Rider 48 v013

Evaluation of Medium-Duty and Heavy-Duty Vehicle Charging Infrastructure and Capacity

TxDOT, September 2024

Texas Department of Transportation

Contents

Glossary

AC – Alternating Current

AFC – Alternative Fuel Corridor

BABA – Build America Buy America

BIL – Bipartisan Infrastructure Law

CCS – Combined Charging System or plug type for DC Fast Charging

CFI – Charging and Fueling Infrastructure Program

Connector – Plug that connects the electric vehicle to the charging equipment.

DC – Direct Current

DC Fast Charging – High power charging 400-800 volt, 150-600 amps, 3 phase.

DOE – Department of Energy

DOT – US Department of Transportation

ERCOT – The Electric Reliability Council of Texas

EV – Electric Vehicle

EVSE – Electric Vehicle Service Equipment

FHWA – Federal Highway Administration

GVWR – Gross Vehicle Weight Rating

IIJA – Infrastructure Investment and Jobs Act

IRA – Inflation Reduction Act

Heavy-Duty Vehicle – Vehicles with a GVWR over 26,000 pounds

kW – Kilowatt (1,000 watts)

kWH – Kilowatt Hour (1,000 watts for 1 hour)

Level II – Medium power charging 240-volt, 15-50 amps, single phase

Location – Physical location where electric vehicles charge

Medium-Duty Vehicle – Vehicles with a GVWR of 10,001 to 26,000 pounds

MHDV – Medium and Heavy-Duty Electric Vehicles

MPO – Metropolitan Planning Organization

MWC – Megawatt Charging (standard for heavy duty charging)

mW – Megawatt (1,000 kilowatts)

mWH – Megawatt Hour (1,000 kilowatts for 1 hour)

NACS – North American Charging Standard, DC Fast Charging connector or plug

NEVI – National Electric Vehicle Infrastructure Program

Port – Charging hardware, usually a pedestal design with connectors for charging electric vehicles

PUC – The Public Utility Commission of Texas

TCEQ – Texas Commission on Environmental Quality

TERP – Texas Emission Reduction Plan

TxDOT – Texas Department of Transportation

3 Phase – Electrical supply from 3 power lines

Executive Summary

In accordance with Rider 48, this report, findings and recommendations are being submitted by the Texas Department of Transportation (TxDOT) on behalf of the interagency task force that was convened and designed to evaluate how to deploy zero-emission medium and heavy-duty vehicle (MHDV) charging infrastructure to support growth in the market.

This report examines the current landscape and future potential of medium and heavy-duty vehicle (MHDV) charging infrastructure in Texas. It explores the influence of federal, state, and local regulations, highlights opportunities for improved information exchange among stakeholders, and underscores the need for statewide oversight and collaboration to enhance infrastructure development.

Policies, regulations, and incentives are often cited as key elements that impact the rate of zero emission vehicles (ZEV) adoption across the country. They may be structured in a way that overtly supports or hinders ZEV adoption or may have indirect impacts. At the federal level, passage of the Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act (IRA) infused a substantial amount of federal investment into programs and incentives that are specific to advancing ZEV adoption.

The report also quantifies the number of electric trucks in Texas, describes their characteristics and typical usage scenarios, and identifies the economic, technical, and environmental considerations essential for the successful expansion of MHDV infrastructure.

Objectives

The primary objectives of this report are to:

1. Assess the impact of federal, state, and local laws on the development of medium and heavy-duty vehicle charging infrastructure in Texas.
2. Identify opportunities for facilitating information exchange between utilities, stakeholders, and private entities regarding fleet charging profiles and projected energy needs.
3. Examine how statewide oversight and collaboration can coordinate and complement existing efforts to expand EV infrastructure across Texas.
4. Quantify the current fleet of medium and heavy-duty electric trucks in Texas and describe their characteristics and usage scenarios.

Key Findings

1. Regulatory Landscape:
    - Federal programs such as the Infrastructure Investment and Jobs Act (IIJA) and the Charging and Fueling Infrastructure grant program provide significant funding and incentives for MHDV infrastructure.
    - State initiatives like the Texas Emissions Reduction Plan (TERP) and the new Direct Current Fast Charging (DCFC) regulations from Texas Department of Licensing and Regulation (TDLR) provide clarity on the development of EV charging stations in Texas.
2. Information Exchange:
    - Effective information exchange is critical for accurate load growth projections and generation across the Electric Reliability Council of Texas (ERCOT) regions.
    - Collaborative platforms and initiatives, standardized data reporting, public-private partnerships, regional workshops, and advanced analytics are key opportunities to improve information exchange.
3. Statewide Coordination:
    - Statewide oversight can ensure uniform standards, optimize resource allocation, and facilitate data sharing.
    - Coordination can enhance local and regional efforts by providing technical assistance, fostering public-private partnerships, and supporting pilot programs.
    - Addressing regional disparities is crucial to ensure comprehensive infrastructure coverage across Texas.
4. Quantification and Characteristics of MHDV:
    - Texas has 3,438 electric delivery vans and 108 medium and heavy-duty electric trucks.
    - Medium-duty trucks typically have a range of 100-200 miles and battery sizes between 100-200 kWh, used primarily for urban delivery and utility work.
    - Heavy-duty trucks have a range of 200-500 miles with battery sizes ranging from 300-850 kWh, suitable for long-haul freight and port drayage.

Recommendations

1. Strategic Initiatives:
    - Develop a comprehensive state plan for MHDV infrastructure that includes clear goals, timelines, and metrics for success.
    - Expand public-private partnerships to leverage private sector innovation and funding.
    - Establish an electric truck advisory committee.
2. Policy Recommendations:
    - Establish uniform statewide standards for MHDV charging infrastructure.
    - Enhance funding and incentives for MHDV infrastructure development.
    - Dedicate resources for state agency staff members to develop and manage programs that support MHDV infrastructure development.
    - Develop or adopt industry tools and methods to guide MHDV charging infrastructure development.
    - Reduce or remove barriers that limit the development of MHDV charging infrastructure.
3. Collaboration Strategies:
    - Foster collaboration among state agencies, local governments, utilities, and private entities to streamline efforts and share best practices.
    - Support regional pilot projects to test new technologies and approaches, using successful models for broader implementation.

Rider 48 Members

Participants

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Meetings

Name	Date
Meeting 1 (virtual)	December 8, 2023, 10 am – 12 pm CST
Meeting 2 (in person, TxDOT Stassney)	March 4, 2024, 11 am – 2 pm CST
Meeting 3 (virtual)	June 20, 2024, 10 am – 12 pm CST
Meeting 4 (virtual)	August 14, 2024, 1 pm – 3 pm CST
Meeting 5 (virtual)	September 13, 2024, 10 am – 12 pm CST

Rider 48 (A)(1)

(1) consider federal, state, and local laws and regulations that may impact the manufacturing, operations, and public and private investments in the development of medium-duty and heavy-duty vehicle charging infrastructure in Texas, including regional differences in infrastructure planning, regulation, and implementation;

Introduction

Texas presents a mixed policy landscape for electric medium and heavy-duty vehicle adoption. Although Texas lacks many of the incentives and state-level mandates that have driven much of the electric MHDV adoption in other areas of the country, Texas offers a business-friendly climate, low costs, and utility policies that are friendlier than those in other states. These latter factors can sometimes provide enough momentum for adoption of electric MHDVs even without certain changes in regulatory structures.

Texas is also home to several MHDV manufacturing facilities and is poised to benefit from new investments in manufacturing in batteries, electric vehicles, and hydrogen electrolyzers and fuel cells, all of which can be part of the electric MHDV supply chain. Data on planned investments is available at www.energy.gov/invest; key investments relevant to zero emission MHDVs are summarized in the following table.

Technology	Product	Projects	Funding Amount
Batteries	Minerals, Materials, Components	9	$1.5 billion*
Batteries	Cells	2	$372 million*
Batteries	Packs	1	Unreported
Electric Vehicles	Chargers	7	$104 million*
Electric Vehicles	Components	3	$85 million
Electric Vehicles	Assembly	1	Unreported
Hydrogen	Electrolyzers, Electrolyzer Components	3	$488 million
*Some projects in this category have not yet reported funding amount.			

Texas is a hub for land, sea, and air freight with international ports of entry, making it a key beneficiary of commercial vehicle electrification for economic and environmental reasons.

To address the considerations posed by the Texas legislature under Rider 48(A)(1), this section will provide information and recommendations on incentive programs, credits, regulatory structures, and laws and policies that will assist Texas in fostering and creating the enabling conditions for the electrification of medium and heavy-duty vehicles.

Federal Resources and Regulations

While not binding, aspirational objectives set by the federal administration can enhance momentum surrounding ZEV adoption and serve as an example for other levels of government, and for the private sector, to emulate. Several of these goals have been established in recent years. The Federal Sustainability Plan sets goals for 100 percent of all light-duty vehicles acquired by the federal government to be ZEV by 2027 and 50 percent of all vehicles to be ZEV by 2030.[1] It also sets an objective for 100 percent carbon-free electricity by 2030, enhancing ZEV benefits on a well-to-wheels basis. Similarly, the August 2021 Executive Order on Strengthening American Leadership in Clean Cars and Trucks[2] set a policy goal that 50 percent of all new light-duty vehicles sold in 2030 be ZEV. This Executive Order ushered in a series of major automaker announcements and commitment to the ZEV transition.

Beyond relevant goals, national "roadmaps" and plans can help advance ZEV adoption by helping align public and private sector investment in terms of both attention and resources. Key documents released recently include:

- The U.S National Blueprint for Transportation Decarbonization, released jointly by the U.S. Departments of Energy, Transportation, and Housing and Urban Development in September 2022.[3] The blueprint supports the goal to eliminate all greenhouse gas emissions from the transportation sector by 2050 and suggests which technologies may be best suited to each major transportation sector.
- The National Zero Emission Corridor Strategy, released by the Joint Office of Energy and Transportation in March 2024,[4] suggests priority hubs and corridors which would be most impactful for near-term investments in electric charging and hydrogen fueling infrastructure to achieve a ZEV freight network by 2040.

In addition, a suite of new EPA standards for both criteria pollutants and greenhouse gases, in both the passenger vehicle and medium- and heavy-duty sectors,[5] are expected to drive further investments in ZEVs by automakers. The same is true of the latest Corporate Average Fuel Economy Standards issued by the National Highway Transportation Safety Administration[6]. While the EPA and NHTSA rules do not explicitly require sale or purchase of ZEVs, it is commonly believed that a way to reach the regulatory standards is to increase the proportion of ZEVs offered by a particular manufacturer.

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[1] Federal Sustainability Plan: Catalyzing America's Clean Energy Industries and Jobs | Office of the Federal Chief Sustainability Officer
[2] Executive Order on Strengthening American Leadership in Clean Cars and Trucks | The White House
[3] The U.S. National Blueprint for Transportation Decarbonization: A Joint Strategy to Transform Transportation | Department of Energy
[4] zef-corridor-strategy.pdf (driveelectric.gov)
[5] https://www.epa.gov/regulations-emissions-vehicles-and-engines/regulations-onroad-vehicles-and-engines
[6] Federal Register :: Corporate Average Fuel Economy Standards for Passenger Cars and Light Trucks for Model Years 2027 and Beyond and Fuel Efficiency Standards for Heavy-Duty Pickup Trucks and Vans for Model Years 2030 and Beyond

Infrastructure Investment and Jobs Act (IIJA) and Inflation Reduction Act

The policy landscape for ZEV adoption has changed substantially in recent years, most notably with the passage of the Infrastructure Investment and Jobs Act (IIJA) in November 2021. This legislation provides substantial investment, not only in terms of the incentives discussed in Chapter 7, but also by making investments in research and other programs that may either enhance or lead directly to deployment projects. Highlights include:[7]

- Measures that Primarily Support Battery Electric Vehicles:
  - $5 billion was invested through the National Electric Vehicle Infrastructure (NEVI) Formula Program and $2.5 billion through Charging and Fueling Infrastructure (CFI) Grant program to fund development of infrastructure; while NEVI is limited to battery electric technology, CFI extends to hydrogen and other gaseous fuels. NEVI was designed originally to enable passenger vehicle traffic but can be used to enable truck charging if adequate funding remains after fulfilling minimum requirements for passenger vehicles. CFI can be used to develop infrastructure that supports either passenger vehicles or medium- and heavy-duty vehicles. Aside from the funding support, an important element of NEVI was development of standards for charging sites through 23 CFR 680. A major goal of these standards is to create consistency in what an EV driver can expect as they travel from one location to another, as every site funded under NEVI must adhere to certain design and operational requirements. In September 2024, FHWA issued a Request for Information related to charging infrastructure for MHD trucks[8]. It is not known whether FHWA will eventually develop a standard for MHD charging, but the Request for Information would be a required step toward any such rules. Moreover, the responses received, which will be publicly available through the Federal Register, could inform development of standards for MHD charging at the state or local level if no federal standards are set forth.
  - BIL Section 11129 sets requirements to modify the Manual of Uniform Traffic Control Devices (MUTCD), which sets guidance at the federal level for elements of the transportation system, by adding standards for electric vehicle (EV) charging stations. The simple addition of EV charging stations to the MUTCD is notable, as the formal recognition of EV chargers as elements of the transportation system reinforces the permanence of the transition toward electrified transportation. The substance of the standards is also important. They require non-proprietary charging connectors and open access payment. Such standards improve the customer experience when using charging stations and can result in greater utilization of infrastructure, which may support faster ZEV adoption and improved return on investment. They are also a critically important foundational element in the face of fast technological, service, and market changes, serving as a future-proofing element. For an EV charging station to receive business identification sign, the charging station must meet NEVI standards and be open for at least 16 hours a day. Example signage for EV charging is available in the MUTCD as well.
  - BIL Section 25006 establishes an Electric Vehicle Working Group as a collaboration between the US Department of Transportation (DOT), US Department of Energy (DOE), US EPA, White House Council on Environmental Quality, and General Services Administration, along with utilities and manufacturers to develop three separate reports on barriers to greater EV adoption. Part of the significance of this measure is the cross-agency collaboration created by the provision, which has often been lacking in the past as different federal agencies have created electrification or efficiency initiatives that seem disconnected or disjointed. Simply by requiring different agencies to collaborate and engage with utilities and the private sector,

[7] https://www.congress.gov/117/plaws/publ58/PLAW-117publ58.pdf
[8] Federal Register :: Notice of Request for Information (RFI) on Medium- and Heavy-Duty Electric Charging Technologies and Infrastructure Needs

this provision could help create more cohesion among federal efforts which may then lead to more effective messaging and implementation of programs to advance electrification.

- BIL Section 40431 modifies the Public Utility Regulatory Policies Act of 1978 by adding language that requires each state to consider measures to promote greater electrification of the transportation sector, including access to charging, an improved customer experience, greater third-party investment in EV charging, and cost recovery. While this section falls short of requiring specific activities beyond developing a "consideration," it does formally establish that state utility regulators and utilities have a role to play in supporting transportation electrification.
- The BIL also provides for substantial investment in the electrical grid, much of which is specific to integration of battery electric vehicles (BEVs). Elements include:
  - Section 40107, which funds methods to enhance grid flexibility, including vehicle-to-grid technologies.
  - Section 40112, which establishes a project to demonstrate second-life applications of EV batteries as energy storage to service the electric grid.
  - Section 40414, which expands data collection on EV and grid integration.
  - Section 40431, which requires state public utility commissions to amend rates to promote greater electrification of the transportation sector.
- Sections 40207, 40208, 40209, and 40210 tackle manufacturing and supply chain elements related to BEVs to address concerns about reliance on foreign sources of EV and battery components, as well as environmental concerns associated with battery manufacturing and disposal. Initiatives include programs to support a domestic supply chain for battery production; to develop and demonstrate second-life EV battery applications; to develop processes for final recycling and disposal; for development of manufacturing facilities; and advancement of critical minerals mining, recycling, and reclamation.

- Measures that Support all ZEVs (Both BEV and FCEV):
  - BIL Section 11403 requires DOTs to establish carbon reduction programs to reduce transportation emissions. ZEV projects certainly fit into the scope of carbon reduction, especially if upstream production of electricity or hydrogen is accomplished through renewable or other low-carbon mechanisms. This program may be part incentive, as some funds could be used for project implementation, but is potentially more impactful in requiring the development of carbon reduction programs that can set a long-term framework for ZEV project support within DOTs.
  - IRA Section 60101 created the Clean Heavy Duty Vehicles program that provides $1 billion in purchase incentives for class 6-7 zero emission vehicles and charging/refueling infrastructure.
  - The IRA also created a commercial EV tax credit (45W) for private enterprises and tax-exempt entities alike.
- Measures that Support Charging Infrastructure:
  - The BIL created the National Electric Vehicle Infrastructure (NEVI) program that provided $5 billion in formula funds and $2.5 billion in discretionary grant funds for the purchase and installation of charging/refueling infrastructure along interstate highways and in communities.
  - The IRA expanded the Alternative Fuel Vehicle Refueling Property credit (30C) to provide additional tax credit amounts for infrastructure and site development for private enterprises and tax-exempt entities alike.

Allowance for Heavier Truck Weight

One constraint to MHDV adoption at the federal level is the limitation on allowable truck weight. This is more problematic for electric trucks because the battery is heavier than traditionally fueled freight trucks. Currently, the Consolidated Appropriations Act allows both natural gas and electric trucks to

weigh up to an extra 2,000 pounds, for a total gross vehicle weight rating (GVWR) not to exceed 82,000 pounds, on Interstates and roadways providing reasonable access to Interstates.[9] Industry representatives have indicated the 2,000-pound allowance is not adequate to cover the full weight of additional batteries on a battery-electric truck, and results in loss of payload for end users who carry cargo, which results in reaching full GVWR weight limitations. Some have proposed an exemption in the range of 5,000 to 7,000 pounds, or an amount equivalent to the weight of the battery pack, would be needed to ensure customers can acquire electric trucks without loss of payload.

A second challenge associated with the heavier weight of electric trucks is that requirements for commercial driver's licenses may be triggered if a truck crosses into a higher weight category due to the added weight of the battery or fuel cell systems.[10] This would require additional driver training and could indirectly create a barrier for MHDV adoption.

Research may be needed on safety and road wear implications of this heavier weight rating to evaluate the appropriate level at which to set weight exemptions and require commercial driver's license training.

Federal Prohibition on Commercial Activities at Interstate Rest Areas

Federal law prohibits commercial activities at Interstate rest areas (State or US highways are not prohibited), with limited exceptions for vending services and tourism-related media.[11] Many state DOT rest areas are prime candidates for siting MHDV infrastructure. This is particularly true for TxDOT rest areas, which are designed expressly to accommodate safe truck parking and serve as stopping points for government-mandated rest areas while also providing basic restroom and vending services.

Current law limits drivers to no more than 14 on-duty hours in a day, with a limit of only 11 hours of driving and a requirement that they must take at least a 30-minute break after driving 8 hours. Many rest stops now also include small museum exhibits and walking trails, which provide opportunities for recreation that are ideal for filling time needed to recharge an MHDV. The federal prohibition against commercial activity precludes addition of charging or fueling services, unless they were to be provided at no cost, which would be financially unsustainable for the state. Notably, this constraint is only present along interstates, leaving opportunity to consider addition of infrastructure at locations along state highways or other non-interstate roadways.

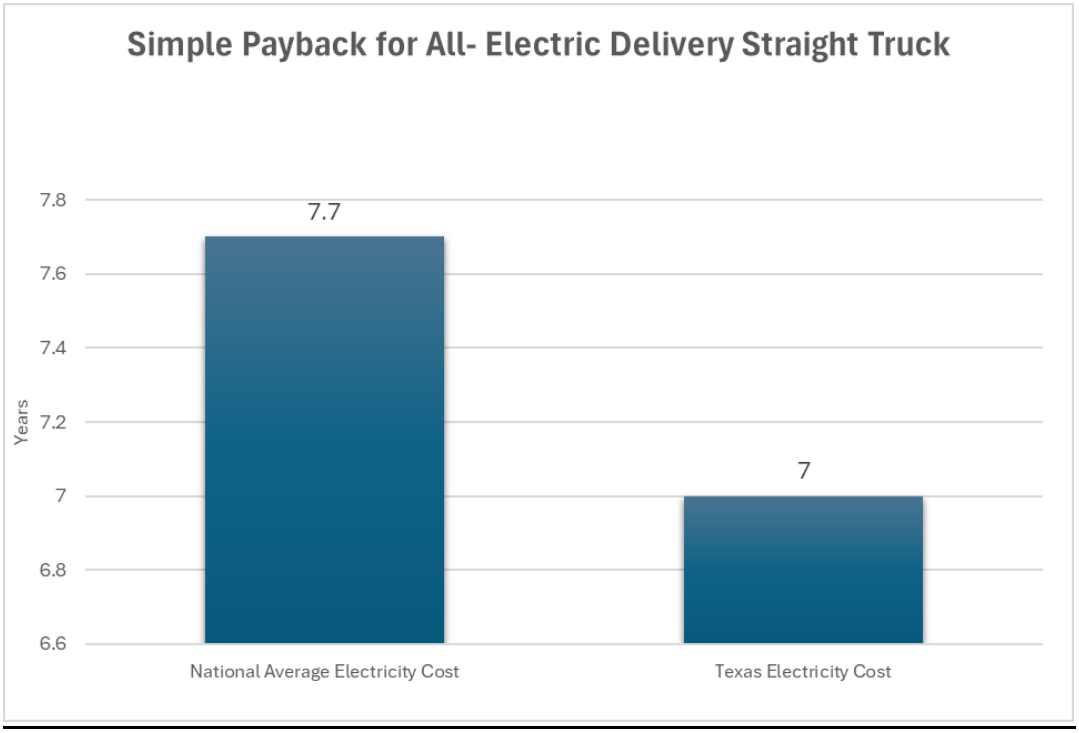
[9] https://ops.fhwa.dot.gov/freight/pol_plng_finance/policy/fastact/tswprovisions2019/index.htm
[10] https://www.fmcsa.dot.gov/registration/commercial-drivers-license/drivers
[11] https://uscode.house.gov/view.xhtml?req=granuleid:USC-2000-title23-section111&num=0&edition=2000

Factors Supporting ZEV Adoption in Texas

Cheaper Electricity

Lower electricity costs in Texas result in a faster return on investment for MHDVs through lower operational costs associated with fuel consumption. Nationwide, the average commercial retail electricity rate was 12.48 cents per kilowatt-hour in May 2024, compared to 8.73 cents per kilowatt-hour in Texas.[12,13] Using 2023 commercial electricity averages and holding all other factors constant, the North Central Texas Council of Governments (NCTCOG) compared the return on investment of a battery-electric delivery straight truck to a diesel delivery straight truck using the Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool developed by Argonne National Laboratory.[14] The difference in price shortened the simple payback by almost a year, as illustrated in Exhibit 1.

Exhibit 1: AFLEET Results for simple payback on a delivery truck, Texas vs National Avg

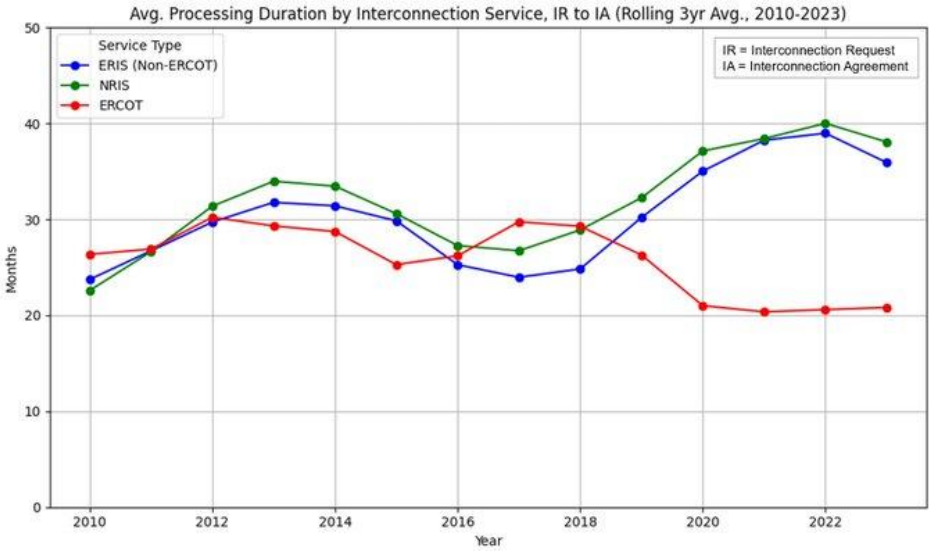


On a larger scale, one challenge nationally for the transition to MHDV charging is how long it can take to connect new larger projects to the grid. A smaller truck stop or private on-site charging build-out servicing no more than 10-15 trucks may not require any infrastructure or connectivity, but larger

[12] https://www.eia.gov/electricity/data/browser/#/topic/7?agg=2,0,1&geo=g&freq=M
[13] https://www.eia.gov/state/data.php?sid=TX#Prices
[14] https://greet.es.anl.gov/afleet

projects and charging for dozens of trucks – at public or private locations – can be met with considerable delays. On this front, Texas maintains an important advantage over other states as interconnection to the grid is twice as fast in ERCOT compared to other areas of the country.

Exhibit 2: Average processing duration.



Definition of an Electric Utility

One key policy factor that supports MHDV adoption is to provide clarity that electric vehicle supply equipment (EVSE) providers are not regulated as utilities simply because they 'sell electricity' to fuel a vehicle. This policy has been found to be one of the most important policy measures that influences MHDV market development.[15] Typically, language is incorporated into a specific regulatory or statutory definition that divorces the sale of electricity for fueling a vehicle from the usual "retail sale" of electricity, creating a "carve-out" in utility regulations. This often also enables EVSE providers to charge for the quantity of electricity consumed (charge by kilowatt) rather than charge for amount of time spent charging. In Texas, Utilities Code, Section 31, as amended by Senate Bill 1202 by the 87th Texas Legislature, which became effective on September 1, 2020, exempts entities that sell electricity for the purpose of providing power to a mode of transportation from the definitions of "retail electric provider and electric utility."[16]

[15] https://www.fuelsinstitute.org/Research/Reports/Evaluation-of-Policies-for-Electric-Vehicle-Chargi
[16] https://capitol.texas.gov/BillLookup/Text.aspx?LegSess=87R&Bill=SB1202

Challenges to ZEV Adoption in Texas

State-Level ZEV Goals

Several states across the country have enacted ZEV initiatives of various forms, ranging from aspirational goals to formal regulations. California is the best-known example, with an Advanced Clean Trucks (ACT) regulation for heavy-duty vehicles which sets requirements for the sale of MHDVs in the state.[17,18] The Advanced Clean Trucks regulation has been adopted by ten other states[19], with ACT campaigns underway in another four state.[20] Additionally, four other states have set aspirational goals toward achieving 100% ZEV sales by 2050 through Memorandums of Understanding.

Texas is not among the states that have adopted regulations or opted into non-binding agreements, which can limit the pace of MHDV adoption. Original equipment manufacturers that have limited MHDV supply may be compelled to send the few MHDVs available for sale to the states where regulations drive demand (and often compensate manufacturers for MHDV sales).

This could create a supply chain disadvantage for potential MHDV buyers in Texas, leaving Texas with less MHDV availability until production capacity expands. Where there are fewer MHDV operating or forecasted to operate, infrastructure developers may be slower to build because they are less certain that there will be sufficient market demand to realize a return on their infrastructure investment.

Alternatively, Texas' ability to transition towards MHDVs at the pace of the market can provide a competitive advantage for the state. Companies that find it difficult to follow state-level targets in other states could decide to prioritize deployment in Texas, drawing more business to the state. An absence of state-level targets may also allow Texas to grow at a pace and scale that prevents unnecessary strains to the grid, so long as Texas is proactive in adopting policies and regulations that support MHDVs.

Complications with the Deregulated Electricity Market (specific to MHDVs)

Texas' deregulated electricity market poses unique challenges, as many of the utility policies and incentives that are widely cited as supporting EV market development in other parts of the country do not translate to the deregulated portions of the state where transmission and distribution service providers (TDSPs) provide service. The Dallas-Fort Worth and Houston areas, which comprise a large proportion of the state population and freight activity, are part of the competitive retail choice areas largely served by these TDSPs. Exhibit 3 illustrates the boundaries of transmission and distribution utilities in the deregulated portion of the State[21].

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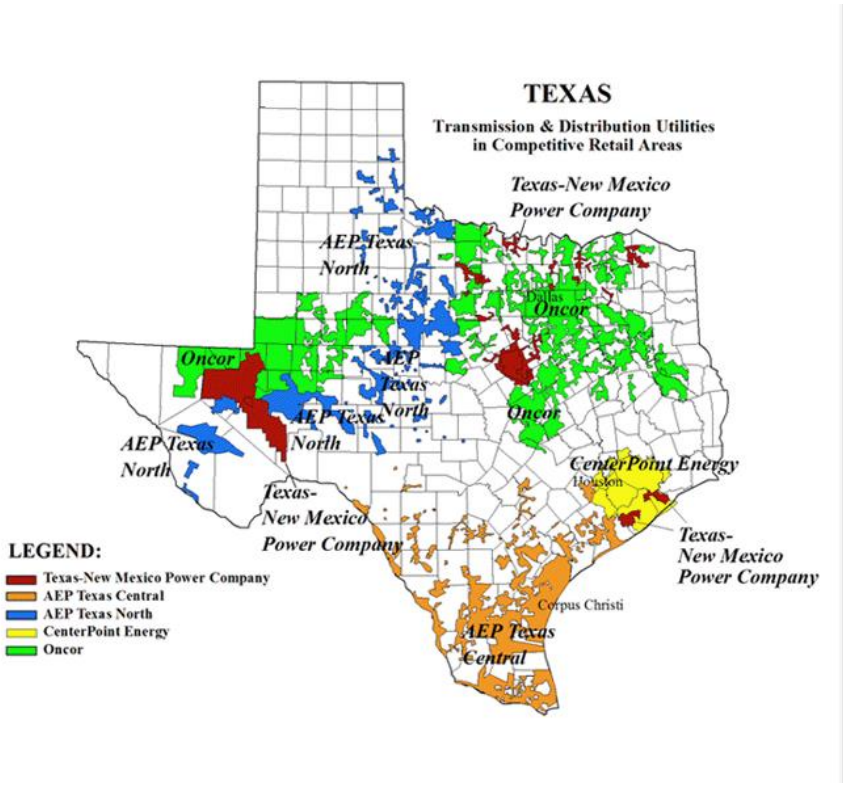
[17] https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program
[18] https://ww2.arb.ca.gov/our-work/programs/advanced-clean-trucks
[19] https://afdc.energy.gov/laws/california-standards#/tab-act
[20] https://www.electrictrucksnow.com/states
[21] https://ftp.puc.texas.gov/public/puct-info/industry/maps/maps/tdumap.pdf

Exhibit 3: Transmission and Distribution Utilities in Competitive Retail Areas of Texas



In these deregulated areas, the TDSP has responsibility solely for delivering electricity. Responsibility for electricity generation falls to de-regulated generating companies and competitive wholesale markets run by ERCOT, and responsibility for selling electricity to the end user falls to retail electric providers (REPs). As part of the transition to a competitive energy market, generation companies and REPs are prohibited under Public Utility Commission of Texas rules from participating in regulated transmission and distribution services and vice versa. That is regulated TDSPs are prohibited from offering competitive services. The REP is the only one of the three entities that has a direct relationship with the electricity end user, and customers are able to choose which REP they wish to use. The TDSP assesses fees for use of the ERCOT transmission system and distribution lines they manage, but these fees are assessed to the electricity customer through the customer's choice of REP.

This complicated dynamic presents challenges to the effective implementation of EV incentives or policies around time-of-use rates or demand charges.

EVSE providers often cite high demand charges as a barrier to building more charging stations in Texas. According to these providers, this issue warrants regulatory or statutory intervention to provide guidance to the TDSP utilities, which are currently unable to alleviate demand charges for purposes of EV charging projects under current standards of just and reasonable cost-based transmission and distribution delivery rates.

Time-of-use rates or EV-specific rates are often cited as a key incentive to encourage EV charging at off-peak times when electricity is more affordable for the end customer and the additional load from EV

demand would add load during times with latent generating capacity. As the Managing the Charging of your Medium and Heavy-Duty Fleet[22] report found:

> With managed charging, fleetwide peak load decreases from 200 kW to 150 kW for the hypothetical fleet, a 25% reduction from the unmanaged scenario. Managed charging saves the hypothetical fleet $714 per month per vehicle, a 37% reduction from the unmanaged scenario. Managed charging allows fleet owners to maximize their savings on operational costs without investing in more infrastructure.

In the competitive retail choice areas of the ERCOT market, the REP would be the entity to offer a time-of-use pricing program. REPs service offers are based on their business decisions and not subject to any PUCT rules. In contrast, TDSPs are limited to providing incentives solely for energy efficiency or other activities that reduce grid load. Because EVs and EV charging represents additional grid load, they cannot be incentivized under current Public Utility Commission rules.

Even if a REP was to offer a special pricing program for EVs, building consumer awareness of these types of programs is a daunting task. Many electricity customers in the ERCOT region can choose from numerous REPs and plans. As an example, 176 different electricity plans are available at the 76011-zip code, which is the home address for North Central Texas Council of Government offices.[23] This includes flat rate plans, variable rate plans, plans that include renewable generation, buy-back for on-site solar generation, and various other features. With this magnitude of choice, it is impractical to inventory EV-specific features, much less publicize or promote them to achieve consumer awareness. Consumers are often overwhelmed by the variety of choices just to choose a basic electricity rate that is best suited for their circumstance.

It should be noted that these challenges are present only in the deregulated portions of the state. There are substantial areas of Texas that do fall within regulated municipally owned utilities or electricity cooperatives, where there is ability to offer many incentives and programs. There may be opportunities to seek implementation of utility policies and programs to grow EV adoption, either by facilitating development of EV charging stations or crafting deployment projects among end users, especially fleets, within these territories.

Lack of Exemption for Heavier Truck Weight

While the Consolidated Appropriations Act provides for additional electric truck weight, it is applicable only to Interstates and facilities providing reasonable access to Interstates. This leaves a gap where heavier trucks may not be allowed on all public highways in Texas without additional policy provisions provided by state law and may create uncertainty or hesitation for fleet end users who operate on routes

[22] Managing your Medium and Heavy-Duty Fleet
[23] http://www.powertochoose.org/

that divert from the Interstate system. Given that electric trucks are most well-suited to shorter-haul routes, which may stay within Texas and frequently follow US Highways or State Highways, this may be particularly problematic. Texas Transportation Code Section 621.101 (b-1) allows an additional 2,000 pounds GVWR (an amount consistent with the federal provision) for trucks powered by natural gas and electric batteries but does not currently extend this allowance to any other fuel type.[24] This provision could be expanded to encompass hydrogen fuel cell electric drive trucks, a consistency that will be important to fleets who choose to own and operate each type of zero-emission MHDV for their fleets' different duty cycles.

In the event the state does not increase allowable weight, trucks as heavy as 88,000 pounds GVWR are allowed to operate in Texas if they possess a valid oversize-overweight permit. However, a need has been flagged for weight up to 91,000 pounds GVWR to accommodate weight-limited electric trucks – specifically, terminal tractors – that haul freight short distances over public roadways.

Limited Benefit of Low Carbon Fuels Standard

The Low-Carbon Fuel Standard creates an economic incentive for companies to produce low-carbon fuel. The fuel producer can pass a portion of the incentive on through reduced fuel costs, thus providing a benefit also to the end user. This policy has helped drive decarbonization of natural gas and biofuels and can have the same impact on hydrogen fuel by shifting production methods away from conventional fossil-fueled steam methane reformation. Texas currently realizes partial benefits of this policy by producing low-carbon fuel that is ultimately sold in other states. Establishment of a low-carbon fuel standard in Texas, either at the state level or nationally, would enable realization of additional economic benefits and support further market development within the state.

Other Texas Legislation Relevant to ZEV Adoption

Texas Electric Vehicle Registration Fee:

Transportation Code 502 as amended by Texas Senate Bill 505[25], 88th Legislative Session, 2023, requires a $200 fee at time of initial registration for fully electric cars and trucks with a GVWR of 10,000 pounds or less. New EV's issued two years of registration to match a two-year inspection are assessed a $400 fee[26]. Due to the rising popularity of electric vehicles, many states have made the decision to add this annual registration fee to ensure EV owners are helping contribute to funding for road and bridge improvements, bridges, and other infrastructure projects. Historically, these improvements were paid for by gasoline/diesel fuel tax dollars, which EV owners were not paying. The Texas annual EV

[24] https://statutes.capitol.texas.gov/Docs/TN/htm/TN.621.htm
[25] https://legiscan.com/TX/text/SB505/id/2796013/Texas-2023-SB505-Enrolled.html
[26] Electric Vehicle (EV) Fee TxDMV EV Fee Memo, April 2023

registration fee is similar to other states, including Washington, Georgia and California, which charge $150, $200 and $100, respectively. The impact of the fee on EV adoption in Texas is not yet clear, and thus far only impacts light and medium-duty vehicles. Similar registration fees in other States have not been reported as having significant impact on vehicle registration.

Electric Vehicle Charger Inspection Regulations

Senate Bill 1001[27] requires the Texas Department of Licensing and Regulation to provide rules for installation and operation of electric vehicle supply equipment and allows periodic inspection of charging stations. TDLR has until December 1, 2024, to adopt rules to govern the program. These requirements are expected to improve the usability of public charging stations, protect consumers and provide a procedure for consumer complaints regarding EV charging stations. As these rules have not been published, their impact is unknown at this time, including if it will impact the MHDV sector.

Public Utility Electric Vehicle Charger Policy Design Requirements

SB 1002[28] addresses electric utilities, transmission and distribution utilities, competitive entities, and the PUCT by establishing a framework for competitively natural policies to encourage competitive private sector investment in public EV charging station, develop and implement electricity tariffs optimized for EV charging, and encourage private investment. As with SB 1001, it is unclear how this law may impact the MHDV market, as it was designed to focus only on light-duty vehicles.

Local Barriers to ZEV Adoption

Soft Costs from Local Regulation & Processes

A recent study by the Rocky Mountain Institute found that "soft costs" – expenses associated with permitting delays, local regulatory processes, etc. – present the greatest opportunity for cost reduction in the expansion of EV charging.[29] Reduction of soft cost barriers can reduce infrastructure expenses and reduce delays and installation time. Municipalities may inadvertently hinder development of MHDV infrastructure projects when they employ strict parking or permitting requirements for EV charging or hydrogen fueling stations. This has been an issue primarily with Direct Current (DC) Fast Charge electric

[27] https://www.tdlr.texas.gov/news/2023/08/24/electric-vehicle-charging-stations-are-regulated-by-tdlr/
[28] https://www.legis.state.tx.us/tlodocs/88R/billtext/html/SB01002F.HTM
[29] Chris Nelder and Emily Rogers, Reducing EV Charging Infrastructure Costs, Rocky Mountain Institute, 2019, https://rmi.org/ev-charging-costs

charging stations due to permitting requirements. At issue is a requirement for both building and electrical permits and, in some cases, there have been reports of parking studies being required because the ancillary equipment to support a DC Fast Charge station (transformers and electrical cabinets, often placed on a cement pad) displaces a few parking spaces.

These challenges can be resolved through adoption of permitting best practices. The Fuels Institute EV Market Regulatory Report gives insight on how streamlined permitting can have a large impact on the effectiveness of installation processes.[30] The report highlights how expedited and streamlined permitting laws can significantly lessen costs associated with site redesigns and administrative delays, both of which may result in less site investment. Ensuring a consistent statewide standard for permitting, instead of allowing local jurisdictions to set widely variable regulations, can provide clarity and confidence to EVSEs and fleets looking to expand MHDV charging in Texas.

Project developers may find the local policy environment to be more friendly in jurisdictions which have adopted sustainability, clean air, or climate action plans. These localities may have already streamlined local regulatory structures, or may be inclined to make changes, to support MHDV adoption. A new program called "Charging Smart" provides a suite of best practices for local governments to select from to receive designation as an "EV-friendly" community in a way that balances the industry's need for streamlining with flexibility that best suits their local circumstances[31].

Federal Incentives

Incentive funding from federal programs to support ZEV projects can be available from formula programs (where a set amount of money is directed to specific entities based on an allocation formula, which often includes population), discretionary programs (where applicants compete for funding via competitive proposals or grant applications), or tax credits. Some federal programs, especially those from the Environmental Protection Agency (EPA) or Department of Energy (DOE), have funded ZEV projects for a long time. However, the availability of federal funding to support ZEV deployments expanded substantially with passage of the Infrastructure Investments and Jobs Act (IIJA) in November 2021. This legislation put increased emphasis on transportation electrification and ZEV infrastructure in many existing federal transportation funding programs and also established a variety of new funding programs. The US Department of Transportation has inventoried federal funding programs available for electrified mobility and identified the key activities for which each program could be used. Key activities relevant to MHDV projects include infrastructure planning, vehicle acquisition, workforce development, and commercial charging infrastructure.

[30] Fuels Institute EV Market Regulatory Report, https://www.fuelsinstitute.org/Research/Reports/EV-Market-Regulatory-Report
[31] Charging Smart - Interstate Renewable Energy Council (IREC) (irecusa.org)

Federal Incentive Summaries:

- Urban Electric Mobility Infrastructure Funding Table | US Department of Transportation
- Rural EV Infrastructure Funding Table | US Department of Transportation

Notably, the Joint Office identifies several large, well-funded programs which are generally focused on traditional transportation or bridge infrastructure, such as the Congestion Mitigation and Air Quality Improvement Program (CMAQ) and Rebuilding American Infrastructure with Sustainability and Equity (RAISE) programs as available sources of funding for ZEV projects.

Substantial amounts of US DOT funding are available for states from the Federal Highway Administration (FHWA) Congestion Mitigation and Air Quality Improvement Program (CMAQ) and the FHWA Surface Transportation Block Grant Program (STBG). Funding from these federal programs flows to the Texas Department of Transportation (TxDOT), which administers some funding at the state level. Metropolitan Planning Organizations (MPOs) also receive formula allocations of these funds from TxDOT. The MPO policy boards make recommendations about which projects should receive funding. Those projects then are allocated dollars either through a contract with the MPO or with TxDOT directly.

State Incentives

Texas has state incentives for 'clean vehicle' type projects through the TERP Program, which was created by the Texas Legislature in 2001 to reduce emissions in Texas' ozone nonattainment and near nonattainment areas. TERP is governed by statutes laid out primarily in Texas Health and Safety Code Section 386. The TERP Program provides financial incentives to eligible individuals, businesses, or local governments to reduce emissions from high-polluting vehicles and equipment. The Texas Commission on Environmental Quality (TCEQ) administers the program through a variety of individual grant initiatives, which have been outlined by the legislature and are laid out in various statutes. The program has been modified over the years in various ways, with additional programs created and funds set aside for certain research purposes, but the overall intent is still focused on reducing emissions of ozone-forming nitrogen oxides in affected counties.

Until Fiscal Year 2022, TERP was subject to legislative appropriation. In many years, the legislature did not appropriate all revenues collected for TERP purposes, resulting in a balance of nearly $2 billion in revenues collected for TERP purposes which have not been appropriated[32] and remain in the state treasury. During the 86th Texas Legislative Session, House Bill 3745 created the TERP Trust Fund, which divorced new incoming TERP revenues from the legislative appropriation process and instead directed them into a trust fund managed by TCEQ. This bill had the overall impact of significantly increasing the

[32] Appendix 1, Texas Emissions Reduction Plan Biennial Report (2019-2020): Report to the 87th Texas Legislature, December 2020. https://www.tceq.texas.gov/downloads/air-quality/terp/publications/sfr/79-20.pdf

total amount of funding available through TERP programs starting with the Fiscal Year 2022-2023 biennium.

In addition, the State of Texas received nearly $209 million from the Volkswagen settlement and designated TCEQ as the agency responsible for administering the funding. TCEQ outlined plans for distributing this money through the Texas Volkswagen Environmental Mitigation Program[33] (TxVEMP). While most funds from TxVEMP were expended through an initial funding cycle that awarded mostly diesel vehicles, the TCEQ did leverage the maximum allowed 15% set-aside to fund EV charging, and approximately $86.6 million "left over" from the first vehicle and equipment funding cycles was released through an "All Electric" funding round that only funded battery or fuel cell electric vehicles or equipment.

Exhibit 4: Inventory of State Funding Programs

Program	Project Scope	Light-Duty/Medium-Duty/ Heavy-Duty Vehicles	Key Constraints
TERP Light-Duty Motor Vehicle Purchase or Lease Incentive Program	Provide rebates for the purchase/lease of light-duty natural gas and ZEV vehicles.	Light-Duty EV and FCEV	Inadequate funding level for ZEV; first-come, first-served awards; arbitrary limits on projects
TERP Texas Clean Fleet Program	Provide funds to replace older diesel vehicles with alternative fuel medium-duty/heavy-duty vehicles.	Light-Duty/Medium-Duty/ Heavy-Duty EV and FCEV	Requires scrappage; overly narrow selection criteria; historically underfunded; cannot be combined with federal funds; does not include infrastructure
TERP Rebate Grants Program	Provide funds to replace older vehicles with newer, conventional and alternative fuel medium-duty/heavy-duty vehicles.	Medium-Duty/Heavy-Duty EV and FCEV	Historically requires scrappage; first-come, first- served awards; cannot be combined with federal funds; overly narrow selection criteria
TERP Emissions Reduction Incentive Grants	Provide funds to replace older diesel vehicles with newer, conventional and alternative fuel medium-duty/heavy-duty vehicles.	Medium-Duty/Heavy-Duty EV and FCEV	Requires scrappage; overly narrow selection criteria; cannot be combined with federal funds; highly competitive; overly narrow selection criteria
TERP Governmental Alternative Fuel Fleet Grant Program	Provide funds for the purchase or lease light-duty/medium-duty/heavy-duty alternative fuel vehicles.	Light-Duty/Medium-Duty/ Heavy-Duty EV and FCEV	Inadequate funding level for ZEV; cannot be combined with federal funds
TERP Seaport and Rail Yard Areas Emissions Reduction Program	Provide financial incentives to replace older drayage and cargo handling equipment with newer lower-emitting equipment.	Medium-Duty/Heavy-Duty EV and FCEV	Requires scrappage; does not encompass required infrastructure; overly narrow selection criteria; cannot be combined with federal funds; first-come, first-served
TERP Alternative Fueling Facilities Program	Provide funds for the installation of alternative fuel infrastructure, with priority given to projects		Broad scope/highly competitive; cannot be combined with federal funds; possibly inadequate funding level for MHDV

[33] https://www.tceq.texas.gov/agency/trust/

	that are publicly accessible.		
Texas Volkswagen Environmental Mitigation Program	Provides funding to replace diesel vehicles with newer, lower emitting vehicles. - School Bus - Freight Trucks - Refuse Trucks - Various Equipment After an initial funding round open for any new fuel type, ~$86.6M was made available just for ZEV through an All-Electric Program	Medium-Duty/Heavy-Duty EV and FCEV	Unreliable funding availability: overly narrow selection criteria (set by the court settlement, not by the TCEQ); first-come, first- served awards

Key Constraints of Existing Incentive Programs

Buy America

Buy America has become a major barrier across a variety of federal programs. Section 165 (49 USC § 5323(j)) of the Surface Transportation Act of 1982 (commonly known as the Buy America Act), was originally established to ensure the use of domestic iron and steel for road and bridge projects. As the scope of eligible projects evolved to include elements such as vehicle purchases, the application of the same domestic content requirements to manufactured goods, including vehicles and more recently, charging stations, has posed challenges. In recent years, this challenge has surfaced most substantially for the CMAQ Program, where current FHWA CMAQ guidance emphasizes funding for cost-effective emissions reductions, and highlights diesel retrofits as a program priority. Despite this prioritization, because the supply chain to manufacture vehicles and many infrastructure components is global in nature, vehicles and infrastructure generally cannot meet this standard. In fact, FHWA has acknowledged that no commercially available vehicle on the market has been identified that can meet FHWA Buy America standards. The consequence of this has been that MHDV projects are eligible on paper but cannot be implemented in practice unless a waiver for Buy America requirements can be obtained for the project. FHWA had initiated a standard quarterly waiver process for vehicle projects but stopped processing these waivers in 2017, following the Presidential Executive Order on Buy American and Hire American issued April 18, 2017.[34] This resulted in the suspension of many CMAQ-funded clean vehicle related projects nationwide. Some ZEV infrastructure may comply, but availability is limited. This has created a disconnect between the stated priorities of the legislation and practical application of regulatory requirements.

[34] https://www.federalregister.gov/documents/2018/04/16/2018-07901/buy-america-waiver-notification

Challenges also exist for MHDV infrastructure. While a limited number of charging stations have been able to document Buy America compliance, there is not a sufficient supply of these stations to fulfill the nationwide demand for electric vehicle chargers to fully implement the National Electric Vehicle Infrastructure Formula Program, let alone other US DOT funding programs. Again, increased emphasis on MHDV deployments from the BIL will likely exacerbate limited supplies of Buy America compliance equipment and components.

Potential Solutions: A variety of solutions to this disconnect have been proposed, including reinstatement of a routine waiver process for vehicles. Updated Buy America guidance was released in early May 2022.[35] The new guidance directs federal agencies to avoid unnecessary disruption and provides direction about the issuance of waivers. The new guidance allows for flexibility to maintain current policies where appropriate to avoid unnecessary disruption to program, or elements of programs, that already meet or exceed Build America, Buy America requirements - this wavier was utilized for the EPA's Clean Ports Program[36] in May 2024. The waiver raised disconnects among stakeholders regarding what is required by legislation and the practical application of regulatory requirements. However, if agencies like FHWA follow the model set forth by the EPA and re-evaluate legislative priorities and institute updates to their policies and procedures, there may be progress towards streamlining previous Buy America compliance challenges.

A preferred solution would be to avoid content restrictions on eligible vehicles or infrastructure, and instead to incentivize U.S. and Texas-based manufactured products through tax credits or bonuses. It may be more practical to implement state-level incentives to help overcome other barriers.

Broad Scope/Highly Competitive

Many federal programs are very broad in scope. While they may accommodate funding for ZEV deployment activities, they may also accommodate a variety of disparate other activities that ZEV deployment projects must compete against (e.g., US DOT programs like the Infrastructure for Rebuilding America Program and the RAISE Program may fund traditional transportation infrastructure like bridges that impact more system users; US Department of Energy (DOE) funding may fund outreach and engagement activities that are lower-cost). It can sometimes be hard for ZEV deployment projects to garner prioritization over other projects.

TERP programs are also highly competitive, with several programs consistently having more funds requested than available. With the creation of the TERP Trust Fund and the associated increase of funds,

[35] https://www.whitehouse.gov/wp-content/uploads/2022/04/M-22-11.pdf
[36] Clean Ports Program

programs which are allocated a percentage of the overall budget, such as TERP's Texas Clean Fleet Program and Governmental Alternative Fuel Fleet Grant Program (GAFF), will be able to take advantage of the additional funds now available and may no longer be underfunded. However, the Alternative Fueling Facilities Program (AFFP) is not allocated a percentage of the overall budget, but rather the maximum amount of funds for this program is set at $6 million by Texas Health and Safety Code (THSC) Section 386.252. For the AFFP to gain additional funds, a change in statute would be needed. Other TERP programs will need to be revisited to evaluate whether the changes in the TERP Trust Fund resulted in these programs no longer being underfunded.

Potential Solutions: Presently, applicants seeking state funding for MHDVs and related infrastructure will navigate 5-6 different grant programs, each of which may have slightly different requirements. The TERP and Trucks[37] report from the Environmental Defense Fund recommends consolidating the programs, to make it easier for applicants to secure funding for MHDVs and related infrastructure, as well as making technical adjustments to the administration of TERP. These recommendations were recently presented to the Texas House Committee on Environmental Regulation, for consideration in advance of expected legislation to be considered during the 89th Regular Session of the Texas Legislature.

For TERP, TCEQ has flexibility to adjust dollars among programs after all incentive programs are competed, if there are "leftover" dollars from a program that has been undersubscribed. This may result in some projects receiving funds simply because they have no competition, even though those projects are not particularly impactful. However, if statute provided this flexibility to TCEQ at the outset of each biennium, the agency would be able to direct funds to programs that are the most oversubscribed, which may increase the proportion of highly meritable projects that are able to be awarded from the high-demand programs. This change would require legislative action. Again, consolidating several of the programs into one will also allow similarly for the distribution of funds.

Unreliable Funding Availability

To effectively track available funding programs and align them with fleet needs, dedicated staff is often required to monitor multiple programs and their timelines. This is particularly difficult for programs that are not formula based. For example, programs from the DOE Vehicle Technologies Office are made available every year but with substantially different topic areas that may be unrelated to the priorities released the prior year. Still others, such as the Environmental Protection Agency (EPA) Diesel Emissions Reduction Act (DERA) or TCEQ's TERP are issued repeatedly and with consistent objectives, but

[37] TERP and Trucks

historically have not adhered to a predictable schedule. In all cases, these characteristics prevent potential applicants from being able to conduct long-term planning and project development.

> **Potential Solutions:** Funding agencies could publish a long-range schedule of funding cycles within each incentive program that includes multiple Fiscal Years at a time. A published schedule or set frequency of funding cycles would enable longer-range planning and coordination among the public and private sector to optimize investments. Ideally, the schedule could include expected application windows, timing of award notices, and timeframes for required project completion. This would also enhance the ability of applicants to leverage federal and state programs together, as the long-range schedule could enable state and local funding agencies to time their incentive programs in a manner that enables leveraging with federal dollars.

Scrappage Requirements

Many programs require scrappage of older diesel vehicles, which is a constraint in several ways. First, the fleets most likely to be early adopters of MHDV are unlikely to have old diesel vehicles in their fleet which meet replacement criteria, as they typically sell vehicles after only a few years of operation to maintain a new, high-performing fleet. By the same token, early MHDV adopters may have already transitioned away from diesel trucks and are using alternative fuel vehicles. Additionally, the requirement to scrap vehicles forces fleets to forfeit resale value, which can make the project economically unviable.

> **Potential Solutions:** The Texas Legislature should require TCEQ to create and maintain a database of individuals and entities that own qualifying vehicles (pre-2009) that would be willing to partner with a third-party scrappage program. Recently, TCEQ began to allow a third-party scrappage arrangement through a waiver process that grant applicants can apply for when seeking funds for new vehicles. For example, an applicant could sell a used 2015 Class 8 truck to an independent owner operator, which would then remove their pre-2009 vehicle from the road. With proper documentation, the applicant can secure grant funding for a new vehicle – less the amount of money made from selling their used vehicle.
>
> TCEQ would provide education materials about the program and include them with any public facing materials (website, webinars, etc.) discussing MHDV programs. The database would include contact information for the third-party participant, their address for place of business, the model year of the vehicle, and other relevant information as determined by the agency. TCEQ may partner with other state and local entities, including port authorities, councils of government, county and city governments, and other stakeholders to recruit participation for the program among third parties, and to promote the program to potential applicants. This proposal is expected to be debated and discussed during the 89th Regular Session of the Texas Legislature.

Cannot be Combined with Federal Funds

TCEQ has stated that funds from various TERP state incentive programs cannot be combined with any other incentive funds that are based on emissions reductions, including EPA DERA funds, to eliminate the risk of double-counting emissions benefits to two different programs. Similar issues may occur in other states. This requires the applicant to secure "matching fund," or the cost of the project that the grant does not cover, from out-of-pocket sources. For MHDV projects that are likely to be expensive and/or require additional infrastructure investment, this can make a project economically unviable.

Additionally, TCEQ recently began requiring the incremental cost of any proposed project to be reduced by the value of any other existing financial incentive that directly reduces the cost of the proposed project, including tax credits or reductions, other grants, or any other public financial assistance. While it is important to ensure that no organization "profits" from incentives, this may be more restrictive than necessary as no TERP program provides 100% funding of the incremental cost of vehicles.

> **Potential Solutions:** The awarding agency could issue clear statements that awarded funding is not claiming emissions reductions for State Implementation Plan or other purposes, and that any emissions reductions resulting from the funding programs may be credited to other grant programs. To guard against recipients "profiting", the funding agency could simply require disclosure and documentation of other incentives received and verify that total funding received does not exceed the costs at the time of reimbursement.

Inadequate Funding Level for MHDVs

Several programs have funding levels that are set too low to encourage the acquisition of MHDVs and related infrastructure, as they still bear the highest incremental cost relative to other fuel types. Often, project applicants prefer funding programs to cover the incremental cost of purchasing an MHDV instead of a conventional diesel or gasoline vehicle to help reach cost "parity." In Texas, NCTCOG has identified several TERP programs as having inadequate funding levels to cover the incremental cost of MHDVs:

> The Governmental Alternative Fueling Facilities Program: Texas Health and Safety Code (THSC) Section 395.007 (a) states the commission may establish standardized grant amounts for the GAFF Program based on the incremental costs associated with the purchase or lease of different categories of motor vehicles, including the type of fuel used, vehicle class, and other categories the commission considers appropriate. Currently, the funding levels are as follows:
>
> - Class 1 vehicles: $15,000
> - Class 2-3 vehicles: $20,000
> - Class 4-6 vehicles: $35,000
> - Class 7-8 vehicles: $70,000

After using the 2023 Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) tool,[38] the average costs of medium and heavy-duty vehicles can be seen below.

Exhibit 5: Average costs of medium and heavy-duty vehicles

Vehicle Type	Diesel Vehicle Cost	EV Cost	Incremental Cost for EV
Class 6 Delivery Straight Truck	$75,000	$185,000	$110,000
Class 7-8 Refuse Truck	$300,000	$500,000	$200,000
Class 7-8 School Bus	$100,000	$300,000	$200,000
Class 7-8 Dump Truck	$170,000	$370,000	$200,000

As seen above, the current funding levels of GAFF are not adequate to cover the incremental cost of medium- and heavy-duty electric vehicles (MHDVs).

The Light-Duty Motor Vehicle Purchase or Lease Incentive Program: Under THSC Section 386.154, the Light-Duty Motor Vehicle Purchase or Lease Incentive Program (LDPLIP) provides rebates for purchasers of light-duty cars or trucks. Currently, the rebate for the purchase or lease of an electric drive (including plug-in hybrids, BEVs, and FCEVs) is up to $2,500. However, according to AFLEET, the incremental cost of light-duty ZEVs is $17,500 for BEVs and $30,000 for FCEVs.

The Alternative Fueling Facilities Program: The AFFP funds new construction or the expansion of existing alternative fueling facilities for public or private entities or individuals within the Clean Transportation Zone. The AFFP funding levels are set in THSC Section 393.006, and funds up to 50 percent, or a maximum of $600,000, for eligible projects, which can include both electric charging equipment and hydrogen fueling facilities. While 50 percent is a workable funding threshold, the $600,000 maximum may be inadequate on charging stations designed for larger vehicles, which are likely to be much more expensive than the light-duty EV charging stations built to date. Removing the $600,000 maximum award, and instead setting the maximum funding per project at 50 percent, could help incentivize MHDV infrastructure.

Potential Solutions: Maintaining funding levels based on a percentage of cost, without specific dollar caps, may be a streamlined way to ensure adequate funding levels. The percentage could be set to a level that is adequate to cover, or nearly cover, the incremental cost. If cost surveys are used to set incentive amounts, they could be refreshed on an annual basis to ensure the latest and greatest data is used to inform funding amounts. The Clean Cities Program collects information on vehicle and station costs annually and can be a source of this information. As a note, applicants have responded favorably to funding levels offered by the EPA Diesel Emissions Reduction Act (DERA), which provides for 45 percent of the total cost of a ZEV and (in the case

[38] https://greet.es.anl.gov/afleet

of an electric MHDV) an accompanying charging station, providing one example of what may qualify as an "adequate" funding level.

Revisiting funding levels under TERP programs may be timely. As previously discussed, the total amount of funding available under TERP should increase substantially due to the change in statute that directs revenues to the TERP Trust Fund rather than leaving them subject to legislative appropriation. The increased revenue may be able to support increased incentive amounts without reducing the total number of projects able to be funded. While GAFF incentive levels are set by TCEQ, funding amounts under the LDPLIP and AFFP are set in statute and can only be increased through legislative action. Adjusting these programs via program consolidation may also alleviate some of the cost constraints by setting a larger total pool of funds for MHDVs and infrastructure.

Several funding programs which can support MHDV replacements do not include infrastructure funding as an eligible cost. For effective charging of MHDVs, fleets will need access to high-powered DC Fast Chargers, which can recharge batteries quickly and enable vehicles to resume operations in a prompt manner that is as comparable as possible to the quick refueling process of diesel-powered trucks. Exhibit 6 below summarizes estimated costs for DC Fast Charge equipment but does not include additional costs associated with transformers, switchgear, installation cost or other utility upgrades.[39]

Exhibit 6: Estimated costs for DC Fast Charge dispensers only.

Charger Type	Cost Range Estimate
DC Fast Charge (50 kilowatts)	$20,000 - $35,800
DC Fast Charge (150 kilowatts)	$75,600 - $100,000
DC Fast Charge (350 kilowatts)	$128,000 - $150,000

New Purchase Incentives for MHDVs

Currently, grant programs are primarily focused on incentivizing MHDVs as replacements for existing, dirtier vehicles (often diesel). As previously described, there are several constraints with this approach, and the fleets who are most likely to be early adopters of MHDV technology are likely to benefit the most from a simple incentive on a new purchase. This could be in the form of a new purchase rebate or a tax credit or tax deduction. To be most impactful, however, many stakeholders have indicated the MHDV incentives should be applied at the point of sale.

MHDV Incentives at the Point of Sale

[39] Chris Nelder and Emily Rogers, Reducing EV Charging Infrastructure Costs, Rocky Mountain Institute, 2019, https://rmi.org/ev-charging-costs

Currently, most incentives are structured to be claimed after a transaction has already been completed. This is also true for many of the federal programs, which are structured as grants or rebates. This means that the fleet or consumer claiming the incentive has to 'front' the entire cost of the MHDV project and wait to be reimbursed after the fact.

> **Potential Solutions:** More programs could be modified to follow the example of the TERP Government Alternative Fuel Fleet Program, which allows recipient government entities to request funds up-front.

Other mechanisms for applying the incentive, such as applying the funds at the point of sale, or advancing funds based on documentation of a purchase order, can reduce the amount of expenses the end user must provide out-of-pocket. This can also expand the pool of potential applicants by reducing the 'barrier to entry' in terms of how much funding an end user must have available or be able to finance, making purchase of an MHDV more affordable.

This is impactful for both consumers looking to acquire a personal vehicle, and for fleets, as many small business fleets or smaller government fleets face affordability challenges like low- and moderate-income individuals. To allow this, an incentive program would need to specify that it does not have to comply with Texas Grant Management Standards. Examples of programs that use these types of approaches are described by the California Hybrid and Zero-Emission Truck and Bus Voucher Incentive Project[40] (HVIP), and include Hybrid and Zero-Emission Truck, Bus Voucher Incentive Program, and the EPA's 2022 Clean School Bus Rebate.

Incentives Provided to the MHDV Dealer/Vendor Instead of the End User

The wide range of incentive programs available for MHDV projects can be very confusing to fleets or consumers as each program has its own set of requirements, eligibility, schedule, and process. This can deter prospective applicants from taking advantage of the programs, especially among smaller organizations that may not have staff dedicated to grant writing or grant processing.

This barrier could be eased by allowing incentives to be claimed by a MHDV dealer or vendor, who likely has more institutional resources or can dedicate a person to becoming an expert in each incentive program and achieve economies of scale. The dealer or vendor could then pass the incentive through to the end user as a discount on the sale, greatly simplifying the process from the fleet or consumer perspective. Examples of programs that use this approach include Hybrid and Zero-Emission Truck and Bus Voucher Incentive Program and the Oregon Clean Vehicle Rebate Program[41]. At one point several TERP programs allowed this via an arrangement called a third-party assignment.

[40] Hybrid and Zero-Emission Truck, Bus Voucher Incentive Program
[41] Oregon Clean Vehicle Rebate Program

Conclusion

The public policy landscape surrounding medium and heavy-duty vehicles continues to evolve, as federal and state officials sort how best to regulate and support the transition to electric MHDVs. Though Texas lacks some of the requirements of other states, it also can benefit from a generally more friendly electricity market, as well as the ability to build off an existing and successful grant program in TERP.

As state legislators and regulators examine the shifting policy landscape that impacts the manufacturing, operations, and public and private investments in the development of MHDV charging infrastructure in Texas, there are several broad ideas and policy areas to prioritize:

- **Utility policies** – Texas has a competitive advantage over the rest of the country when it comes to electricity prices and new generation and new load interconnection services especially in the competitive areas of the state. The state should build on those advantages by seeking to implement regulatory frameworks, including mechanisms outside of rate cases, that direct utilities to make proactive investments to serve MHDV electrification hot spots without waiting for individual fleets to make load requests. Managed charging, build-to-need infrastructure policies, and clarity on the role that REPs, TDSPs, and generators play in adopting these new regulatory policies should be incorporated into ongoing grid planning and studies already underway at the PUCT and ERCOT.

- **State-level incentives** – Federal Build America Buy America[42] (BABA) requirements place a heavy strain on what types of vehicles and infrastructure can qualify for funding; Texas' state grant programs have no such constraints. Additional incentives that reward Texas-based manufacturing products should be considered by the state, as well as broader reforms for TERP such as consolidation and third-party scrappage. The ability to pair federal and state funding for certain projects, as well as point-of-sale and/or dealer or vendor focused incentives, may also be considered.

- **Permitting and truck regulations** – Delays to permitting for building and energy codes, which can vary tremendously across regions of the state, can be mitigated through the adoption of statewide standards. Additional examination of weight limits for zero-emission trucks, especially on more local routes that are more likely used by regional haul trucks that will electrify first, should also be considered.

[42] Build America Buy America

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(2) identify opportunities to facilitate the exchange of information between utilities, stakeholders, and private entities regarding fleet charging profiles and projected energy needs in the coming decade to improve load growth projections and generation allocations across Electric Reliability Council of Texas (ERCOT) regions;

Introduction

In the coming decades, a buildout of high-power charging infrastructure and a measured, scalable expansion of power grid will be needed to meet the growing demand of electric MHDV deployment. According to the International Council on Clean Transportation[43], Texas is projected to have the highest share of energy needs from MHDV charging in the country by 2030. The ability to accurately project how much, where, and when that energy will be needed is key to proper modeling and planning.

The North American Council on Freight Efficiency counsels that, "Assuming 'worst case' values, for example, can significantly skew science-based decision-making by underestimating or overestimating benefits and challenges." Collecting data on each use case and calibrating load impacts at the substation and distribution feeder level requires better inputs from fleets, more open energy mapping from utilities, and stronger oversight and collaboration from state regulators.

To examine this challenge, the taskforce reviewed existing analyses on MHDV charging needs in Texas, met with fleets deploying electric trucks and buses in Texas and other states, and met with companies who have built MHDV charging stations around the country to better understand the energy needs and scalability of their sites.

A few common themes emerged from our research and conversations:

1. **Fleet charging profiles vary based on vehicle class, geography, and use-case.** Electric school buses will operate differently and have different charging needs throughout the state, just like their diesel counterparts. Class 8 heavy-duty trucks used for short-haul regional trips in the Greater Houston area can charge slowly overnight; Class 8 heavy-duty trucks used for longer trips from McAllen to Fort Worth need faster public charging along highway corridors. These variables require robust information sharing to generate inputs that inform state and utility modeling and planning are as accurate as possible.

2. **Fleets, charging companies, utilities, and regulators recognize the value of exchanging data and would all benefit from more information.** Private companies and utilities are eager

[43] https://theicct.org/wp-content/uploads/2023/05/infrastructure-deployment-mhdv-may23.pdf

to accelerate the build-out of MHDV charging infrastructure. That build out should be done in a manner that provides benefits to existing Texas utility customers beyond enabling fleet electrification by delivering improved reliability, resiliency, job creation, and renewable energy integration. There is a shared economic and environmental interest among stakeholders to exchange data about charging profiles and energy supply early and efficiently, so long as doing so does not result in any lost competitive advantages. Future technical solutions are available to facilitate the exchange of information, within the bounds of official guidance and requirements set forth by lawmakers and regulators.

3. **Stakeholders are still learning how MHDV charging works in Texas**. Private fleets and charging companies are still learning how utilities operate in Texas, and how different the regulatory landscape is here compared to other leading MHDV states such as California. Likewise, utilities and state regulators are still discovering what fleets and charging depot centers require to be shovel-ready for onsite capacity today while maintaining the ability to scale up in future years.

4. **Leadership from the Legislature can help set the balance between short-term and long-term investments needed for modeling, planning, and grid improvements.** Investments in personnel and expertise among regulators and utilities must be prioritized to ensure high-quality forecast modeling and planning efforts are the standard in Texas. Improved real-world data ensures the long-term investments needed for transportation electrification can be properly incorporated into both transmission and distribution system upgrades and grid improvement policies pursued by the state.

Additional information on these topics is detailed below. The choices made on these topics, including the level of commitment and urgency with which they are implemented, will determine how well fleets, utilities, infrastructure developers, and regulators can improve communication and grid planning for transportation electrification.

Fleet Charging Profiles

The fleet manager's main goal is to maintain operational readiness for their fleet's vehicles. This requires understanding the duty cycle of the vehicles daily – where does the vehicle need to go and how far can the delivery van, school bus, or tractor trailer go with a single fueling – as well as longer timelines for maintenance and replacement of every vehicle in the fleet. Variables such as fuel costs, traffic, climate, and on-road accidents are considered and built into operational planning.

Similar planning is required to electrify fleets. Properly scaling a transition to electric fleets on a timeline that provides for piloting a few vehicles, building internal expertise for maintenance and operation, and adding vehicles as power becomes more available and costs for MHDVs decreases is critical to a

successful transition. As utilities prepare for this transition to MHDVs, understanding the fleet charging profile is key to ensure that capacity is available at the location of the charging infrastructure, particularly for the larger depots. However, the charging profile for a fleet today may vary for a fleet tomorrow as more vehicles are electrified within that fleet, and also across the transportation sector as a whole. The dynamic exchange of information on fleet charging profiles is important to get right today for the decades to come.

For example, imagine a school district that owns and operates 100 school buses. At least 20 school buses need to travel over 50 miles each way, over lots of hills, starting at 5am, and then be available for similar return routes and/or longer trips for football and band after school that require them to not return to their base until late at night. However, the other 80 school buses never travel more than 50 miles in a day, and even with hills and hot temperatures, a day's charge is more than sufficient. Due to costs and grant availability, a school district that wanted to electrify their fleet may only be able to secure 10 electric school buses in any one year. Ultimately, then, the school district – and the utility, and the state – can know that in three years, that one school will need enough power to charge 30 buses during off-peak hours overnight and have access to at least one public charging station along a highway corridor (or at a neighboring county's football stadium) where they can charge for longer trips as needed. However, grid planners can only know about the timing of this transition with proper modeling and data exchange.

The transition to electric fleets will be slow and steady. In our interviews with companies that have built charging depots around the country, we discovered that most are building out sites with at least 60 and as many 100 chargers of mixed speeds. They will have some rapid chargers for quick-pull throughs, and regular chargers for trucks that park overnight. While there are many variables in specific designs and services provided at these centers, one common detail was that these companies launched their centers with build-out for charging only 20-30 trucks. Each company stated that smaller loads of approximately 3-5 MW would be all they needed for the first 2-3 years (which may still require utility upgrades, depending on site locations), with more trucks coming online – and with additional fast-chargers built on their sites – in the out years. These companies are planning sites that would require 20-25 MW of charging for up to 100 trucks many years down the line.

Among the major freight distribution centers in Houston and the Dallas-Fort Worth regions, utilities have expressed that they can, as of today, make 3-5 MW of power available with minimal, if any, infrastructure improvements necessary. The consistent feedback from interviews was that the first phase of build-out for charging of class-8 trucks in Texas – both for private, onsite charging and for public/private depot centers – could be completed quickly with reliable power and available with minimal delays. Construction and permitting timelines, as well as cost, remain mitigating factors for any project involving MHDV electrification transition.

However, today's conditions will not last forever. In terms of grid readiness, the challenge will grow quickly when adoption of electric MHDVs accelerates in the coming years as trucks become cheaper and

batteries become more powerful and can perform at longer ranges. Furthermore, while utilities in the state's largest regions can handle small, managed growth today, staff at ERCOT, the PUCT, and utilities need to be ready for when they need to collect hundreds of thousands of data points about MHDVs and their charging needs from every fleet manager across the state.

Utilities Code, Section 37 as amended by House Bill 5066[44], from the 88th Regular Session allows ERCOT to include forecasted loads "for which the electric utility has yet to sign an interconnection agreement" when considering whether to certify a reliability transmission project due to a need for additional service. In doing so, the Legislature created a path to alleviate the chicken-and-egg waiting problem that planned-but-not-yet-built loads can create for customers and utilities alike.

The next step, then, is to improve the modeling and inputs the state utilizes for planning for the MHDV transition. ERCOT currently models for charging profiles, at the substation level, for all classes of MHDVs. The ERCOT EV Allocation Study does it's best to utilize existing data and project how much, and where, growth will come. However, ERCOT's study also makes assumptions about where regional trucks will charge that are inconsistent with other studies – for example, assuming a 50/50 split of public and private charging needs for MHDVs instead of an 80% private, 20% public split that is more common in other studies – ERCOT's own analysis ultimately acknowledges that "this is still a very nascent research area" and that more granular data is needed to truly understand the impact the MHDV transition will have on the grid.

Fortunately, there are now newer, more improved solutions for modeling, and improving the exchange of information regarding the coming transportation electrification load between customers and utilities.

Opportunities for Information Exchange between Customers and Utilities

There are several opportunities for facilitating the exchange of transportation electrification load information between customers and utilities. First, as noted above, it is important to recognize that customers are at varying stages of the transition to electric vehicles. Many start electrifying just a few vehicles, while making plans to electrify the entire fleet in future years. From the utility perspective, while understanding the individual charging plan and profile for each vehicle would be ideal, a minimum understanding of the fleet electrification plans of a fleet is a reasonable starting point. The opportunities below reflect ways to facilitate the exchange of information not only on fleet charging profiles, but also

[44] https://www.legis.state.tx.us/BillLookup/History.aspx?LegSess=88R&Bill=HB5066

on fleet electrification plans. Both can assist in identifying the projected energy needs for the fleet and thus the strategic and prioritized grid build that could be needed to meet the load.

In terms of the fleet charging profiles, there are a few existing tools that can show generic load profile information for medium and heavy-duty vehicles electric vehicles (MHD EV). The Medium and Heavy-Duty EV Infrastructure - Load Operations and Deployment (HEVI-LOAD) model, developed by the Lawrence Berkeley National Lab (LBNL), is one tool that shows the charging load profiles for MHDVs. Using a series of inputs, the model can predict the quantity, types and locations of MHDV charging stations and associated power requirements, and the load profiles for these MHD EVs by region and vehicle type. Texas could work with LBNL to adapt the model specifically for the state. Another tool is the CALSTART MHD EV Deployment: Data Collection dashboard. This dashboard tool is continually being updated with real-world data on MHDV duty cycles, performance factors, model attributes and more, all of which can be helpful for building MHD load profiles. Though the tool does not currently have TX fleet data, some generic assumptions on the MHDV fleet at large can be helpful as more information becomes available.

More specifically for Texas, EPRI's eRoadMAP™ tool is a first-of-its-kind interactive and public map that shows the approximate amount of energy (MWh) needed at a granular level to electrify the MHD fleet over time out to 2030, and at a full electrification scenario. The unique data set includes specific fleet electrification plans and telematics data for fleets operating in TX (and nationwide) and is continually updated with additional fleet plans and data. The map also includes an option to show the power (MW) needed over time as well, at a 0.28 square mile resolution (hexagon level). Each hexagon shows a load profile for the LD and MHD load; further efforts will segment out the MHD load further into specific vehicle classes. The eRoadMAP™ tool can assist utilities with their own scenario planning for EV load, which can lead to an identification of where there may need to be specific distribution grid upgrades or additional grid build.

Another tool from EPRI is called GridFAST and is related to the eRoadMAP™ tool. GridFAST, available in January 2025, will be a secure, online database exchange that is designed to provide utilities with actionable information from their customers on pending MHDV charging loads (e.g. the size of the coming load, fleet electrification plans, the location of the depot) earlier in their planning processes, such as those planning processes for distribution and transmission infrastructure. Fleets and other customers with MHDV charging loads (such as fueling retailers and charging site developers) will be able to enter project plans and/or fleet charging profiles (if that information is known) into the database and be matched with the right utility. EPRI will then provide a brief load assessment and connect the customer with the matching utility, where the customer will be provided additional information that has been customized by the utility.

The customized utility information will include a single point of contact for that customer, any available MHDV charger rebate information, make-ready funding, etc. The matching utility could also provide information on capacity available (e.g. hosting capacity maps) if applicable. To connect the eRoadMAP™ tool to GridFAST, EPRI will feed the fleet electrification plans (anonymized and aggregated) back into

the eRoadMAP™ tool to continue to show a picture of where and when MHDV charging loads are coming so that utilities can plan and prioritize their grid build. This publicly available tool could be encouraged to be utilized by Texas utilities and any commercial customer with a medium-to-large MHDV charging load.

Finally, fleet advisory services at a utility can also provide fleet electrification plans to the utility. As the customer engages with the utility early-on in the fleet electrification journey, the utility can identify what the potential load from MHDV charging might be and begin to identify if there is capacity at the project site. Fleet advisory services vary from utility to utility and in those offered and may need to be approved by regulators. However, fleet advisory programs can be a valuable first stop for the small to medium customers that may need additional assistance, particularly as these customers may not have been an existing account for the utility to consider as needing a large load.

How Texas is Different Than Other States

The technical exchange of modeling information is a critical, albeit granular, area of improvement that Texas can and must prioritize to improve load growth projections and support fleets' transition towards electric vehicles. However, it is not the only area of policy where additional education and understanding about how Texas' market is different than other states.

One consistent finding from interviews and research reviews was that, for the early phases of electric truck and bus deployment, there was lower onsite power needs than utilities originally anticipated. A charging depot that only requires 3-5 MW of power in the early years offers exponentially less risk to the grid than data centers; in North Texas, for example, data centers require more than 565 MW of power, over 100 times more than what 10 truck depot centers would require. Early bottlenecks for the buildout of charging are much more likely to be due to permitting than power. In the coming decade, charging for MHDVs will be much greater than it is today – which is why planning now for the future can be such a critical step for the state.

Texas is different in other ways, too. As previously discussed, electricity is significantly cheaper in Texas than in states like California, which impacts the overall cost considerations for charging MHDVs. Texas' major utilities also make it easy for simple line extensions, which is a challenge for other coastal states. On the other hand, Texas is still in the early stages of integrating distributed energy resource (DER) policies into broader grid planning, whereas some other states rely on DER as part of the MHDV electrification solution. Allowing solar and battery storage at public and private depot centers, as well as near warehouses and onsite private charging areas, can mitigate impact to the grid, limit the need for larger infrastructure investments, and save money for customers. However, there is no easy, central space for fleets or EVSEs to understand the statewide as well as utility-specific policies that govern DER policies, thereby limiting the ability of fleets to calculate how to integrate onsite DER with fleet charging.

Importance of Information Exchange

Understanding fleet charging profiles and projected energy needs is imperative. ERCOT, responsible for managing much of the state's electrical grid, must anticipate and plan for increased demand from MHDVs. Effective information exchange among utilities, stakeholders, and private entities can improve load growth projections and ensure that generation allocations meet future energy needs.

Collaborative Platforms:

Creating collaborative platforms where utilities, fleet operators, and private entities can share data and insights is essential. These platforms can facilitate real-time data exchange on charging patterns, peak usage times, and projected fleet growth. It should be noted that some entities may need to sign Non-Disclosure Agreements (NDA) in order to participate in collaborative platforms in order to preserve competitive advantage over other fleets.

Standardized Data Reporting:

Establishing standardized data reporting requirements for fleet operators and charging infrastructure providers can streamline information sharing. This standardization can help regulatory agencies like the PUCT and municipal utility companies better predict load growth, plan generation capacity, and establish a method to calculate "uptime" at the MHDV charging port level.

Public-Private Partnerships:

Encouraging public-private partnerships can leverage the strengths of both sectors. Private entities, such as MHDV charging companies, and EV infrastructure developers can provide detailed usage data, while public entities can offer insights into grid capacity and expansion plans. These partnerships can lead to more accurate load forecasts and tailored infrastructure development.

Regional Workshops and Conferences:

Hosting regional workshops and conferences focused on MHDV infrastructure and energy needs can foster knowledge sharing and collaboration. These events can bring together diverse stakeholders, including representatives from ERCOT, utilities, fleet operators, infrastructure developers, and policymakers, to discuss challenges and solutions.

Advanced Analytics and Forecasting Tools:

Utilizing advanced analytics and forecasting tools can enhance the accuracy of load growth projections. Machine learning algorithms and predictive modeling can analyze historical data and project future energy needs based on fleet expansion plans and charging behavior.

Inter-Utility Coordination:

Promoting coordination among utilities within and across ERCOT regions can ensure a cohesive approach to energy management. Regular meetings and joint planning sessions can align efforts to meet the projected increase in electricity demand from MHDVs.

Immediate and Long-Term Investments Benefit from More Information

From detailed modeling to broader grid planning, more information will help policymakers better understand how to earn the greatest return from immediate and long-term investments that can support MHDV infrastructure.

The most immediate and potentially most important investment that can help with the exchange of information is ensuring that the PUCT and ERCOT have sufficient full-time employees to plan for and support a transition for MHDVs. Dedicated staff are necessary to educate fleets, utilities, retail electric providers, EVSEs, and other stakeholders about Texas' policies regarding MHDV electrification. Staff at the PUCT and ERCOT need to be able to integrate electrification transportation modeling and planning into the broader grid planning and policy development efforts. Utilities need training on how to develop and implement modeling scenarios as well as follow rules promulgated by the agency. TxDOT will need staff that understand how to incorporate MHDV policies and deployment projections into broader transportation planning efforts. As MHDV deployment and charging scale up, so must state staff experts and expertise.

In the long term, the state needs to begin studying and preparing to exchange information about larger projects. The state should plan for the "clusters" that need priority for larger updates along the Phase 1 & Phase 2 hubs in the national zero-emission freight corridor strategy. Texas should also examine how to incorporate MHDV charging into broader build-to-need plans[45] beyond HB 5066 requirements as codified in Utilities Code Section 37. This would help utility regulators implement regulatory frameworks that direct utilities to make proactive investments to serve MHDV electrification hot spots without waiting for individual fleets to make load requests. Simpler, stronger guidance on opportunities for distributed energy resources can help entities looking to launch or expand MHDV charging in Texas plan for reliable energy that could even provide energy back to the grid if needed.

[45] https://www.edf.org/sites/default/files/2024-01/BuildingGridforNeed2024.pdf

Conclusion

As the federal and state policies discussed in the first section of this report continue to develop, there is a clear need for ongoing education and consumer awareness of what Texas can offer for the MHDV transition. With intentional planning and preparation, Texas can stay ahead of the expected rapid growth in demand for MHDV charging. Coordination and cooperation among the public and private sectors will be instrumental to the success of private businesses seeking to electrify their fleets, utilities that need to build infrastructure and generate revenue for MHDV charging, private infrastructure developers aiming to expand charging networks, and consumers that want to prioritize MHDV charging.

Policy and regulatory recommendations that can advance the opportunities to facilitate the exchange of information among utilities, stakeholders, and private entities to improve load growth projections and generation allocations across Texas include:

- **Investment in personnel** – Additional full-time employees at the PUCT, ERCOT, and TxDOT are all needed to integrate the planning and modeling necessary to ensure a smooth transition for the electrification of the transportation sector. Consumer outreach and awareness, utility training and education, and technical administration of standardized data and reporting are critical to this success, and Texas' agencies will need more people whose focus is dedicated to the unique challenges and opportunities presented by MHDV charging needs.

- **Modeling and Fleet Advisory Programs** – The Legislature could instruct the PUCT to promulgate rules around modeling for the electric MHDV transition and integrate such modeling into regional grid planning efforts. Whether through state-driven efforts or contracting with private services, tools for modeling as well as outreach to fleets on how to integrate their plans with state planning requirements will be important.

- **Distributed energy resource integration** – In addition to the need to create uniform, statewide permitting practices around the construction of MHDV charging infrastructure, Texas may consider or explore rules and programs that allow for battery and storage systems that can be utilized at charging sites. Whether it is for managed charging, vehicle-to-grid charging, or simply to alleviate some of the power demand at larger sites, maintaining clear and comprehensive guidance on how to possibly integrate DER policies into the build-out of MHDV charging can provide a boost to the MHDV transition.

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3) examine how statewide oversight and collaboration can complement and coordinate existing efforts to study and expand medium-duty and heavy-duty vehicle charging infrastructure throughout the state.

Introduction

The expansion of medium and heavy-duty vehicle charging infrastructure in Texas is essential for the state's transportation future. While local and regional initiatives are vital, statewide oversight and collaboration can significantly enhance these efforts. This section examines how statewide coordination can complement and coordinate existing work to expand MHDV infrastructure throughout Texas. The Texas Freight Advisory Committee[46] is a successful example of a strategic framework designed to optimize the movement of goods across the state, support economic growth, and maintain Texas' status as a major logistics hub.

The Role of Statewide Oversight

Statewide oversight provides a unified framework for MHDV infrastructure development, ensuring consistency and coherence across different regions. State utility, transportation, and environmental entities may hold the expertise needed to support this oversight, guiding local and regional efforts to align with broader state objectives. A unified framework creates clear channels of communication across state agencies, allowing for coordinated timelines to develop, implement, and review policies and regulations that support MHDV infrastructure development. Oversight can ensure efficiencies are made in policy development and implementation that reduce the risk of dissonant regulations or requirements that create barriers to deployment.

Benefits of Statewide Coordination

Uniform Standards and Regulations:

Establishing uniform standards and regulations for MHDV charging infrastructure can streamline the development process (see regulation of DCFC dispensers by TDLR[47]). This includes standardizing technical specifications, safety protocols, permitting procedures, and performance measures for public charging equipment to ensure "uptime". Consistent regulations across the state can reduce barriers for manufacturers and operators, facilitating faster and more efficient infrastructure deployment.

[46] https://www.txdot.gov/about/advisory-committees/texas-freight-advisory-committee.html
[47] https://www.tdlr.texas.gov/ev-charging/

Resource Allocation:

Statewide oversight can optimize resource allocation by identifying priority areas for infrastructure development. This includes directing funds from federal programs like the National Electric Vehicle Infrastructure (NEVI) program, Charging and Fueling Infrastructure Program (CFI), Carbon Pollution Reduction Program (CPRG), and state initiatives like the Texas Emissions Reduction Plan (TERP) to regions with the highest need and potential impact.

Data Sharing and Analytics:

Coordinating data sharing among local governments, utilities, and private entities can enhance understanding of charging patterns and energy needs. Statewide platforms for data exchange can help aggregate and analyze information, improving load growth projections and generation planning. Advanced analytics tools can be employed to create more accurate forecasts and identify trends.

Complementing Local and Regional Efforts

Local and regional initiatives are crucial for addressing specific needs and challenges within communities. However, statewide collaboration can enhance these efforts by providing additional support and resources.

Technical Assistance and Capacity Building:

State agencies can offer technical assistance and capacity building to local governments and regional planners. This includes training and familiarization workshops, access to travel/commodity data, and expertise in EV infrastructure development. This type of assistance, done at the state level, adds value to the wide variety of existing national resources on EV infrastructure development by filtering recommendations, best practices, etc. through the lens of applicable Texas laws and governmental structures. By building local capacity, statewide efforts can ensure that all regions are equipped to implement effective charging solutions.

Public-Private Partnerships:

Statewide oversight can facilitate public-private partnerships by connecting local projects with potential private investors and stakeholders. These partnerships can leverage private sector innovation and funding, accelerating the deployment of charging infrastructure.

Pilot Programs and Demonstration Projects:

Statewide coordination can support pilot programs and demonstration projects in different regions and along heavily traveled corridors to test new technologies, locations, methods, and approaches. Successful pilots can serve as models for broader implementation, with lessons learned informing statewide strategies. Urban areas like Austin and Houston, which are already leading in EV adoption, can be ideal test beds for these initiatives.

Statewide coordination can also facilitate a balance in projects across the state. While major freight corridors and logistics hubs can and should be the focus of the early build-out of MHDV infrastructure development, it will be critical that MHDV charging solutions are replicable along state highways, more regional distribution centers, and in smaller utility markets. MHDV infrastructure development opportunities and barriers in communities across West, East, and South Texas must be understood and accounted for in pilot project development alongside those focused on interstate corridors and the state's largest urban centers.

Texas Freight Advisory Committee Example

The Texas Freight Advisory Committee (TxFAC) is a strategic body established to enhance the efficiency and effectiveness of freight transportation within the state of Texas. Formed under the Texas Department of Transportation (TxDOT), TxFAC's mission is to provide guidance on policies, plans, and investments related to freight movement. The committee is composed of representatives from various sectors, including transportation, logistics, business, and government. These members collaborate to address critical issues impacting freight transportation, such as infrastructure needs, regulatory challenges, and funding priorities.

TxFAC's primary objectives include improving freight infrastructure, streamlining regulatory processes, and fostering public-private partnerships. The committee plays a crucial role in identifying and prioritizing projects that alleviate congestion, improve safety, and boost the efficiency of freight networks. For instance, TxFAC has been instrumental in advocating for investments in highway expansions, port enhancements, advanced freight management technologies, and truck parking.

Application to Electric Medium and Heavy-Duty Trucks

A similar committee focused on electric MHDVs could offer substantial benefits to the development and deployment of these vehicles. This proposed Electric Truck Advisory Committee (ETAC) would aim to accelerate the adoption of electric trucks and support the transition to electrified transportation solutions. Here's how ETAC could be utilized effectively:

1. **Infrastructure Development**: ETAC could identify and prioritize infrastructure needs such as electric truck charging stations, battery swapping facilities, and high-capacity power sources. By working with stakeholders, ETAC could help map out strategic locations for these facilities to ensure they align with freight routes and operational hubs.
2. **Policy Recommendations**: The committee could provide valuable input on policies and incentives that encourage the adoption of electric trucks. This might include recommendations for tax credits, rebates, and funding programs to reduce the initial cost burden for fleet operators.

3. **Regulatory Guidance**: ETAC could offer guidance on regulatory issues specific to electric trucks, such as weight limits, emissions standards, and safety requirements. This would ensure that regulations support the operational needs of electric trucks while maintaining safety and performance standards.
4. **Technology and Innovation**: The committee could serve as a platform for discussing and promoting technological advancements in electric trucking. This includes advancements in battery technology, electric drivetrains, and autonomous driving features, fostering innovation and ensuring that Texas remains at the forefront of electric truck technology.
5. **Public-Private Partnerships**: Similar to TxFAC, ETAC could facilitate partnerships between private companies, government agencies, and research institutions. These collaborations could focus on joint ventures for developing and testing electric truck technologies, sharing best practices, and driving industry-wide adoption.
6. **Educational Outreach**: ETAC could lead initiatives to educate stakeholders, including fleet operators, logistics companies, and policymakers, about the benefits and practicalities of electric trucks. This could help address misconceptions, promote best practices, and support a smoother transition to electric vehicles.

In summary, while TxFAC addresses traditional freight challenges, ETAC would focus on the emerging sector of electric medium and heavy-duty trucks. By leveraging the structure and objectives of TxFAC, ETAC could effectively manage the adoption of electric trucks, support necessary infrastructure, and foster a collaborative environment to advance electrically powered freight solutions.

Conclusion

The expansion of medium and heavy-duty vehicle charging infrastructure across Texas presents an opportunity for advancing the state's transportation network and sustainability goals. Statewide oversight and collaboration are essential in complementing and coordinating existing efforts to achieve a cohesive and efficient expansion of EV infrastructure. By establishing a framework akin to the Texas Freight Advisory Committee, Texas can ensure uniform standards, optimize resource allocation, and foster valuable public-private partnerships. Such a statewide approach not only enhances local and regional initiatives but also addresses broader strategic needs, including technical assistance, pilot programs, and innovation in charging technologies.

As Texas continues to lead in logistics and transportation, adopting a coordinated strategy for MHDV infrastructure will be crucial in meeting future demands, supporting economic growth, and advancing environmental objectives. Through this collaborative effort, the state can prepare itself to effectively manage infrastructure development for medium and heavy-duty freight trucks.

Other Considerations

First Responder/Incident Management Training Needs

There is a broad sentiment that the pace of comprehensive safety and incident management training, particularly for first responders, is lagging the pace of technology adoption in the ZEV space. This is particularly true for fires involving lithium-ion battery technology. Where there are gaps in training, misinformation and fear become bigger challenges. A long list of resources is maintained at the Alternative Fuels Data Center[48], but it is not particularly easy to digest or reference and is largely limited to passenger vehicle information. There is an urgent need for more well-developed, cohesive, and comprehensive information and guidance to be distributed quickly and widely. This is an area where state agencies[49] may be particularly helpful in providing consistent, quality training statewide.

The Texas Department of Insurance, State Fire Marshal's Office[50] (SFMO) – The SFMO plays a role in investigating fire incidents in Texas, including those involving EVs. They collaborate with fire departments and other agencies to develop safety guidelines and best practices for fire response. Texas Fire Chiefs Association (TFCA) – The TFCA works on various fire safety initiatives, including developing training and resources for handling EV-related fires. This group may have subcommittees or task forces focusing on emerging fire hazards like EVs.

[48] Alternative Fuels Data Center: Electric Vehicle Safety Training Resources for First and Second Responders (energy.gov)
[49] Electric Vehicle (EV) Safety for the First Responder
[50] https://www.tdi.texas.gov/fire/

Medium and Heavy-Duty Electric Trucks in Texas

Texas has seen a gradual increase in the adoption of medium and heavy-duty electric trucks, driven by companies desiring cleaner fleets and utilizing economic incentives. According to September 10, 2024 VIN data from the Texas Department of Motor Vehicles (provided by the Dallas-Fort Worth Clean Cities EV Registration Tool), there are approximately 3,438 electric delivery vans and 108 medium and heavy-duty electric trucks operating within the state. The ERCOT EV Allocation Summary forecasts medium and heavy-duty vehicles to grow significantly by 2029 to 225,000[51] *"adding 1.36% of load to ERCOT's electric load forecast in 2029, up from 0.14% in 2022".*

Characteristics of Medium and Heavy-Duty Electric Trucks

Medium-Duty Electric Trucks (Class 2B-5)[52]:

- Range: Typically, 100 to 200 miles on a single charge, depending on the battery size and load.
- Battery Size: Commonly range from 100 kWh to 200 kWh.
- Usage Scenarios: These trucks are often used for urban delivery services, utility work, and regional transport. They are favored for their reduced emissions in densely populated areas and lower operating costs over time.
- Availability: As of September 2024, an estimated 51 MD electric models were available from 30 EMs for the U.S. market, according to the Zero-Emission Technology Inventory[53]
- Examples: Models like the International eMV, the Freightliner eM2 and the BYD 8TT are popular choices in this category.

Heavy-Duty Electric Trucks (Class 6-8):

- Range: Typically, 200 to 350 miles on a single charge, with advanced models achieving up to 500 miles.
- Battery Size: Ranges from 300 kWh to 850 kWh, depending on the model and manufacturer.
- Usage Scenarios: These trucks are primarily used for long-haul freight, port drayage, and intercity transport. They are integral in reducing emissions in logistics hubs and along major transport corridors.
- Availability: As of September 2024, an estimated 59 HD electric models were available from 25 OEMs for the U.S. market, according to the Zero-Emission Technology Inventory[54]
- Examples: Prominent models include the Tesla Semi, Volvo VNR Electric, and Peterbilt 579EV.

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[51] https://www.ercot.com/files/docs/2023/08/28/ERCOT-EV-Adoption-Final-Report.pdf
[52] Medium and Heavy-Duty Truck Classes
[53] Global Commercial Drive To Zero Program — Zero-Emission Technology Inventory (ZETI) (globaldrivetozero.org)
[54] Global Commercial Drive To Zero Program — Zero-Emission Technology Inventory (ZETI) (globaldrivetozero.org)

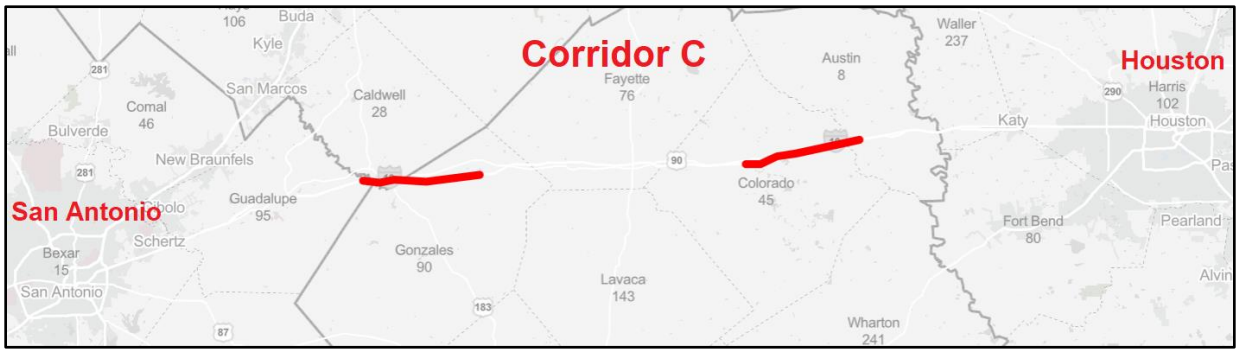
Typical Distances Along Corridors in Texas

Stops and mileage are provided to evaluate the typical range of medium and heavy-duty EVs, with scenarios of potential MHDV charging stops enumerated for illustration purposes.

Exhibit 7: Corridor lengths (from city center), mileage between stops, and potential charging stops.

Name	From	To	Corridor Length (mi)	Potential MHDV Charging Stops	Miles Between Stops
Corridor A	San Antonio	Laredo	150	2	50
Corridor B	San Antonio	Corpus Christi	136	2	45.3
Corridor C	San Antonio	Houston	200	2	66
Corridor D	San Antonio	DFW	250	3	62.5
Corridor E	San Antonio	El Paso	550	5	91.6
Corridor F	DFW	Houston	230	3	57.5
Corridor G	DFW	EL Paso	605	5	100.8
Corridor H	DFW	Texarkana	190	2	63.3
Corridor I	DFW	Shreveport	195	2	65
Corridor J	Lubbock	Amarillo	118	1	59

Exhibit 8: Illustration is provided to show distance between urban centers and spacing between two potential MHDV charging stops along a corridor; it is not a recommendation for EV truck stop locations.



Typical Usage Scenarios

Urban and Regional Delivery:

Medium-duty electric trucks are ideal for urban delivery services due to their range and payload capabilities. Companies like Amazon and UPS have integrated these trucks into their fleets for last-mile delivery, benefiting from the lower emissions and noise levels.

Utility and Municipal Services:

Electric trucks are increasingly used by utility companies and municipal services for tasks such as waste collection, maintenance, and infrastructure development. Their ability to operate quietly and with zero emissions is particularly beneficial in residential areas.

Long-Haul Freight:

Heavy-duty electric trucks are being adopted by logistics companies for long-haul routes. Although their range is currently shorter than diesel counterparts, advancements in battery technology and the expansion of charging infrastructure are making them more viable for longer distances.

Port Drayage:

Electric trucks are particularly well-suited for port drayage operations, which involve short-distance transport of goods between ports and nearby warehouses or distribution centers. This reduces the environmental impact in port areas, which are often heavily polluted.

Construction and Mining:

Both medium and heavy-duty electric trucks are being tested and adopted in the construction and mining industries. Their ability to provide high torque from standstill is advantageous for heavy lifting and hauling in these sectors.

Truck Stop Conversion Estimates

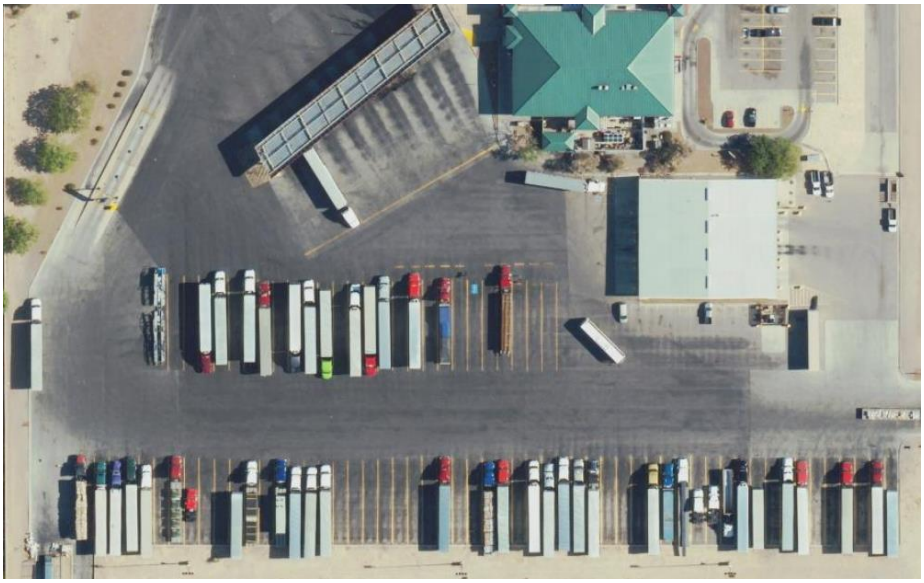
Single Truck Stop Conversion Estimate

This sample is based on a truck stop along I-10 in El Paso[55]. At the sample location there are 12 pull through diesel pumps. In this scenario the 12 diesel pumps are replaced with 12-megawatt class Direct Current Fast Charge (DCFC) dispensers and all necessary electrical/utility equipment for operation.

The maximum power rating for the truck stop after electrification conversion would be 12 MW. As a point of reference, the peak load for the Empire State Building is approximately 9-10 MW[56], and a typical data center is approximately 100-300 MW[57].

- Twelve (12) One MW rated DCFC dispensers and necessary electrical equipment/upgrades
    - 12 MW (max power if all dispensers used at their max rate at the same time)
    - $6M construction cost estimate for stations, equipment, dispensers, etc.
        - Use of federal funding, which typically requires BABA could increase costs
    - $3M construction cost estimate for electrical substation/distribution network upgrade
        - Lead time 3-5 years

Exhibit 9: Sample Truck Stop



[55] Sample Truck Stop
[56] Figure 21. *Electric Highways: Accelerating and Optimizing Fast-Charging Deployment for Carbon-Free Transportation.* November 2022. https://www.nationalgrid.com/document/148616/download
[57] Data Center Power

Mass Conversion Estimate

Extrapolating the single conversion estimate above to all 2,791 diesel pumps identified at 462 public truck stops in the Texas Delivers 2050 - Texas Freight Mobility Plan[58], we can develop a hypothetical estimate for the required power and cost of electrifying truck stops.

- 2,791 One MW rated DCFC dispensers and necessary electrical equipment/upgrades
    - 2.719 GW (max power if all dispensers used at their max rate at the same time)
    - $1.39B construction cost estimate for stations, equipment, dispensers, etc.
    - $1.3B construction cost estimate for electrical substation/distribution network upgrade

Max Power estimate: ((2,791 dispensers * 1000 kW) /1,000 MW)/1,000 GW = **2.791 GW**

Construction Cost estimate: (2,791 dispensers and equipment * $500,000) = **$1,395,500,000**

Electrical substation/distribution network upgrades cost estimate (1 for each of the sites identified in the Texas Freight Mobility Plan): (462 locations * 3,000,000) = **$1,386,000,000**

Note: *This estimate is for illustration purposes only and does not represent any professional analysis of what a mass conversion could require. Truck stops in Texas, today, only maintain a 78% utilization rate. Electricity costs will vary by region and can change significantly over time, as will the power needed to charge batteries that are projected to become more efficient and powerful in the future.*

[58] https://www.txdot.gov/projects/planning/freight-planning.html