Missouri Freight Electrification Strategy

2026

MISSOURI DEPARTMENT OF NATURAL RESOURCES

NASEO
National Association of State Energy Officials

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- Ameren Missouri
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- Missouri Trucking Association
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Cover Photo: Terminal Consolidation Co. pure-electric terminal truck
Photo credit: Orange EV

A Note from Division of Energy Leadership

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The U.S. State Energy Program exists primarily to advance state priorities related to the energy sector. While energy makes up only a small portion of the overall economy, many other sectors depend entirely on the availability and affordability of energy, be it in the form of electricity, natural gas, motor fuels, or any of the other sources of energy we rely on every day. Transportation industries are becoming an increasingly important part of energy conversations through discussions of vehicle electrification, which this strategy contemplates, as well as other emerging vehicle technologies such as hydrogen, renewable drop-in fuels, and biofuels, which will be the focus of updates to this strategy in future years.

Electrification, especially of the freight sector, is still an emerging technology. As the technology improves and becomes more common, care must be taken to ensure that small, independent businesses and rural communities aren't left behind or disproportionately burdened by decisions made to support early adopters. This strategy is intended as a comprehensive view of medium- and heavy-duty electrification with that consideration in mind, and made to support Missouri industries as they consider future additions to their fleets.

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Executive Summary

Commercial fleets are increasingly interested in adopting medium- and heavy-duty (MHD) electric vehicles (EVs). While early adopters have shown that this technology can be leveraged to reduce operating expenses compared to conventional MHD vehicles, initial pilots have shown that the freight sector faces unique and exacerbated challenges to electrification. As such, the Missouri Department of Natural Resources, Division of Energy, in partnership with the National Association of State Energy Officials (NASEO), has developed the Missouri Freight Electrification Strategy that follows.

This strategy includes a suite of potential tactics that the state and relevant stakeholders can undertake to promote freight electrification and promote fuel and powertrain choice for this vital industry.

The strategy was developed based on industry-leading research, conversations with stakeholders, and guidance from the NASEO Freight Electrification Advisory Group. The strategy is intended to be a starting point and a living document that can be updated as freight electrification technologies and business models mature. The strategy is divided into three categories based on core competencies of the State Energy Office: planning, programs, and policies. Tactics included in the strategy are summarized below:

- **Planning:**
  - Understand Anticipated Charging Needs
  - Engage Directly with Local Fleets
  - Map Minimum Practical MHD EV Charging Network
- **Programs:**
  - Incentive Programs
  - Financing Opportunities
  - Utility Programs
  - Technical Assistance for Fleets
  - State Fleet Electrification
  - Recognize Leading Fleets
  - Organize Ride and Drives
  - Invest in Workforce Development
- **Policies:**
  - Adopt the Federal Weight Exemption for MHD EVs
  - Consider Implementing a Clean Fuel Program and/or an Indirect Source Rule
  - Adopt EV-Friendly Grid Policies

Additional information on freight electrification and relevant U.S. trends shaping electrification efforts and timelines can be found in Appendix A.

Acronyms

CaaS . . . . . Charging as a Service
CCS . . . . . Combined Charging Standard
CFS . . . . . Clean Fuel Standard
DESL . . . . . Dollar and Energy Saving Loan Program
DNR . . . . . Department of Natural Resources
DRPEP . . . . . Distributed Resources Plan External Portal
EPRI . . . . . Electric Power Research Institute
eTRU . . . . . Electric Transport Refrigeration Unit
EV . . . . . Electric Vehicle
FHWA . . . . . Federal Highway Administration
Fleet-ZERO . . . . . Fleet Zero-Emission Resource Opportunity
ICE . . . . . Internal Combustion Engine
ISR . . . . . Indirect Source Rule
kW . . . . . Kilowatts
LCMS . . . . . Load Control Management System
MCS . . . . . Megawatt Charging System
MHD . . . . . Medium- and Heavy-Duty
MoDOT . . . . . Missouri Department of Transportation
MoTA . . . . . Missouri Trucking Association
MSRP . . . . . Manufacturer's Suggested Retail Price
NACFE . . . . . North American Council for Freight Efficiency
NASEO . . . . . National Association of State Energy Officials
NYSERD . . . . . New York State Energy Research and Development Authority
NZEFC . . . . . National Zero-Emission Freight Corridor Strategy
OEM . . . . . Original Equipment Manufacturer
PAC . . . . . Powering America's Commercial Transportation
PS . . . . . Public Service Commission
SCE . . . . . Southern California Edison
SEP . . . . . U.S. State Energy Program
TCC . . . . . Terminal Consolidation Company
TCO . . . . . Total Cost of Ownership
TERP . . . . . Texas Emissions Reduction Plan

Introduction

Each year, over 313 million tons of freight, representing over $381 billion in value, is moved throughout Missouri by truck.[1] Professional drivers deliver groceries, clothing, medications, e-commerce packages, and other essentials to keep the economy thriving. This industry includes companies ranging from national giants like Prime (headquartered in Springfield), Artur Express (headquartered in Hazelwood), and Anheuser-Busch (headquartered in St. Louis) to small, "mom and pop" independent owner-operators with one truck. Together, the more than 187,000 freight vehicles on the road in the state travel over five billion miles each year.[2]

The vast majority of freight vehicles utilize conventional, internal combustion engine (ICE) powertrains that run on diesel or gasoline fuel. However, prices for these fuels are increasingly volatile, making long-term planning and profitability challenging for carriers.[3] Meanwhile, communities are impacted by the exhaust from these vehicles; cleaner options would support better air quality.[4] For example, diesel-burning trucks contribute to St. Louis' Ozone Nonattainment Area, shown in green in Figure 1 below.

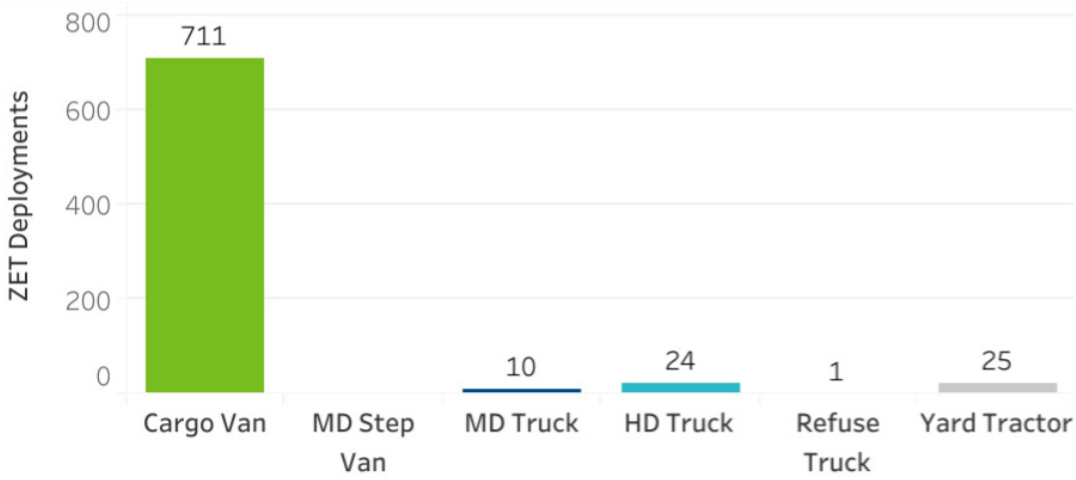
Figure 1: St. Louis Ozone Nonattainment Area and Monitoring Locations (Missouri DNR)[5]

Although medium- and heavy-duty vehicles make up just over one in 10 of the vehicles on the road, they are responsible for over half of the fine particulate matter and nitrogen oxides emitted from on-road vehicles.[6] Knowing this, trucking companies – "carriers" – are adopting alternative fuel vehicles, including EVs, to reduce pollution and ensure that they are good stewards of the communities in which they operate. Some fleets may have internal sustainability goals driving this adoption, while others may simply be interested in preserving their social license to operate.[a] Many fleets are also switching to EVs because of demands from their customers – "shippers" – many of which have internal sustainability goals of their own and are increasingly seeking opportunities to reduce emissions from their hired carriers in order to achieve their targets and minimize climate risk.[7]

a The social license to operate refers to the ongoing acceptance of a company or industry's standard business practices and operating procedures by its employees, stakeholders, and the general public.

As a result, fleets across the country are transitioning their ICE vehicles to MHD EVs to meet their operational needs. In Missouri, at least 771 zero-emission freight vehicles have already been deployed.[8] On the medium-duty side, Missouri residents may have seen one of Amazon's electric delivery vans from Rivian delivering packages in their neighborhood. With more than 25,000 on U.S. roads since 2022, these Amazon vehicles are operating in thousands of cities across the country, including Kansas City and St. Louis.[9]

Figure 2: Zero-Emission Truck Deployments in Missouri by Vehicle Segment (CALSTART)



Electric freight vehicle deployments in Missouri include heavy-duty models as well. For example, in 2020, Terminal Consolidation Co. (TCC), with financial assistance from the state's Volkswagen Trust Vehicle Replacement Program, became the first fleet in Missouri to deploy a fully electric Class 8 truck by placing into service an Orange EV pure-electric terminal truck to move shipping containers at TCC's Kansas City operation.[10] TCC General Manager David Aubrey said of the deployment, "We are always looking to take advantage of new technology, systems, and equipment to make us more efficient, but now more than ever, it's important to provide the best tools to keep our personnel safe and healthy. We anticipate that going green with Orange EV will be better all-around: for the environment, for drivers, and for bottom-line operations."

Figure 3: Terminal Consolidation's Orange EV Electric Terminal Truck

Headquartered in the Kansas City metropolitan region, Orange EV represents the economic development potential of freight electrification. Since its founding in 2012, Orange EV has deployed over 1,700 electric terminal trucks for more than 360 fleets across 40 states, along with Canada and the Caribbean. Cumulatively, Orange EV trucks have surpassed 30 million miles and 11.4 million hours of operation.[11] Their success has drawn the attention of both fleet operators and politicians, with Congressman Sam Graves (R-MO), Chairman of the U.S. House Committee on Transportation and Infrastructure, visiting their facility in Kansas City in 2025.[12]

Figure 4: Congressman Sam Graves Visiting Orange EV's Kansas City Facility (Orange EV)

Fleets in Missouri are well-positioned to adopt MHD EV technology. Over three-quarters of the freight vehicles in the state return to a central location between trips, and more than 95 percent travel less than 200 miles per trip, making their operations prime candidates for electrification using current technology. [13]

However, despite the success of early adopters of EV technology, a myriad of barriers still exists for many fleets interested in freight electrification, including a lack of accessible charging infrastructure, upfront costs, long project timelines, and limited industry knowledge.[14]

To help address these barriers and ensure that the freight industry can choose the best technologies and powertrain options for its operations, the Missouri Division of Energy has developed this Freight Electrification Strategy. In the pages that follow, this strategy outlines important information for Missouri-based fleets considering MHD EVs and ways that the State of Missouri may remove barriers to make purchasing and deploying electric freight vehicles and charging infrastructure less complex and challenging.

Options for Missouri

This strategy outlines actions that the State of Missouri, along with private and public-sector partners, can take to advance freight electrification. Building on the success of the Department of Natural Resources' (DNR's) minimum practical EV charging network for passenger cars, this strategy outlines what a similar network might look like for MHD vehicles traveling along the state's key freight corridors – and lays out tactics to help achieve such a network and enable fuel and powertrain choice for Missouri's essential freight industry.

This strategy was developed by the State Energy Office, the Missouri Division of Energy, in partnership with NASEO based on industry-leading research, conversations with stakeholders, and guidance from the NASEO Freight Electrification Advisory Group. Stakeholder engagement included a kickoff workshop in November 2024.[15] Electric truck and electric transport refrigeration unit (eTRU) manufacturers, the Missouri Trucking Association (MoTA), Clean Cities and Communities groups, electric utilities and utility associations, Missouri Public Service Commission (PSC) staff, local government, labor representatives, and nonprofit subject matter experts all participated in the workshop, and their feedback is included in the options that follow.

Figure 5: Missouri Freight Electrification Kickoff Event in Jefferson City (NASEO)

This strategy is intended to be a starting point and a living document that can be updated as freight electrification technologies and business models mature. The strategy is divided into three categories, based on core competencies of the State Energy Office: planning, programs, and policies.

Planning for Freight Electrification

One of the most important action items states can undertake as it relates to freight electrification is planning for it. The transition is no longer a question of if, but when. The State Energy Office is in early planning with key partners in the freight and electricity sectors to project adoption of MHD EVs and plan for required charging infrastructure and power needs.

In addition to the charging needs of the vehicles themselves, the state is considering charging needs for transport refrigeration units, which are increasingly electrifying as well. The State Energy Office is uniquely positioned to lead much of this work and can consult with and inform the governor, other state agencies, legislators, and utilities as the effort develops.

Understand Anticipated Charging Needs

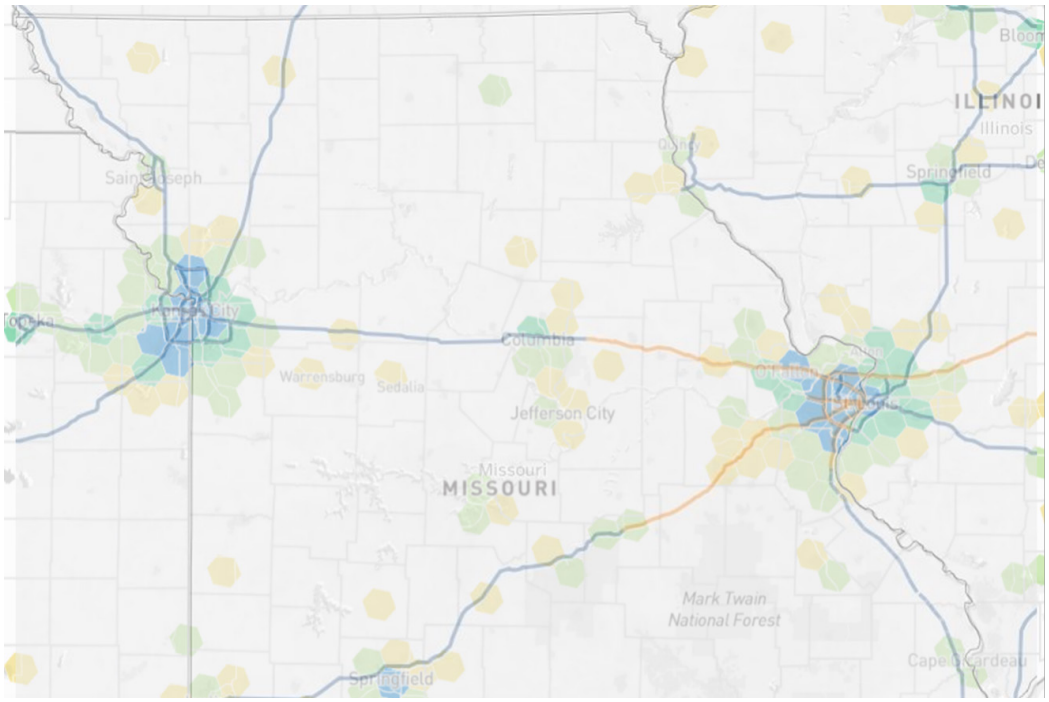
The state can anticipate where charging may be needed by mapping "hot spots" of freight activity, especially operations that are relatively easily and economically electrified (see Appendix A). By understanding where charging is likely to be needed, the state can target outreach and education efforts and prioritize utilities to work with to prepare the grid for this new load. Because State Energy Offices don't act as regulators or utilities, they can focus on informing both stakeholder groups.

For example, in New Jersey, the state has developed a "Medium and Heavy-Duty Electric Vehicle Charging Infrastructure Mapping Tool" designed to visualize and analyze critical transportation data for fleet management and electric vehicle infrastructure development. It offers users insights into MHD vehicle registrations throughout the state, key freight routes, and existing MHD EV charging stations.[16]

Similarly, in New York, the New York State Energy Research and Development Authority (NYSERDA) commissioned a study to estimate the cost of various clean transportation futures considered in the state's Clean Transportation Roadmap for the state's electric distribution system.[17] This study included anticipated impacts from MHD EVs.

However, the state need not undertake a unique study to begin understanding where charging hot spots are likely to exist for MHD EVs. Nonprofit partners have developed tools that any state can use, often at no cost. For example, the Electric Power Research Institute (EPRI) developed eRoadMAP, an interactive, online tool for understanding where, when, and how much EV charging load is likely to materialize on the U.S. electric grid, including from MHD EVs.[18] This free public resource highlights both immediate and future charging needs. While eRoadMAP includes anticipated electricity needs for all segments of transportation electrification, EPRI shared the below map specific to *MHD* needs.

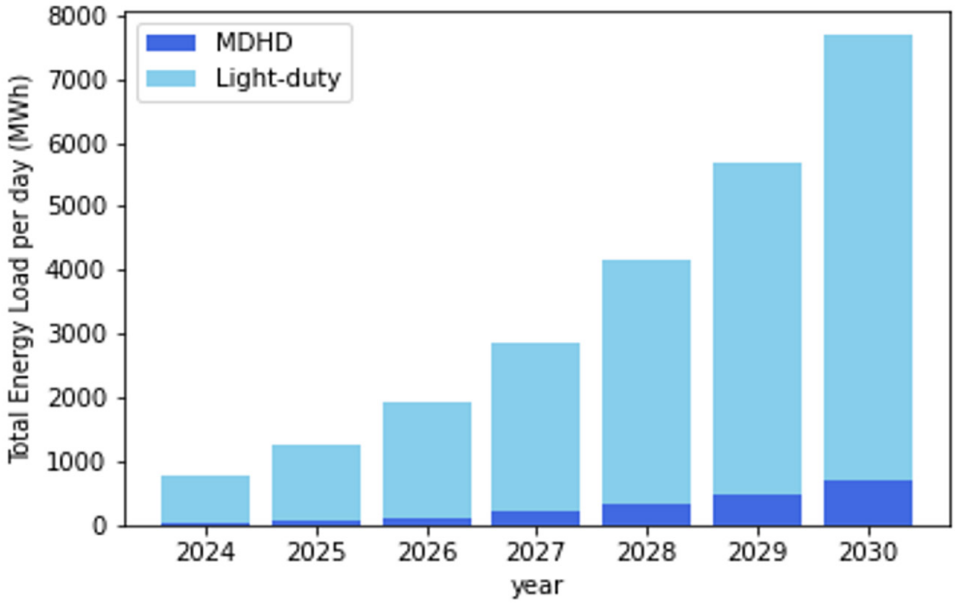
Figure 6: Anticipated MHD EV Energy Needs in 2030 (EPRI)



The colored hexes in the map represent where electricity is anticipated to be needed to support MHD EVs in 2030. Darker colors represent higher demand, which is clustered around St. Louis, Kansas City, Springfield, and Columbia. In St. Louis County alone, projected electricity load from MHD EVs in 2030 is anticipated to be 236,371 MWh.[19]

Holistic grid planning should include not just charging needs for MHD EVs, but for *all* transportation electrification sectors, including passenger cars. That said, important differences exist between light-duty and MHD EV needs. For example, while anticipated load from light-duty EVs is large, it is typically spread across the entire distribution system. Meanwhile MHD load is clustered in fewer, denser locations.

Figure 7: Projected Missouri Total EV Energy Use per Day (EPRI)



Hotspot analyses like these can help states understand the scale of new load coming and can help prioritize local governments and utilities for additional outreach and coordination. For utilities, hotspot analyses can guide which substations to upgrade and where to prioritize capacity investments. They can also inform integrated resource plans, which for most Missouri utilities, do not yet account for transportation electrification. For regulator such as the Missouri PSC, these analyses can inform rate cases and cost-recovery mechanisms that enable proactive investment in grid infrastructure.[20] Utilities' legal duty to serve obligates them to anticipate and prepare for future end-use electrification loads, including freight electrification.[21] Since grid upgrades can take multiple years to move through the regulatory and permitting process, planning ahead is key to ensure sufficient grid and generation capacity to support MHD EVs.[22]

Engage Directly with Local Fleets

No model is perfect, but projections can be refined and updated based on real world input from fleets operating in the state. The state may undertake direct outreach and/or try to convene fleets for state-hosted events, or it may prefer to meet fleets where they are by participating in local freight events in order to learn about their electrification efforts and plans. For example, the Missouri Trucking Association, a participant in the state's planning efforts to develop this strategy, hosts an Annual Convention each fall for its members, in addition to other events throughout the year.[23]

The State Energy Office also has a long history of collaboration and partnership with local Clean Cities and Communities coalitions, which have existing relationships with local fleets interested in alternative fuels. Missouri is home to three such coalitions, including:

- Eastern Missouri Alliance for Clean Transportation
- Kansas City Regional Clean Cities Coalition
- Ozarks Clean Fuels Coalition

Fleets' electrification plans can be reflected in EPRI's eRoadMAP tool mentioned above. It can also be shared privately with relevant electric utilities using EPRI's GridFAST tool, a secure information exchange platform that helps businesses and other organizations engage early and efficiently with utilities to accelerate the energization of EV charging projects.[24] Once a utility match is made, EV customers can get expert advice and resources to refine their plans, while utilities can start preparing for the future increased load capacity, thereby saving time and money for all involved parties. Missouri may wish to encourage utilities and fleets to utilize GridFAST or another similar tool for smoother planning processes.

In addition to soliciting input from fleets, the state may share information about available resources. For example, the state can share Missouri-specific information on available incentive programs (grants, vouchers, rebates, tax credits), local dealers that offer electric commercial vehicles, EV-certified maintenance shops, certified EV charging installers and/or technicians, a map of public and shared charging options within the state, links to relevant fleet advisory services, and local case studies and success stories. The state may also be able to share key points of contact at each electric utility to make it easy for fleets to get in touch with relevant staff. This type of information can be shared directly with fleets via meetings and events, and online on a new state government webpage, for example.

Map Minimum Practical MHD EV Charging Network

Based on the hot spot mapping described above, as well as fleet input on electrification plans, the state can begin to map out a minimum practical network for MHD EV charging throughout the state.

Building off the National Zero-Emission Freight Corridor Strategy (NZEFCS), the state may choose to establish a charging hub in the St. Louis area and develop shared and public charging out from there, prioritizing sites along I-70 and I-44. The NZEFCS envisions this would happen by 2027. Over the next 15 years, the strategy envisions that charging will be fully built out along these corridors, as well as along I-29, I-35, I-49, and I-55.

Figure 8: Phase 1 of the National Zero-Emission Freight Corridor Strategy (JOET)

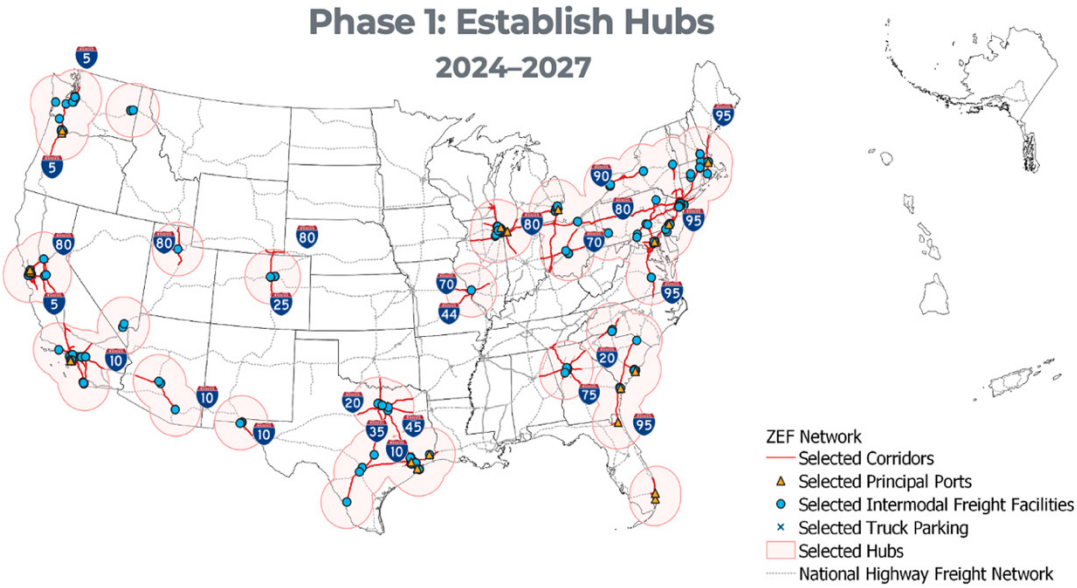
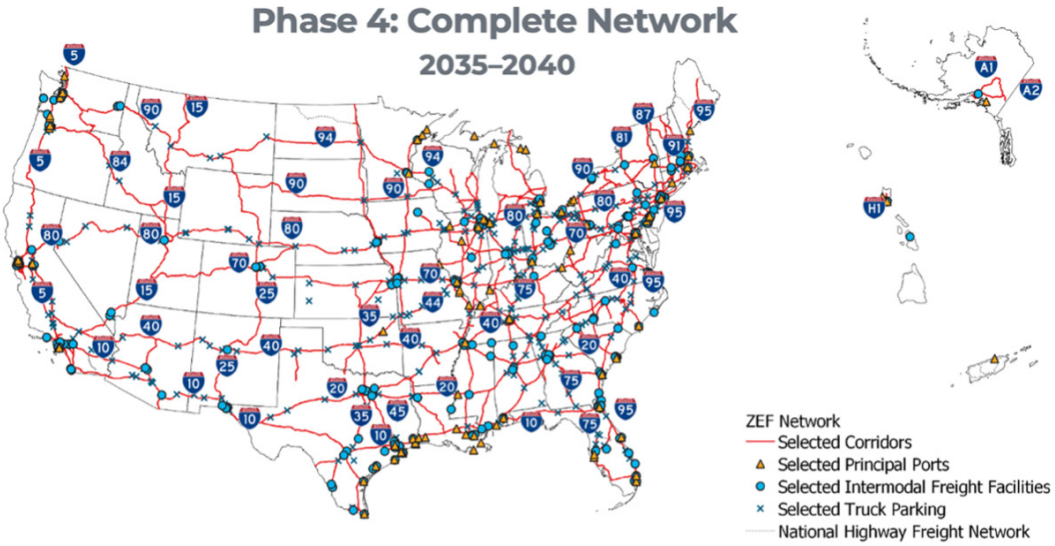
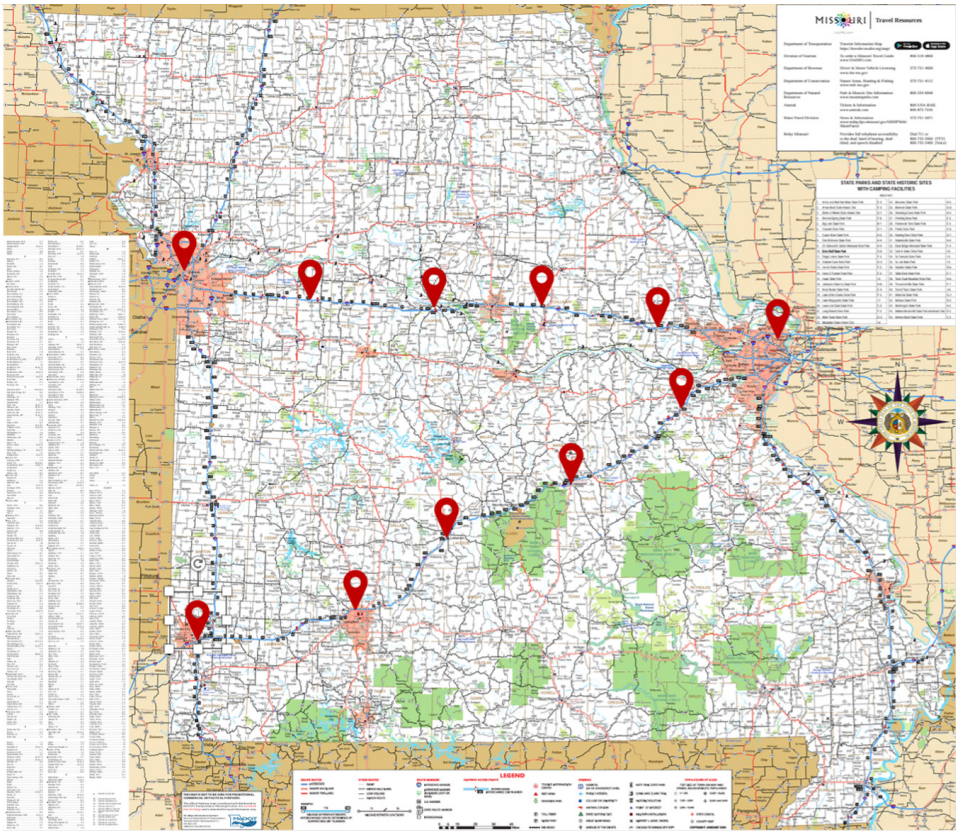


Figure 9: Phase 4 of the National Zero-Emission Freight Corridor Strategy (JOET)



While there are not yet any formal standards for how far apart MHD charging stations should be placed along corridors, leading states anticipate charging stations will be needed every 50-100 miles.[25] Figure 19 below outlines what this might look like for Missouri, with an initial charging hub in St. Louis, then five additional stations built along I-70 to cover the whole corridor to Kansas City. These stations might be located in or near Warrenton, Kingdom City, Boonville, Concordia, and Kansas City. Five additional stations would sufficiently address MHD charging needs along I-44, with stations potentially located near St. Clair, Rolla, Lebanon, Springfield, and Joplin.

Figure 10: Missouri Minimum Practical MHD EV Charging Network for I-70 and I-44 (NASEO and Missouri State Highway Map)



Missouri may wish to engage the many municipal and coop utilities, particularly along the I-44 corridor, to better understand their electricity rate structures, which vary from one utility to another. The variability in rate structure may prove challenging for building out charging along some corridors such as I-44. The State Energy Office, in collaboration with the PSC and other relevant agencies, may find it useful to provide technical assistance to these utilities and help stakeholders understand key differences in existing rate structures in order to plan more strategically for charging hubs. The state may also work with utilities to evaluate capacity at locations identified in early phases of the NZEFCS. For example, in Texas, CenterPoint Houston has reviewed each of the locations within their territory identified as a Phase 1 hub location and analyzed the projected magnitude and timing of loads and the anticipated distribution system investments needed to serve such loads.[26]

As Missouri continues its *Improve I-70* project through 2030 to "provide a safe, efficient, environmentally sound and cost-effective transportation facility that responds to corridor needs as well as expectations of a national interstate," it may wish to consider any efforts

that might be taken concurrently, such as ensuring power is available near any truck parking for future charging needs. Regardless of electrification trends, stakeholders have been clear that additional truck parking is needed throughout the state, and ideally Missouri can tackle these needs together since lower-power, overnight charging is more economical and better for the grid. The Missouri Division of Energy can work with the Department of Transportation to ensure any such highway projects are appropriately added to the *Statewide Transportation Improvement Program*.

In addition to engaging fleets, as described above, the state could utilize this minimum practical network to reach out to Charging-as-a-Service (CaaS)[b] providers and existing truck stop operators in priority locations to discuss their plans for MHD EV charging investment in Missouri, and potentially build interest in specific site hosts at these locations.

Once the state has completed initial planning actions, it can use the information gleaned to develop and implement programs to support freight electrification efforts within Missouri.

Programs Supporting Freight Electrification

Incentive Programs

State-run incentive programs for both vehicles and charging infrastructure are becoming more common across the U.S. Over a dozen states already offer some form or another of financial incentives to help address the upfront cost of MHD EV technology.[27]

Vehicle Incentives

Because of the price premium associated with many MHD EVs today – especially heavy-duty models – vehicle incentives are one of the most impactful strategies to support fleets with electrification ambitions.[28] Vehicle incentives can take a myriad of forms, from grants to "on the hood" vouchers. The latter are generally preferred by fleets because of their ease of use and the credits being applied directly at the point of sale. Incentive reimbursement *after* a purchase can be challenging from a cash flow perspective and require short-term bridge loans to cover the cost.

Nevada, for example, established a voucher incentive program in 2023 for the purchase of zero-emission MHD vehicles, offering up to $175,000 per vehicle.[29] Texas has offered a variety of grants as part of the Texas Emissions Reduction Plan (TERP).[30] The Rebate Grants Program provided funding for heavy-duty EVs in certain areas of Texas, while the Texas Clean Fleet Program provided funding to replace diesel-powered vehicles with alternative fuel and hybrid vehicles, including EVs.[31] [32] The programs are expected to re-open in April 2026 and January 2027, respectively. Indiana also offers grants to help replace or retrofit medium- and heavy-duty vehicles with new alternative fuel vehicles, including MHD EVs. [33] North Dakota offered a similar program, though it is no longer accepting applications.[34] As mentioned previously, the state's Volkswagen Trust Vehicle Replacement Program assisted in funding the first electric Class 8 terminal tractor in Missouri, and though few participants in that program chose to invest in electric vehicles, a more dedicated funding program could find success based on a similar model.

b Charging-as-a-Service (CaaS) is a subscription business model where a provider supplies, installs, manages, and maintains EV charging infrastructure for customers (e.g., fleets), bundling hardware (EVSE), software (management systems), installation, upkeep, and customer support into one service. CaaS models help eliminate large upfront costs and operational burdens for the customer through predictable monthly fees.

State incentive programs vary dramatically across the U.S. relative to funding amounts, eligible segments, and other criteria. For example, a state may focus limited funds on vehicle types most likely to electrify in the near term, or on those with the biggest impact on pollution reduction. Missouri may choose to offer incentives for bulk purchases of MHD EVs. Tailoring incentives to encourage large volume purchases (e.g., a minimum number of vehicles) could help drive overall adoption, focus adoption on fleets with capacity to manage the change, and help fleets secure better pricing from vehicle original equipment manufacturers (OEMs).[35]

Charging Incentives

By effectively narrowing the price gap between conventional and electric freight vehicles, states can increase demand for MHD EVs. In turn, this increased demand can spur demand for charging infrastructure, thereby making CaaS providers more likely to invest. Incentives for charging infrastructure can also help eliminate financial barriers to freight electrification.

Some state incentive programs offer funding toward both vehicles and charging infrastructure. For example, Texas' All-Electric grant program, which began in 2023, offers grants on a first-come, first-served basis for repowering or replacing eligible vehicles and equipment with all-electric models, along with supporting infrastructure.[36] Similarly, Tennessee's Medium- and Heavy-Duty Vehicles Grant Program provides competitive grants for replacing eligible MHD diesel vehicles with alternative fuel vehicles, including EVs, and funding can help cover associated charging infrastructure costs.[37] Meanwhile, some state incentive programs offer funding specifically for charging. For example, Colorado's Fleet Zero-Emission Resource Opportunity (Fleet-ZERO) program offers competitive grant funding for EV charging to support electric fleet vehicles and equipment, including charging to serve MHD EVs.[38]

When considering incentives for MHD charging infrastructure, the state may wish to make funding available for depot-based and shared charging, knowing that both will be needed. The Fleet-ZERO program referenced above is available for private depot charging; shared, public, and semi-public fleet charging; and fleet CaaS. Where possible, Missouri could encourage managed charging to mitigate load and grid impacts, as well as minimize charging expenses for fleets. Managed charging may not work for all fleets and may be less feasible for fleets that prioritize operational continuity over cost savings from fueling. As such, Missouri should be flexible where possible to preserve fleet optionality. Missouri's utilities may be able to develop managed charging infrastructure pilots, and the state may be able to convene stakeholders around this effort.

The state may also wish to make local energy assets like battery energy storage systems eligible for funding in order to help alleviate grid capacity concerns, particularly around peak demand. The state may also wish to make electrical system upgrades eligible for funding, as these will likely be required in addition to the charging hardware and can sometimes be more costly than the charging hardware itself.

The state could also consider using its position as a neutral public-sector party to aggregate demand from multiple fleets for a centralized charging hub. This demand could include smaller fleets that wouldn't otherwise be able to build or invest in their own charging sites, and could help ensure that small businesses aren't left behind with respect to this new technology. Demonstrated demand can help the state solicit top-tier proposals for charging incentives.

Funding State Incentive Programs

When contemplating a new incentive program, whether for MHD EVs, charging infrastructure, or both, Missouri should think creatively about potential funding sources. There are many options for these sorts of programs. Many states fund MHD EVs via their states' Volkswagen Diesel Emissions Settlement, including Missouri. For example, the Tennessee, North Dakota, Indiana, and Texas All-Electric programs mentioned above were funded by the states' Volkswagen Settlement Programs.[39] Under Missouri's Beneficiary Mitigation Plan, the state made $41 million available for government entities and private business owners with old diesel vehicles and equipment, as well as for EV charging infrastructure.[40] Over $6,000,000 was dedicated to EV charging infrastructure projects, representing the maximum 15 percent allowable to the award category, though this category is strictly limited to light-duty infrastructure.[41]

Figure 11: VW Award Categories and Funding (MO DNR)

Award Categories		Eligible Mitigation Action Overview	Amount (Millions)
Vehicle Replacement Programs	1. School Buses	School buses with 2009 and older engines can be replaced with a new bus or engine	$12
	2. Government Trucks	Large and medium government-owned trucks with 1992 to 2009 engine can be replaced with a new vehicle or engine	$6
	3. Transit and Shuttle Buses	Transit and shuttle buses with 2009 and older engines can be replaced with a new bus or engine	$4
	4. Nongovernment Trucks	Large and medium nongovernment-owned trucks with 1992 to 2009 engine can be replaced with a new vehicle or engine	$6
	5. Locomotive and Marine	Older switchyard locomotives can be replaced or repowered; older ferries and tugs can be repowered.	$2
	6. Airport and Cargo Equipment	Older airport ground support equipment can be replaced with electric vehicles or engines; forklifts can be replaced with electric vehicles or engines	$2
	7. DERA Option	States can use VW Trust funds as their non-federal voluntary match for the federal DERA program, allowing project types not otherwise allowed under the VW Trust to be funded	$3
8. Electric Vehicle Charging Stations		Electric vehicle charging stations can be built for light duty vehicles near highways, workplaces, or multi-unit dwellings	$6

As of July 2025, Missouri has drawn and expended $39 million of the $41 million available to the state. As such, the state may consider developing new funding sources to incentivize MHD EVs and charging. For example, Colorado's Clean Fleet Vehicle and Technology program offers competitive grant funding for eligible clean fleet vehicles and technologies, including MHD EV options.[42] As mentioned above, the Fleet-ZERO program provides grants for charging.[43] Both programs are funded by an innovative Retail Delivery Fee on deliveries like e-commerce packages.[44] Texas' TERP programs mentioned above are funded by a designated stream of funding from specific statewide surcharges and fees applied to the sales, use, storage, registration, and inspection of heavy-duty off-road and on-road vehicles and motors, including truck-tractors and semi-trailers.[45] Still other states have secured funding via federal programs like the Federal Highway Administration's (FHWA's) Charging and Fueling Infrastructure (CFI) Discretionary Grant Program.[46] States may also consider a revenue- and technology-neutral manufacturer incentive program that encourages cleaner internal combustion engine vehicle sales while providing significant incentives to zero-emission vehicles.[47]

Additional potential sources of funding for state-run incentive programs include:

- **National Electric Vehicle Infrastructure Program** (FHWA) – can be used to fund EV charging stations, including for MHD EVs
- **Vehicle Technologies Office Funding Opportunities** (U.S. Department of Energy) – changes each year but often has funding available for MHD EV demonstrations and pilots
- **Congestion Mitigation and Air Quality Improvement Program** (FHWA) – can fund MHD EVs and related charging equipment
- **Diesel Emissions Reduction Act funding** (U.S. Environmental Protection Agency) – provides grants and rebates that protect human health and improve air quality by reducing harmful emissions from diesel engines
- **U.S. State Energy Program (SEP) funding** (U.S. Department of Energy) – longstanding program that provides flexible, formula-based funds to State Energy Offices, which can utilize this funding for a number of energy-related activities, including advancing state-led energy initiatives tailored to their unique resources, delivery capacity, and energy goals
- **Charging and Fueling Infrastructure discretionary grant program** (FHWA) – provides funding for infrastructure investments for charging and refueling stations for electric, hydrogen, propane, and natural gas vehicles, both for communities and corridors; unclear when future rounds will open

Tax Credits

Finally, when considering incentives, it's important to remember that they need not always take the form of grants, vouchers, or rebates. For example, some states offer tax credits and/or sales tax exemptions for MHD EVs. For example, Georgia offers tax credits up to $2,500 to businesses that install EV charging infrastructure.[48] Colorado offers both tax credits and sales tax exemptions for MHD EVs.[49] [50] Missouri could consider offering tax credits for MHD EVs purchased within the state. Because the market for MHD EVs is currently small, any initial impacts on state revenue would be minimal.

Financing Opportunities

In addition to financial incentives like grants and vouchers, the state could offer financing support for MHD EVs. For example, the Nebraska Department of Water, Energy, and Environment, the State Energy Office, administers the Dollar and Energy Saving Loan (DESL) Program, which provides low-interest loans for energy-related projects, including certain alternative fuel and electric transportation investments. [51]

DESL financing is available for commercial electric vehicle projects and associated charging infrastructure, but not for consumer electric cars or trucks, with eligible borrowers able to finance up to $500,000 per project at interest rates of five percent or less, depending on the project type and terms. The DESL Program loan capital is funded through Oil Overcharge and American Recovery and Reinvestment Act funds, while program administration is funded by the U.S. State Energy Program. California runs a Zero-Emission Truck Loan Pilot Project, designed to provide financing opportunities for both heavy-duty zero-emission vehicles and charging or fueling infrastructure.[52] Due to unknown residual values for this new technology and the risk associated with this unknown, government-backed loan guarantees can be highly effective in unlocking competitive financing options for MHD EVs.[53]

Utility Programs

States can work with utilities to develop and share information about their program offerings. These can include make-ready programs that allow utilities to pay for necessary site upgrades for EV charging in order to reduce the upfront costs of installing EV charging stations, making it more accessible for fleets. Make-ready programs are typically rate-based by utilities, and regulatory approval is needed to enable these programs at investor-owned utilities. As of the publication of this strategy, the authors are not aware of any make-ready programs for fleets within Missouri.

Additional utility programs can include vehicle and/or charging incentives offered through utilities, as well as technical assistance. A summary of example offerings from Missouri utilities is below:

UTILITY	PROGRAM	DESCRIPTION
Ameren Missouri[54]	Fleet Advisory Service	Complimentary third-party fleet electrification studies, including feasibility, costs, available incentives, and contractor connections
	Charge Ahead – Electric Vehicles Program	Incentives for fleet charging infrastructure
	Charge Ahead - Business Solutions Program	Incentives for eTRU charging ports
Evergy MO[55]	Fleet Advisory Too/	Online tool powered by Zappy Ride that allows business customers to compare the cost to own an EV vs. a gasoline vehicle. The tool offers charger configuration recommendations based on operational needs, fuel cost savings, electric rate comparisons, available incentives, carbon reduction estimates, and return on investment calculation.
	EV Charging Rebates	Incentives for fleet charging infrastructure
	Business EV Rate Plan	Time-of-use plan for businesses with separately metered EV chargers, which can lower energy bills by incentivizing charging outside of high demand times
Liberty Utilities (Algonquin Power & Utilities Corporation)[56]	Missouri Commercial Vehicle Electrification Program	Pilot program that supports the deployment of smart Level 2 EV charging stations for use by EV fleets. Chargers are installed, owned, and operated by Liberty
	Missouri Non-Road Rebate Pilot Program	Pilot program that provides incentives to encourage adoption of qualifying electric technologies that would otherwise be powered by gasoline or diesel, including electric forklifts, eTRUs, and truck stop electrification equipment to power driver cabin appliances

The state can help get the word out to fleets about these types of utility programs. The State Energy Office can also engage regulators and legislators about the need for these types of programs.

If and when make-ready programs are launched in Missouri, the state can work with utilities to track key performance indicators such as the number and location of sites that leverage such programs, and the impact of this new charging on grid load and rates. This data will be important to inform future iterations of the programs, as well as other MHD EV programs.

Technical Assistance for Fleets

The state might consider managing a technical assistance program for fleets. States like Massachusetts and New Jersey offer fleet advisor services free of charge, and this sort of tailored concierge service can help fleets develop electrification plans and take them from the planning stage to implementation.[57] [58] Technical assistance can include analyses of fleets' existing operations, available MHD EV models that would be a good fit to replace existing ICE vehicles, available incentive programs, and more.

State Fleet Electrification

The state can lead by example with respect to freight electrification by electrifying its own fleet of vehicles. Not only will this spur increased market demand for these vehicles, but it will also help develop expertise within state government about MHD EVs and charging. For example, in North Carolina, Executive Order Number 271 directs cabinet agencies to prioritize zero-emission vehicles in the purchase or lease of new MHD vehicles with a gross vehicle weight rating greater than 8,500 pounds. To support implementation of this directive, the North Carolina Department of Administration is working to add MHD EVs to state term contracts for its replacement vehicle program and will report on its efforts in the agency's annual North Carolina Motor Fleet ZEV Plan.[59] Vermont requires the state to purchase or lease hybrid or plug-in EVs "to the maximum extent practicable," and to ensure that at least 75 percent of vehicles purchased or leased annually by the Department of Buildings and General Services must be EVs.[60] Nevada requires state purchasers to prefer vehicles that minimize emissions and total cost of ownership and has set a goal to "pursue and support, to the extent practicable, a transition of all publicly-owned vehicles [including MHD vehicles] to vehicles which emit zero tailpipe emissions by 2050."[61] Michigan has committed that all MHD vehicles in the state fleet will be zero-emission by 2040.[62] Additional states have established requirements for state procurement of zero-emission vehicles, set preferences for EVs and other zero-emission vehicles, and evolved state procurement processes to support electric options.[63]

In addition to saving taxpayers money, electric state vehicles can help educate the community, including local fleet operators, who see the state vehicles on the road or at job sites and thereby gain exposure to the technology. Resources exist to help states plan and implement the electrification of their fleets. For example, the State Fleet Electrification Cohort, an initiative of the Electrification Coalition, provides a forum for state agencies to share resources, exchange information, and collaborate.[64] States also have access to Drive EV Fleets, an online procurement portal created by Sourcewell and the Electrification Coalition that provides U.S. public entities, including state governments, with equal access to competitively bid EVs and charging infrastructure.[65]

As the state constructs EV charging to support its own fleet, it may consider making this infrastructure available to the public to increase utilization and return on investment while increasing access to charging for other fleets.

Recognize Leading Fleets

In addition to integrating MHD EVs into the state's fleet, Missouri could choose to recognize and celebrate other fleets successfully operating MHD EVs within the state. For example, in addition to the Amazon and TCC EVs mentioned above in the Introduction, Artur Express acquired three fully electric trucks in 2023, including two Freightliner eCascadias and one Volvo VNR Electric for use on a dedicated local route in the St. Louis area.[66] Drivers praised the trucks' quiet and smooth operation, and Vice President of Corporate Administration Kristi Randall said the purchase "affirms [Artur's] willingness to not only embrace the future of freight, but to lead it."

Figure 12: Artur Express' Electric Truck Fleet (Artur Express)

Missouri might consider creating a program to recognize fleets like Artur Express, TTC, and Amazon for their leadership. Such a program could showcase best practices to other local fleets, helping spread awareness of this technology and how it's being utilized in Missouri. A recognition program may also help local shippers hoping to contract with carriers utilizing MHD EVs connect with these fleets. The Tennessee Green Fleets Certification Program, for example, recognizes fleets that are based or operate in Tennessee to receive certification for their efforts to reduce petroleum consumption, use alternative fuels or advanced vehicle technologies, and reduce emissions.[67] Certified fleets are honored at an annual awards event.

Organize Ride and Drives

The state may consider hosting MHD EV Ride and Drive events to familiarize fleets with available models, conveniently bringing many together in one place for test drives and to let fleet managers and drivers kick the tires. These types of events have been successful in the light-duty space and may be even more important for MHD operators, who need full confidence in a technology's ability to meet their needs. The state can work with local dealers to organize these events and may be able to secure venues for the evens and/or cover event expenses such as catering and A/V needs.

Invest in Workforce Development

The state may support workforce development programs for MHD EVs. Much of this training is unique to EVs but not necessarily MHD vehicles. For example, electricians and technicians must be trained to install, maintain, and repair EV chargers. By utilizing U.S. State Energy Program funding, the Georgia Environmental Finance Authority provides scholarships to Gwinnett Technical College and Ogeechee Technical College students interested in learning about the growing EV infrastructure field and its expanding demand. Scholarships cover tuition and personal protective equipment to utilize in the classroom and the field. During the 50-hour EV Charging Equipment Technician course, students learn about charger installation, commissioning, networking, troubleshooting, safety, and best practices.[68]

Technicians must be trained to work on MHD EVs. Much of this training is provided by equipment manufacturers, though states may support training via scholarships. Vehicle dealers must be trained as well. To prepare for growing demand, truck dealerships are increasingly investing in training and certification programs for staff. For example, the Nextran Truck Center in Kansas City is a certified electric dealer for Volvo Trucks, signifying that they have fully trained their sales and service teams to support customers' electric truck deployments.[69] Missouri may consider working with additional local truck dealerships to help educate them about charging access across the state and relevant state and utility programs and incentives.

The state can also support training of emergency responders on how to respond to incidents involving EVs and battery fires. For example, Tennessee has hosted many Alternative Fuel Vehicle Safety Trainings for first responders through the National Fire Protection Association. In the spring of 2025, Tennessee hosted three trainings that brought together over 110 attendees representing 22 different organizations across federal, state, county, city, volunteer, and private fire departments.[70] In Missouri, the Division of Energy is already supporting the Missouri Division of Fire Safety's Training and Certification Unit.[71] The state may wish to prioritize training in communities with MHD EV hot spots, as identified above and expand these trainings.

Policies Supporting Freight Electrification

The state could consider adopting new policies to remove barriers to freight electrification, including policies related to vehicles, charging, and the electric grid.

Weight Exemption for MHD EVs

Due primarily to their battery packs, EVs tend to weigh more than their conventional ICE counterparts. Because vehicles are limited by how heavy they can be, this additional weight can reduce vehicles' payload capacity, thereby impacting a fleet's bottom line. To avoid this scenario and ensure that MHD EV operators are not negatively impacted by the additional weight, the federal government has adopted weight exemptions for alternative fuel vehicles, including EVs, allowing them to operate at higher gross vehicle weight rating limits – often 2,000 pounds greater than those for comparable conventional vehicles.[72] Many states have followed suit, including Arizona, Arkansas, California, Colorado, Connecticut, Florida, Maryland, Michigan, Nebraska, Nevada, North Carolina, Ohio, Oklahoma, Oregon, Pennsylvania, Tennessee, Texas, Utah, Virginia, and Washington, all of which offer the weight exemption on state roads and highways in addition to interstates, which are covered by the federal exemption.

Missouri already has such a weight exemption in place for vehicles primarily powered by natural gas.[73] The state might consider expanding this exemption to apply to electric vehicles as well.

Clean Fuel Program

The state could consider adopting a Clean Fuel Standard (CFS) program. CFS programs use a market-based approach to require fuel suppliers to gradually lower the carbon intensity of fuels they produce and distribute. Fuel suppliers can comply by producing low-carbon fuels (like biofuels or electricity), improving fuel production efficiency, or purchasing credits from other providers who generate them. Potential beneficiaries of clean fuel standards are commercial fleet operators that can take advantage of lower operating costs related to electricity as a fuel. Charging providers are also potential beneficiaries. California, Washington, Oregon, and New Mexico have or are soon implementing CFS programs to incentivize the use of lower-carbon transportation fuels statewide, and many other states are considering similar policies.

Missouri is the second-largest producer of biodiesel in the nation, with a production capacity of 257 million gallons annually, using soy oil or animal fats as feedstock. CFS programs that emphasize these biofuels may provide additional benefits to the biofuels producers and help mature these emerging markets, in addition to incentivizing EV adoption.[74]

EV-Friendly Grid Strategies

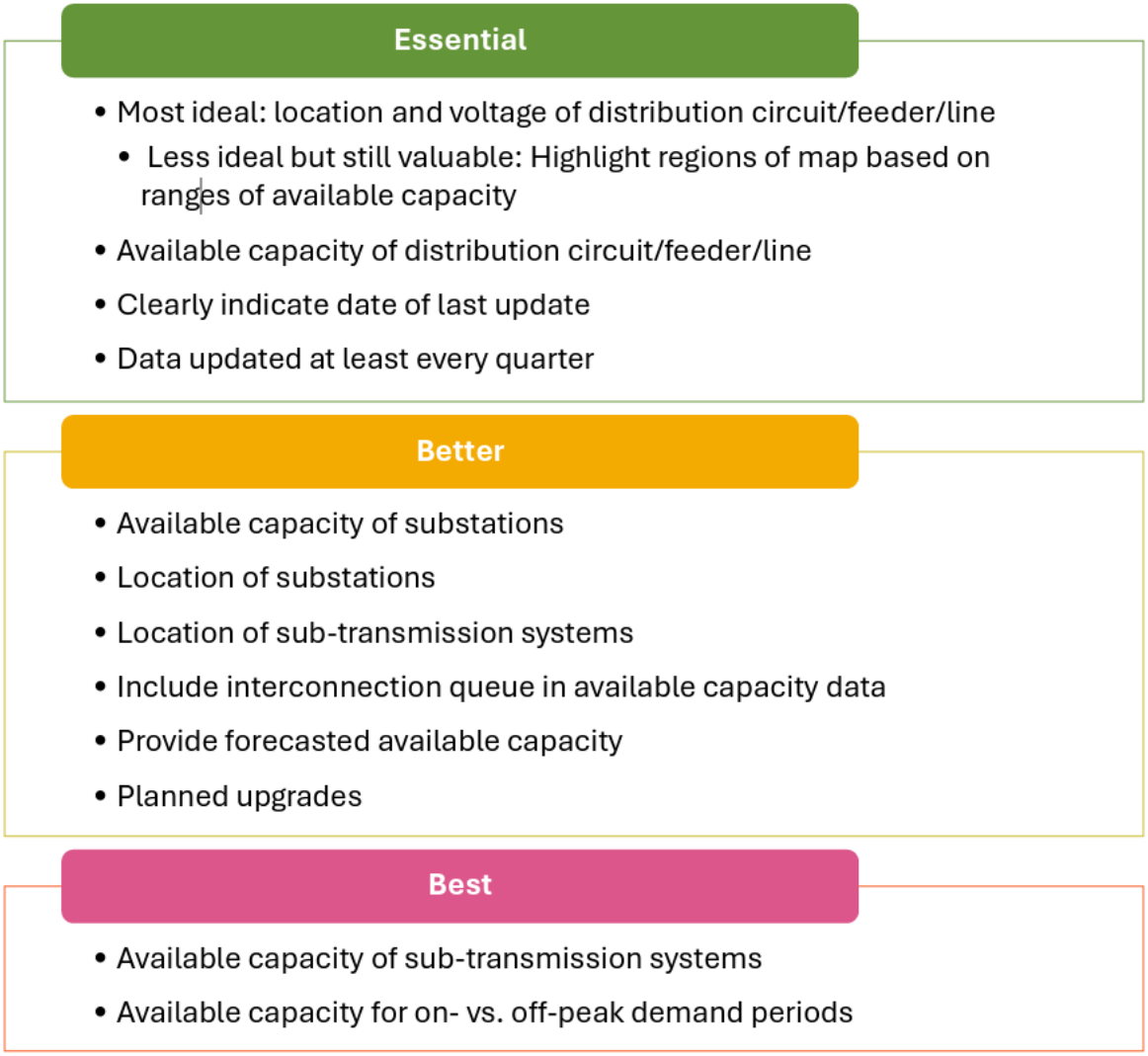
There are a variety of strategies related to the electrical grid that the state could support to streamline and reduce costs for freight electrification. The State Energy Office may wish to collaborate with the PSC and/or local utilities on the following strategies.

Hosting Capacity Maps

Hosting capacity maps show areas of the grid with available electrical capacity and potential constraints, enabling fleets and charging developers to make informed decisions that can significantly reduce costs and shorten project timelines.[75] While hosting capacity maps are beneficial for light-duty EV charging projects, they are particularly useful for MHD projects, which tend to require more power per site.

State policymakers can require or assist in the development of hosting capacity maps for EV charging and potentially require detailed improvements to map content, data accessibility, and utility processes. Key data elements to include in hosting capacity maps for EV charging (Atlas Public Policy) can be found below.

Figure 13: Key Data Elements to Include in Hosting Capacity Maps for EV Charging (Atlas Public Policy)



For example, the Minnesota Public Utilities Commission directed Xcel Energy, the state's largest utility, to enhance its 2020 Hosting Capacity Analysis. The commission required Xcel to incorporate more detailed distribution system data and make it easily accessible to the public. Xcel Energy had to provide downloadable data for each distribution line segment, identify the locations of system lines, and develop a data validation plan with input from key stakeholders.

The "gold standard" of hosting capacity maps, Southern California Edison's (SCE's) Distributed Resources Plan External Portal, includes data on substation location and available capacity. It also shows forecasted available capacity, versus only current available capacity.

Missouri could consider requiring investor-owned utilities to develop hosting capacity maps as well.

Proactive Grid Upgrades

Missouri could consider allowing proactive grid upgrades in "no regrets" zones where MHD charging is expected to be needed but grid capacity is not currently available. Grid upgrades often take years to implement, and by the time a fleet or CaaS customer requests one – typically when they already have EVs on order – this timeline can be a major barrier to electrification. To address this challenge, utilities must be given the authority to get ahead of freight electrification and proactively upgrade the grid in anticipation of the load these new MHD EVs will bring.[76] Multiple studies have found that while proactive expansion will require investments, it can be done without harming ratepayers and be beneficial to both fleets and utilities.[77] [78] The state and utilities may wish to focus specifically on feeders with very limited capacity that serve commercial customers with fleets.[79]

While proactive investments involve forecast-based uncertainty, they can also provide benefits, including faster charger energization and cost savings. Distribution planners and regulators must weigh the risks of investing proactively against the risks of waiting. [80]

Figure 14: Comparison of Risk Factors Between Reactive and Proactive Investment Approaches (CHARGED)

Low Medium High

RISK FACTOR	CURRENT INVESTMENT APPROACHES	PROACTIVE INVESTMENT APPROACHES
Lifecycle Cost Impact	higher unit costs, recurring work/ revisit assets, and lost synergies between investments	minimizes potential repeated work and prevents urgency-based inefficiencies
Stranded/ Underutilized Asset Risk	investments made after growth is known	risks driven by potential for forecast inaccuracies
Utility Cost Recovery Risk	investments justified by known load growth	Depends on Regulatory Process Design
Dissatisfaction of Customers Adopting Electrification Measures	delays in new connections likely due to lack of capacity	capacity available for new / upgraded connections without delays
Policy Alignment Risk	lags policy timelines	removes barriers to achieving policy goals
Execution Complexity	simpler planning, but requires rapid mobilization under pressure; fewer complex forecasting models	requires complex forecasting, integrated processes, and robust project justification

Following the NYSERDA Distribution System Impact Study mentioned earlier, the New York PSC directed utilities to pursue proactive infrastructure planning to support electrification in major logistics and distribution hubs. Utilities in the state submitted Urgent Upgrade filings for 65 projects needed for developing charging infrastructure in advance, instead of waiting for customers to request connections later. In June 2025, the PSC authorized development of (and cost recovery for) 29 of these projects.[81] Longer term, the PSC aims to work with utilities to develop a process for continually identifying proactive upgrade needs, including granular load forecasts for high-electric need industries to feed into the Coordinated Grid Planning Process and assessing risks of and selecting appropriate proactive investments.

Missouri could work with its regulators to enable a similar process within the state. Steps for identifying and assessing the appropriateness of proactive investments are shown below.

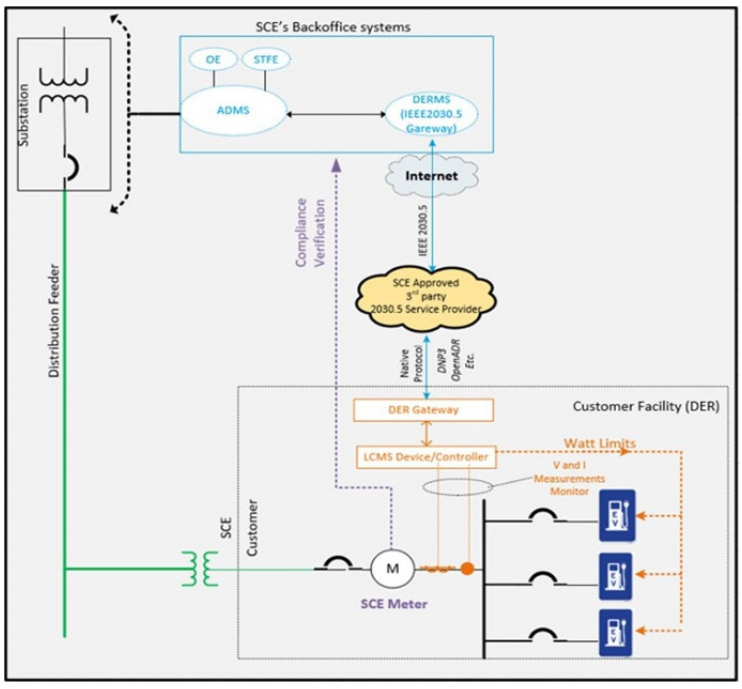
Figure 15: Key Steps in Proactive Investment Decision-Making (CHARGED)

Flexible Service Connections

Regardless of how much proactive planning is completed, there will inevitably be fleets that need power where capacity does not exist. To help electrify these sites as quickly as possible, some utilities are experimenting with flexible service connections. Arrangements between customers and utilities, flexible service connections optimize the magnitude and timing of customer loads (such as EV charging) in response to grid conditions. A temporary solution, these arrangements allow the customer to operate their loads flexibly, meaning they can increase their load when the network is less constrained and automatically reduce load upon a utility's direction.[82] These solutions leverage advanced technologies and strategic management practices to ensure that EV fleet charging integrates seamlessly with existing grid infrastructure without overloading it until the grid upgrade can be completed. Flexible service connections cannot be used everywhere since their feasibility is dependent on the capacity of local circuits, and even when feasible, the amount of available capacity varies. Under the right circumstances, however, flexible service connections can allow fleets to energize their charging depots faster than otherwise possible.[83]

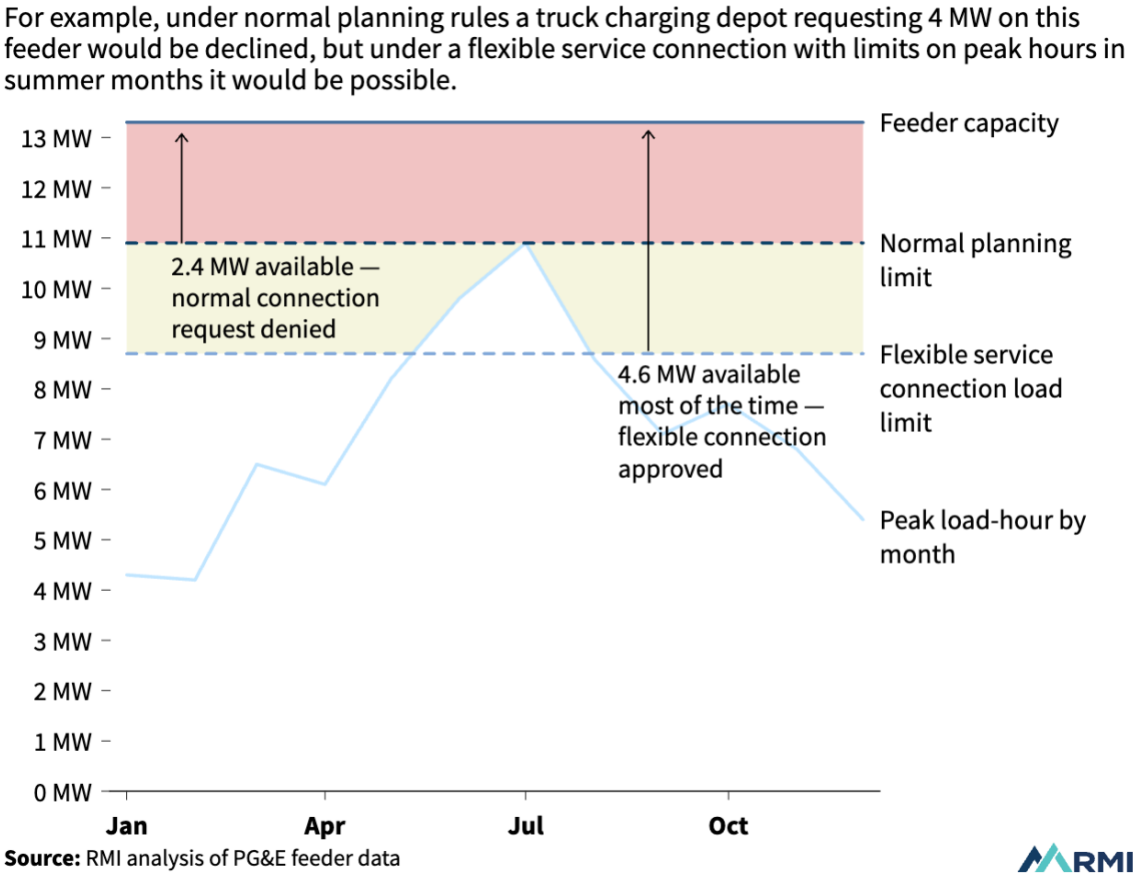
Southern California Edison (SCE) is piloting a two-year Automated Load Control Management Systems (LCMS) program to allow customers to receive electrical service connection based on the currently available grid capacity as opposed to delaying the EV charging interconnection until required grid upgrades are completed to support full capacity charging. The conceptual architecture for the LCMS pilot is illustrated to the right.

Figure 16: Load Control Management System Conceptual Architecture (SCE)



Also in California, PG&E offers a flexible service connection program known as Flex Connect.[84] One of its early pilot customers for the program, PepsiCo, was able to increase a site from 30 to 50 electric trucks 18 months sooner than conventional load planning would have allowed. PepsiCo estimated that this saved the company $1 million in fuel costs.[85]

Figure 17: Large amounts of feeder capacity for new site energizations can be unlocked by load shifting from peak hours during certain months (RMI)



In New York, National Grid will soon be launching a flexible service connection pilot program called Flex Connect.[86]

In Missouri, the state might collaborate with regulators, utility planners, and EV charging developers to co-create supportive regulatory frameworks that facilitate the adoption of flexible service connection strategies. Examples of existing programs, as well as recommendations for utilities and regulators, can be found in the Alliance for Transportation Electrification's 2025 white paper, *Energizing EV Charging Stations: New and Flexible Approaches to Capacity Constraints*.[87]

Demand Charge Holidays

Last but certainly not least, the state may consider working with regulators to allow for demand charge holidays or flexibility for MHD EV charging hubs. Demand charges are fees based on brief periods of maximum energy use. They exist to account for the capacity a utility must deliver to a site, regardless of how often that capacity is used – an important consideration for rates. However, because of their structure, demand charges can make EV charging station operation prohibitively expensive below a certain threshold of utilization. This is particularly problematic during the early years of freight electrification, when MHD EV adoption may not be significant enough to achieve high utilization of chargers. To avoid penalizing charging providers and fleets for building stations ahead of demand, utilities can institute demand charge holidays – programs that reduce or eliminate demand charges for EV charging stations for a specified period of time (recovering delivery costs through volumetric pricing in the meantime), and phase them back in over time.[88] [89] Such demand-charge holidays should become unnecessary as the market matures and station utilization increases.

Utilities in New York and California offer such programs, ranging from demand charge holidays for public EV chargers, including MHD chargers, to new tariffs where the demand charge increases as utilization of the charging station increases. Missouri could consider doing the same.

Strategy Implementation

The options outlined above are meant to be a starting point but not an exhaustive list of the potential actions Missouri stakeholders can take to remove barriers to freight electrification. As action gets underway, it's likely that innovative new approaches may be devised.

Successful implementation of this strategy will require collaboration among a wide range of stakeholders. State government cannot undertake all of the above on its own. The State Energy Office in particular, while leading development of this strategy, is limited by both bandwidth and statute in implementing some of these strategies.

Going forward, the Division of Energy will coordinate with the governor's office, other state agencies, legislators, the private sector, and local government to further prioritize and advance this strategy. It will also work to take advantage of available funding opportunities, whether from the federal government or the philanthropic sector, to advance these tactics. Some potential sources of federal funding are outlined in the *Programs* section above.

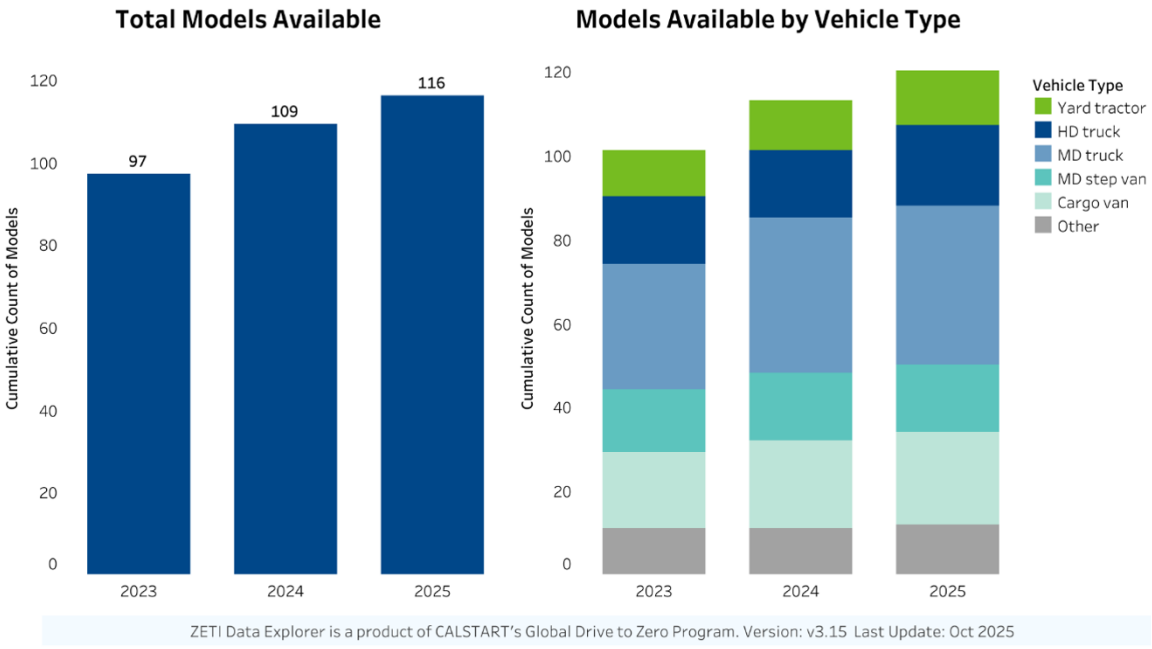
Finally, the Division of Energy will also share progress related to the strategy and update it as needed as the industry evolves.

Appendix A:
Freight Electrification Overview and Trends

Technology Availability

To meet growing demand, truck builders have made significant technological advancements in recent years, with all U.S.-based OEMs now producing battery-electric models. In the U.S. alone, there are approximately 116 battery-electric freight vehicle models available across a wide range of vehicle segments, including cargo vans, step vans, MHD trucks, and yard tractors.[90]

Figure 18: Battery-Electric Truck Models Available in the U.S. (CALSTART Drive to Zero)



Cost Considerations

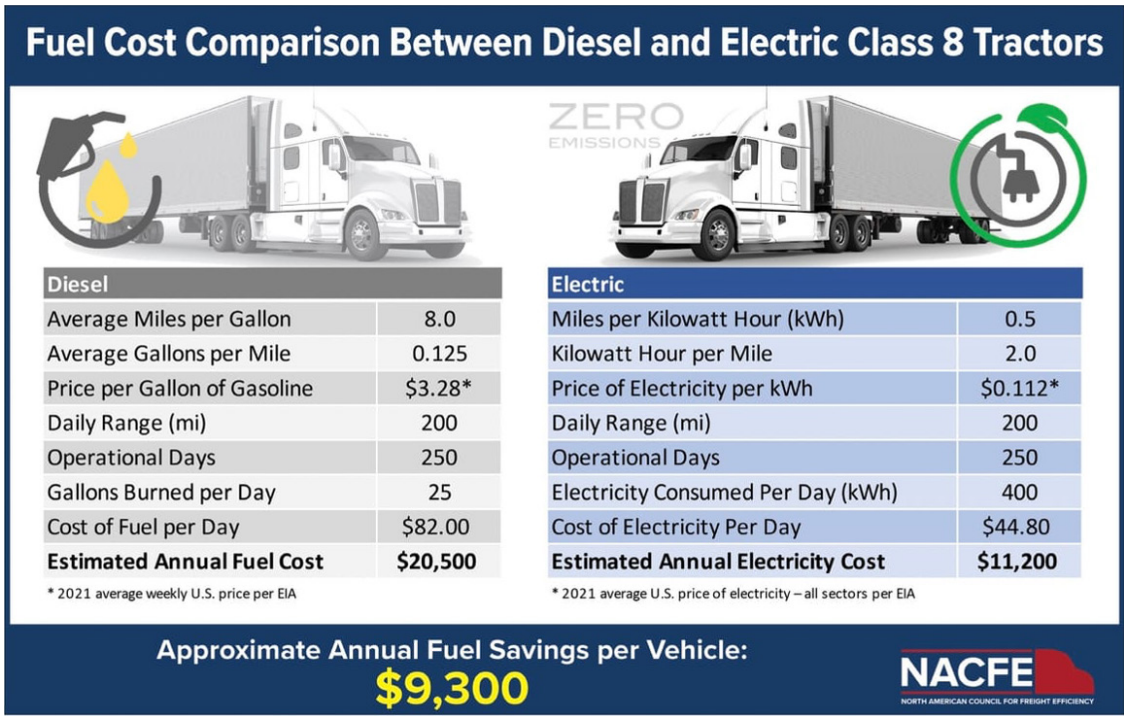
From an economic perspective, electric freight vehicles can also save fleets money. Some medium-duty options are already near price parity or even offered at a lower manufacturer's suggested retail price (MSRP) than their conventional counterparts. For example, the MSRP for the Ford E-Transit cargo van is more than $10,000 less than its gasoline-powered Transit counterpart.[91]

Figure 19: Starting MSRP for Ford E-Transit and Transit (Ford)

MHD EV prices are expected to decrease in the coming years as battery costs continue to fall and energy density improves. In fact, prices for battery electric Class 5 and smaller vehicles are already decreasing[92]. And some predict that electric trucks will be half the price of diesel trucks by 2030.[93]

Even for vehicle segments for which the upfront purchase price of an EV is greater than its ICE counterpart, fleets have an opportunity to save money over the life of the vehicle due to lower operational costs such as maintenance and fuel/energy.[94] A North American Council for Freight Efficiency (NACFE) analysis found that for Class 8 tractors, fleets can nearly halve their fuel costs by switching from diesel to electric.[95]

Figure 20: Diesel vs Electric Fuel Savings per Class 8 Tractor (NACFE)



Electric powertrains are also intrinsically more efficient than ICE vehicles, thanks in part to regenerative braking – a component of all EVs – which captures unused kinetic energy back into the battery. These savings are particularly pronounced in more urban environments with frequent stops.[96]

Total cost of ownership (TCO) analyses – critical for commercial fleet decision-making – vary by fleet, vehicle type, and operation. Because Missouri tends to have low electricity rates compared to many other states, fleets operating within the state may realize TCO savings more quickly than those operating elsewhere.[97]

Freight Segments Primed for Electrification

Freight vehicles will not all electrify at once. From an operational and financial perspective, the best candidates for electrification today are terminal tractors, delivery vans, box trucks, and heavy-duty trucks operating in regional haul applications, generally less than 300 miles per day.[98] Return-to-base operations are also ideal for MHD EVs because it means that the vehicles return to a depot or warehouse at which private "behind the fence" charging can be built for use exclusively by the fleet. Fleets can right-size and manage this charging infrastructure for their operations and know that it will be available when needed.

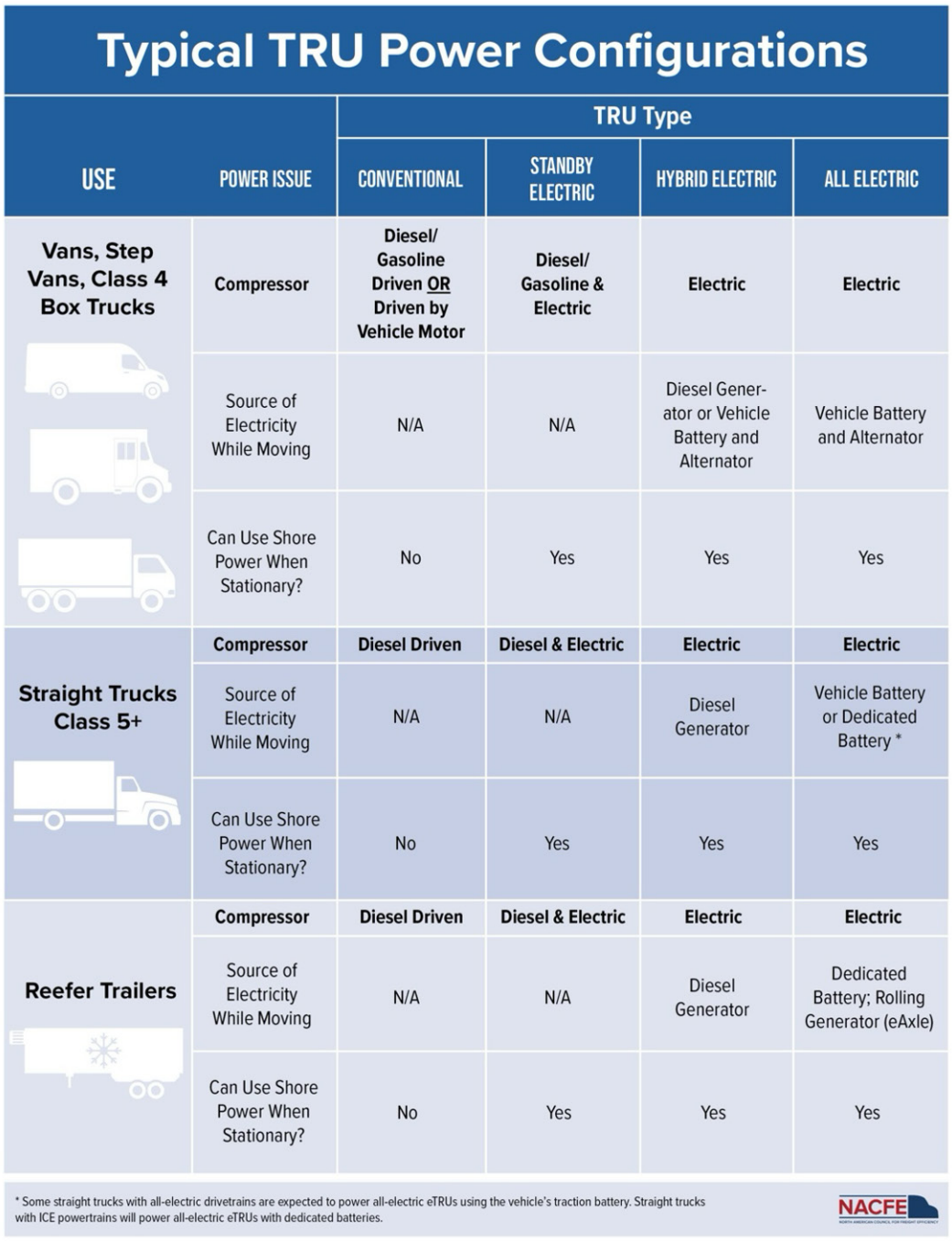
Figure 21: Common Factors in Urban and Regional Haul (NACFE)

Although not vehicles themselves, transport refrigeration units (TRUs) are another type of freight equipment with electric models (eTRUs) now commercially available. TRUs control the temperature of goods as they're transported and are used by approximately 15 percent of all straight trucks and trailers.[99]

Figure 22: Class 8 Truck with TRU on the Trailer (Forum Mobility)

eTRUs replace the conventionally diesel-fueled internal combustion engine driving the compressor with an electric motor. The motor is generally powered by either the traction battery when installed on an electric straight truck chassis or by dedicated batteries when installed on a trailer. Axle-mounted generators (eAxles) can help deliver more power to the batteries. Hybrid solutions also exist that either accept plug-in shore power or run primarily on electricity but have diesel backups to support long run times.

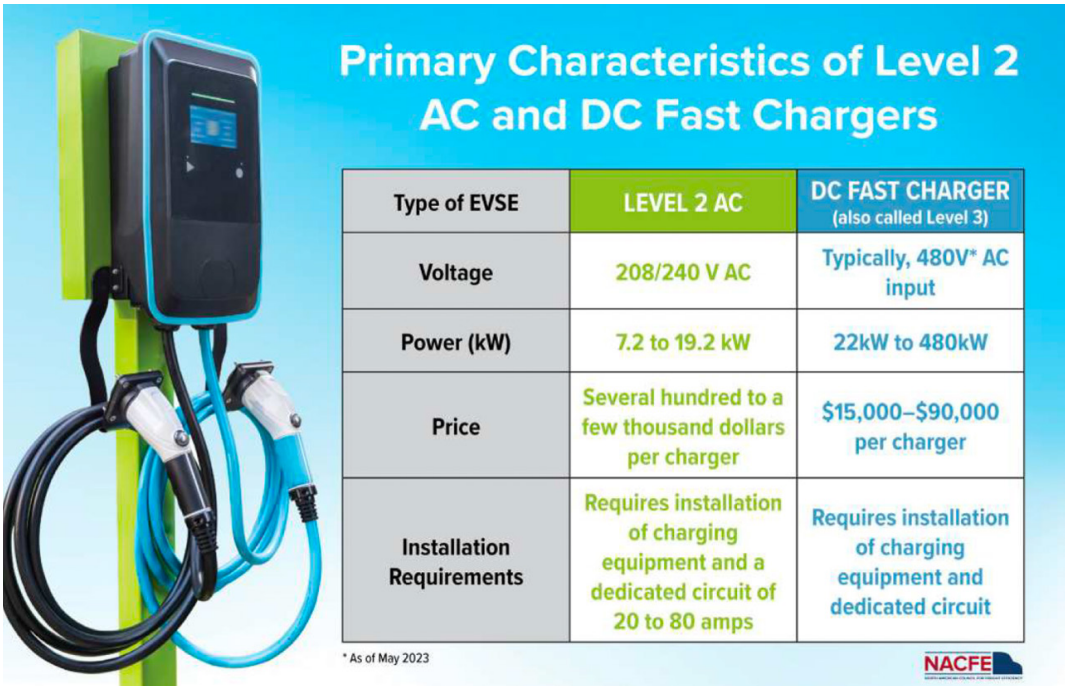
Figure 23: Typical TRU Power Configurations (NACFE)



Charging Infrastructure for Electrified Freight Movement

The vast majority of MHD EV early adopters rely on private charging infrastructure at their own depot for charging. These chargers can range from Level 2 chargers, like those used by passenger cars for home charging or medium-duty urban duty cycles, to high-power Combined Charging Standard (CCS) chargers[c] up to 350-kilowatts (kW) for larger vehicles with longer routes and/or less dwell time. Some electric heavy-duty trucks, like the Tesla Semi, are using Megawatt Charging System (MCS) charging. The characteristics of a fleet's vehicles, and how they are deployed, as well as the availability of power at their site will determine the power levels and types of chargers that are most appropriate for each fleet. Generally, spreading charging over the longest time and using lower charging power makes both the charging equipment and electricity costs lower and maximizes battery life.[100]

Figure 24: Characteristics of Level 2 AC vs. DC Fast Chargers (NACFE)



Not all fleets own their own depot or are able to install charging infrastructure. Shared MHD charging hubs are being developed to serve the needs of multiple fleets, often near key freight centers and along corridors.[101] Because shared charging sites are often owned and operated by businesses with energy expertise, they can take advantage of managed charging, thereby reducing stress on the electrical grid and potentially putting downward pressure on rates.[102] They can maximize utilization of the charging assets since they are used by multiple fleets. These innovative CaaS models can eliminate capital cost and complexity for fleets, enabling them to operate with stable, usage-based fees.[103] CaaS providers are also able to effectively work with utilities on grid planning to upgrade necessary sites near freight hotspots to enable timely charging development where it's needed most.

c The Combined Charging System (CCS) is a universal EV charging standard that combines Level 2 AC charging and high-speed DC fast charging into a single, larger port, allowing one plug for all charging needs, common for North American and European vehicles, featuring extra pins below the standard J1772 connector for faster power delivery.

Figure 25: Terawatt's Rancho Dominguez MHD Shared Charging Hub (Windrose)

As shared and public charging is built out along corridors across the country, long-haul, over-the-road operations will also begin to electrify. The National Zero-Emission Freight Corridor Strategy demonstrates how infrastructure can be phased in around favorable launch areas in priority regions to ultimately achieve a national zero-emission freight network.[104] According to the strategy, Missouri should focus on establishing a charging hub in the St. Louis area and developing charging out from there, along critical freight corridors such as I-70 and I-44 by 2027. Over the next 15 years, the strategy envisions that charging will be fully built out along these corridors, as well as along I-29, I-35, I-49, and I-55.

Figure 26: Phase 1 of the National Zero-Emission Freight Corridor Strategy (JOET)

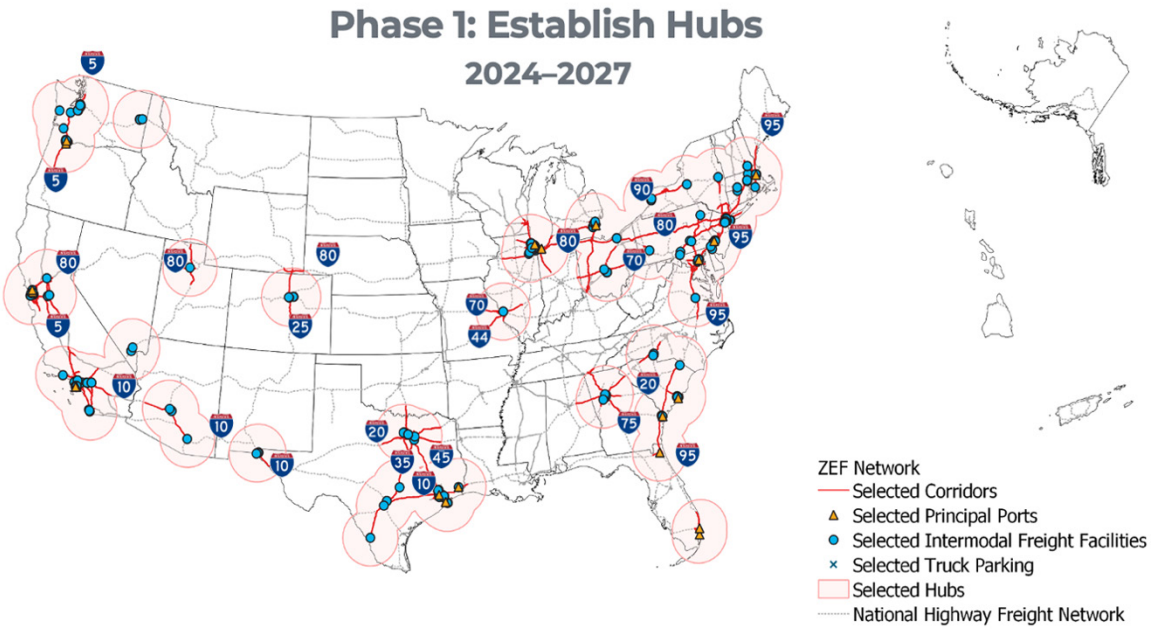
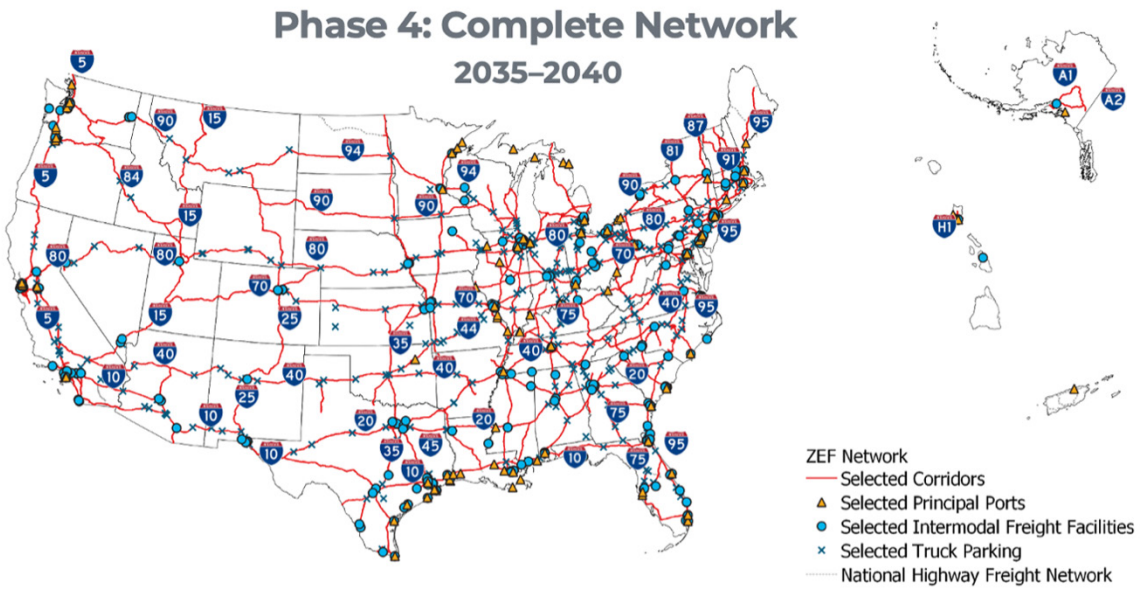


Figure 27: Phase 4 of the National Zero-Emission Freight Corridor Strategy (JOET)



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