Future-Proofing Convenience Stores for Electric Vehicle Charging

New-Build Site Requirements and Considerations

The Petroleum Equipment Institute (PEI), NACS and the Fuels Institute have developed this document to help convenience retailers plan for electric vehicle (EV) charging infrastructure at new liquid fueling sites. With careful planning and efficient site design, ground-up facilities can be constructed to keep fuels convenient and safe for store personnel and the public.

Incorporating critical future infrastructure needs into store design will enable the retailer to add EV charging services whenever the timing is right while minimizing costs to retrofit the facility. Preplanning is important because new stores are 20+ year assets, and industry experts project that EVs will acquire a significant market share during this time.

DC Fast Charging (DCFC) is the optimal technology for EV charging at convenience stores. This guidance document is for stores with the minimum DCFC requirements described below. Stores that do not meet these minimums can still operate a battery-buffered DCFC system (covered in a separate "Retrofitting Convenience Stores for Electric Vehicle Charging" guidance document).

Battery energy storage systems (BESS) may have additional requirements beyond those of the 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 addressed during design and construction to prepare for DCFC service:

1) Property ownership
2) Utility service
3) Zoning
4) Charger location
5) Other site considerations

1) Property Ownership

- Options
  - Confirm or acquire outright ownership of land, store and related structures
  - If property is leased, lease terms should include the right to install EV charging stations and renewable energy equipment to provide resiliency and cost assurance/peak shaving savings. Securing these terms during lease negotiations will facilitate your ability to enter the EV charging business whenever the time is right.
- Confirm available real estate is sufficient for all requirements in this document.
- Many utilities will require a permanent easement.
  - Landlords may require that easements be vacated if the chargers are removed. Utilities may do this upon request; however, some will not agree in writing in advance.

2) Utility Service

- If possible, get a preliminary site power assessment, including:
  - Power availability
  - Feeder capacity
  - Proximity to substation
  - Right-of-way or easement issues.
- Utility pricing is fully regulated, but you should understand how your local utility works:
  - Get to know their planning process, especially at the distribution and feeder level.
  - Make sure utility decision makers have a basic understanding of convenience store business and ROI models.
- Plan for at least 1000 amp at 480/277V, 3-phase service.
  - Highly recommended: the option to separate EV charging service and billing from the c-store service and billing.
    - Some utilities require separate metering due to special EV-only electricity rates.
  - Communicate service needs to the utility during site design.
  - Plan for the possibility of below-grade primary power service. Routing and ground disturbance designs (red concrete encasement) should be considered.
  - Evaluate the location of existing conduits, fuel piping and other underground utilities before any ground disturbance excavations for utility improvements.
  - Plan for any code requirements that prohibit aerial utility services above bulk/truck offload areas.
  - Route all service and charger conduits to avoid classified locations that would require explosion-proof construction and increase costs.

- Switchgear and transformer must be capable of handling normal store operation, a car wash (if desired) and EV charging.
  - Planning for and securing this equipment during construction rather than during a later retrofit will be less expensive, require less space and simplify installation.
  - Design for appropriate primary side infrastructure and switchgear ampacity.
    - Designing for 2000 amp will help the utility right-size infrastructure for the pads and conduits required to service that load.
  - Switchgear, transformers and power panels must protect against arc flash and comply with OSHA and National Electrical Code (NEC) requirements.
- Back-up power:
  - Required by some local authorities having jurisdiction
  - Infrastructure must accommodate the greater generator capacity and fuel requirements of DCFC system.
- Consider anticipated utility tariffs, power rate classes and electricity demand charges.
  - Demand charges may be substantially more than the energy used to charge the vehicle.

3) Zoning

Understanding federal, state and local permits, approvals, easement and inspection requirements will require conversations with contractors and the authority having jurisdiction.

- Verify zoning allows for EV charging:
  - Equipment setbacks, utility rights-of-way and easements will impact EV charging station design and implementation.
  - Some local codes prohibit EV charging stations in flood zones. Whether required or not, do not locate proposed chargers in flood zone.
- Some zoning districts may restrict the number and types of chargers.
- Review the NEC for applicable code and standards. This includes Article 625 and other applicable sections.
- Verify allowable and required signage.
- Determine how users will be charged:
  - By kWh
  - By charging time
  - By space usage.
- DCFC Battery Based Energy Supply presents unique fire considerations and typically requires additional setbacks or fire wall construction near building/ car washes (NFPA 855)
- Hydrogen, LNG, LPG, gasoline and diesel will have different hazard protection area zoning and space requirements.
  - Proximity of EV charging infrastructure must ensure public safety.
- Establish relationships with local authorities who do not have direct permitting oversight but would need to be contacted in case of emergencies (e.g., local police & fire departments).

4) Charger Location

- Provide a clear run from the utility source to the charger location.
- If construction will include grading, run EV charger-appropriate conduit from the switchgear to the approximate location of each intended (or potential) charger.
  - 2-inch to 4-inch conduit is typically used; 4-inch conduit is recommended.
  - Consider adding spare conduit for future installation of additional chargers.
- Ensure that each planned EV charger has a network connection/conduit.
  - Consider separate intercom and CCTV conduits.
- Allocate at least 1,200 sq. ft. for the EV charger service.
  - Approximately 200 sq. ft. for supporting infrastructure
  - Approximately 800 sq. ft. for four or five charging stalls
  - Approximately 1500 sq. ft. for eight charging stalls.
- Base number of chargers on site location and power capability.
  - Load management allows multiple chargers to be installed on a given power circuit; as more chargers are initiated, the overall power draw is reduced for each charger to keep the entire system under circuit restrictions.
  - Consider providing enough power for all chargers in parallel; reduced power may negatively impact the user's experience.
- Determine the best vehicle positioning for EV charging:
  - Traditional fuel island style
  - Perpendicular parking spots
  - Diagonal parking spots
  - Parallel parking spots
  - Proper orientation of parking stalls or charger aisles will be critical to charger access
  - Consider optimal charging cable length
    - Lengths greater than 25 feet will require a cable management system and practices to limit trip-and-fall hazards.
  - Plan for bollards and/or other equipment protection devices.
- Ensure that charger locations meet applicable electrical code setback requirements for hazardous locations, including liquid fuel dispenser islands, vent stacks and storage tank fields.
  - Setbacks for electrical equipment will depend on the liquid fuel being dispensed.
  - Ensure cables/connectors do not fall within classified areas surrounding gasoline dispensers, vents or storage tanks.
- Ensure that each planned EV charger has a conduit and means for remote emergency shutdown (Estop).
  - Consider integrating this Estop into the site liquid fueling Estop so that it is one system.
  - Consider a means to reset the system from inside the store, comparable to liquid fueling Estop reset.

- Allow sufficient ingress and egress for EVs:
  - Allow for proper turning radii.
  - Consider queuing lanes for EVs waiting to charge to reduce traffic backups on the site or adjacent street.
- Charging locations should not impede, restrict or limit tanker truck traffic (including backing).
- Grade and allow for adequate distance from liquid fueling equipment to protect EV chargers and ancillary equipment in the event of a surface spill.
- Future growth possibilities must account for electrical room (physical) space in addition to onsite power and charger space.

5) Other Site Considerations

- Americans with Disabilities (ADA) requirements may affect the physical space required for EV charger service.
  - At least two EV charging stalls should meet ADA cross-slope and access requirements.
  - Some states require ADA-compliant parking stalls, accessible routes, and paths of travel.
- Consider EV owner foot traffic; ensure that safe and identified pedestrian walkways are established.
- Determine 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.
- Charger operation varies by climate and temperatures.
  - What snow, ice removal will be required?
  - Determine whether charging equipment requires any temperature control device.
  - Establish whether the charger and cord are air- or liquid-cooled.
- Consider other site amenities:
  - Canopies
  - Bathroom facilities
  - Food service
  - Proper lighting and security
  - Wi-Fi service
  - Air machine
  - Car wash

SUMMARY CHART

While DC Fast Charging is the preferred technology for convenience stores, Level 2 requirements are also listed in this summary chart.

	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