm_ford/live/en_us/ford/nameplate/f-150f-150/2022/collections/3_2/2022_Ford_F150_Towing_Info_Oct20.pdf

100. https://rivian.com/support/article/what-is-the-maximum-towing-capacity

101. https://www.tesla.com/cybertruck#:~:text=With%20the%20ability%20to%20pull,any%20extreme%20situation%20with%20ease.

102. https://auto.howstuffworks.com/auto-parts/towing/towing-capacity/information/towing-gas-mileage.htm

103. https://www.motortrend.com/features/how-far-can-you-tow-with-electric-truck-range/

104. https://rivian.com/support/article/what-are-the-onboard-outlets-in-the-r1t

105. https://www.press.canoo.com/press-release/canoos-new-pickup-is-all-electric-all-american-ready-for-work-the-weekend

106. https://cleantechnica.com/2020/06/28/lordstown-motors-takes-the-wraps-off-its-endurance-electric-pickup-truck/

107. https://insideevs.com/news/560088/gm-trademark-onboard-power-bar/

108. https://www.arcimoto.com

109. https://www.purewatercraft.com/product/pure-outboard/

110. https://www.taigamotors.com/products/nomad

111. http://electric.travel/best-of/the-best-electric-atvs-as-of-december-2021/

112. https://www.nrel.gov/docs/fy14osti/60068.pdf

113. https://thomasbuiltbuses.com/school-buses/saf-t-liner-c2-jouley/

114. https://thomasbuiltbuses.com/content/uploads/2021/11/brochure-c2_jouley_and_proterra-winter-2021.pdf

115. https://www.evconnect.com/blog/what-is-vehicle-to-grid-for-electricvehicles#:~:text=Vehicle%2Dto%2Dgrid%2C%20or,cells%20for%20the%20electrical%20 grid.

116. https://innovationatwork.ieee.org/vehicle-to-grid-v2g-technology/

117. Ibid.

118. https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/individual-benefits

119. https://www.consumerreports.org/hybrids-evs/evs-offer-big-savings-over-traditional-gas-powered-cars/

120. https://publications.anl.gov/anlpubs/2021/05/167399.pdf

121. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf Based on savings over a 15-year period for rural households in Vermont and Virginia who switched to an EV.

122. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf

123. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf.

124. https://epm.ucdavis.edu/sites/g/files/dgvnsk296/files/inline-files/Preparing%20Rural%20America%20for%20the%20Electric%20Vehicle%20Revolution.pdf

125. https://epm.ucdavis.edu/sites/g/files/dgvnsk296/files/inline-files/Preparing%20Rural%20America%20for%20the%20Electric%20Vehicle%20Revolution.pdf

126. https://data.bts.gov/stories/s/ida7-k95k#household-expenditures-in-urban-and-rural-areas

127. https://www.energy.gov/eere/vehicles/fact-759-december-24-2012-rural-vs-urban-driving-differences

128. https://www.bls.gov/cex/tables/calendar-year/mean-item-share-average-standard-error/cu-area-type-2019.pdf

129. https://epm.ucdavis.edu/sites/g/files/dgvnsk296/files/inline-files/Preparing%20Rural%20America%20for%20the%20Electric%20Vehicle%20Revolution.pdf

130. https://newsroom.aaa.com/wp-content/uploads/2021/08/2021-YDC-Brochure-Live.pdf

131. https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/individual-benefits

132. https://www.mjbradley.com/sites/default/files/MJBA_Report_Rural%20Transportation%20Opportunities_Final_0.pdf

133. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf

134. https://www.transportation.gov/rural/ev/toolkit/ev-benefits-and-challenges/

References

individual-benefits

135. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf

136. https://www.ucsusa.org/sites/default/files/2020-11/rural-transportation-opportunities.pdf

137. https://www.ers.usda.gov/data-products/ag-and-food-statistics-charting-the-essentials/ag-and-food-sectors-and-the-economy/#:~:text=What%20is%20agriculture's%20share%20of,about%200.6%20percent%20of%20GDP.

138. https://www.ars.usda.gov/research/publications/publication/?seqNo115=346067

139. https://fs.hubspotusercontent00.net/hubfs/8829857/ZETA-WP-MHDV-Electrification_Opportunities-and-Barriers_Final3.pdf

140. https://www.experian.com/content/dam/noindex/na/us/automotive/market-trends/q4-2021-experian-auto-market-trends.pdf

141. https://www.energy.gov/oe/services/electricity-policy-coordination-and-implementation/transmission-planning/coordination

142. https://pubs.aeaweb.org/doi/pdfplus/10.1257/jep.24.3.233

143. https://www.forbes.com/sites/retailwire/2021/06/15/pandemic-e-commerce-boom-a-boon-for-retails-biggest/?sh=690d145ac286

144. https://www.eesi.org/articles/view/beyond-cities-breaking-through-barriers-to-rural-electric-vehicle-adoption

145. Ibid

146. https://www.morganlewis.com/-/media/files/publication/presentation/webinar/2019/autohour_distribution-vehicles-us--impact-state_law_19june19.pdf

OUR MEMBERS

Southern Company
RIVIAN
ioneer
EVgo
PG&E Corporation
WAVE
SIEMENS
Schneider Electric
SRP
Livent
SEA Electric
enel x
LUCID
electrum
ENGIE Impact
DUKE ENERGY
Momentum Automated Wireless EV Charging
Xcel Energy
Uber
ANALOG DEVICES AHEAD OF WHAT'S POSSIBLE
Copper Development Association Inc. Copper Alliance
PROTERRA
wallbox
EDISON INTERNATIONAL
AMPLY FLEET CHARGING SIMPLIFIED
Qmerit
NEXTera ENERGY
REDWOOD MATERIALS
ABB
volta
LORDSTOWN
NOVONIX
chargepoint
Li-Cycle
TESLA
Panasonic
PIEDMONT LITHIUM
conEdison
nrg
GreenPower MOTOR COMPANY
EVBOX
flo
Jervois
ARCIMOTO
BEAM
Faraday Future
VISTRA
ABTC American Battery Technology Company
ALBEMARLE
ARRIVAL
Lithium Americas

100% electric vehicle sales by 2030.

The next decade will be critical in implementing federal policies that accelerate the transition to zero emission vehicles and help address these problems head-on.

The advanced transportation sector already boasts hundreds of thousands of jobs but, if we encourage its growth, the U.S. can decisively win the global race to develop a new clean vehicle economy. This leadership will drive American prosperity and secure billions of dollars of economic benefits and job creation for generations to come.

ZETA

info@zeta2030.org | zeta2030.org