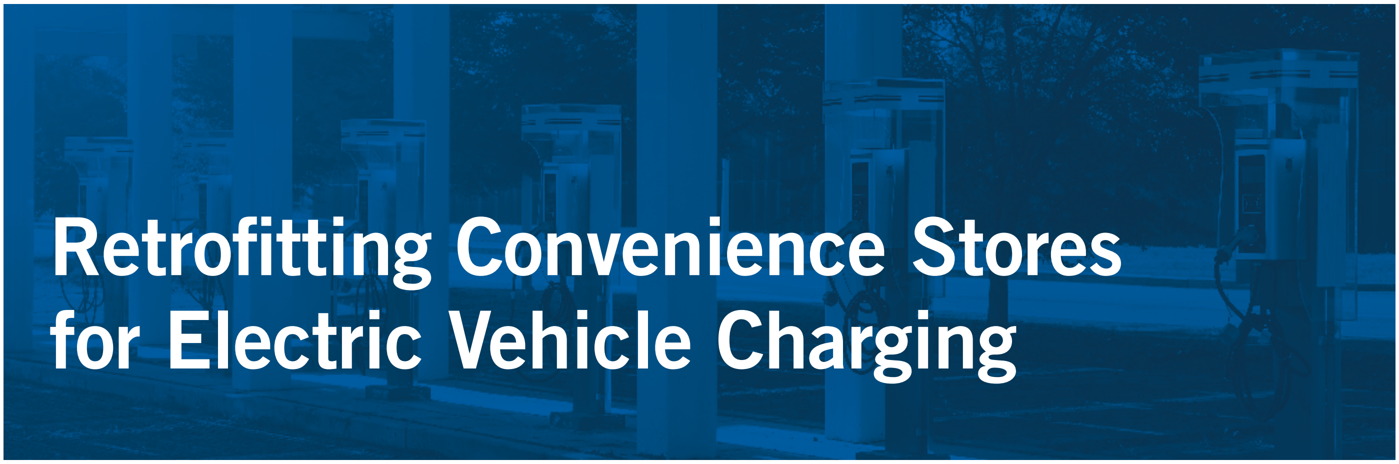

Retrofitting Convenience Stores for Electric Vehicle Charging

The Petroleum Equipment Institute (PEI), NACS and the Fuels Institute have developed this document to help convenience retailers who are considering whether to incorporate electrical vehicle (EV) charging infrastructure into existing liquid fuel sites.

Many factors must be taken into account when retrofitting an existing facility for EV charging. Electrical installation and connectivity, construction costs, tax credits and rebates, projected growth of EVs in the market, station downtime, permitting requirements, competition, maintenance and upkeep, third party funding availability, and technology all require careful consideration.

DC Fast Charging (DCFC) is the optimal technology for EV charging at convenience stores. DCFC charging times fit well with convenience store amenities and customer visit times. Adequate space and utility requirements for a full DCFC system are generally:

- Utility: at least 1000 amp at 480/277V, 3-phase separately metered service with:
  - A clear run or easement from the utility source
  - Adequate space for primary side infrastructure and switchgear ampacity.
- Space: at least 1,200 sq. ft. for the EV charger service, with:
  - 200 sq. ft. for supporting infrastructure
  - 800 sq. ft. for four or five charging stalls
  - 1500 sq. ft. for eight charging stalls.

This guidance document is for stores retrofitting an existing site. Existing stores must first determine if they meet adequate utility requirements. Additionally, the sites must have adequate space. These minimum requirements are listed below. However, there are other options for sites that do not meet the utility and/or space requirements for full-power DCFC infrastructure. These sites can deploy a lower-cost DCFC system customers can use to "top off" their vehicles with a quick EV charge. The solution for these stores may be a battery-buffered system with a smaller footprint, lower utility requirements and reduced utility demand charges. These sites utilize battery energy storage systems (BESS) which may have additional regulatory requirements beyond those of the non-BESS EV charger. Discuss with the local authority having jurisdiction to determine if any additional requirements will apply.

This document covers five areas that must be considered during the design phase to ensure safe, convenient and legal EV charging:

1) Power to the site
2) Zoning/regulatory requirements
3) Site factors/space allocation
4) Relationship to liquid fueling infrastructure
5) Customer experience

1) Power to the Site

Anticipating current and future electrical needs is essential. Store owners and operators will need to consult with their local utility provider to answer the following questions:

- What is the best EV charging approach?
  - A single power feed that serves the entire site?
  - Separate feeds for EV chargers and the rest of the site?
- Can the local utility accommodate the additional draw required by the EV charging station infrastructure?
  - Battery-buffered DCFC (Level 2): minimum 400 amp at 208V
  - DCFC: 1000 amp at 480V, 3-phase
- Does the existing electrical installation need to be upgraded to achieve the required input power for charging equipment?
- Will separate utility agreements and metering be required to insulate the facility from demand rate changes?
- What are the applicable utility tariffs and anticipated utility energy and demand charges, and how will EV charging affect the site's electricity bill?
- What power backup is needed?
- Will the existing electrical panel accommodate the addition of EV chargers?
- Will a new or upgraded service/line/transformer/panel be required?

Future growth possibilities must account for electrical room (physical) space in addition to onsite power and charger space.

2) Zoning/Regulatory Requirements

Understanding required federal, state and local permits, approvals, easements and inspections will require conversations with contractors as well as the authority having jurisdiction. Starting this process early will reduce construction delays and later corrections or revisions. Key questions to ask are:

- Does the existing zoning allow for installation of charging infrastructure?
- How far away must the EV charging equipment be from the fuel dispensers to comply with the local fire code?
- Will back-up power be necessary to meet local requirements?
- Does local zoning restrict the number and/or types of EV chargers?
- What are the regulatory requirements for setbacks from hazardous locations, including liquid fuel dispensers, vent stacks and storage tanks?
- What signage is required for EV charging?

- Review the National Electrical Code (NEC) for applicable code and standards. This includes Article 625 and other applicable sections.
- Will the addition of EV charging affect the site's Americans with Disabilities Act (ADA) or weights & measures compliance?
- Determine how will users be charged:
  - By kWh
  - By charging time
  - By space usage.

3) Site Considerations

Incorporating EV chargers into an existing liquid fueling facility creates unique challenges when determining space allocation and the appropriate type/number of charging stations. Key questions to ask are:

- What impact will EV chargers have on the site's traffic pattern?
- How many spaces can be allocated to EV chargers?
- Can the EV chargers be located near transformers/incoming power to reduce saw cutting, trenching and new conduit?
- Can an existing air compressor station or Level 2 charger and associated parking space be repurposed?
- Can the chargers use an on-site hard-wired network or will cellular communications capabilities be required?
  - If site is hard-wired ethernet, how can network cabling best be routed to the chargers?
- Will reconfiguration of emergency access lanes be required?
- Are canopies/awnings/lights needed?
- Will the site configuration allow growth into other fueling options (hydrogen, LNG, LPG, etc.)?
- What kind of physical protection (e.g., bollards) will be needed around EV chargers?
- Will the charger cables reach both the front and back of the vehicle being charged?
  - Cable length greater than 25 feet will require a cable management system and practices to limit trip-and-fall hazards.
- What is the appropriate safety training for personnel conducting regular inspections and maintenance?

Lock down and tag out any non-functioning equipment. Consider continuous monitoring of current for EV charging stations to alert the facility of any outage or equipment failure.

4) Relationship to Existing Fueling Infrastructure

Vehicle charge time and real estate usage may impact other c-store operations. In some cases, tanks, dispensers, piping and/or other liquid fueling infrastructure components may have to be removed or reconfigured to make room for EV chargers. Key questions to ask are:

- What is the current optimal ratio of EV charging stations to liquid fueling positions for the site; how might this ratio change over time?
- Would installing the EV charger on the island block liquid fueling?
- Where are the fuel tanks and piping in relationship to the power conduit?
- Will the charging locations be outside of where a fuel spill would flow?
- Will there be decommissioning costs if fuel points have to be moved to make room for chargers or create necessary spacing?
- Are separate software platforms needed for liquid fuel operations and EV power management?

5) Customer Experience

Charging a vehicle typically requires more time than liquid fueling. The experience during charging is likely to affect the customer's selection of one site over another. Questions to ask are:

- Does the site have adequate internet connection to transmit/receive data from the charger?
- Should Wi-Fi be offered to customers who are charging or waiting to charge?
- If one does not already exist, should an air-conditioned or heated area be provided for customers' use while their vehicles are charging?
- What service provider will process the payments and handle any issues?
- Can the existing internet connection handle the charging station network as well as the existing POS?
- Will EV charging integrate into existing loyalty systems, if any?
- How can EV charging be incorporated into store marketing?
- Will a canopy enhance the user experience?
- Should the chargers be a part of an EV charging network and if so which one?
- Who will service the chargers to ensure high reliability?
- Is there adequate lighting for security and usability purposes?
- Does site ingress/egress support safe charging?

SUMMARY CHART

While DC Fast Charging is the preferred technology for convenience stores, Level 2 requirements are also listed in this summary chart since Level 2 infrastructure can be utilized for battery buffered DCFC systems.

	Level 3 (DC Fast Charging)	Level 2 (AC Charging)
Ideal Dwell Time	15-30 min	120+min
Typical Input Voltage	480/277V	120/208V
Recommended Ampacity/Service Size (EVSE Load Only)	1000A	400A
Typical Breaker Size	250A-700A (80% Rated) - Product Dependent	60A
Utility Transformer Required	Yes	Yes
Utility Capacitor Required	Yes (Utility Dependent)	No
Utility Switch/Fuse Cabinet	Yes (Utility Dependent)	No
Step-up/down Transformer Needed	Yes (If main service @ 120/208V)	Yes (If main service @ 480/277V)
Recommended Conduit Size (stubbed to desired charging stall location)	4-inch	2-inch
EV Charging Stalls	TBD, based on site constraints, typically 4 – 8	TBD, based on site constraints, typically 4 – 10
Equipment Footprint Needed	200 sq. ft.	<20 sq. ft.
Recommended Stall to Equipment Distance	<300’	<500’
ADA Standard Accessible Stall	Yes - State Dependent	Yes - State Dependent
ADA Van Accessible Stall	Yes - State Dependent	Yes - State Dependent
ADA Accessible Route (cross-slope compliant)	Yes - State Dependent	Yes - State Dependent
Fiber/WiFi	Y - (if cell connectivity is poor)	Y - (if cell connectivity is poor)
Ask for EVSE Checklist/Streamlined Permit Process	Yes	Yes
Ask about EV-Specific Utility Rates (May be beneficial to locate your EVSE on a separate meter)	Yes	Yes