



**North Central Texas
Council of Governments**

**Ensuring Resilience and
Rapid Response**

North Texas Resilient Electric Vehicle Plan: DRAFT PLAN

*A guide to continuing critical
transportation operations
during grid outages*

June 2025

About NCTCOG

The North Central Texas Council of Governments (NCTCOG) is a voluntary association of, by, and for local governments within the 16-county North Central Texas Region. The agency was established by state enabling legislation in 1966 to assist local governments in planning for common needs, cooperating for mutual benefit, and coordinating for sound regional development. Its purpose is to strengthen both the individual and collective power of local governments, and to help them recognize regional opportunities, resolve regional problems, eliminate unnecessary duplication, and make joint regional decisions – as well as to develop the means to implement those decisions. North Central Texas is a 16-county metropolitan region centered around Dallas and Fort Worth.

The region has a population of more than 8.5 million (which is larger than 38 states), and an area of approximately 12,800 square miles (which is larger than nine states). NCTCOG has 235 member governments, including all 16 counties, 170 cities, 20 independent school districts, and 29 special districts. NCTCOG's structure is relatively simple. An elected or appointed public official from each member government makes up the General Assembly which annually elects NCTCOG's Executive Board. The Executive Board is composed of 17 locally elected officials and one ex-officio non-voting member of the legislature. The Executive Board is the policy-making body for all activities undertaken by NCTCOG, including program activities and decisions, regional plans, and fiscal and budgetary policies. The Board is supported by policy development, technical advisory and study committees – and a professional staff led by Todd Little, Executive Director. NCTCOG's offices are located in Arlington in the Centerpoint Two Building at 616 Six Flags Drive.

About this Plan

Authors of this plan include staff from the NCTCOG Emergency Preparedness Department, who bring expertise in the realm of emergency management; as well as the NCTCOG Transportation Department, who bring expertise in fleet management and alternative fuels in their work as staff to the Dallas-Fort Worth Clean Cities Coalition, which is hosted at NCTCOG.

This material is based upon work supported by the Joint Office of Energy and Transportation through the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy (EERE) under Award Number DE-EE0011235.

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Record of Changes

Date	Name and Title	Page (s)	Revision Description (s)

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Key Definitions

Battery Electric Vehicles (BEVs) – vehicles that require plugging into electric power to refuel and operate, not able to run on any other fuel type.

Critical Operations- activities that must continue even during emergency situations because if disrupted it would cause delays in the delivery of essential services.

Critical Vehicle/ Critical Vehicle Assets- vehicles used to conduct critical operations such as transporting essential goods during emergency situations.

Critical Fueling Assets- resources that provide fuel during normal and emergency situations.

Resilience Strategies- plans used to prepare, respond, or recover from an emergency.

I. Introduction

During emergency situations of various types (e.g. severe storms, pandemics, acts of violence, etc.), business-as-usual activities are often suspended until circumstances return “back to normal”. However, even during these situations, certain essential activities must occur, such as the delivery of food or medicine, evacuation of residents, restoration of water/electric services, repair of roads or other infrastructure, or removal of refuse/debris. These activities are referred to in this plan as “critical operations”. They cannot be performed without use of vehicles needed to transport goods or personnel, which are referred to in this plan as “critical vehicles”. As adoption of battery-electric vehicles (BEVs) increases, organizations that are involved in carrying out essential activities must carefully consider the implications of deploying BEVs that may be needed as critical vehicles. To perform critical operations, critical vehicles must be able to refuel reliably and quickly. If the critical vehicle is a BEV, the organization must proactively plan for operational needs, risks, and strategies to ensure continuity of operations that may be different from conventional vehicles.

One of the main considerations which could impact the ability of BEVs to perform critical operations is the risk of a power grid outage that could compromise the ability to recharge the vehicle. This risk may be more pronounced in Texas, where the relative isolation of the power grid serving most of Texas limits the redundancy of power availability. This risk was clearly highlighted by Winter Storm Uri in February 2021. In the immediate aftermath of Winter Storm Uri, several fleet managers expressed gratitude that they had not yet put BEVs into service in the parts of their fleet that were used to help with storm recovery. They noted how problematic it would have been if, for example, the trucks used to sand the roads had been electric and were unable to recharge because all electric power was out. Since then, BEV adoption has continued, and fleets are now beginning to deploy BEVs in more functional roles (e.g. fire trucks, refuse trucks, school and transit buses) rather than strictly administrative roles. This signals a need to ensure proper planning is done to ensure readiness in case of an emergency.

II. Purpose

The North Texas Resilient Electric Vehicle Plan (NTX-REV) was developed to address the risk of critical operations being interrupted in the event that a grid outage occurs and BEVs are being used to complete work. The purpose of the NTX-REV Plan is to increase regional preparedness for future grid outages which could impact BEVs that serve critical operations.

III. Objective

The objectives of the NTX-REV Plan are:

- Identify risks associated with grid disruption in maintaining continuity of operations for electrified critical vehicles.
- Provide guidance and actionable recommendations to ensure that BEVs are capable of recharging to perform critical operations (e.g. debris removal, evacuation services, paratransit services, etc.), even in the event of a grid outage,
- Build regional awareness and understanding among fleet operators, transportation planners, and emergency preparedness staff, of the benefits and risks of the electrification of critical transportation assets/disruptions to EV charging,
- Recommend resilience strategies that can enable BEV charging during a grid outage,
- Distribute findings to updated regional emergency response procedures/hazard mitigation plans.

IV. Scope

Project Scope

The NTX-REV Plan addresses regional preparedness for situations where power grid failures compromise the ability to fuel battery electric vehicles (BEVs) which have been deployed in critical operations. The scope of the Plan encompasses the 16-county region served by the NCTCOG, which includes Collin, Dallas, Denton, Ellis, Erath, Hood, Hunt, Johnson, Kaufman, Navarro, Palo Pinto, Rockwall, Somervell, and Wise counties.¹ The region is generally centered on the urban Dallas-Fort Worth metroplex but extends through suburban areas into largely rural counties.

In 2023, the region was estimated to have a population of approximately 8.2 million residents,² and is projected to grow to 12.3 million by 2050.³ The Dallas Ft. Worth region also has one of the highest adoptions of plug-in electric vehicle (PHEV) and BEV in Texas, 36.77%, as of June 2025⁴, underscoring the need for proactive planning for the electrification of critical transportation assets.

The NTX-REV plan does not address the following:

¹ [NCTCOG - NCTCOG Region Map](#)

² [m2045exsummary_digital_1.pdf](#) pg.4

³ [1-Introduction.pdf](#)

⁴ [EVs in Texas | DFWCC](#)

- Issues related to demand management/peak shaving/reliability of the grid. Therefore, EV charging technologies such as Smart Charging Management, which can optimize EV charging based on grid constraints by controlling when and how much BEV charges, are not included in this plan.
- Operations of non-critical transportation assets, such as BEV used by non-essential workers for commuting.
- Operation of assets that are not related to transportation, such as ensuring the continued operations of hospitals or other critical facilities.
- Recommendations to improve resiliency technologies/strategies for non-BEV serving critical operations, such as providing back up fuel storage for gasoline or diesel vehicles. However, resiliency technologies and/or strategies for non-BEV were referenced for comparing/identifying how these operations can be adjusted to accommodate BEV adoption.
- The operations of assets that are outside of the NCTCOG 16-county region. However, the content of this plan is likely relevant to many other geographic areas.

This draft plan was developed based on literature review, meetings, and stakeholder discussions, but is largely theoretical. Even the organizations within the region who have adopted BEVs into critical operations have not yet tried to use them during a grid outage. To gain observed, tangible experience and data, NCTCOG will conduct both a table-top demonstration and a real-world demonstration after development of this draft plan to test and refine the technology recommendations of the NTX-REV Plan. These demonstrations will measure key performance indicators such as BEV miles of travel enabled during outages, downtime between power loss and backup activation, charging time, and the number of BEVs supported. After the completion of these demonstrations, a final NTX-REV Plan will be developed, informed by demonstration project results.

Regional Engagement and Stakeholder Input

To develop the draft plan, NCTCOG established a stakeholder group to provide input as part of the Project Team. A subset of stakeholders will be asked to participate in the tabletop and real-world demonstration projects that will inform the final plan. The Project Team included over 70 individuals representing 40 organizations. Entities represented in the Project Team included public works entities, local governments, advocacy groups, academic and research institutions, utility providers, electrical suppliers, energy consultants, transit agencies, freight operators, and technology vendors. See **Appendix A** for a full list of the NTX-REV Project Team.

To create the Project Team and collect feedback for the development of the NTX-REV Plan, NCTCOG conducted outreach through the creation of a project website (www.dfwcleancities.org/ntx-rev), distribution of informational flyer/social media posts/and email blasts and presenting at various regional meetings. Once the Project Team was established, bimonthly project meetings were held to gather input used to develop the NTX-REV Plan, collaborate on project activities, and provide progress updates. Additionally, one-on-one meetings with regional stakeholder groups were conducted to collect feedback, with specific outreach being conducted to entities which have already adopted BEV that could serve a critical operation. For a full inventory of outreach conducted, see **Appendix B**.

The NTX-REV Plan summarizes the input received from this engagement, with key engagement topics including what transportation assets serve critical needs/how vehicle electrification could impact these assets, potential resiliency technologies and strategies (ex: generators, solar integrated EV charging, etc.) of interest to the region to support the electrification of critical assets, and other risks/threats/benefits to the electrification of critical transportation assets.

Situation Overview

State of the Texas Electric Grid

The entirety of the NCTCOG regional planning area is part of the electric grid managed by the Electric Reliability Council of Texas (ERCOT). The ERCOT grid is largely self-contained, with minimal connections to the two major U.S. grids, the Eastern Interconnection and the Western Interconnection.

The isolation of the ERCOT power grid provides both risks and benefits. The market structure unique to ERCOT has yielded a high variety of electricity generation sources. Renewable energy has been widely adopted, with explosive growth in both wind and solar energy in recent decades. Net renewable energy (wind, solar, and hydroelectric) generation increased from 28 percent in 2021 to 42 percent as of March 2025 ⁵. When combined with nuclear power, emissions-free sources account for nearly 51 percent of total electricity generation in the ERCOT grid.⁵ The remaining grid is powered from traditional energy sources – primarily natural gas at 39 percent, with some coal at 10 percent.⁵ Battery storage is not considered to be a “generating” resource, but the quantity of battery storage has grown immensely since Winter Storm Uri and totals, including the addition of 10,000

⁵ <https://www.eia.gov/state/?sid=TX#tabs-4>

MW battery storage from 2021-2024.⁶ This variety of power generation sources provides resilience against fuel supply disruptions and price volatility.

Despite the variety of electricity generating assets, the ERCOT grid has been experiencing an increasing number of power outages, often related to severe weather. Between 2003 and 2023, Texas saw 193 weather-related outages, and 111 of those occurred in just the last five years. With instances of extreme heat, cold, and hurricanes becoming more common, the risk of weather-related power disruptions remains a concern, as shown in **Exhibit 1**.

Exhibit 1. Total Texas Outages⁷

Cause of Outage	Outages Within the Last 5 Years (2019-2023)	Outages Within the Last 20 Years (2003-2023)	Percentages of Outages in Last 20 Years Occurring in Last 5 Years
Severe Weather	111	193	58%
Systems Operations	45	62	73%
All Causes	263	435	60%

While generating capacity continues to grow, ERCOT is forecasting a marked increase in energy demand in the coming years. From 2025 to 2031, the ERCOT grid is projected to have an average annual growth rate (AAGR) of 13.6 percent⁸— with a total annual electricity demand of 1,037,7442 GWh, as shown in **Exhibit 2**. Notably, between 2014 to 2022, the AAGR was only 3.1 percent. The primary reason for the significant increase in the AAGR between 2025 and 2031 is due to the increased need for computing power for artificial intelligence/cryptocurrency mining and future large industrial loads (i.e. oil and gas exploration, chemical processing, and hydrogen production facilities).⁹

Additionally, summer peak demand is projected to rise steeply from 85,199 MW in 2024 to 144,522 MW in 2031.¹⁰

⁶ <https://www.ercot.com/files/docs/2025/03/14/ERCOT-2024-State-of-the-Grid.pdf> pg. 9

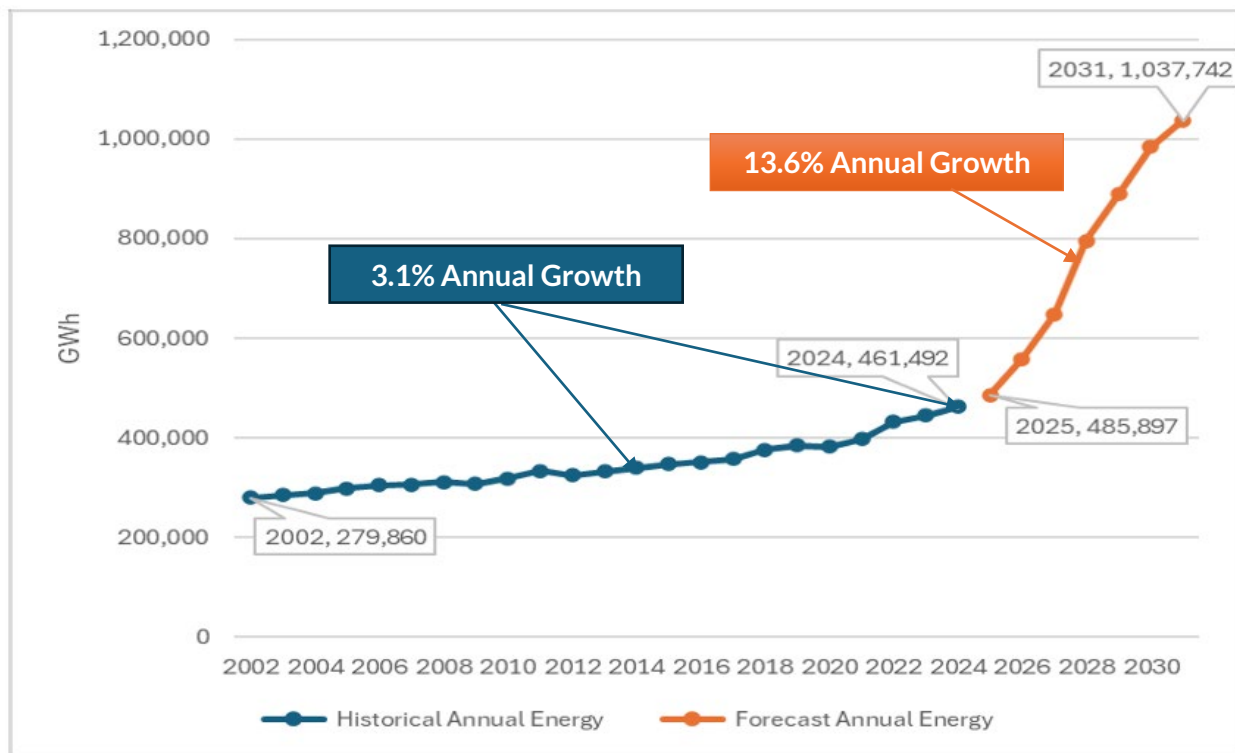
⁷ <https://paylesspower.com/blog/blackout-tracker/>

⁸ <https://www.ercot.com/files/docs/2025/04/08/ERCOT-2025-Long-Term-Load-Forecast-Report.pdf> pg. 11

⁹ https://www.ercot.com/files/docs/2024/01/18/2024_LTLF_Report.docx

¹⁰ <https://www.ercot.com/files/docs/2025/04/08/ERCOT-2025-Long-Term-Load-Forecast-Report.pdf> pg. 10

Exhibit 2. ERCOT Annual Forecast

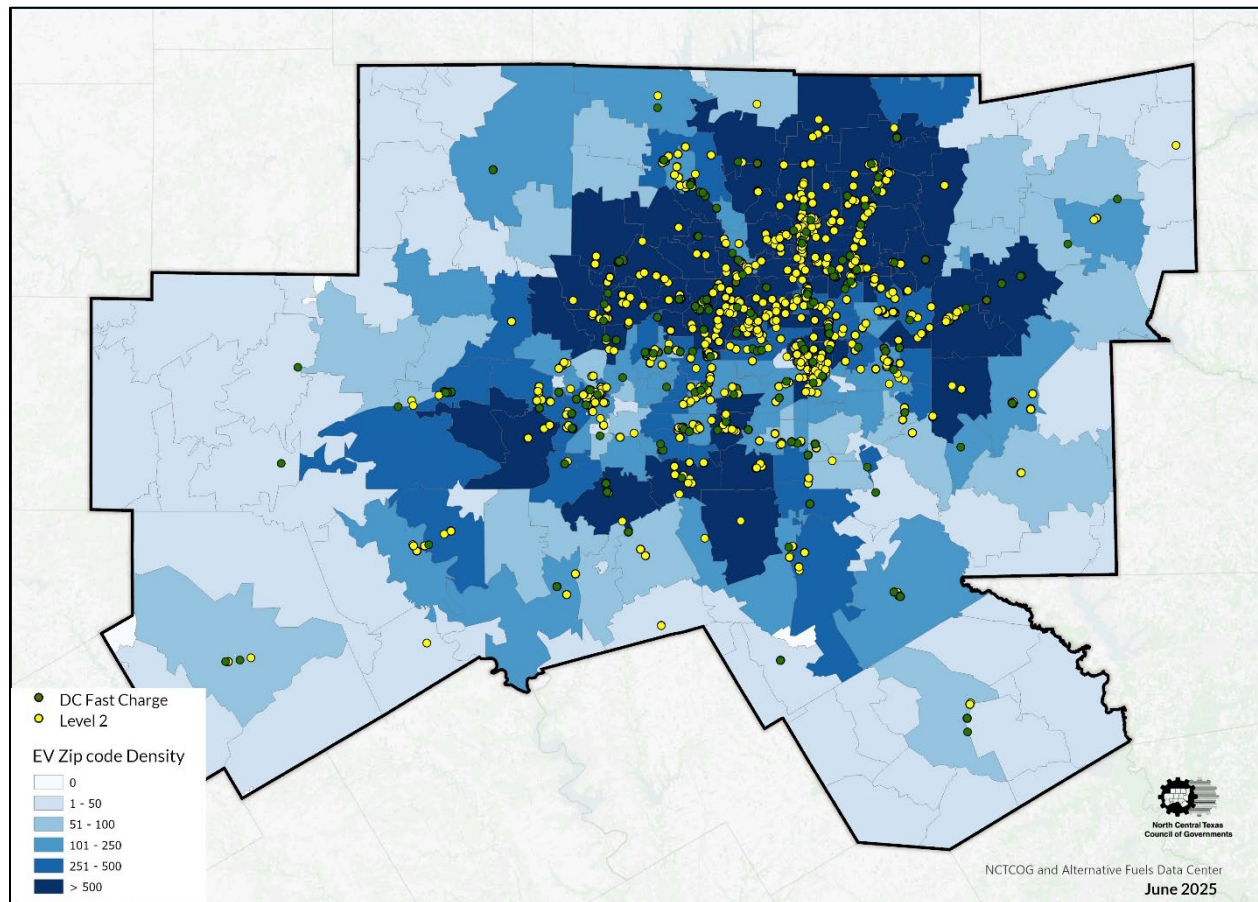


State of Vehicle Electrification

EVs, which include BEV and PHEVs, are beginning to see wide adoption in North Texas as more models become available, and additional EV charging is installed. From June 2022 to June 2025, the number of EVs registered in North Texas increased by 94,905, representing a 206 percent increase and bringing the total number of EV to over 140,000.¹¹ **Exhibit 3** shows the number of electric vehicle registrations by zip code across the region along with locations of charging stations.

¹¹ <https://www.dfwcleancities.org/evnt>

Exhibit 3. Electric Vehicle Registration by Zip Code and Charging Station Locations



As part of the Dallas-Fort Worth Clean Cities (DFWCC) Annual Report,¹² local public and private fleets report operating efforts to reduce emissions through the adoption of alternative fuel or electric vehicles and other emission reduction initiatives, such as reducing idling. In 2019, stakeholders reported operating 69 PHEV and EVs, and in 2024 stakeholders reported operating 363 PHEV and BEVs, representing a 426 percent increase in EV adoption. As adoption has increased, DFWCC staff have noted that more public and private fleets are purchasing EVs which could be used in critical operations, such as fire trucks, police cars, refuse trucks and freight vehicles. These are largely small fractions of the "critical vehicle" fleet, often only one to two vehicles for a pilot or demonstration project.

These EVs reported through the DFWCC Annual Report are not the only EVs which are, or may in the future, serve a critical operation. While most of the EVs represented in **Exhibit 4** are light-duty vehicles and likely serving as commuter vehicles (i.e. non-critical operations), nearly 1,700 of the PHEV and EVs registered in June 2025 were Class 2b-8 and

¹² <https://www.dfwcleancities.org/annualreport>

are trucks being used by local governments or private entities.¹³ Additionally, **Exhibit 4** details several funding programs that will soon bring additional BEV to the region which could serve critical operations. These initial deployments signal the need to begin advance planning for the point at which BEVs may comprise a substantial portion of the fleet performing critical operations.

Exhibit 4. Funding Programs Supporting Battery-Electric Vehicles (BEVs) for Critical Operations in North Texas

Funding Source	Award Amount	Purpose of Funding	Potential Critical Operations Use
EPA Clean School Bus Program	~\$20 million ¹⁴	Replace emitting buses with clean school buses	School buses identified in hazard mitigation plans as assets for evacuation services
North Texas Zero Emission Vehicles Project	\$60 million ¹⁵	Electrification of vocational vehicles (refuse trucks, step vans, transit vehicles)	Refuse and transit vehicles could support critical operations such as debris removal, paratransit, and emergency transport
Diesel Emissions Reduction Act (DERA) (via NCTCOG Calls for Projects since 2018)	\$8 million ¹⁶	Replace medium- and heavy-duty diesel vehicles with lower-emitting versions, including ZEV	Refuse collection, freight operations, utility operations, etc. could support critical operations
Texas Emissions Reduction Plan (TERP)	~\$500 million (regionally allocated) ¹⁷	Replace various vehicle vocations and class sizes with lower-emitting versions, including ZEV; infrastructure projects	Light-, medium-, and heavy-duty vehicles that serve a critical operation could be funded through TERP programs, including buses, heavy-duty trucks
Texas Volkswagen Environmental Mitigation Program (TxVEMP)	\$134 million (statewide) \$29+ million to DFW region for EV projects ¹⁸	Replace various vehicle vocations and class sizes with lower-emitting versions, including ZEV; infrastructure projects	Medium- and heavy-duty vehicles that serve a critical operation could be funded through TxVEMP programs, including buses, heavy-duty trucks, refuse trucks

¹³ <https://www.dfwcleancities.org/evsinnorthtexas>

¹⁴ <https://www.epa.gov/cleanschoolbus/clean-school-bus-program-awards>

¹⁵ <https://www.nctcog.org/trans/quality/air/funding-and-resources/chdv>

¹⁶ www.nctcog.org/trans/funds/cfps/ntdercfp

¹⁷ <https://www.tceq.texas.gov/downloads/air-quality/terp/publications/sfr/79-24.pdf>

¹⁸ <https://www.vwenvironmentalmitigationtrust.com/sites/default/files/2025-02/State%20Trust%20Semi%20Annual%20Reporting%20-%202012.31.2024.pdf>

State of Electric Vehicle Infrastructure

The availability of EV charging stations in the region has increased substantially to accommodate the concurrent rise in EV adoption. As of June 2025, over 3,100 charging ports were operational in the NCTCOG region, compared to 2,400 in 2023. Growth in EV charger deployment has been largely driven by the private sector, but investments are also being made by federal and state programs such as the Texas Department of Transportation's (TxDOT) Electric Vehicle Infrastructure Plan, NCTCOG's Charging and Fueling Infrastructure (CFI) Community Program, and TCEQ's Alternative Fueling Facilities Program.

Despite the rapid expansion and significant investment in EV charging, the widespread adoption of resiliency technologies to support EV charging does not seem to be occurring in North Texas. Most of the EV infrastructure in the NCTCOG region was installed without consideration of resiliency features. NCTCOG is aware of a limited number of EV charger installations in the region that incorporate resiliency technologies, but these are typically not publicly accessible and may not be an accurate picture of regionwide installations. Funding programs are beginning to incorporate resiliency features. TxDOT's Texas EV Infrastructure Plan included strategies to ensure funded charging locations mitigate risks that could lead to downtime but referenced emergency mobile charging as a solution in the event of an emergency evacuation and NCTCOG's CFI Community Program will incorporate resiliency features as funding is implemented.¹⁹ As resiliency features are incorporated in more installations, data on which chargers incorporate these elements is not readily available. One of the primary ways NCTCOG identifies EV chargers is through the Alternative Fuels Data Center (AFDC) Station Locator Tool.²⁰ The AFDC Station Locator Tool can be used to identify public and private EV chargers, but it does not have details on any resiliency technologies installed. This can make it difficult for fleets to use public charging during a grid outage, as there is no guarantee of the chargers being online.

Resilience for chargers along evacuation routes is important to the NCTCOG region. In the event of an evacuation along the Gulf Coast, often associated with hurricanes, a substantial portion of evacuating traffic is likely to reach the NCTCOG region along one of the several hurricane evacuation routes that terminate in North Central Texas. As a result, NCTCOG has an interest in adding resiliency technologies to EV charging stations located along the evacuation routes of IH-45, US-175, IH-20, and US-287.

¹⁹ <https://ftp.txdot.gov/pub/txdot/get-involved/statewide/EV%20Charging%20Plan/TexasElectricVehicleChargingPlan.pdf>

²⁰ <https://afdc.energy.gov/stations#/find/nearest>

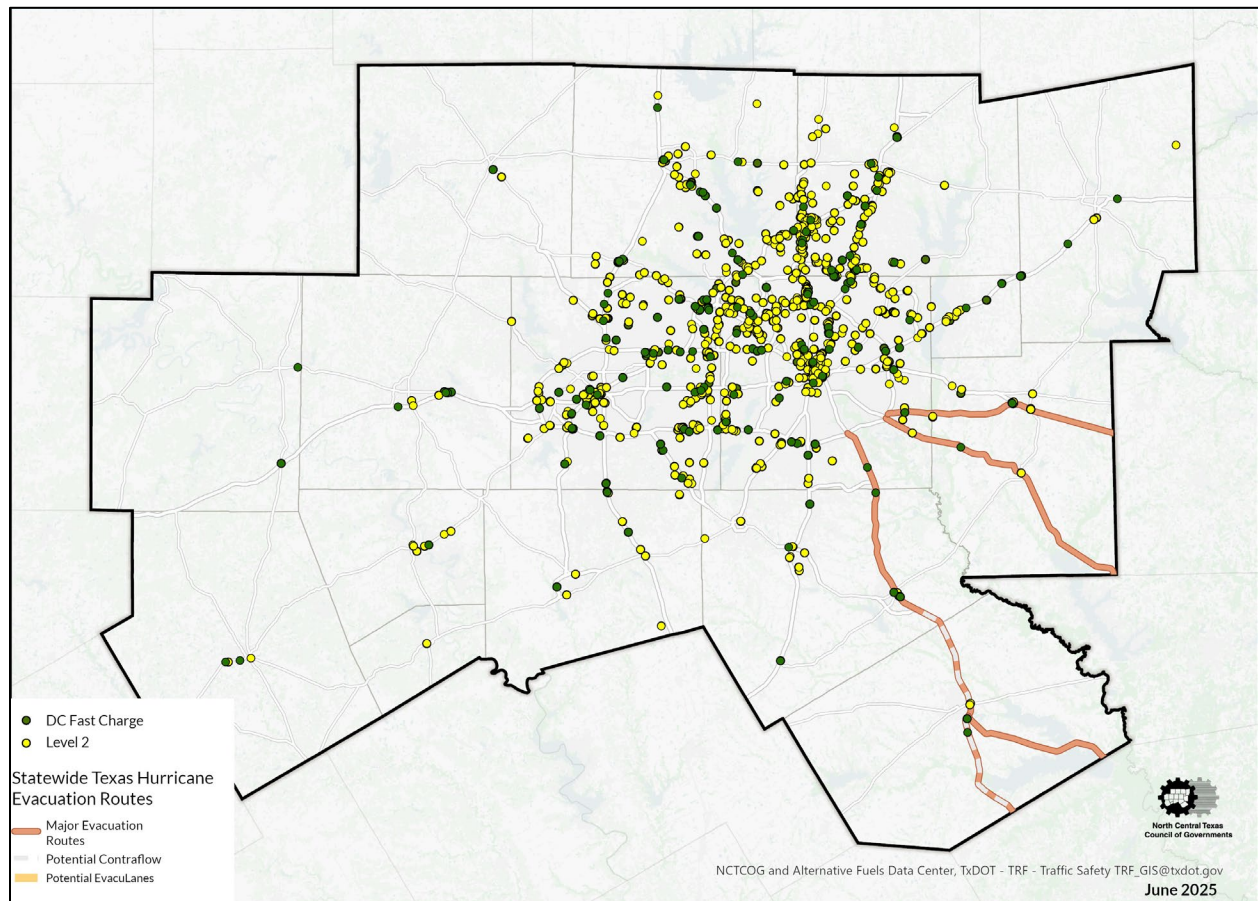
As of June 2025, the segments of these highways (IH-45, US-175, and IH-20) that fall within the NCTCOG boundary include 11, 4, and 11 charging station locations, respectively. These locations consist of 11 DCFC and 15 Level 2 locations. Currently, there are no charging locations along US-287.²¹ **Exhibits 5 and 6** illustrate the locations and quantities of charging stations along these corridors. NCTCOG will complete an assessment of the appropriate level of resiliency needed to ensure fuel availability in the event of an evacuation and develop recommendations about specific deployment frequencies.

Exhibit 5. Number of Charging Stations Along Hurricane Evacuation Routes in the NCTCOG Region

Hurricane Evacuation Route (NCTCOG region)	Total Charging Locations	Level 2 Locations	DCFC Locations
IH-45	11	4	7
US-175	4	3	1
IH-20	11	8	3
US-287	0	0	0

²¹ https://www.dot.state.tx.us/apps/statewide_mapping/StatewidePlanningMap.html

Exhibit 6. Segments of Evacuation Routes and Locations of Charging Stations in the NCTCOG Region



State of Emergency Preparedness for Off-Grid Critical Transportation Operations

Regional Planning for Emergency Incidents and Grid Outages

County and local level emergency management agencies create and maintain emergency management and all-hazard emergency plans for their communities. Critical transportation assets are addressed in emergency management plans and how they play a role, preparedness, and response efforts. Emergency management plans are available by request to the local jurisdiction. Hazard Mitigation Plans address the threats/hazards in a geographic area and the strategies needed to mitigate and lessen the impact of future disasters. All 16 counties in the north central Texas region have a mitigation plan, although not all jurisdictions in the region are covered by one. Hazard mitigation plans are available online via the county/local jurisdiction emergency management website.²²

²² <https://www.nctcog.org/ep/mitigation>

Regional Collaboration

Extensive regional collaboration related to emergency planning is conducted in the North Texas region, including training and exercise assistance, regional planning initiatives, and regional coordination facilitated by the NCTCOG Emergency Preparedness Staff. For example, mutual aid, such as personnel and assets (i.e. vehicles, generators, equipment, etc.), can be loaned between local jurisdictions and used to provide additional resiliency during a grid outage. Local jurisdictions can request and/or provide mutual aid under the Statewide Mutual Aid Agreement.²³ Additionally, some jurisdictions have agreements with others to provide services during emergencies, such as the Public Works Emergency Response Team (PWERT) mutual aid agreement.²⁴

In addition to mutual aid, regional coordination to test the strategies recommended for enabling BEV charging during a grid outage will be conducted in the future, including a tabletop exercise (TTX) planned for Fall 2026. A TTX is a discussion-based emergency preparedness activity that allows stakeholders to walk through a simulated scenario where a transportation asset servicing a critical operation is electrified and there is a grid outage in a low-stress, informal setting. Due to the extensive adoption of BEV in North Texas and the frequency of changes in the availability/technological capabilities of resiliency technologies and BEV, it may be a best practice to regularly conduct a TTX to identify how the electrification of a critical transportation asset could impact operations. Goals of the TTX include:

- Test and refine the NTX-REV Plan,
- Clarify the roles & responsibilities,
- Identify the gaps, including any potential transportation assets/operations that were not identified as critical (**Exhibit 7**) or additional resiliency technologies needed,
- Identify barriers to the implementation of recommended strategies,
- Enhance coordination & communication,
- Support training and education.

The TTX scenario will be established by the exercise planning team will consist of key project partners. The TTX planning process will be compliant with the Homeland Security Exercise and Evaluation Program (HSEEP). The TTX planning process overview will consist of -

1. Planning Phase
2. Pre-Exercise Documentation

²³ [GOVERNMENT CODE CHAPTER 418. EMERGENCY MANAGEMENT](#)

²⁴ [NCTCOG - Public Works Emergency Response Team \(PWERT\)](#)

3. Exercise Execution Support
4. Post-Exercise Deliverables

Proposed TTX Scenario: A severe winter weather event has caused major power outages that have impacted the state-wide power grid, causing prolonged power outages which impacts the electric vehicle charging infrastructure that supports everyday mobility & emergency response.

Finally, after the TTX Scenario, the Project Team plans to conduct simulated grid outages at selected EV charging sites. This demonstration will evaluate the performance of resilient energy technologies under real-world power interruption conditions.

Technology Demonstration Overview:

- **Planning Phase**
The Project Team will identify participating EVSE locations, finalize equipment lists, and coordinate with utility, DER, and local government partners. Simulated outage scenarios will be developed and documented, including disconnecting grid power from selected EVSE sites during scheduled windows.
- **Pre-Demonstration Documentation**
Site-specific test plans will be developed to outline the demonstration protocols, including equipment configurations, metrics to be collected, and roles/responsibilities. Documentation will also include safety procedures, vendor coordination plans, and performance baseline information.
- **Demonstration Execution Support**
The demonstration will test the ability of various resilient technologies to maintain or restore EV charging capabilities. During each demonstration event, the Project Team will deploy and test resiliency technologies identified in the Feasibility Analysis. Charging performance, energy throughput, vehicle readiness, and system response times will be closely monitored and recorded. This includes evaluating:
 - The time between power loss and the activation of backup systems
 - The ability to charge EVs to a predetermined state of charge
 - Total number of EV miles of travel enabled during the outage
 - Capacity of charging stations to serve multiple vehicles under emergency power

Additional performance metrics will include energy delivery rates, system efficiency, downtime durations, and operational costs associated with each strategy. Weather

conditions, charger characteristics, and system status will be recorded during each event to provide a comprehensive context for analysis.

- **Post-Demonstration Deliverables**

Following each demonstration, the Project Team will produce summary reports detailing technology performance, operational effectiveness, and resilience metrics. These findings will inform the broader regional resilience plan and support decision-making around future technology deployments.

Critical Transportation Operations and Frequently Requested Assets and Equipment During Emergency Incidents

In discussion with city and county emergency managers and other officials within the NTX-REV Project Team, certain services and operations provided were emphasized as critical to maintain in the event of emergency or grid disruption. Overarchingly, public works services and operations that affect the health, safety, and comfort of the public are prioritized above all else. A full list of potential operations is available in **Exhibit 7**, but key operations include:

- Evacuation of Residents
- Medical Transport, Paratransit, Transport to Shelters
- Public Safety (i.e. fire, police, EMS, etc.)
- Utility Repair, Water and Electricity Restoration
- Refuse and Debris Removal
- Transportation of Critical Goods (i.e. food, water, medical supplies, etc.)

Based on stakeholder discussions, along with review of the FEMA Inventory, Public Works Emergency Response Team requests, and assets identified in county-wide Hazard Mitigation Plans, NCTCOG identified the following assets, equipment, and vehicles as *frequently utilized* for critical services and operations during emergency incidents:

- Generators (diesel, gasoline, and alternative fuels)
- Fuel Reserves (battery storage and traditional fuels)
- Medium-Duty Trucks (commercial work pickups, straight trucks (e.g. dump, refuse, fire), and multi-use trucks (e.g. utility, service))
- Bus Fleets (Public works and emergency response fleets, public transit, paratransit, and school district fleets)
- Debris Clearing tools (woodchipper, chainsaw, water pump, excavators, salt trucks)
- Additional tools (trailers, light towers, radio system)
- Personnel

Vehicles Utilized for Critical Transportation Operations

Through engagement with the NTX-REV Project Team, NCTCOG has identified the types of vehicles which could serve a critical operation (i.e. operations that if ceased, would be harmful to human health or safety), as summarized in **Exhibit 7**. Certain vehicle types are utilized more frequently than others. For example, medium-duty trucks are most frequently used due to their ability to carry a significant amount of equipment/debris/staff/etc. However, while certain vehicle types are used more frequently than others, in the event of an emergency any asset could be used, as demonstrated in the “Likelihood of Use for Critical Operations” column in **Exhibit 7**.

Exhibit 7. Vehicle Types Identified as Useful for Critical Operations

Vehicle Type*	Example Conventional Vehicle Make/Model	Likelihood of Use for Critical Operations	Example Critical Operations
HD Pickup	Ford F-2/350	High	Water/electricity/utility repair; Small or medium debris removal hauling/towing (equipment); Salting roads during severe weather
Box/Straight Truck (Class 6-8)	Peterbilt Model 537	High	Public safety (Fire Truck); Construction (Dump Truck); Refuse collection; Salting roads during severe weather
Medium Heavy-Duty Multi Truck (Cabover)	Peterbilt Model 220	High	Large road debris removal; Cleaning streets (i.e. street sweeper); Other municipal services
Box/Straight Truck (Class 4-5)	Isuzu FTR	High	Transport of critical goods; Misc. municipal services; Public Health (ambulance/emergency services)
LD Pickup	Ford F-150	Medium	Misc. municipal services; Hauling/towing (equipment)
Step Van	Freightliner MT55	Medium	Transport of critical goods
Tractor/Semi	Mack Anthem	Medium	Transport of critical goods and equipment (drayage or long-haul)
Sedan	Honda Civic	Medium	Public safety (police or environmental Services)
Shuttle Bus	Ford E-450 Shuttle Bus	Medium	Transport for medical services, evacuation, or moving to shelters
School Bus	Blue Bird Vision	Medium	Transportation, evacuation, or moving to shelters
Transit Bus	New Flyer Excelsior	Low	Evacuation of residents; Establishing an emergency Mobile command center

**Vehicle type classifications are based on weight classes and categories defined by EPA –*

<https://afdc.energy.gov/data/10380>

Strategies for Continuing Operations of Conventional Fuel Critical Transportation Assets

Many organizations in the North Texas region have existing strategies to ensure the continuity of operations for conventionally fueled vehicles. As a result of this familiarity, conventional vehicles remain the primary vehicle to use for critical services. Fleets with some BEVs in key roles have even stated that part of their continuity of operations plan is simply to have a conventional vehicle as a backup for the BEV because the processes needed to support conventional vehicles are perceived to be 'easier'. Strategies to continue operations of conventional vehicles include:

- Topping off on-site fuel reserves and vehicle fuel tanks prior to events.
- Activation of fleet fuel cards to facilitate access to emergency supplies and refueling at retail stations.²⁵
- Deployment of portable fuel canisters or mobile fueling units (also known as direct-to-truck fueling or "wet hosing") to deliver fuel directly to vehicles, most frequently at fleet depots.²⁶
- Installation of bulk fuel tanks at fleet refueling facilities to ensure the availability of fuel.
- Preventive maintenance, reducing the likelihood of breakdowns when parts and service access may be limited.²⁷
- Addition of auxiliary generators, microgrids, solar panels, or other sources of power to sustain the refueling of vehicle and equipment when electricity access is disrupted, as refueling stations often need electricity to operate.²³

Following the occurrence of an emergency, emergency managers prioritize the restoration of services and evaluation of performance to kickstart recovery.

- *Restoration of Services:*
 - Repair damaged charging infrastructure quickly,
 - Deploy backup power (e.g., generators, fuel reserves, solar-plus-storage) to sustain operations,
 - Assess system performance post-incident.
- *Evaluation and Improvement*

²⁵ <https://www.disasterresponseguide.com/fleet-hurricane-preparation-strategies>

²⁶ <https://www.disasterresponseguide.com/disaster-fuel-strategy-for-fleets>

²⁷ <https://www.disasterresponseguide.com/fleet-disaster-readiness-and-recovery>

- Regularly update emergency plans based on lessons learned,
- Involve stakeholders and regional partners to refine strategies,
- Invest in and explore innovative, resilient EV infrastructure solutions.

As BEVs become part of critical operations, these recovery efforts will require additional planning to address charging infrastructure, power reliability, and evolving technology needs.

State of Emergency Preparedness for Off-Grid Electrified Transportation Operations–

Discussion with regional emergency officials and transit operators has revealed that the North Texas region is experienced in maintaining continuity of conventional fuel transportation assets but is still in the early stages of preparing for a future that relies on BEV. Local governments, transit agencies, and public agencies have built emergency protocols around conventionally fueled vehicles, such as maintaining fuel reserves, deploying mobile fueling units, and operating trailer-mounted generators.

However, few agencies have substantially integrated BEV or resilient EV charging into these protocols. For example, while some organizations have on-site generators for providing backup to buildings or conventional fuel refueling stations, those on-site generators are not providing power to EV charging stations. Additionally, organizations have contracts with fuel providers for delivering conventional fuel, but they do not have an equivalent contract to bring backup electricity for BEV. However, many of the strategies/standard operating procedures used for conventional fuel vehicles could also apply to BEV, such as ensuring a vehicle has a full tank- or battery- prior to a severe weather event or other potential emergency incident.

V. Inventory of Resiliency Technologies

Resiliency Technologies Identified For the NTX-REV Plan

The NTX-REV Project Team identified the following technologies in **Exhibit 8** as potential technologies to use for off-grid EV charging. All technologies identified can serve as an independent power source during a grid-outage (ex: a solar panel providing power at a critical fleet facility) or are able to store energy for use during a grid-outage (ex: a natural gas generator or energy storage system). Note, many of these technologies are typically used in combination with each other. For example, the Beam Global- EV ARC system, which is used by several stakeholders in the region, uses On-Site Power Generation (solar)

and an Energy Storage System (batteries).²⁸. If the Beam Global –EV ARC System, or a similar system, was capable of connecting and disconnecting to the grid, then it would also be considered a microgrid. Resiliency technologies which are used to conduct peak shaving to minimize grid demand are not included. While these technologies were acknowledged as important by the NTX-REV Team, the scope of this plan is to identify technologies which can assist with off-grid operations of BEV.

An analysis of the availability of these technologies in the North Texas region is included in the **Gap Analysis**. An analysis of the ability of each technology to support specific assets which serve critical operations is included in the **Feasibility Analysis**.

²⁸ <https://beamforall.com/wp-content/uploads/2021/06/BEAM-EV-ARC-2020-Info-Sheet-v1.1.pdf>

Exhibit 8. Inventory of Resiliency Technologies to Assist with Off-Grid EV

Technology Category	Technology	Capable of Generating Power?	Energy Storage	Energy Generation Capacity	Energy Storage Capacity (i.e. battery storage/fuel storage)	Conventional Fuel Vehicle Resiliency Technology Equivalent	Case Study
Energy Storage Systems	Batteries	No	Yes	N/A	20 chargers with battery storage for 3MWh of storage	Stored combustible fuel for combustion-fueled vehicles	Planned Battery Storage EV Charging Superhub – Watters Creek Village in Allen, TX ²⁹
	Hydrogen Fuel Cell	No	Yes	N/A	N/A	Stored combustible fuel for combustion-fueled vehicles	N/A
On-Site Renewable Generation	Solar	Yes	No	4.3 kW solar canopy ³⁰	20 – 40 kWh battery energy storage options;	N/A	US Department of Agriculture Forest Service – Remote Charging Station ³¹
	Wind	Yes	No	Three turbines generating a total of 500,000 kWh annually	N/A	N/A	Apogee Stadium Wind Turbines - University of North Texas Denton, TX ³²
Generators	Propane	Yes	No	25 mobile generators each with eight Level 2 chargers, to collectively deliver 30.7MWh every night	N/A	Used by Fleets to power critical buildings and refueling stations	Propane-Powered Mobile Charging – School District Electric School Bus Fleet ³³

²⁹ <https://www.xcharge.us/news/xcharge-north-america-unveils-plans-for-battery-storage-ev-charging-superhub-at-watters-creek-village-near-dallas>

³⁰ <https://beamforall.com/wp-content/uploads/2021/06/BEAM-EV-ARC-2020-Info-Sheet-v1.1.pdf>

³¹ <https://www.energy.gov/femp/united-states-forest-service-leverages-ev-charging-solution-remote-areas>

³² <https://www.nrdc.org/sites/default/files/collegiate-game-changers-NorthTexas-case-study.pdf>

³³ https://cdn.prod.website-files.com/640df8525617002587e869cd/668f131344bda607127df074_Pioneer%20e-Building%20247M%20Order%20for%20Large%20Public%20Electric%20School%20Bus%20Fleet.pdf

Technology Category	Technology	Capable of Generating Power?	Energy Storage	Energy Generation Capacity	Energy Storage Capacity (i.e. battery storage/fuel storage)	Conventional Fuel Vehicle Resiliency Technology Equivalent	Case Study
	Natural Gas	Yes	No	300 kW DCFC	No	Stored combustible fuel for combustion-fueled vehicles	Liquid Natural Gas-Powered EV Chargers – Texas Pilot program ³⁴
	Diesel	Yes	No	Four 600kW generators ran continuously for 68 hours	N/A	N/A	Stockton East Water District – Stockton, CA ³⁵
	Gasoline	Yes	No	N/A	N/A	N/A	N/A
Mobile Charging	Mobile Charging Unit – ESS	No	Yes	N/A	80kwh battery storage	For Mobile Charging - “Wet Hosing” is similar	Mobile e-charger Charging Electric Construction Equipment-North Carolina Pilot program ³⁶
	Mobile Charging – Generator	Yes	No	7.7 kW continuously for up to 6 hours ³⁷	N/A	Stored fuel for traditionally fueled vehicles.	AAA Roadside Assistance Utilizing a Generator Powered Mobile Charger for EVs ³⁸

³⁴ <https://www.pioneerpowersolutions.com/investors/newsroom/239-ppi-to-provide-e-boost-solution-to-launch-macaw-energies-low-carbon-lng-to-ev-charging-in-texas/>

³⁵ [generac-industrial-power_case-study_stockton-california-wastewater-treatment-facility.pdf](https://www.generac.com/resources/case-study/stockton-california-wastewater-treatment-facility.pdf)

³⁶ <https://electrek.co/2023/11/14/these-two-companies-are-electrifying-asphalt-paving-in-the-us/>

³⁷ <https://ecokruz.com/products/blink-portable-level-2-gas-generator-powered-mobile-ev-charger-roadside-assistance>

³⁸ <https://www.carscoops.com/2023/04/ev-out-of-juice-aaas-mobile-charger-will-come-to-the-rescue/>

Technology Category	Technology	Capable of Generating Power?	Energy Storage	Energy Generation Capacity	Energy Storage Capacity (i.e. battery storage/fuel storage)	Conventional Fuel Vehicle Resiliency Technology Equivalent	Case Study
	Vehicle to Vehicle (V2V)	N/A	N/A	N/A	N/A	No equivalent	N/A
	Battery Swapping	N/A	N/A	N/A	N/A	No equivalent	N/A
Self-Contained Power Systems	Microgrids	Yes	Yes	Brookville – three 633kW natural gas generators and 1.6 MW solar array EMTOC - 4.84 MW solar; 1 MW hydrogen electrolyzer	Brookville – 3 MW battery energy storage system EMTOC – 2 MW/6.88 MWh battery storage	Similar to using Public or Private refueling stations that have back up power from generators or microgrids.	Montgomery County, Maryland – Brookville Smart Bus Depot³⁹ and Equipment Maintenance & Transit Operation Center (EMTOC)⁴⁰
	Remote Grids	Yes	Yes	36.5 kW solar and two 35 kW propane generators	27.2 kW/68.4 kWh battery storage	Similar to using Public or Private refueling stations that have back up power from generators or microgrids.	Briceburg, CA PG&E Remote Grid ⁴¹

³⁹ https://alphastruxure.com/wp-content/uploads/2022/10/AlphaStruxure-Written-Customer-Story_-FINAL.pdf

⁴⁰ <https://alphastruxure.com/case-studies/emtoc/>

⁴¹ <https://investor.pgecorp.com/news-events/press-releases/press-release-details/2021/New-Remote-Microgrid-Replaces-Traditional-Electric-Poles-and-Wires-Reducing-Wildfire-Risk-for-PGE-Customers-in-High-Fire-Threat-Area/default.aspx>

Overview of Resilient Technologies

Energy Storage Systems

Energy storage systems, or (ESS), can be configured with hardware and software to power EV charging stations in the event of a power outage or disruption. The two types of ESS considered for the NTX-REV Plan include battery energy storage systems (BESS) and hydrogen fuel cell ESS. ESS can either be free-standing or might be an integrated feature as part of a charging station.

Battery energy storage systems (BESS), which usually come in the form of either lithium ion (Li-ion) batteries or lithium iron phosphate batteries (LFP), can store power from the grid or generated on site to provide electricity to a BEV during a grid outage. Li-ion batteries are more commonly used because they can store more energy, but they are highly flammable. LFP batteries cannot store as much power but are more difficult to ignite due to having a simpler thermal battery management system.⁴² Overall, BESS have higher upfront costs, are less energy dense than stored fuel, and requires an electricity source to “refuel”. However, they are also very flexible, reliable, and require little maintenance.⁴³

Hydrogen fuel cells can be used as backup for electricity due to their ability to create an electrochemical reaction to convert hydrogen fuel to electricity. These are not as widely adopted and therefore can have a high upfront cost. However, hydrogen is typically more energy dense when compared to Li-ion batteries.⁴⁴

On-Site Renewables

On-site renewables, such as solar photovoltaics (or solar panels) and wind turbines, can continuously supply power to EV chargers under certain conditions: the on-site renewables could be grid-tied with a utility transfer switch, or might not be grid-tied at all. However, the amount of energy generated can vary from tens of kW to several MW, depending on the size of the installation, weather, and time of day. It is important to size the system appropriately for EV charger use and not generate too much or too little power. Pairing on-site renewables with ESS can help provide flexibility on this point. Solar panels have been widely adopted by NTX-REV stakeholders for powering buildings, and they have begun to be used in combination with EV charging and BESS, as detailed in the **Gap Analysis**.

Generators

⁴² Electric Vehicle (EV) Battery Management Study

⁴³ [Power-Resiliency-Electric-Fleets.pdf](#)

⁴⁴ <https://afdc.energy.gov/fuels/properties>

Emergency generators can burn fuels such as diesel, gasoline, natural gas, or propane, to provide electricity to a BEV in the event of a grid outage. Generators are widely adopted in North Texas, as detailed in the **State of Emergency Preparedness for Off-Grid Critical Transportation Operations**, due to the lower upfront costs, high longevity/durability, and high energy density. Diesel fuel has a particularly high energy density with one gallon equaling 113 percent of the energy in one GGE, meaning it is more energy dense than gasoline, natural gas, propane, electricity, or hydrogen.⁴⁴ However, not all generators are capable of charging an BEV, as the generator's capacity, voltage, and other features may not be compatible with the BEV hardware and software. Additionally, stakeholders in the NTX-REV Project Team have reported difficulty with maintenance of generators leading up to grid outages, as well as challenges in getting fuel delivered to refuel the generator during a grid outage event.

Mobile Charging

Mobile charging can be used by combining a mobile generator/BESS with EV chargers, typically mounted on a truck or other on-road vehicles. Mobile charging has the benefit of being incredibly flexible, which was expressed as an important consideration by the NTX-REV Project Team as it can be difficult to predict when and where a grid outage will take place. Since the region regularly participates in mutual aid or asset sharing, as detailed in **State of Emergency Preparedness for Off-Grid Critical Transportation Operations**, mobile charging has the added benefit of being able to move between jurisdictions. This is similar to wet hosing (also known as mobile, direct, or truck-to-truck fueling), where fuel is delivered directly to vehicles and equipment at job sites, eliminating the need for on-site fuel storage or trips to existing refueling sites.^{45,46} This type of application is widely used at construction sites and reduces downtime of vehicles and equipment.

Microgrids

Microgrids, or a backup power system capable of isolating itself from the grid which incorporates energy generation and ESS, can provide electricity to BEV during a grid outage. Microgrids can usually provide power for a longer duration than other resiliency technologies, but they typically cost more to initially deploy. During discussions with the NTX-REV Project Team, it was expressed that when deploying microgrids for supporting critical transportation operations using BEV, they should be in a centralized location, where they can either provide power to assets that are frequently used in critical operations, or shared between multiple jurisdictions.

⁴⁵ [What is Wet Hosing? Mobile Fueling and On-Site Fuel Delivery Explained](#)

⁴⁶ <https://www.disasterresponseguide.com/disaster-fuel-strategy-for-fleets>

New Resiliency Technologies

New resiliency technologies are regularly being introduced. For example, battery swapping, where modular batteries are swapped out of a BEV to ensure they do not have to stop their operations to recharge. Battery swapping has been piloted in Kyoto, Japan using taxis. A multi-year pilot is set for September 2025 in Tokyo across 14 modular battery swapping stations which will be fully automated.⁴⁷ One of the pilot's targets is to keep battery swapping to five minutes to reduce vehicle downtime during charging.

Bidirectional charging is another newer technology that can be considered. It is a type of mobile energy storage since it uses one EV to charge another EV. It is also known as vehicle-to-vehicle (V2V). The technology is one of the newer options, and Ford-150 Lightnings, a growing choice for fleet EVs, are one of the vehicles able to charge another EV using the proper plug adapter and charging connector.⁴⁸

VI. Strengths, Weakness, Opportunities, and Threats (SWOT) Analysis

SWOT Analysis Overview

The purpose of the SWOT Analysis for the NTX-REV Plan is to analyze the risks and threats which could impact the electrification of critical transportation assets, with a focus on the impacts to potential technologies/strategies which could be deployed in North Texas.

Exhibit 9 provides a summary of what has been identified by the Project Team, with additional details provided below.

Exhibit 9. NTX-REV SWOT Analysis Overview

Strengths
- Existing Regional Emergency Management Plans, Coordination, and Mutual Aid Agreements - Existing Resiliency Plans - Existing EV Charging and/or Resiliency Technologies - Diverse Energy Sources
Weaknesses
- Limited Inclusion of EV Resilience in Emergency Management and Operations Plans - Jurisdictional Silos in Communication and Planning - Constraints and Vulnerabilities in the ERCOT Grid

⁴⁷ <https://www.worktruckonline.com/10242042/international-consortium-rolls-out-ev-battery-swapping-initiative-in-tokyo>

⁴⁸ <https://www.conservenorthtexas.org/getattachment/5f6d0a14-6e7b-44f5-8283-389b763d4c33/nctcog-resilientevcharginginfrastructure-whitepaper.pdf> pg. 19

- Grid Isolation and Single-Point Vulnerability
- Lack of Data on Charger Resiliency Features
- Limited Fleet Resilience Planning
- Increased Grid Outages Driven by Severe Weather
- Gaps in Electrification of Critical Operations
- Uneven Distribution and Limited Resilience in Existing Charger Network
- Resistance to Change

Opportunities

- Regional Adoption of Electrified Vehicles Used for Critical Operations
- Ongoing Regional Planning, Studies, and Demonstration Projects
- Access to Resilience and Clean Energy Funding
- Future Funding for Emission Reduction Technologies
- Establishing a Regional Resilience Working Group

Threats

- Rising Electricity Demand Driven by Rapid Population and Economic Growth
- Exposure to Natural Disasters and Severe Weather Events
- Technological Failures Impacting Infrastructure Performance
- Cybersecurity Vulnerabilities in Electrified Transportation Systems
- Human-Caused Disruptions to EV Infrastructure
- Global Supply Chain Dependencies and Material Shortages

SWOT Analysis Development

To develop the SWOT Analysis, NCTCOG developed a series of questions to guide stakeholder discussions and identify regional strengths, weaknesses, opportunities, and threats. Staff drafted an initial SWOT analysis to facilitate stakeholder review and feedback and also conducted one-on-one listening sessions with individual agencies using a tailored set of questions. The final SWOT analysis reflects a compilation of this feedback.

Detailed SWOT Analysis

Strengths

Existing Regional Emergency Management Plans, Coordination, and Mutual Aid Agreements

As discussed in **State of Emergency Preparedness for Off-Grid Critical Transportation Operations**, cities and counties in the NCTCOG region possess “all-hazard” emergency management plans which include strategies to respond to power outages and Continuity of Operation Plans (COOP) to ensure continuation of essential services during emergencies. These existing plans can be used as a “reference guide” when electrifying critical transportation assets to identify the types of vehicles used in critical operations and how/where they will be used.

Mutual aid, such as to personnel and assets (i.e. vehicles, generators, equipment, etc.) can be used to provide additional resiliency during a grid outage. Local jurisdictions can request and/or provide mutual aid under the Statewide Mutual Aid Agreement.⁴⁹ Additionally, some jurisdictions have an agreement with others to provide services during emergencies, such as the Public Works Emergency Response Team (PWERT) mutual aid agreement.⁵⁰

Existing Resiliency Plans

Currently, Oncor Electric Delivery, which serves as the transmission and distribution service provider for 94.76 percent of the census tracts in the NCTCOG region, is the only project partner which has adopted a resiliency plan. Oncor's System Resiliency Plan (SRP), approved by the Public Utility Commission of Texas (PUCT) in 2024, outlines a pathway to strengthen and modernize Oncor's transmission and distribution grid. Once implemented, these initiatives will help grid resiliency and mitigate infrastructure damage that leads to electricity outages during severe weather events, thus reducing risk to any critical operations relying on BEVs. Investment has focused on hardening overhead and underground infrastructure, optimizing load distribution automation, enhancing wildfire mitigation, and more.⁵¹

Existing EV Charging and/or Resiliency Technologies

As of June 2025, over 3,100 EV charging ports are available across over 1,100 locations in the NCTCOG region. Availability of EV Charging infrastructure will continue to expand with private sector investment and grant funding available through programs such as the Texas Electric Vehicle Infrastructure Plan, the CFI Community Program, and the Alternative Fueling Facilities Program. Funding programs, such as \$15M available through the CFI Community Program, may provide an opportunity to integrate resiliency features such as solar and battery backup. NCTCOG is aware of a few EV chargers in the region utilizing these features, but adoption is limited, especially for publicly accessible charging stations. Widespread inclusion of resiliency features will ensure continued operation during power outages or emergencies, allowing essential vehicles to recharge and continue travel. It is possible new and existing EV charger installations could support Vehicle-to-Everything (V2X) technology and provide temporary backup power to homes, businesses, or critical facilities like hospitals or shelters.⁵²

⁴⁹ [GOVERNMENT CODE CHAPTER 418. EMERGENCY MANAGEMENT](#)

⁵⁰ [NCTCOG - Public Works Emergency Response Team \(PWERT\)](#)

⁵¹ <https://www.oncor.com/content/oncorwww/us/en/home/Oncor-System-Resiliency-Plan.html>

⁵² <https://www.nrel.gov/news/detail/program/2023/evs-play-surprising-role-in-supporting-grid-resiliency>

Diverse Energy Sources

As mentioned in **State of the Grid**, electricity in Texas is produced by a diverse number of sources. In March 2025, ~42 percent of electricity generated came from net renewable energy (wind, solar, and hydroelectric), ~9 percent from nuclear power, and the remaining ~48 percent from traditional energy sources such as coal and natural gas.⁵³ Battery storage is also widely used to reinforce the stability of the grid and account for surges in demand. This diversity increases the resiliency of the Texas electrical grid and provides numerous sources of generation/fuel sources, expanding the options available to fleets. For example, if fleets are interested in a skid-mounted EV charging system powered by natural gas, they would easily be able to find an existing natural gas hookup to refuel their system.

Weaknesses

Limited Inclusion of EV Resilience in Emergency Management and Operations Plans

While many jurisdictions across the NCTCOG region maintain Continuity of Operations Plans (COOPs) and emergency response frameworks, these typically do not directly address BEV resilience and lack provisions for the integration and support of electrified critical transportation assets, such as transit fleets or emergency vehicles. Existing emergency protocols do not yet reflect the operational needs or infrastructure requirements of electric mobility systems during grid disruptions.

Jurisdictional Silos in Communication and Planning

Regional coordination on interdisciplinary topics like resilience planning is challenged by fragmented communication channels across local governments and agencies. Often, planning efforts occur within jurisdictional silos, limiting collaboration, knowledge-sharing, and unified approaches to integrating resilience into transportation electrification efforts.

Constraints and Vulnerabilities in the ERCOT Grid

The resilience and reliability of the ERCOT power grid, which serves the entire NCTCOG region, are challenged by population growth, expansion in industrial power demands, and intensifying weather extremes. According to ERCOT's 2024 State of the Grid report, Texas added more than 500,000 residents in one year, resulting in increased residential and commercial electricity demand—particularly in the fast-growing areas of the region. Additionally, the expansion of energy-intensive operations such as data centers, hydrogen facilities, and cryptocurrency mining has driven unprecedented non-coincident peak loads. ERCOT's 2024 Grid Reliability and Resiliency Assessment identified major vulnerabilities in the transmission network, especially under extreme winter or hurricane

⁵³ <https://www.eia.gov/state/?sid=TX#tabs-4>

scenarios. These systemic stressors threaten the reliability of critical electrified transportation systems which depend on uninterrupted access to charging infrastructure.⁵⁴

Grid Isolation and Single-Point Vulnerability

The entire NCTCOG planning area operates within the ERCOT grid, which is largely disconnected from other U.S. power grids. This grid isolation increases the risk of widespread service disruption during outages, as electricity cannot be imported from external systems. If ERCOT experiences a failure, the entire region could lose access to power, with no immediate recourse for external energy support—posing a substantial threat to continuity of charging for EVs during emergencies.

Lack of Data on Charger Resiliency Features

As EV adoption grows and more chargers are deployed, there remains limited publicly available data on the resiliency features of existing charging infrastructure. It is often unclear whether chargers in the region include backup power, smart grid connectivity, or off-grid capabilities. This lack of transparency limits local governments' ability to incorporate chargers and EV resilience into comprehensive emergency preparedness planning.

Limited Fleet Resilience Planning

Regional fleets, including emergency and public works vehicles and transit operators, often do not have formal operations plans that include resilience strategies for electrified vehicles. While these fleets typically have well-established contingency measures for conventional fuels, similar plans for electric assets are not prioritized. Without investments in resilient solutions such as mobile charging units, microgrids, and local battery storage, and inclusion of these considerations in regional plans, EV fleets remain vulnerable to cascading power outages and may be sidelined during emergencies.

Increased Grid Outages Driven by Severe Weather

Outage frequency and duration in Texas has increased significantly in recent years, largely due to severe weather. Between 2003 and 2023, Texas experienced 435 grid outages, and 263 of these occurred in just the past five years (2019-2023), accounting for 60 percent of the total outages, with each outage lasting an average of 160 minutes.⁵⁵ Severe weather

⁵⁴ <https://www.ercot.com/files/docs/2025/03/14/ERCOT-2024-State-of-the-Grid.pdf> pg. 2, 8

⁵⁵ 7 <https://paylesspower.com/blog/blackout-tracker/>

alone was responsible for 111 of the 193 such outages recorded over the 20-year period, underscoring a trend of increasingly volatile weather impacts on grid reliability.⁵⁶

Gaps in Electrification of Critical Operations

Despite progress in light-duty EV adoption among personal users in the region, significant gaps remain in the electrification of vehicles used for critical operations. Local governments and fleet operators have expressed hesitation in electrifying critical vehicles due to concerns over dependability. Electric vehicles are often viewed as unreliable during power outages in comparison to traditional fuel vehicles supported by more robust contingency frameworks.

Uneven Distribution and Limited Resilience in Existing Charger Network

Although the region has seen investment in EV charging infrastructure, only a small share of installed chargers includes resiliency features such as battery backup or solar integration. The uneven geographic distribution of chargers also reduces the effectiveness of the public charging network, particularly outside urban centers. Even within urbanized areas, gaps in charger access may limit the ability of critical fleets to operate continuously during emergencies. Additional infrastructure and upgrades are needed to support growing electrification goals and ensure operational reliability during power disruptions.

Resistance to Change

Local governments and fleet operators have expressed hesitation in electrifying critical vehicles due to concerns over reliability, high upfront costs of charging solutions, lack of technical expertise, and limited examples of resilient EV fleet deployments. The absence of charging solutions like energy storage, vehicle-to-everything (V2X) charging, and mobile charging support further limits stakeholder confidence. Consequently, electric vehicles are often viewed as unreliable during power outages, especially in comparison to traditional fuel systems supported by more robust contingency frameworks.

Opportunities

Regional Adoption of Electrified Vehicles Used for Critical Operations

Local jurisdictions, transit providers, and regional agencies are increasingly exploring the use of BEVs to support critical operations during emergencies. A range of vehicle types including EV sedans, refuse trucks, electrified buses and rail, and fire trucks have been deployed or are being considered for future deployment to support public safety and emergency response functions. Transit providers in the region, such as those operating

⁵⁶ <https://paylesspower.com/blog/blackout-tracker/>

diesel, gasoline, and compressed natural gas (CNG) cutaway buses, are expanding their fleets to include micro transit vehicles and EV buses that can transport residents to shelters, hospitals, and freight hubs during severe weather events. Electrified rail systems also contribute to regional connectivity and mobility under emergency conditions. Continued expansion of these applications can improve operational resilience, reduce emissions, and support critical mobility needs in times of disruption.

Ongoing Regional Planning, Studies, and Demonstration Projects

The region benefits from the actions of “early adopter” organizations. Multiple stakeholders across the region are actively engaged in planning, research, and demonstration projects that lay the foundation for resilient EV infrastructure integration in the region. NCTCOG previously developed a white paper on integrating energy resilience into hazard mitigation planning, identifying strategies such as battery storage, distributed energy resources (DERs), and microgrids⁵⁷. DFW International Airport (DFWIA) is working with the Department of Energy and the National Renewable Energy Laboratory (NREL) to design microgrid systems and prioritize EV charging for emergency vehicles, ground support equipment, and passenger transport services. Similarly, Dallas Area Rapid Transit (DART) has completed an energy audit, developed a Climate Action Plan, and was awarded funding from the Promoting Resilient Operations for Transformative, Efficient, and Cost-Saving Transportation (PROTECT) Program to develop a vulnerability assessment and identify resilience strategies to make necessary improvements for its transportation network⁵⁸. Local governments and utilities are incorporating energy resilience into facility and fleet operations. The City of Dallas is developing a regional catastrophic preparedness framework to address supply chain vulnerabilities and is preparing a freight mobility plan under the RAISE program to minimize disruptions caused by freight traffic. The City of Irving and the City of Dallas are piloting battery storage and microgrid systems that can sustain operations when the main grid is offline. XCharge North America and the City of Allen have implemented a battery system with 3 MWh of storage capacity, while other jurisdictions are preparing to scale these innovations to public libraries, city facilities, and transit hubs. Oncor Electric Delivery, the region’s largest utility, has implemented resilience strategies across its command centers, including on-site backup generation, uninterruptible power supplies, and microgrids with energy storage. Oncor is also exploring the integration of vehicle-to-grid (V2G) capable EVs as distributed energy assets.

⁵⁷ <https://www.conservenorthtexas.org/getattachment/5f6d0a14-6e7b-44f5-8283-389b763d4c33/nctcog-resilientevcharginginfrastructure-whitepaper.pdf>

⁵⁸ https://www.fhwa.dot.gov/environment/protect/discretionary/grant_recipients/

Research institutions in the region are actively exploring how EVs can enhance local grid resilience. The University of North Texas (UNT) is modeling the use of EVs as mobile energy storage units to support neighborhood microgrids.⁵⁹ By integrating EV batteries, solar panels, and smart charging systems, the project aims to create energy-flexible campuses and communities capable of maintaining critical functions during grid outages. This work supports broader regional objectives to build decentralized energy systems and leverage EVs as active components of local energy infrastructure. These initiatives provide transferable knowledge, tested technologies, and data that will benefit regional resilience planning for EV infrastructure and demonstrate scalable models for other fleet and infrastructure locations across the NCTCOG region.

Access to Resilience and Clean Energy Funding

Federal and state programs offer funding opportunities to support resilient electrification projects. Jurisdictions with FEMA-approved hazard mitigation plans are eligible to apply for mitigation funding following presidential disaster declarations. Additional programs such as the Energy Efficiency and Conservation Block Grant (EECBG) provide direct funding to local governments to support clean energy and energy efficiency efforts. Cities including Farmers Branch, Arlington, Plano, and Grand Prairie have already used EECBG funds to purchase EVs, install charging stations, and deploy solar-powered infrastructure.⁶⁰ The State Energy Conservation Office (SECO) also offers free Preliminary Energy Assessments (PEAs) and low-interest loans through the LoanSTAR program to help local agencies improve energy performance and deploy technologies like solar, battery storage, and EV charging.⁶¹ STAR Transit used a PEA to guide the installation of solar panels and EV chargers at one of its facilities.⁶²

Future Funding for Emission Reduction Technologies

The Texas Emissions Reduction Plan (TERP) includes grant programs such as the New Technologies Implementation Grant (NTIG), which can fund up to 50 percent of project costs for emission-reducing technologies, including stationary systems like microgrids and energy storage. The NTIG program is typically made available during the Fall of every even-numbered year.⁶³ With sufficient planning and project readiness, regional stakeholders can

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https://research.unt.edu/news/unt_researchers_investigating_use_of_electric_vehicles_as_alternative_grid_supporting_power_resources_for_neighborhoods.html

⁶⁰ [https://www.conservenorthtexas.org/article/2025/Energy-Efficiency-and-Conservation-Block-Grant-\(EE](https://www.conservenorthtexas.org/article/2025/Energy-Efficiency-and-Conservation-Block-Grant-(EE)

⁶¹ <https://comptroller.texas.gov/programs/seco/programs/local/pea.php>

⁶² https://www.startransit.org/wp-content/uploads/2022/04/2022111_RFP_SolarPV-v2-1.pdf pg. 44

⁶³ <https://www.tceq.texas.gov/airquality/terp/ntig.html>

take advantage of this and other grant opportunities to enhance the resilience of EV infrastructure and reduce environmental impacts from transportation operations.

Establishing a Regional Resilience Working Group

This project provides an opportunity to formalize and sustain the interdisciplinary partnerships developed through the NTX-REV stakeholder group. NCTCOG, in its role as a regional convener, can continue to bring together municipalities, transit agencies, utilities, researchers, and other stakeholders through a continuation of this group as a dedicated working group or advisory committee focused on EV resilience. These forums align with the agency's core mission of fostering cross-sector collaboration and supporting long-term regional planning. Maintaining a formal working group would allow for regular knowledge exchange, funding coordination, and alignment of priorities to advance resilient electrification across the NCTCOG region.

Threats

Rising Electricity Demand Driven by Rapid Population and Economic Growth

North Central Texas is undergoing significant population and economic expansion, placing mounting pressure on the electrical grid. The NCTCOG region, home to approximately 7.5 million people in 2019, is projected to grow to 12.2 million residents by 2050. This rapid growth is expected to drive a sharp increase in electricity consumption due to higher residential, commercial, and industrial energy needs. ERCOT's latest Long-Term Hourly Peak Demand and Energy Forecast predicts a 13.6 percent average annual growth rate (AAGR) in energy demand across the region between 2025 and 2031, compared to just 3.1 percent during the prior decade. The increase is primarily driven by large-scale electricity users such as data centers, particularly those supporting artificial intelligence (AI) applications, along with cryptocurrency mining, hydrogen production, oil and gas operations, and other heavy industrial users. By 2031, ERCOT projects' energy demand will reach nearly 1 million gigawatt-hours (GWh) annually. Without adequate planning and investment in grid resilience, this exponential demand could outpace infrastructure capacity, compromising power reliability for critical EV charging and transportation systems. North Central Texas is undergoing significant population and economic expansion, placing mounting pressure on the electrical grid. The NCTCOG region, home to approximately 7.5 million people in 2019, is projected to grow to 12.2 million residents by 2050. This rapid growth is expected to drive a sharp increase in electricity consumption due to higher residential, commercial, and industrial energy needs. ERCOT's latest Long-Term Hourly Peak Demand and Energy Forecast predicts a 13.6 percent average annual growth rate (AAGR) in energy demand across the region between 2025 and 2031, compared to just

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Exposure to Natural Disasters and Severe Weather Events

North Central Texas is vulnerable to a range of natural disasters—including winter storms, flash floods, tornadoes, and high-wind events—that have the potential to damage both EV infrastructure and the electric grid. These events can result in prolonged power outages that disrupt the operation of EV charging stations and leave critical transportation assets offline during emergencies. Severe weather events pose a growing risk to the physical integrity and functionality of above-ground and surface-level EV equipment.

Technological Failures Impacting Infrastructure Performance

EV charging infrastructure relies on a complex ecosystem of hardware and software systems that are susceptible to a variety of failures. Hardware malfunctions, network connectivity issues, and software bugs can affect the operability of charging stations, especially those with smart or remote management capabilities. When such failures coincide with grid outages or emergency conditions, they can prevent emergency response fleets and essential public services from accessing charging power. The lack of redundancy or fail-safes in some EV charging networks further elevates the risk of single-point failures, which could undermine regional preparedness and transportation continuity during crises.

Complications of Maturing EV Charger Infrastructure Industry

The EV charging infrastructure industry is still relatively new with many different companies offering their own hardware and software solutions, as evident by the industry still reacting to vehicle manufacturers announcing a shift from the Society of Automotive Engineers (SAE) CCS1 port to the SAE J3400 in 2023. Several charging solutions include proprietary components and software, making it difficult for other entities to operate and maintain the station in the event the original developer is unavailable or no longer operational. The National Electric Vehicle Infrastructure Standards and Requirements⁶⁴ are attempting to

⁶⁴ [eCFR :: 23 CFR Part 680 -- National Electric Vehicle Infrastructure Standards and Requirements](#)

address this for federally funded infrastructure, but the issue remains for privately funded and legacy charger installations.

Cybersecurity Vulnerabilities in Electrified Transportation Systems

As EV infrastructure becomes increasingly digitized and connected, it also becomes more vulnerable to cybersecurity threats. Cyber-attacks targeting networked charging stations, communications systems, or grid-connected vehicle-to-everything (V2X) technologies could disrupt operations or expose sensitive data. Attackers may seek to disable charging networks, manipulate energy pricing or availability, or compromise emergency communication systems. A strong cybersecurity posture, including regular assessments and redundant safeguards, will be essential to ensure that EV systems remain operational and secure during emergencies.

Human-Caused Disruptions to EV Infrastructure

Beyond technological and environmental risks, EV infrastructure is also vulnerable to human-related disruptions. These include vandalism, accidents, operational errors, and logistical delays in maintenance or repairs. In particular, vandalism or theft of EV chargers or copper wiring can render stations inoperable and delay restoration. Additionally, workforce shortages or mismanagement in deployment and maintenance can limit the effectiveness of resilience planning. These risks highlight the importance of developing response protocols, training programs, and contingency resources to maintain infrastructure readiness.

Global Supply Chain Dependencies and Material Shortages

The development and maintenance of EV infrastructure currently depend on the availability of materials such as lithium, cobalt, and rare earth elements, many of which are sourced from outside the United States.⁶⁵ Disruptions to global supply chains due to geopolitical tensions, trade restrictions, or natural disasters may delay the delivery of EV chargers, batteries, or key components. This dependence can slow the expansion of resilient EV infrastructure and hinder the timely repair of damaged assets, particularly in rural or high-demand areas. Ensuring diversified supply chains and developing domestic manufacturing capacity will be critical to minimizing vulnerabilities associated with global market fluctuations.

⁶⁵ [mcs2025.pdf](#), Table 5.—Estimated Salient Critical Minerals Statistics in 2024

VII. Feasible Resilient Technologies and Strategies

The primary focus of the NTX-REV Plan is to ensure the continuity of critical operations if BEVs are used in essential activities. The Project Team expressed the following primary considerations for deploying BEV and resiliency technologies:

- Ensure critical operations can continue with as few changes in vehicle/refueling operations as possible due to using BEV instead of conventional fuel vehicles. Resiliency technologies should be easy to use, easily serviceable, and user-friendly.
- Prioritize portable/flexible resiliency technologies, as it can be difficult to predict when and where an emergency will occur.
- If using non-portable resiliency technologies, such as larger generators or a microgrid, then the resiliency technologies must be located in a place that is centralized to fleet operations.

BEV Considerations for North Texas

Despite widespread adoption of BEV in North Texas, as shown in **State of Electrification**, BEV operation is different from conventional fuel vehicles in several ways. This includes performance (payload, towing capacity, range, etc.), costs, maintenance, time to refuel/charge, market availability, impacts in extreme temperatures, and emissions. **Exhibit 10** outlines the key differences between gasoline/diesel and BEV and **Exhibit 11** outlines the difference in BEV and conventional fuel mileage for each vehicle type.

Exhibit 10. Key Differences Between Gasoline and Diesel BEV

Fuel/Vehicle Type	Cost	Maintenance (\$/mile)	Fuel Economy	Time to Refuel/Charge	Market Availability	Impacts in Extreme Temperature
BEV – Light Duty	Slightly higher upfront costs, lower lifetime costs	\$0.09- \$0.10*	73.5 -118.2 Miles Per Gasoline Gallon Equivalent (MPGGE)*	Fast Charge (DCFC): ~20 minutes Slow Charge (Level 2): ~ 2 hours	Widely Available	25-28% decrease in fuel economy at 114.8-122 ° Fahrenheit ⁶⁶ Up to 39% decrease in fuel economy at 20° Fahrenheit ⁶⁷
Gasoline/Diesel – Light Duty	Lower upfront cost, higher lifetime costs	\$0.15-\$0.25*	25.1 - 30.7 MPGGE*	2 minutes ⁶⁸	Widely Available	Can sometimes operate better in warmer temperatures, but AC use will decrease fuel economy ⁶⁹ ~15% decrease in fuel economy at 20 ° Fahrenheit ⁷⁰
Diesel- Heavy-Duty		**\$0.20 - \$3.07**	1.7 – 6.5 Miles Per Diesel Gallon Equivalent (MPDGE)**	8-11 minutes ⁷¹		
BEV- Heavy Duty	Higher upfront costs typically lower lifetime costs	\$0.13- \$2.05**	6.2 – 26.1 MPDGE**	Fast Charge (DCFC): ~2 hours Slow Charge (Level 2): ~9+ ⁷²	Limited	Minimal information available; Expected be similar as BEV-LD

***Source: Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool: <https://afleet.esia.anl.gov/home/> Gasoline Passenger Car and Diesel Light-Duty Truck; All-electric car and all-electric light-duty truck**

****Source: Alternative Fuel Life-Cycle Environmental and Economic Transportation (AFLEET) Tool: Diesel Refuse Truck and Diesel Step Van; All-Electric Refuse and Step Van**

⁶⁶ <https://www.sciencedirect.com/science/article/abs/pii/S0306261924024358>

⁶⁷ <https://www.aaa.com/AAA/common/AAR/files/AAA-Electric-Vehicle-Range-Testing-Report.pdf>

⁶⁸ <https://www.api.org/oil-and-natural-gas/consumer-information/consumer-resources/staying-safe-pump>

⁶⁹ <https://www.fueleconomy.gov/feg/hotweather.shtml>

⁷⁰ <https://www.fueleconomy.gov/feg/coldweather.shtml>

⁷¹ <https://www.prettypmotors.com/how-long-does-it-take-to-fill-up-a-semi-truck/>

⁷² <https://www.volvotrucks.com/en-en/trucks/electric/FAQ/faq-batteries---charging.html#accordion-d53410fc73-item-fd75c53814>

While there are many differences between BEV and conventional fuel vehicles, the following are the most important to entities using BEV in critical operations in North Texas:

Temperature Impact

A BEV typically has the highest fuel efficiency when operating at a temperature of approximately 70° Fahrenheit⁷³. However, in Dallas-Fort Worth, only 3 months (April, May, and October) out of the year have a normal mean temperature within 5° of a BEVs' preferred operating temperature⁷⁴. Additionally, as shown in **Exhibit 1**, 111 of the 263 grid outages in Texas over the past 5 years were caused by severe weather events, which often have high or low temperatures associated with them. Between 2000 and 2023, Texas reported 107 power outages because of summer heat, 60% more often than they did between 2000 and 2009.⁷⁵ Therefore, it is likely a BEV providing critical operations in North Texas will not realize the range provided by vehicle manufacturers unless the vehicles are used in operations where they can recoup a significant amount of energy through regenerative braking. Therefore, it might be best practice to test BEV, or request information from other entities operating the same BEV, to understand how various temperatures and operations impact the range prior to determining which resiliency technologies are needed.

Cost of BEV

BEV typically have a higher upfront cost than conventional fuel vehicles. However, the difference in upfront cost can vary significantly depending on the vehicle type and battery size. In 2024, the average price paid for a new light-duty BEV was \$56,328, compared to the average price paid for a gasoline vehicle of \$47,790.⁷⁶ This is a difference of ~\$8,800, or approximately 16 percent higher cost for the BEV. However, the cost difference can be much higher depending on the vehicle type, with a heavy-duty all-electric semi-truck costing 2-3 times more than a diesel semi-truck.⁷⁷ Typically, this increase in cost is offset by lower maintenance costs, as shown in **Exhibit 10**, and lower fuel costs. However, these fuel and maintenance savings are optimized with vehicles that run higher miles or hours. Typically, Texas has a lower overall electricity cost, with commercial electricity customers paying an average of 9.0 cents per kWh compared to 13.09 cents per kWh for commercial electricity customers as of April 2025.⁷⁸ However, this electricity price can vary with demand, and if fleets are refueling at public EV charging or gasoline/diesel stations, they may not pay the same rate they would when filling at their own facility. The use of resiliency technologies can have co-benefits even when the grid is operational, enabling vehicles to shift their charging load to off-peak hours when power may be available at lower costs and/or avoiding

⁷³ <https://www.geotab.com/blog/ev-range/>

⁷⁴ https://www.weather.gov/fwd/dfw_records_normals

⁷⁵ [Weather-related Power Outages Rising | Climate Central](#)

⁷⁶ <https://www.nerdwallet.com/article/cars/car-shopping/electric-cars-vs-gas-cars?msocid=1cee35a9234762811d9e23b1221763a7>

⁷⁷ <https://theicct.org/cost-electric-semi-feb22/>

⁷⁸ [Electric Power Monthly - U.S. Energy Information Administration \(EIA\)](#)

demand charges. While this load-shifting opportunity is outside the scope of this Plan, it is a notable consideration for estimating return on investment.

Fuel Efficiency of BEV

As shown in **Exhibit 11**, conventional fuel vehicles typically have a higher “typical” range than BEV. This range limitation is one of the main considerations when using a BEV for a critical operation. Despite the lower range, BEVs have the benefit of using regenerative braking to recapture and reuse energy and waste less energy while idling. For example, a light-duty BEV can regain 34 percent of energy expended in stop and go operations.⁷⁹ This makes BEV more ideal for critical operations which will involve significant stop-and-go, such as refuse or debris collection. However, when traveling along highways, BEV do not have the benefit of regenerative braking. Therefore, BEV may be less ideal for critical operations which require a substantial proportion of operations on highways or at freeway speeds, versus operations where the vehicle may be used more locally or may be idling for a substantial period. Prior to purchasing a BEV for use in critical operations, fleets should consider the typical speeds (city or highway) the vehicles operate, the distance the vehicle may travel (for example, if needing to restore water/electric utilities or if could be loaned to a different jurisdiction), and any auxiliary power needs (such as fire trucks which need power to operate water hoses or police vehicles needing power for equipment/lights).

It is important to note that while current BEV models have lower range than conventional fuel vehicles, BEV are more fuel efficient than conventional fuel vehicles, as shown in **Exhibit 10**. This is primarily due to BEV only losing 15-20 percent of energy compared to 64-75 percent for a gasoline vehicle.⁸⁰ Because of the fuel efficiency of BEV, the limiting factor for BEV range is primarily the batteries, which are less energy dense than conventional fuels and add to the overall weight, therefore requiring more electricity to move the vehicle. For example, Tesla batteries may weigh over 1,000 pounds, depending on the model,⁸¹ and batteries for MD and HD-BEV would weigh even more. However, as improvements in existing batteries/new battery technologies are developed, such as solid-state batteries, it is likely BEV range will increase. For example, Toyota’s Solid-State Battery, which could be in production as early as 2027, claims to offer a 745-mile range on a single charge.⁸²

⁷⁹ <https://www.fueleconomy.gov/feg/atv-ev.shtml>

⁸⁰ <https://www.fueleconomy.gov/feg/atv-ev.shtml>

⁸¹ <https://axlewise.com/electric-car-battery-weight/>

⁸² <https://www.forbes.com/sites/peterlyon/2025/05/07/the-ev-holy-grail-a-battery-that-can-travel-745-miles-on-one-charge/>

Exhibit 11. Difference in Range from Electric Vehicles and Conventional Fuel Vehicles

Vehicle Vocation	Vehicle Class	EV Battery Capacity	EV Range (miles)	Conventional Fuel Vehicle Range (miles)	EV Charging Connector
HD Pickup	N/A	N/A	N/A	N/A	N/A
Box Straight Truck (Refuse)	6-8	60-282 kWh Average: 171 kWh	100-250 Average: 175	125-450	J3400
Box/Straight Truck	6-7	100-565 kWh Average: 254 kWh	100-218 Average: 210	Unknown	J1772 and CCS1
Medium- Heavy Duty Multi Truck (Cabover)	3-6	67-165 kWh Average: 115 kWh	150-320 miles Average: 187 miles	Unknown	J1772, CCS1, and J3400
Box/Straight Truck	4-5	60-210 kWh Average: 138 kWh	41-235 Average: 132	220	J1772 and CCS1
LD Pickup	1-4	92.5-215 kWh Average: 127 kWh	258-422 miles Average: 347 miles	384-708 miles	J1772 and CCS1
Step Van	5-6	127-343 kWh Average: 147 kWh	100-250 Average: 139	188-260	J1772 and CCS
Tractor/Semi Truck	7-8	105-1,000 kWh Average: 456 kWh	100-500 Average: 243	480-1,800	CCS1 and CCS2
Sedan	1-4	32-53 kWh Average: 42.5 kWh	114-361 Average: 204	324-555	J1772, J3400, and CCS2
Shuttle Bus	3-6	113-194 kWh Average: 139 kWh	150-200 miles Average: 158 miles	285	J1772 and CCS1
School Bus	6-8	118-388 kWh Average: 187 kWh	90-300 Average: 151 miles	270-1000	J1772 and CCS1
Transit Bus	6-8	120-738 kWh Average: 489 kWh	150-400 Average: 260 miles	180-750	J1772 and CCS1

Data is based on research conducted by NCTCOG staff, as detailed in **Appendix C and D, however, due to data limitations, this is not a comprehensive analysis of the range of all gasoline, diesel, or all-electric vehicle.*

Resiliency Technology Considerations for North Texas

Many of the considerations when selecting a resiliency technology to provide off-grid EV charging are similar to the considerations which need to be made when evaluating a resiliency technology for any asset/operation. **Exhibit 12** outlines somewhat standard

considerations for selecting resiliency technology for supporting critical assets and where there may be special considerations for use of BEVs.

Exhibit 12. Traditional Resiliency Planning Compared to BEV Resiliency Planning

Consideration	Traditional Resiliency Planning	Resiliency Technology for Supporting BEV
Sizing Resiliency Technologies	Determine critical load and/or length of time an asset must run without being connected to the grid Determine peak demand/starting watts and continuous/rated power needed	Similar; use fuel efficiency and battery capacity of BEV to determine energy needed for resiliency technologies
Acceptable Amount of “Down Time”	Determine how long the resiliency technology must take to “restart” normal operations at a critical asset (Example: how long can a building be without power until the backup generator turns on)	Similar; consider the resiliency technologies’ power output, or the charging rate, which will determine how quickly the BEV can return to operations
Location of Asset (if immobile)	Where is the most “centralized location” for where emergency operations typically occur	Similar; BEV range limitations are more limiting than available range on conventional vehicles
Availability of Public or Mutual Aid Assets	Consider the availability of critical assets such as generators, vehicles, equipment, or even buildings which could be used in the event the facility typically used does not have power	Similar; consider availability of publicly-available or shared-access EV chargers with resiliency features
Ownership of Asset	Third-party servicing needs	Same
Maintenance Needs	Amount of regular maintenance needed to ensure operations	Same
Avoided Costs	Costs associated with operational interruptions (opportunity costs and often-inflated expenses associated with purchases made during emergency response/recovery) May realize additional utility bill savings associated with use of resiliency technologies by avoiding demand charges or peak shaving, even during normal operations	Same
Financial Resources	Potential rebates or incentives for resiliency technologies	Same
Duty Cycle and Ambient Conditions	Conventional fuel vehicles will have lower fuel economy in conditions that require significant HVAC use or in operations which will require idling or power for power take-off applications.	Similar; BEV will also be impacted by conditions which require significant HVAC use, but will not have the fuel economy decrease during conditions which require significant idling. Range may be impacted by power take-off applications.
Long-Term Sustainability or Environmental Goals/Plans	Conventional fuel generators can produce harmful emissions, which may not be consistent with an entity's sustainability or environmental goals/plans.	Same

In addition to the standard considerations illustrated above, specific resiliency technologies prompt additional considerations if planned to support BEV. These are outlined below. Note that many of these could also apply to the use of microgrids, as microgrids could be a combination of any of the following resiliency technologies.

Generators:

When identifying generators for use in supporting EV charging, considerations unique to BEV primarily focus on identifying features which will ensure a generator is able to support a BEV. For example, generators should be equipped with Automatic Voltage Regulation, where the output is consistently maintained at a predetermined level,⁸³ or an Inverter Generator, which typically has “cleaner” power (i.e. low total harmonic distortion, or THD), which will minimize the potential impact to sensitive electronics.⁸⁴

Using generators with flexible features, such as a generator with Parallel Connectivity, which is when multiple generators simultaneously connect to each other and an external system to share the power demand, can help entities in deploying BEV for critical operations⁸⁵. Using a generator with Parallel Connectivity would provide entities flexibility in sizing the generators to support BEV being used for critical operation. For example, generators with Parallel Connectivity could be used to “stack” generators as additional EV adoption occurred, combined when providing power to a vehicle with a large battery capacity, or separated when they need to travel with multiple BEV being sent to different areas.

Maintenance of a generator leading up to, and delivery of fuel during, a grid outage is also important to consider when deploying BEV. For example, stakeholders in the NTX-REV Project Team have reported difficulty with maintenance of conventional fuel generators leading up to grid outages, as well as challenges in getting fuel delivered to refuel the generator during a grid outage event.

Mobile Charging:

Mobile charging is when a mobile generator/BESS is combined with EV chargers and transported/mounted on a vehicle, typically a truck. Mobile charging can occur in a wide variety of use cases, such as when an entity owns its own mobile chargers, or when a third-party delivers a mobile charger to a vehicle. Owning a mobile charger may cost more up

⁸³ <https://swiftequipment.com/what-is-an-automatic-voltage-regulator-avr-and-why-does-my-generator-need-one/>

<https://generatordecision.com/pros-and-cons-of-inverter-generators/>

⁸⁵ <https://yourpowerguide.com/parallel-generators/>

front but may provide more flexibility for the entity in the long run. A third party owning a mobile charging that can be brought to the fleet can have a lower upfront cost, but there could be barriers to getting the mobile charging delivered during severe weather events.

Since Mobile Charging uses generators or ESS, the same considerations for those technologies still apply here. The NTX-REV Project Team stated portable technologies are particularly important in critical operations, as it can be difficult to predict when and where a grid outage will take place. Since the region regularly participates in mutual aid or asset sharing, as detailed in **State of Emergency Preparedness for Off-Grid Critical Transportation Operations**, mobile charging has the added benefit of being able to move between jurisdictions.

Energy Storage Systems:

Specific risks can occur when using ESS-Batteries in combination with an EV charger. For example, if the battery and EV charger require software to communicate/operate with each other and the battery, software, and/or EV charging company go out of business, it can be difficult to continue the operations of battery-integrated EV charging. Federally funded stations must meet the National Electric Vehicle Infrastructure Standards and Requirements for EV charging stations, including compliance with Open Charge Point Protocol (OCPP) 2.0.1.⁸⁶ As the industry moves to more widespread compliance with OCPP regardless of federal funding, it should reduce allow for integrated ESS to more easily switch between networks and reduce risk in the event the original network company is no longer operational.

Battery Swapping and Vehicle to Vehicle Charging

Battery swapping and vehicle to vehicle charging have had minimal to no adoption in Texas. Battery Swapping could improve the continuity of critical transportation assets by allowing “slower” resiliency technologies (such as a small Solar PV deployment), to recharge a battery while a BEV continues to operate. After the operating BEV has used most of its battery’s energy, the operating vehicle could swap its empty battery with the fully charged battery, minimizing the downtime associated with traditional EV charging. Vehicle to Vehicle is likely only useful in certain situations, such as when a BEV is stranded, but it has similar potential benefits as Battery Swapping.

Qualitative Feasibility Assessment

Prior to selecting resiliency technologies to use in the Feasibility Analysis, NCTCOG conducted a qualitative feasibility assessment to determine further evaluation of

⁸⁶ <https://www.ecfr.gov/current/title-23/chapter-I/subchapter-G/part-680>

technologies based on regional interest, characteristics, and availability. As demonstrated in **Exhibit 13**, many of these technologies are best deployed in combination with each other, such as combining ESS with On-Site Renewable Generation.

Exhibit 13. Qualitative Feasibility Assessment for All Resiliency Technologies

Technology Category	Technology	Regional Considerations	Feasibility Assessment	Estimated Costs ⁸⁷
Energy Storage Systems	Batteries	Already being piloted locally	Likely to be Feasible	Upfront costs \$392-493/kWh; Fuel costs \$0-.13/kWh; Non-fuel annual operating costs \$4-5/kWh
Energy Storage Systems	Hydrogen Fuel Cells	Commercially available, substantial hydrogen fuel cell momentum in Texas	Likely to be Feasible	Unknown
On-Site Renewable Generation	Solar	Already being piloted locally	Likely to be Feasible if paired with ESS	Upfront costs \$1630-1840/kW; Fuel costs \$0/kWh; Non-fuel annual operating costs \$5-6/kW
On-Site Renewable Generation	Wind	Limited wind development within the NCTCOG area due to wide urbanization and presence of numerous airports	Not Likely to be Feasible	N/A
Generators	Gasoline	Already widely adopted. However, present air quality concerns due to ozone nonattainment	Likely to be Feasible	Unknown
Generators	Propane	Already adopted, though less widely	Likely to be Feasible	Unknown
Generators	Natural Gas	Already widely adopted	Likely to be Feasible	Upfront costs \$1000/kW; Fuel costs \$0.10/kWh; Non-fuel annual operating costs \$35/kW
Generators	Diesel	Already widely adopted. However, present air quality concerns due to ozone nonattainment	Likely to be Feasible	Upfront costs \$800/kW; Fuel Costs \$0.27/kWh; Non-fuel Annual Operating Costs \$35kW

⁸⁷ <https://www.edf.org/sites/default/files/2024-04/Power-Resiliency-Electric-Fleets.pdf> pg. 15

Technology Category	Technology	Regional Considerations	Feasibility Assessment	Estimated Costs ⁸⁷
Mobile Charging	Mobile Chargers with ESS	Commercially available locally	Likely to be Feasible	Unknown
Mobile Charging	Mobile Charger with Generator	Commercially available locally	Likely to be Feasible	Unknown
Mobile Charging	Vehicle to Vehicle (V2V)	Not desirable as the available power capacity is reduced if the “donor” vehicle has to travel to the location of the “recipient” vehicle	Not Likely to be Feasible	N/A
Mobile Charging	Battery Swapping	Not commercially available in the United States	Not Likely to be Feasible	N/A
Self-Contained Power Systems	Microgrids	Already being piloted locally	Likely to be Feasible	Unknown
Self-Contained Power Systems	Remote Grids	Likely not desirable as most areas of the NCTCOG are not remote enough or have a significant wildfire risk	Not Likely to be Feasible	N/A

Resiliency Technology Assumptions

The resiliency technologies selected were determined to be feasible for the region (i.e. commercially available, necessary/useful, and able to operate in the region), have been in the region/are similar to an existing resilient technology deployed in North Texas, and are capable of supporting a BEV. As discussed in **Resiliency Technology Considerations for North Texas**, not all resiliency technologies can be used with an EV charger. For example, a single solar panel may not have adequate power to support a “Fast Charge” without battery storage, or non-inventor generators, which may not provide electricity that is stable enough to charge a BEV.

When completing the analysis in **Section Feasibility Analysis**, if a “range” of energy storage was available, staff took the highest energy storage available. Additionally, the **Feasibility Analysis** only considers energy storage available and does not factor in the energy that could be generated by resilient technologies (e.g. electricity produced from solar generation). This is because there is no guarantee that the grid outage will occur in a situation where additional energy could be generated. Additionally, the calculations for the

Feasibility Analysis assume all energy storage capacity is being provided to BEV, and no support is being provided to other assets, like buildings.

Note that some of the technologies are multiple resiliency technologies combined, such as the *On-Site Renewable Generation and ESS – Battery* technology. Also note that all technologies evaluated in the Feasibility Analysis come with an EV charger. **Exhibit 14** outlines the full list of technologies for which a full feasibility analysis was completed.

Exhibit 14. Resiliency Technology Assumptions

Technology	Energy Storage Capacity (i.e. battery storage/fuel tank)	Charging Speed	Generating Capacity	Considerations
Mobile Charging - Batteries*	300- 500kWh: assumed 500 kWh	80-125 kW	N/A	Cannot “Generate” New Power Unless Connected To Grid Or Swapped Out
On-Site Renewable Generation and ESS – Battery**	20-40kWh: assumed 40kWh	5.76 kW	4.3 kW per solar panel (not factored into refill)	Slow Charging And Energy Generation
Generator (Natural Gas)***	180kW - 600kW: assumed 600kw	90-350 kW	N/A	Emissions; Less Mobile Due to Size
Microgrid	2MW/6.88 MWh battery storage	180 kW	4.84MW of rooftop and canopy solar generation (not factored into refill)	Not mobile, could be more difficult to use and maintain

*<https://www.sparkcharge.io/mobile-battery-ev-charger>

** <https://beamforall.com/wp-content/uploads/2021/06/BEAM-EV-ARC-2020-Info-Sheet-v1.1.pdf>

***<https://www.pioneer-emobility.com/products/e-boost-pod>

****<https://alphastruxure.com/case-studies/montgomery-county-brookville-bus-depot/>

BEV Assumptions

As detailed in **Exhibit 7**, it is difficult to predict when and where an emergency could occur, resulting in a wide variety of vehicles potentially being used in an emergency operation. To compare the support each resiliency technology could provide each vehicle, NCTCOG took the average battery capacity of each vehicle type and identified the potential benefit of using each individual resiliency technology in **Exhibit 14**. Note that the BEV range used in calculations represents what the manufacturer's provided and does not consider the potential range that could be lost due to extreme temperatures, as detailed in **Exhibit 10**, the potential amount of energy that could be recovered through regenerative braking, or a

scenario in which the BEV was not fully charged when the grid outage occurred. Additionally, these calculations only consider power needed for a single BEV.

Feasibility Analysis

The goal of the Feasibility Analysis is to identify which resiliency technologies would be best suited for supporting BEVs serving critical operations in North Texas. **Exhibit 15** shows the potential number of “refuels” a resiliency technology could provide to a BEV of various types, and what that is equal to in miles of range added to the BEV’s operation. Note that in this example, the total amount of miles a BEV could operate during an off-grid situation would be equal to the total of the “EV Range (miles)” column + the “Miles Added” for the appropriate resiliency technology.

Exhibit 15. Feasibility Analysis – Comparison of Resiliency Technologies for Supporting BEV Critical Operations

BEV Vehicle Information			Mobile Battery* Storage Capacity: 500kWh		Generator: Natural Gas* Storage Capacity: 600kW	Microgrids Storage Capacity: 6.88 MW	Solar Integrated EV Charging** Storage Capacity: 40 kWh				
BEV Vehicle Type	Battery Capacity (in kWh)	EV Range (miles)	Miles added	Numbers of “refuels”	Miles added		Numbers of “refills”	Miles added	Numbers of “refills”	Miles added	Numbers of “refills”
Box Straight Truck (Refuse)	171.00	175.00	511.70	2.92	614.04		3.51	7040.94	40.23	40.94	0.23
Box/Straight Truck	254.00	210.00	413.39	1.97	496.06		2.36	5688.19	27.09	33.07	0.16
Medium Heavy-Duty Multi Truck (Cabover)	115.00	187.00	813.04	4.35	975.65		5.22	11187.48	59.83	65.04	0.35
Box/Straight Truck (Class 4-5)	138.00	132.00	478.26	3.62	573.91		4.35	6580.87	49.86	38.26	0.29
Light-Duty Pickup	127.00	347.00	1366.14	3.94	1639.37		4.72	18798.11	54.17	109.29	0.31
Step Van	147.00	139.00	472.79	3.40	567.35		4.08	6505.58	46.80	37.82	0.27
Tractor/Semi	456.00	243.00	266.45	1.10	319.74		1.32	3666.32	15.09	21.32	0.09
Sedan	42.50	204.00	2400.00	11.76	2880.00		14.12	33024.00	161.88	192.00	0.94
Shuttle Bus	139.00	158.00	568.35	3.60	682.01		4.32	7820.43	49.50	45.47	0.29
School Bus	187.00	151.00	403.74	2.67	484.49		3.21	5555.51	36.79	32.30	0.21
Transit Bus	489.00	260.00	265.85	1.02	319.02		1.23	3658.08	14.07	21.27	0.08

Key Takeaway from Feasibility Analysis:

BEV with a Highly Likelihood of Being Used in Critical Operations (HD Pickups, Class 4-8 Box Straight Trucks, and Medium-Heavy-Duty Multipurpose Trucks)

One of the most widely used vehicle types during critical operations is heavy-duty pickup trucks, such as a Ford F-250 or Ford F-350. A BEV heavy-duty pickup is not currently commercially available. Some new BEV, such as the new Hummer EV and Tesla Cybertruck, have a Gross Vehicle Weight Rating (GVWR) of over 8,501, which would technically make them a “heavy-duty truck” under EPA’s classification.^{88 89 90} However, it is generally agreed that these vehicles do not have similar towing capacity or payload as heavy-duty pickup trucks and, in most instances, cannot serve the same operations. For example, the Cybertruck has a payload of 2,000 – 2,500 pounds, but the Ford F-250/F-350 can have payloads of up to 4,246 pounds and 8,000 pounds, respectively.^{91 92 93}

Other frequently used vehicles include Box/Straight Trucks (Class 4-8), Step Vans, Medium-Duty Multipurpose Trucks, and Semis. The feasibility of utilizing these BEVs during grid outages will depend on the critical operation it is performing. In general, these BEV are more likely to be successfully used in stop-and-go operations rather than operations which require highway speeds. For example, a BEV collecting refuse or debris would be better suited to use during a grid outage than a semi-truck hauling critical freight goods for a significant number of miles along a highway. Regardless of use case, these vehicles would likely need resiliency technology with a high storage and output capacity.

Conclusion:

- BEV heavy-duty pickups are not commercially available and thus not feasible for use at all.
- BEV semi-trucks are possibly feasible depending on critical operations.
- BEVs for municipal or utility use (such as debris and refuse), are the most likely to be successfully operated during an outage but should be evaluated carefully

⁸⁸ <https://afdc.energy.gov/data/10380>

⁸⁹ <https://tfltruck.com/2022/02/here-is-how-the-gmc-hummer-ev-compares-to-the-rivian-on-efficiency/>

⁹⁰ https://www.tesla.com/ownersmanual/cybertruck/en_us/GUID-12A976DD-EB60-431B-AFF1-5A37E95006DB.html

⁹¹ https://www.tesla.com/ownersmanual/cybertruck/en_us/GUID-12A976DD-EB60-431B-AFF1-5A37E95006DB.html

⁹² <https://www.riverbend-ford.com/research-ford-f-250-towing-guide.html>

⁹³ https://www.vdm.ford.com/content/dam/brand_ford/en_us/brand/towing/pdf/2026-Ford-Super-Duty-Pickup-Towing-Guide-V2.pdf

prior to electrifying and may require more expensive/larger-scale resiliency technologies.

Light-Duty Vehicles (Sedan and Light-Duty Pickup)

Sedans and light-duty pickups have the highest range, smallest battery, and high fuel efficiency, making them one of the easier vehicles to plan for using during off-grid critical operations. Almost all resiliency technologies, including those with low generating or storage capacity such as small portable generators or single solar panels, are likely adequate for small fleets or pilot projects. Wet hosing, or using a mobile charger is also adequate, especially for fleets with multiple BEV or BEV which drive significant miles/are used to support other jurisdictions. However, as sedans and light-duty pickups have limited space, payload, and towing capacity, they aren't frequently used for critical operations.

Conclusion:

- BEV light-duty vehicles have a high feasibility of use for critical operations during off-grid operations.

Shuttles and Transit/ School Buses:

During discussions with stakeholders, Shuttles were expressed as the more likely to be used during critical operations when compared to full-size transit or school buses due to their smaller size and flexibility in use. BEV shuttles are smaller, resulting in less battery capacity needed, higher range, and higher fuel efficiency, making them easier to plan for operating in an off-grid scenario. Full size buses would only be used during large scale evacuation operations, with many counties having identified school districts and their associated assets in hazard mitigation plans. Prior to adopting BEV full-size buses, entities should evaluate the potential evacuation routes they may need to service and compare that to the range of the BEV, publicly available EV charging capable of providing off-grid operations in those areas, and various resiliency technologies to identify if electrification of full-size buses could occur while still providing evacuation assistance.

Conclusion:

- BEV Shuttle buses have a high feasibility of use for critical operations during off-grid operations.
- School and Transit Buses feasibility will depend on potential use case for critical operations.

VIII. Gap Analysis

Exhibit 16 details the resiliency technologies available in North Texas which could potentially be used in the real-world demonstration to test off-grid EV charging. This information was gathered primarily through the regional engagement detailed in **Appendix B**, but overall, NCTCOG has limited data on local charger resilience. As mentioned in the SWOT Analysis, the Alternative Fuels Data Center Station Locator, which is the primary tool used by NCTCOG to identify EV chargers, lacks data on resilience features.

Exhibit 16. Resiliency Technologies for Use in North Texas

Technology	Currently deployed in North Texas?	EV Charging Available	Barriers/ Considerations	Functional Ability	Equivalent Conventional Fuel Strategy
Energy Storage Systems: Batteries	City of Allen	Yes	Limited power reserve; Limited to the location of installation	Support EV charging infrastructure and equipment; offer reserves during grid disruption	Conventional Fuel Generator or Fuel Reserves
On-Site Renewable Generation: Solar	STAR Transit; Dallas County	Yes	No storage included; limiting power which can be provided to fleets during off-grid operation	Solar output; support EV charging infrastructure and equipment	N/A
Combination of On-Site Renewable Generation: Solar and ESS: Batteries	Dallas County, City of Grand Prairie, UNT Zero Lab	Yes	Limited to the location of installation	Solar output; support EV charging infrastructure and equipment; offer reserves during grid disruption	N/A
Generators: Gasoline, Natural Gas, Diesel	Widely available but not integrated with EV chargers	Unknown	Connected to existing building; no storage included; Limited to the location of installation	Energy reserves during grid disruption; support operation of critical infrastructure and equipment	Same

Technology	Currently deployed in North Texas?	EV Charging Available	Barriers/ Considerations	Functional Ability	Equivalent Conventional Fuel Strategy
				during disruption	
Mobile Charging Unit	Commercial options for leasing third party agreements/purchasing available in the region; Actual deployments unknown		Limited power reserve;	Offer energy to critical EVs and EVSE during operation and when offsite from critical infrastructure	Wet-hosing/direct-to-truck fueling/mobile fueling units
Microgrids	Potentially: Pilot Project from DFWIA; Former project at Oncor Electric Delivery	Yes (Oncor, previously operational)	Limited to the location of installation	Energy generation and reserve; support operation of critical infrastructure and equipment during disruption	N/A

The gap in availability of resilient technologies to support EV charging continuity challenges the region's ability to electrify critical fleets without compromising emergency preparedness. While stakeholders have made significant investment in contingencies for conventionally fueled vehicles, similar investment and exploration into resilient EV charging has not occurred. Several regional stakeholders shared plans and pilot projects to acquire or expand battery storage systems, generators, and incorporate on-site renewable generation into charging infrastructure, but few have ventured into the exploration of microgrids or mobile charging. Stakeholders' hesitation to invest in resilient EV charging technologies reportedly stems from high costs, operational complexity, limited technical familiarity, and doubts about the ability of the technologies to meet the unpredictable and mobile demands of emergency operations.

The gap analysis, in tandem with the feasibility analysis, highlights three main gaps in resilient technologies currently available for use in North Texas. On-site renewable generation, most commonly solar, has been piloted regionally but provides very limited kW output, which may not be sufficient to support the charging needs of medium- and heavy-duty vehicles which are heavily relied upon for emergency operations.

Hydrogen fuel cell systems could be a potential off-grid solution but are not currently present in the region and would require local testing to determine feasibility. Mobile charging units have not been deployed within any regional fleets and would likely need to be leased by commercial providers to assess their suitability. Though microgrids and generators have been explored by stakeholders in the region, significant technical limitations persist. Many generators and microgrids are not specifically designed to power EV chargers and may be technically incompatible, posing a high risk of inoperability during critical events. These limitations, combined with mobility constraints and the lack of precedent for integration with EV infrastructure, further widen the region's preparedness gap for EV fleet resiliency.

IX. Next Steps

Other Planning Considerations for Resilient EV Chargers

Resilience considerations related to EV chargers extend beyond the ability to provide power during a grid outage. Other risks can include flooding, which poses electrical hazards or can damage EVSE. Strategies to mitigate these challenges include installing the infrastructure with proper elevation off the ground to reduce the possibility of water damage, ensuring that chargers are not installed within flood zones, and placing any temporary/mobile EVSE safely outside of flood zones to support evacuation and recovery operations.

Even if an EV charger has power, in an emergency situation that requires evacuation or high-intensity BEV use, long queues for charging may build up as charging times are slower than liquid fueling times, even when using fast chargers. This reinforces the need for supplemental fast-charging infrastructure that can be deployed in various locations on a temporary basis, most likely mobile charging units. Extremely hot or cold weather can slow charging speeds to maintain lower operation temperatures, which optimizes safety but then takes more time to charge the BEV. In hot weather, shade structures over the chargers can alleviate some heat load. In extreme cold, some sort of shelter, such as a barn-like structure that can be driven into, could provide some insulation against the harshest temperatures.

Codes and standards published by the International Electrotechnical Commission (IEC) provide general durability requirements for EVSE. The IEC 61851-1 outlines requirements for minimum impact protection (IK) and ingress protection (IP) for indoor and outdoor use. IK ratings dictate the joules of impact that equipment can withstand, and IP ratings define how protected equipment is from solid foreign objects and water, with both ratings

pertaining to electrical equipment in general. Another aspect of this standard is that the EV charging station must operate under certain environmental conditions, including extreme heat and cold. The National Fire Protection Association (NFPA)'s National Electric Code (NEC) 625.102 requires outdoor charging infrastructure to be installed 24 inches above ground level to mitigate flood damage.⁹⁴ Implementing these standards will help increase the reliability of EV charging stations and mitigate any risks posed by adverse weather impacts.

Additionally, regular maintenance on installed electric vehicle charging stations can help identify and prevent issues before they occur, ensuring availability in the event of an emergency. Implementing regular preventative maintenance as well as ensuring a supply of common replacement parts can help reduce charging station downtime. In the event of an outage, redundant power sources, such as emergency backup generators, can also help ensure vehicles are still able to recharge and travel.

Other Standard Operating Procedures for Continuing Operations of Electrified Critical Transportation Assets

In addition to the technologies listed above, which are needed to complete a demonstration of off-grid EV charging, there are standard operating procedures (SOPs) which can be adopted for use in EV fleets with minimal to no upfront costs. **Exhibit 17** outlines common SOPs used for conventional fuel vehicles and what the BEV equivalent would be:

⁹⁴ <https://docs.nrel.gov/docs/fy24osti/89896.pdf> Page 30-31

Exhibit 17. Comparison of SOPs for Conventional Fuel Vehicles and BEVs⁹⁵

SOP for Conventional Fuel Vehicle	BEV Equivalent
Refilling before incident	Same
Wet hosing	Same; utilize V2V, battery swaps, or mobile charging units
Mobile Fueling	Same; deployment of mobile charging units to vehicles and command centers
Maintaining Fuel Reserves	Same; monitor battery state-of-charge and regularly top off fuel at public or private stations; maintain auxiliary battery storage
Integrate weather and outage data with real-time fleet telematics to proactively reroute vehicles	Same as conventional fuel
Regular maintenance	Same as conventional fuel vehicle; BEV may have lower maintenance costs
Testing of off-grid operations (similar to TTX)	Same as conventional fuel vehicle
Use fleet fuel cards for refueling when power is not available at typical refueling facility or when vehicles are deployed away from “home base”	Same as conventional fuel; EV charging networks can offer fleet “discounts” to lower costs of charging at public EV chargers

⁹⁵ [How Electric Fleets Can Prepare for Natural Disasters: Charging, V2G, V2H and Crisis Readiness](#)

Future Efforts

Moving forward, the Project Team will utilize the inventory of critical transportation assets and operations to inform strategic planning and guide deployment of resilient technologies where they are needed most. Following completion of the Draft Plan, NCTCOG will use the Gap Analysis to inform execution of the demonstration projects discussed in *Regional Collaboration*. Entities which own assets of interest will be asked to participate in the TTX and the real-world demonstrations; NCTCOG will conduct a procurement to lease resilience technologies that are feasible but not readily available from a participating stakeholder/project team member. Insights from the tabletop exercise (TTX), the technology demonstrations, critical vehicle and resilient technology inventories, and stakeholder input will be synthesized and incorporated into the final version of the NTX-REV Plan. The final plan will include new sections on actionable recommendations for preparedness and recovery, grounded in tested strategies and refined by stakeholder feedback. This iterative process will help ensure that regional plans evolve alongside advancements in EV and resiliency technologies, closing the gap between electrification goals and emergency readiness.

X. Appendices

Appendix A: NTX-REV Project Team

Appendix B: NTX-REV Outreach Inventory

Appendix C: Conventional Fuel Vehicle Range

Appendix D: BEV Range and Battery Capacity

Appendix A: North Texas Resilient Electric Vehicle Infrastructure (NTX-REV) Project Team

Organization	Type of Entity
Asset Market	Electric Vehicle (EV) Charging Provider
Beam Global	EV Charging Provider
BNSF Railway	Transportation
City of Arlington	Local Government
City of Dallas	Local Government
City of Dallas	Local Government
City of Fort Worth	Local Government
City of Irving	Local Government
City of Irving	Local Government
City of Midlothian	Local Government
City of Rowlett	Local Government
Crawford Electric Supply	Utility
Dallas County	Local Government
Dallas Area Rapid Transit	Transportation
Dallas-Fort Worth International Airport	Transportation
Energy Utility Group	Utility
Eveeo Inc	EV Charging Provider
Graviti Energy	EV Charging Provider
Harnyss	Energy Storage
Hermann Services, Inc	Transportation
Megmeet USA, Inc.	Energy Storage
NCTCOG Emergency Preparedness	NCTCOG Staff
North Texas Innovation Alliance	Non Profit/Other
Oncor Electric Delivery	Utility
Parker County	Local Government
SK Signet	EV Charging Provider
Southern Methodist University, Department of Electrical and Computer Engineering	University
Southwest EV Installation Services LLC	EV Charging Provider
Tarrant County	Local Government
Texas Energy Poverty Research Institute	Non Profit/Other

Appendix A: North Texas Resilient Electric Vehicle Infrastructure (NTX-REV) Project Team

Organization	Type of Entity
Texas A&M Transportation Institute-Clean Energy Program	University
Texas Research Alliance	Non Profit/Other
U.S. DOT Gulf Region SBTRC	Government Entity
University of North Texas	University
University of Texas at Arlington	University
Vehicle-Grid Integration Council (VGIC)	Non Profit/Other
Volta/Shell	EV Charging Provider
XCharge North America	EV Charging Provider

Source: North Central Texas Council of Governments

North Texas Resilient Electric Vehicle Infrastructure (NTX_REV) Plan
Appendix B: NTX-REV Outreach Inventory

Event/Meeting	Date	Item Type (Presentation, Email Blast, Workshop, Flyer Distribution, Open House, Announcement, Media Coverage)	Project Team Meeting or Other Meeting/Outreach
Regional Freight Advisory Committee	11/12/2024	Presentation	Other Meeting/Outreach
Planning Resilient Electric Vehicle Charging Webinar	12/4/2024	Presentation	Other Meeting/Outreach
Project Partner Kick Off Meeting	1/22/2025	Presentation	Project Team Meeting
DFW Clean Cities Technical Advisory Committee	1/27/2025	Presentation	Other Meeting/Outreach
North Texas Regional Integration of Sustainability Efforts (RISE) Coalition	1/29/2025	Presentation	Other Meeting/Outreach
Project Partner Meeting	2/11/2025	Presentation	Project Team Meeting
DFW Clean Cities Stakeholder Input Session	2/26/2025	Presentation	Other Meeting/Outreach
NCTCOG Surface Transportation Technical Committee	2/28/2025	Presentation	Other Meeting/Outreach
Air North Texas Meeting	3/20/2025	Presentation	Other Meeting/Outreach
NTX-REV Stakeholder Meeting	3/25/2025	Presentation	Project Team Meeting
Stakeholder Kick-Off	3/26/2025	Presentation	Project Team Meeting
Denton County Transportation Authority Listening Session	5/16/2025	Presentation	Other Meeting/Outreach
STAR Transit Listening Session	5/19/2025	Presentation	Other Meeting/Outreach
Trinity Metro Listening Session	5/20/2025	Presentation	Other Meeting/Outreach
Stakeholder Meeting: Local Governments and Public Works	5/21/2025	Presentation	Project Team Meeting
Stakeholder Meeting: Technology and Subject Matter	5/21/2025	Presentation	Project Team Meeting
Key Partner Check-In	6/26/2025	Presentation	Project Team Meeting
Dallas-Fort Worth Clean Cities Email Blast	6/27/25; 6/18/25; 6/10/25; 6/5/25; 5/27/25; 5/21/25; 5/8/25; 4/22/25; 4/16/25; 4/9/25; 3/27/25; 3/18/25; 3/12/25; 3/5/25; 2/27/25; 2/19/25; 2/12/25; 2/5/25	E-Newsletter	Other Meeting/Outreach
Recap of First Stakeholder Meeting for NTX-REV	May	Social Media Post	Other Meeting/Outreach
Stakeholder Input Session	March	Social Media Post	Other Meeting/Outreach
NTX-REV Seeking Stakeholders	February	Social Media Post	Other Meeting/Outreach
Source: North Texas Council of Governments (NCTCOG)			

North Texas Resilient Electric Vehicle Infrastructure (NTX-REV) Plan									
Appendix C: Conventional Fuel Vehicle Range									
Year	Make	Model	Estimated Range (mi)	Class	Fuel Type	Features	Fuel Tank Size (gallons)	AFLEET gas/diesel MPG	Source
Sedan									
2025	Nissan	Versa	324	1 - 4	Gasoline	1.6 L, 4 cyl, Manual 5-spd, Regular Gasoline, 3.3 gal/100 mi	10.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48598
2024	Mitsubishi	Mirage G4	340	1 - 4	Gasoline	1.2 L, 3 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.7 gal/100 mi	9.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=46779
2024	Nissan	Kicks	356	1 - 4	Gasoline	1.6 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 3.0 gal/100 mi	10.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47240
2024	Mitsubishi	Mirage	359	1 - 4	Gasoline	1.2 L, 3 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.6 gal/100 mi	9.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=46778
2025	Kia	K4	360	1 - 4	Gasoline	2 L, 4 cyl, Automatic (AV-S1), Regular Gasoline, 3.0 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48179
2025	Nissan	Versa	378	1 - 4	Gasoline	1.6 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	10.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48597
2024	Nissan	Versa	378	1 - 4	Gasoline	1.6 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	10.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47236
2024	Toyota	Camry TRD	411	1 - 4	Gasoline	3.5 L, 6 cyl, Automatic (S8), Regular Gasoline, 43.8 gal/100 mi	15.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47085
2025	Mazda	3 5-Door 2WD	396	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (S6), Regular Gasoline, 3.3 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48027
2025	Volkswagen	GLI	396	1 - 4	Gasoline	2.0 L, 4 cyl, Manual 6-spd, Turbo, Regular Gasoline, 3.3 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47999
2025	Nissan	Sentra SR	409	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 3.0 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48501
2025	Mazda	3 4-Door 2WD	409	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (S6), Regular Gasoline, 3.2 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47989
2024	Toyota	Camry	411	1 - 4	Gasoline	3.5 L, 6 cyl, Automatic (S8), Regular Gasoline, 3.8 gal/100 mi	15.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47085
2024	Hyundai	Elantra	446	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S1), Regular Gasoline, 2.8 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47075
2025	Honda	Civic 4Dr	519	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.0 gal/100 mi	10.6	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48018
2025	Nissan	Sentra	422	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48500
2024	Honda	Civic 4Dr	434	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47071
2025	Toyota	Corolla Hatch	462	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S10), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47996
2025	Hyundai	Elantra	446	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S1), Regular Gasoline, 2.8 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48020
2024	Hyundai	Elantra	446	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S1), Regular Gasoline, 2.8 gal/100 mi	12.4	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47075
2024	Kia	Forte	448	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 3.1 gal/100 mi	14	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47080
2025	Toyota	Corolla	449	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48493
2024	Volkswagen	Jetta	449	1 - 4	Gasoline	1.5 L, 4 cyl, Automatic (S8), Turbo, Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47055
2025	Toyota	Corolla	462	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48493
2024	Toyota	Corolla	462	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S10), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47343
2025	Toyota	Corolla Hatch	462	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S10), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47996
2024	Toyota	Corolla Hatch	462	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S10), Regular Gasoline, 2.9 gal/100 mi	13.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47345
2025	Honda	Accord	474	1 - 4	Gasoline	1.5 L, 4 cyl, Automatic (AV-S1), Regular Gasoline, 3.0 gal/100 mi	14.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48504
2024	Kia	Forte	448	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 3.1 gal/100 mi	14	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47080
2024	Nissan	Altima	518	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (variable gear ratios), Regular Gasoline, 3.1 gal/100 mi	16.2	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47081
2024	Kia	K5	474	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (S8), Regular Gasoline, 3.3 gal/100 mi	15.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47719
2025	Chevrolet	Malibu	490	1 - 4	Gasoline	1.5 L, 4 cyl, Automatic (variable gear ratios), Turbo, Regular Gasoline, 3.2 gal/100 mi	15.8	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48015
2025	Subaru	Impreza	498	1 - 4	Gasoline	2.0 L, 4 cyl, Automatic (AV-S8), Regular Gasoline, 3.3 gal/100 mi	16.6	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48507
2025	Hyundai	Sonata FWD	509	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (S8), Regular Gasoline, 3.1 gal/100 mi	15.9	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48045
2025	Subaru	Legacy AWD	555	1 - 4	Gasoline	2.5 L, 4 cyl, Automatic (AV-S8), Regular Gasoline, 3.3 gal/100 mi	18.5	30.7	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47778
Light/Medium Duty Pickup Truck									
2025	GMC	Sierra	384	2	Gasoline	4WD, 5.3 L, 8 cyl, Automatic (S10), Regular Gasoline, 6.2 gal/100mi	24	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48240
2024	Nissan	Frontier	441	2	Gasoline	2WD, 3.8 L, 6 cyl, Automatic (S9), Regular Gasoline, 4.8 gal/100mi	21	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47249

North Texas Resilient Electric Vehicle Infrastructure (NTX-REV) Plan									
Appendix C: Conventional Fuel Vehicle Range									
Year	Make	Model	Estimated Range (mi)	Class	Fuel Type	Features	Fuel Tank Size (gallons)	AFLEET gas/diesel MPG	Source
2025	Chevrolet	Colorado	428	2	Gasoline	2 WD, 2.7 L, 4 cyl, Automatic 8-spd, Turbo, Regular Gasoline, 5.0 gal/100 mi	21.4	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48882
2025	GMC	Canyon	428	2	Gasoline	2WD, 2.7L, 4 cyl, Automatic(s8), Turbo, Regular Gasoline, 5.0 gal/100 mi	21.4	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48887
2025	Chevrolet	Silverado	408	2	Gasoline	2WD, 5.3 L, 8 cyl, Automatic 10-spd, Regular Gasoline, 5.6 gal/100 mi	24	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48202
2025	GMC	Sierra	408	2	Gasoline	2WD 5.3 L, 8cyl, Automatic (S10), Regular Gasoline, 5.6 gal/100 mi	24	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48207
2025	Honda	Ridgeline	410	2	Gasoline	AWD, 3.5 L, 6 cyl, Automatic (S9), Regular Gasoline, 4.8 gal/100mi	19.5	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48246
2025	Ford	Maverick	412	2	Gasoline	AWD, 2 L, 4 cyl, Automatic 8-spd, Regular Gasoline, 4 gal/100 mi	16.5	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48874
2025	Jeep	Gladiator	418	2	Gasoline	4WD, 3.6 L, 6 cyl, Automatic (S8), Regular Gasoline, 5.3 gal/100 mi	22	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48513
2025	Toyota	Tacoma	419	2	Gasoline	2WD, 2.4 L, 4 cyl, Automatic (S8), Turbo Regular Gasoline 4.3 gal/100mi	18.2	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48872
2025	Chevrolet	Colorado	428	2	Gasoline	2WD, 2.7 L, 4 cyl, Automatic 8-spd, Turbo, Regular Gasoline, 5 gal/100 mi	21.4	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48882
2025	GMC	Canyon	428	2	Gasoline	2WD, 2.7L, 4 cyl, Automatic(s8), Turbo, Regular Gasoline, 5 gal/100 mi	21.4	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48887
2025	Chevrolet	Silverado	432	2	Gasoline	2WD, 2.7 L, 4 cyl, Automatic 8-spd, Regular Gasoline, 5.3 gal/100 mi	24	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48201
2025	GMC	Sierra	432	2	Gasoline	2WD, 5.3 L, 8cyl, Automatic (S10), Regular Gasoline, 5.6 gal/100mi	24	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48207
2025	RAM	1500	432	2	Gasoline	Regular Gasoline	23-26	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47723
2025	Ford	F-150	437	2	Gasoline	2WD, 5 L, 8 cyl, Automatic (s10), Regular Gasoline, 5.3 gal/100mi	23	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	Nissan	Frontier	441	2	Gasoline	2WD, 3.8 L, 6 cyl, Automatic (S9), Regular Gasoline, 4.8 gal/100mi	21	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	Ford	Ranger	460	2	Gasoline	2WD, 2.3 L, 4 cyl, Automatic(S10), Turbo, Regular Gasoline, 4.3 gal/100mi	20	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48883
2025	Ford	F-150	460	2	Gasoline	2WD, 5 L, 8 cyl, Automatic (s10), Regular Gasoline, 5.3 gal/100mi	23	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	Ford	F-150	483	2	Gasoline	2WD, 5 L, 8 cyl, Automatic (s10), Regular Gasoline, 5.3 gal/100mi	23	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	Ford	F-150	437 - 684	2	Gasoline	2WD, 5 L, 8 cyl, Automatic (s10), Regular Gasoline, 5.3 gal/100mi	23	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	Ford	F-150	437	2	Gasoline	2WD, 5 L, 8 cyl, Automatic (s10), Regular Gasoline, 5.3 gal/100mi	23	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48886
2025	RAM	1500	506 - 572	2	Gasoline	2WD, 3.6 L, 6 cyl, Automatic (S8), Regular Gasoline, 4.5 gal/100 mi	23 - 26	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47723
2025	Toyota	Tundra	450 - 644	2	Gasoline	2WD, 3.4L, 6 cyl, Automatic (S10), Turbo, Regular Gasoline 5 gal/100mi	22.5 - 32.2	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48511
2025	RAM	1500	506 - 572	2	Gasoline	2WD, 3.6 L, 6 cyl, Automatic (S8), Regular Gasoline, 4.5 gal/100mi	23 - 26	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=47723
2025	Ford	Ranger	460	2	Gasoline	2WD, 2.3 L, 4 cyl, Automatic (s10), Turbo, Regular Gasoline, 4.3 gal/100 mi	20	20.9	https://www.fueleconomy.gov/feg/Find.do?action=sbs&id=48883
Box Truck									
2024	Chevrolet	4500 HD Low	220	3-5	Diesel		38.6	5.7	24my-LCF-BBM-GSA-Updates-May2023-1b.pdf
School Bus									
2025	ICBus	CE Series	390 - 1000	8	Diesel		65 100	5.8	ICBus CE Series Type C School Bus - Up to 83 Passengers ICBus
2025	Blue Bird	Vision Diesel	270 - 600	8	Diesel		45 60	5.8	Vision Diesel - Blue Bird Corporation https://www.bluebirdbusstore.com/pages/blue-bird-vision-diesel
Step Van									
?	Ford	F59 Step Van	188	3-5	Gasoline		40	4.7	Ford F59 P1200 Stepvan (Utilimaster Body) - FedEx Trucks
2026	Ford	E-350 Stripped	260	3	Gasoline		40	6.5	2026 E-350 Stripped Chassis
2026	Ford	E450	350	3	Gasoline		55	6.5	E-Series Cutaway E-450 DRW
2024	Freightliner	MT55G	250	6-7	Diesel		40	6.5	Freightliner MT55 P1100 Stepvan
2024	Freightliner	MT45	290	4-5	Diesel		45	6.5	Freightliner MT45 P1000 Stepvan
2024	Utilimaster	p700	260	3-5	Gasoline		40	6.5	Ford F59 Utilimaster 14' P-700
2024	Utilimaster	p900	350	3-5	Gasoline		55	6.5	Ford E-450 16' Utilimaster P900
Transit									
2025	New Flyer	Xcelsior	400 - 600	7 & 8	Diesel		100 125	4.4	Xcelsior® Clean Diesel - New Flyer North America's Bus Leader
2024	Nova Bus	LFS	580 - 750	8	Diesel		125	4.4	LFS Diesel brochure_march2021_EN.pdf
2024	Blue Bird	Vision Transit	180 - 600	7 & 8	Diesel		45 60 100	4.4	Vision Diesel - Blue Bird Corporation
Refuse									
2025	Mack	TerraPro	175 - 315	8	Diesel		70	1.7	Mack® TerraPro® Mack Trucks
2025	Freightliner	EconicSD	125 - 360	8	Diesel		80	1.7	EconicSD Freightliner Trucks
2025	Kenworth	T880	250 - 450	8	Diesel		100	1.7	T880 Kenworth
Semi									
2025	Freightliner	Cascadia	1,560 - 1,800	8	Diesel		240	6.5	https://www.premierfleets.com/product/2025-
2025	International	RH Series	480 - 1,400	8	Diesel		70 200	7	https://www.international.com/-/media/project/tratongroup/international/international/brochures-and-collateral/rh-series/pm_int_rhseries-daycabspecs-2024-9-23-1.pdf?rev=193bdc59c77541b08bd0c2ffacfd42fe
2025	Kenworth	W990	1,394	8	Diesel		170	8.2	W990 Kenworth

Source: North Central Texas Council of Governments

North Texas Resilient Electric Vehicle Plan									
Appendix D: BEV Range and Battery Capacity									
Year	Make	Model	Battery Capacity (kWh)	Class	Estimated Range (in mi)	Time to charge (240 V)	Fuel Economy (kWh/100 mi)	Charging Connector Type	Source
Street Sweeper									
2021	Global Environmental Products	M3EV	210 kWh	7	Unknown	9 to 11 hours	Unknown	J1772	Global-M3EV-1-1.pdf
2023	Global Environmental Products	M4EV	250 kWh	7	Unknown	8 to 10 hours	Unknown	J1772	GLOBAL_M4_EV_082924_SM.pdf
Light/Medium Duty Pickup Truck									
2025	Rivian	R1T Dual Max	141.5 kWh	1 - 4	420	15 hours	87 kWh	CCS1 or J1772	2025 Rivian R1T Review, Pricing, and Specs
2025	Rivian	R1T Dual Large	141.5 kWh	1 - 4	329	12 hours	85 kWh	CCS1 or J1772	Rivian R1T Electric Truck: Price, Range & Features
2025	Rivian	R1T Dual Large Plus	108.5 kWh	1 - 4	330	12 hours	82 kWh	CCS1 or J1772	Rivian R1T Electric Truck: Price, Range & Features
2025	Rivian	R1T Dual Standard	92.5 kWh	1 - 4	258	9.5 hours	79 kWh	CCS1 or J1772	Rivian R1T Electric Truck: Price, Range & Features
2025	Ford	F-150 Lightning 4WD ER1	98 kWh	1 - 4	320	14.6 hours	70 kWh	J1772	F-150 Lightning 4WD ER1
2025	Chevrolet	Silverado EV 5WT	215 kWh	1- 4	422	18.6 hours	70 kWh	CCS1 or J1772	2025 Silverado EV
Box Truck									
2024	Freightliner	eM2	194 kWh	7	180	1 to 3 hours	Unknown	J1772	eM2 Freightliner Trucks
2024	International	eMV	210 kWh	7	135	1 to 3 hours	Unknown	CCS1 or J1772	eMV Series
2024	Isuzu	NRR EV	60 kWh 100 kWh 140 kWh 180 kWh	5	41-235	1 to 10 hours (depending on charger)	Unknown	CCS1 or J1772	N-Series NRR EV
2025	Kenworth	K270E/K370E	141 kWh 282 kWh	6-7	100-200	1 to 2 hours (depending on charger)	Unknown	DC Fast Charging/AC Charging (specific connector type unknown)	Kenworth K270/K370
2024	Lion Electric	Lion5	210 kWh	4-5	190	1.5 hours (minimum)	Unknown	DC Fast Charging/AC Charging (specific connector type unknown)	Lion5 - Lion Electric
2024	Lion Electric	Lion6	252 kWh	6-7	218	2 hours (minimum)	Unknown	Unknown	Lion6 - Lion Electric
2023	Hino Trucks	M5e	148 kWh	5	190	Up to 8 hours	Unknown	Unknown	Hino M Series
2025	RIDE	Class 6 Box Truck	281 kWh 343 kWh	6	200+/250+	2.5-3.5 hours (depending on charger)	Unknown	Unknown	RIDE 6F Class 6 Truck
2026	Bollinger Motors	B5 Commercial Truck	280 kWh	5	160	2 to 9 hours (depending on charger)	Unknown	CCS1/AC Charging	
2025	Peterbilt	220EV	148 kWh	6-7	100-200	2.1 hours (minimum)	Unknown	DC Fast Charging (specific connector type unknown)	Peterbilt Model 220EV Peterbilt

North Texas Resilient Electric Vehicle Plan

Appendix D: BEV Range and Battery Capacity

Year	Make	Model	Battery Capacity (kWh)	Class	Estimated Range (in mi)	Time to charge (240 V)	Fuel Economy (kWh/100 mi)	Charging Connector Type	Source
School Bus									
	Blue Bird	All American RE Electric	155 kWh	8	150	2 to 8 hrs (depending on charger)	Unknown	CCS1 with AC and DC fast charging capabilities	Blue Bird All American RE Electric
	Blue Bird	Micro Bird G5 Electric	175 kWh	4	200	1.5 - 7 hours (depending on charger)	Unknown	SAE J177s CCS type 1	Our alternative buses: G5 Electric
	Blue Bird	Vision Electric	194 kWh	7	150	2 - 7 hours (depending on charger)	Unknown	CCS1	Vision Electric - Blue Bird Corporation
	BYD	Achiever Type A	156 kWh	6	120	1.5-8 hours (depending on charger)	Unknown	CCS Combo DC/J1772 AC	Achiever Battery-Electric Type A School Bus - RIDE
	BYD	Creator Type C	188 / 282 kWh	8	170	2.5 - 15 hours (depending on charger)	Unknown	CCS Combo DC/J1772 AC	Creator Battery-Electric Type C School Bus - RIDE
	BYD	Dreamer Type D	255 kWh	8	155	2.5 - 15 hours (depending on charger)	Unknown	CCS1 Combo DC/J1772 AC	Dreamer Battery-Electric Type D School Bus - RIDE
	Collins Bus Corp.	Ford E-Transit	68 kWh	2	100	15 minutes-8 hours (depending on charger)	Unknown	DC fast charger/AC charging (specific charger not known)	Holt Truck Centers Collins Bus All-Electric Ford E-Transit School Bus - Holt Truck Centers
	IC Bus	Electric CE Series	210 kWh 315 kWh	7	135 200	5.5-13 hours (depending on charger)	Unknown	CCS1	electric_ce_series_brochure_spread_format.pdf
	Lion Electric	LIONC	210 kWh	7	160	minimum 1.5 hours	Unknown	AC/DC Charging (specific charger not known)	LionC - Lion Electric
	Lion Electric	LIOND	210 kWh	8	150	minimum 2.5 hours	Unknown	AC/DC Charging (specific charger not known)	LionD - Lion Electric
	Starcraft	E-Quest	87 kWh 105 kWh	6	90 110	2.5 hours	Unknown	AC J1772	E-Quest Starcraft Bus Sales
	Starcraft	E-Quest XL	127 kWh	6	105	8 hours	Unknown	J1772 / 15 kW	E-Quest XL Starcraft Bus Sales
	Thomas Built	Saf-T-Liner C2 Jouley	246 kWh	7	150	2-3 hours	Unknown	J1772	Saf-T-Liner® C2 Jouley® - Thomas Built Buses
Step Van									
2021	Utiilmaster	Walk-In Van EV	127 kWh	6	105	8 hours	Unknown	J1772/CCS	Walk-in Van EV - Utiilmaster - A Shyft Group Brand
2023	Workhorse	W56	140 kWh 210 kWh	5-6	150	less than 2 hours-12 hours(depending on charger)	Unknown	J1772/CCS1	Electric Step Van W56 Available Now CL 5-6 Workhorse
2023	Workhorse	W750	118 kWh	4	150	3-11 hours(depending on charger)	Unknown	J1772/CCS1	Electric Step Van W750 Available Now CL 4 Workhorse
2025	XOS	SV	280 kWh	6	100-200	2-6 hours(depending on charger)	Unknown	J1772/CCS1	2025 XOS Step Van
2022	Freightliner	MT50e	226 kWh	6	180	3 hours	Unknown	DC Fast/AC Charging	MT50e-Flyer-Work-Truck-Show-2024.pdf
2021	Motiv Delivers	F-59 Step Van	158 kWh	5-6	Up to 150	1.75-7.25 hours (depending on charger)	Unknown	J1772/CCS1 DC	Step Vans - Motiv Electric Trucks
2024	Motiv Delivers	Argo L	237 kWh	6	200	1.5-8 hours (depending on charger)	Unknown	Unknown	Motiv Electric Trucks Launches Argo - A New Truck Configurable for Multiple Applications
2024	ZM Trucks	ZM8	140 kWh	6	160	minimum 36 minutes	Unknown	Unknown	ZM to Bring Zero-Emission Work Trucks to North America - TT

North Texas Resilient Electric Vehicle Plan									
Appendix D: BEV Range and Battery Capacity									
Year	Make	Model	Battery Capacity (kWh)	Class	Estimated Range (in mi)	Time to charge (240 V)	Fuel Economy (kWh/100 mi)	Charging Connector Type	Source
Transit									
	BYD	C10MS	446 kWh	8	230	2 - 3.5 (depending on the charger)	Unknown	Unknown	c10ms-cut-sheet_final_digital.pdf
	BYD	C8MS	313 kWh	8	170	2.5 - 4.5 (depending on the charger)	Unknown	Unknown	c8ms-cut-sheet_final_digital.pdf
	BYD	K11M	576-578 kWh	8	193-220	4.5 hours (depending on the charger)	Unknown	Unknown	RIDE_K11M_2024_Cutsheet_52024.pdf
	BYD	K7M	313 kWh	8	135	3 hours (depending on the charger)	Unknown	Unknown	BYD K7M ER 30' ELECTRIC BUS Price and Review - EV Database
	BYD	K8M	391 kWh	8	196	3.5 hours (depending on the charger)	Unknown	Unknown	RIDE_K8M_2024_Cutsheet_52024.pdf
	BYD	K9MD	455 kWh	8	208	3.5 hours (depending on the charger)	Unknown	Unknown	RIDE_K9MD_2024_Cutsheet_52024.pdf
	COBUS Industries	e.COBUS 3000	120 kWh	8	155	4 hours (DC Fast Charger)	Unknown	Unknown	COBUS INDUSTRIES
Refuse									
	Peterbilt	567EV	625	8	100-250	1.5 - 2 hours (80% charge)	Unknown	Unknown	Peterbilt Model 567EV Peterbilt
	McNeilus	Volterra ZSL	battery capacity approximately 20% higher on average	8	299	2 - 4 (DC Fast charger)	Unknown	Unknown	McNeilus Volterra™ ZSL™ Electric Side Loader Garbage Truck
Semi									
	Freightliner	eCascadia	438 kWh 291 kWh	8	155 - 230	1.5 - 5 hours (depending on the charger)	Unknown	Unknown	eCascadia Freightliner Trucks
	Tesla	Semi	900 kWh 1,000 kWh	8	500	1.5 hours (depending on the charger)	Unknown	Unknown	Semi Tesla
	Volvo	VNR Electric	565 kwh	8	275	1.5 hours (80% charge)	Unknown	Unknown	VNR Electric Volvo Trucks USA
Sedan									
2024	Nissan	LEAF	40 kWh	1-4	149	8 hours	111 kWh	J1772	2024 Nissan LEAF
2025	Fiat	500e Automatic	42 kWh	1-4	149	6 hours	116 kWh	unknown	The New FIAT® 500e: Small Electric 2-Door vehicle FIAT® USA
2024	MINI USA	Cooper SE	32.64 kWh	1-4	114	4 hours	110 kWh	CCS2	Mini Cooper Electric Features and Specs
2025	Hyundai	Ioniq 6 Standard Range	53 kWh	1-4	240	6 hours	135 kWh	J1772	2025 Hyundai IONIQ 6 Features & Specs Hyundai USA
2024	Hyundai	Ioniq 6 Long Range	53 kWh	1-4	361	7.5 hours	140 kWh	J1772 or NACS	2024 Ioniq 6 Specifications
2025	Nissan	LEAF SV	53 kWh	1-4	212	11 hours	109 kWh	J1772	2025 Nissan LEAF Features: Range, Charging, Battery & More
Source: North Central Texas Council of Governments									