Electric Vehicle Charging Insights – Code & Safety Advancement and Implications

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Objectives

- Trends related to Electric Vehicle Charging
- Brief review of forces driving change and expanding opportunities
- Overview of codes and standards applicable to EV charging
- Understanding the evolving electrical safety trilogy
- Applicable NECA performance standards
- Review the perspectives of and role electrical contractors
- Overview of expanding need/use of energy management systems
- High level look at business development opportunities for ECs

Electric Vehicle Charging

Trends and Growth

- Public affordability
- Conductive and Inductive (wireless) charging equipment
- Growth in EVSE and charging equipment types
- Smart Power Distribution Systems
- V2X Technologies
- Autonomous Electric Vehicles

The Pace of Change

- The electrical industry is changing and evolving
- Change is not necessary, because survival is not mandatory – W.E. Deming
- Installation and safety rules must change and evolve accordingly
  - Codes standards must stay relevant to be adoptable and effective
- Workplace safety rules must be practical, enforceable, understandable

Forces driving change

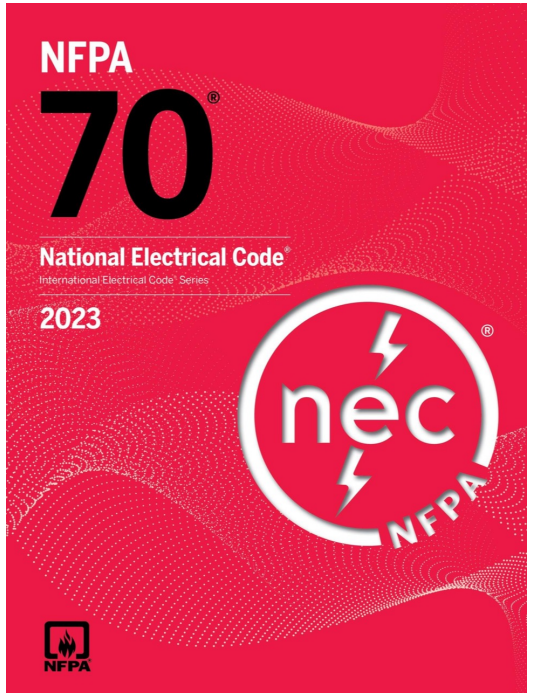
- New Federal Laws (mandates) for growth of electric vehicle charging infrastructure.
- Recent Federal Laws (mandates) to reduce energy use and improve energy efficiency.
- Expanded adoption of the International Energy Conservation Code (IECC) and ASHRAE 90.1.

Electrical Standards Safety trilogy

- Three electrical standards refer to and are dependent on one another.
- NEC is typically adopted into law.
- NFPA 70E developed at the request of OSHA for compliance with CFR 1910 and 1926 electrical safety rules.
- 70B Standard for Electrical Equipment Maintenance

NFPA 70 – National electrical code

- Individual Branch Circuit Requirements – 625-42
- Load Calculations Article 220 (no demand factors at this time)
- Energy Management Article 750 (applicable uses)
- New Service and Maintenance rules in the NEC require qualified persons perform these operations.
- NEC is expanding to address commissioning of building electrical systems.



NFPA 70B-2023 Standard for Electrical Equipment Maintenance

- Scope
- This standard covers the preventive maintenance of electrical, electronic, and communications systems and equipment.
- Contains 38 Chapters and Annexes A through M.
- Differentiated from the installation requirements of the NEC and the electrical workplace safety requirements of NFPA 70E.

NECA 91 Recommended Practices for Maintaining Electrical Equipment (NEW)

- Scope

This Recommended Practice describes general maintenance procedures for operating, servicing, inspecting, testing, maintaining, calibrating, repairing, and reconditioning building electrical systems, equipment, and components.

This Recommended Practice includes industry-accepted practices and is intended to be used in conjunction with equipment-specific manufacturer instructions.

NOTE: Also, see NFPA 70B, Standard for Electrical Equipment Maintenance.

Applying NFPA 70E to EVSE INSTALLATIONS

- NFPA 70E Standard for Electrical Safety in the Workplace must be followed when performing site assessments, and any justified energized work meeting the provisions in 70E Section 110.4.

  - Site assessment of existing service and power sources for capacity.
  - Use of test instruments for troubleshooting equipment.
  - Servicing and maintaining EVSE and chargers.

Electrical Safety in the Workplace

- Do not work on energized equipment, unless energized work meets justification thresholds in NFPA 70E.
- Strive to establish electrically safe work conditions.
- Determine justified energized work in accordance with 110.1 through 110.4 of NFPA 70E.
- Use appropriate Personal Protective Equipment (PPE) when performing justified energized work on or near energized electrical equipment.

Courtesy of NFPA

Qualified Persons

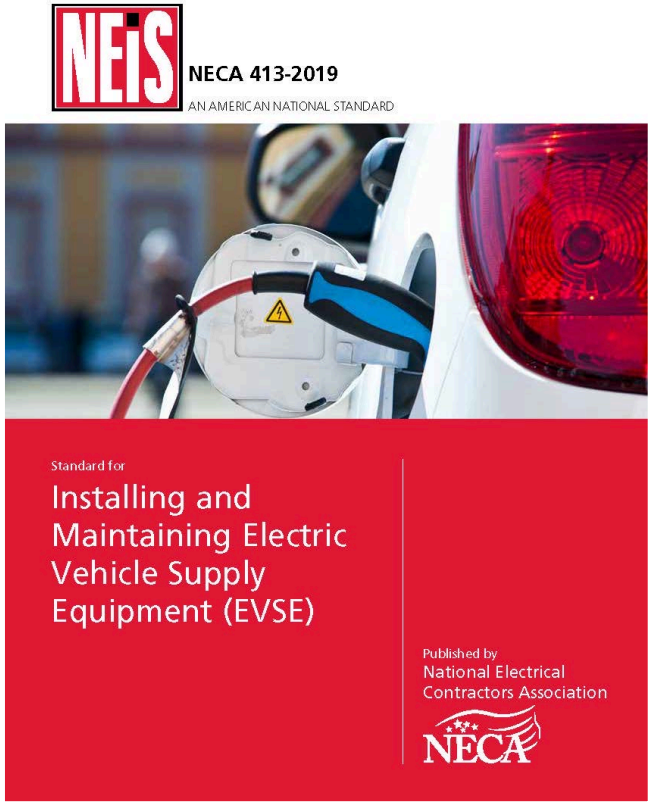
- Qualified Person. One who has demonstrated skills and knowledge related to the construction and operation of electrical equipment and installations and has received safety training to identify the hazards and reduce the associated risk.

NECA Standards Related to EV Charging

- NECA 413
- NECA 701
- NECA 416
- NECA 91 (New)

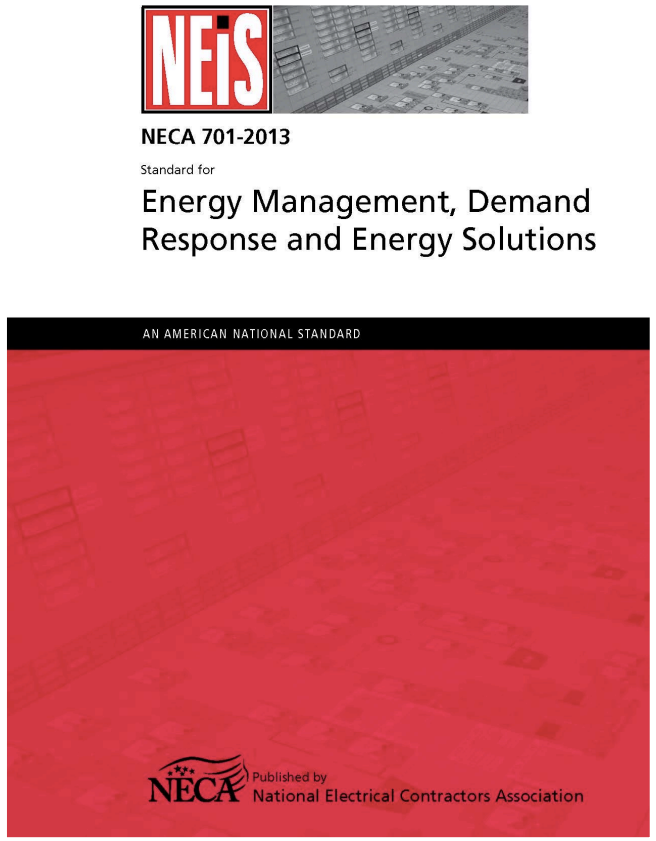
NECA 413

- ANSI Standard for Installing and Maintaining Electric Vehicle Supply Equipment
- Provides performance requirements for site assessment and safe sound growth of electrical charging infrastructure.
- Aligns with Articles, 220, 625, and 750 of the NEC.



NECA 701

- ANSI Standard for Energy Management, Demand Response, and Energy Solutions
- Addresses performance requirements for energy management.



Electrical Contractor Perspectives

- Communication with dealer, coordinator, owner, inspector, supplier, others
- Understand the types of EVSE and which type is to be installed
- Perform and accurate efficient site assessment of existing power service
- Provide accurate and clear estimate of necessary upgrades (if applicable)
- Coordinate with the applicable utility and authority having jurisdiction
- Business as usual for electrical contractors, but…
- Use expertise to ensure a positive customer experience

Basic Steps in the Process

- Electrical contractor must perform a site assessment for EVSE installation
- Obtain electrical wiring permit(s) and coordination of the inspection and approval processes.
- Coordinate with local utility company for time-of-use (TOU) meters, off-peak metering, etc.)
- Facilitate the installation of the EVSE and associated branch circuit wiring
- Inspection, startup, and commissioning completed EVSE installation

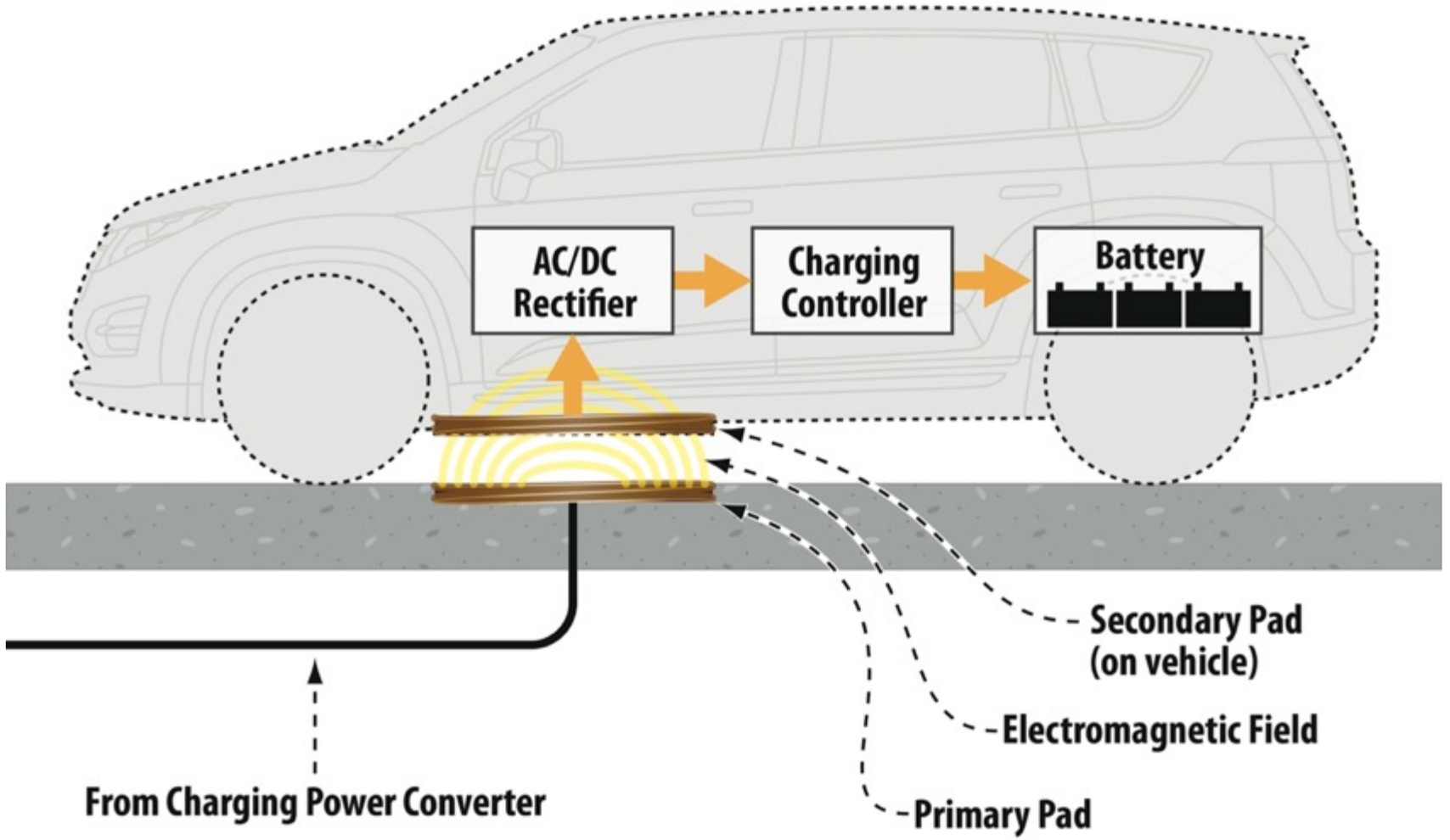
Electric Vehicle Charging Installations

- Understanding the equipment and system charging levels.
- Addressing the customers needs (individual and fleet applications.
- Site assessment expertise is essential.
- Coordination with applicable utilities for service capacities.

Electric Vehicle Charging Equipment


EVgo
FAST CHARGING
ABB
EVgo
FAST CHARGING
DALLAS
C7229
EVgo
FAST CHARGING
evgo.com

Wireless Power Transfer Equipment (WPTE)

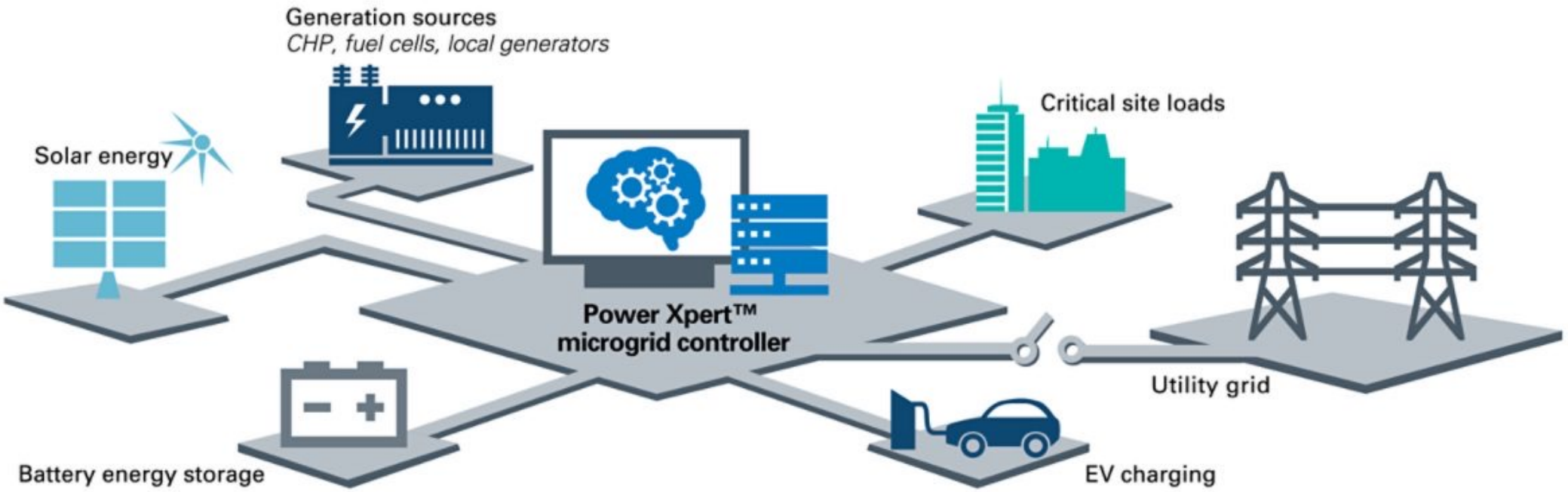


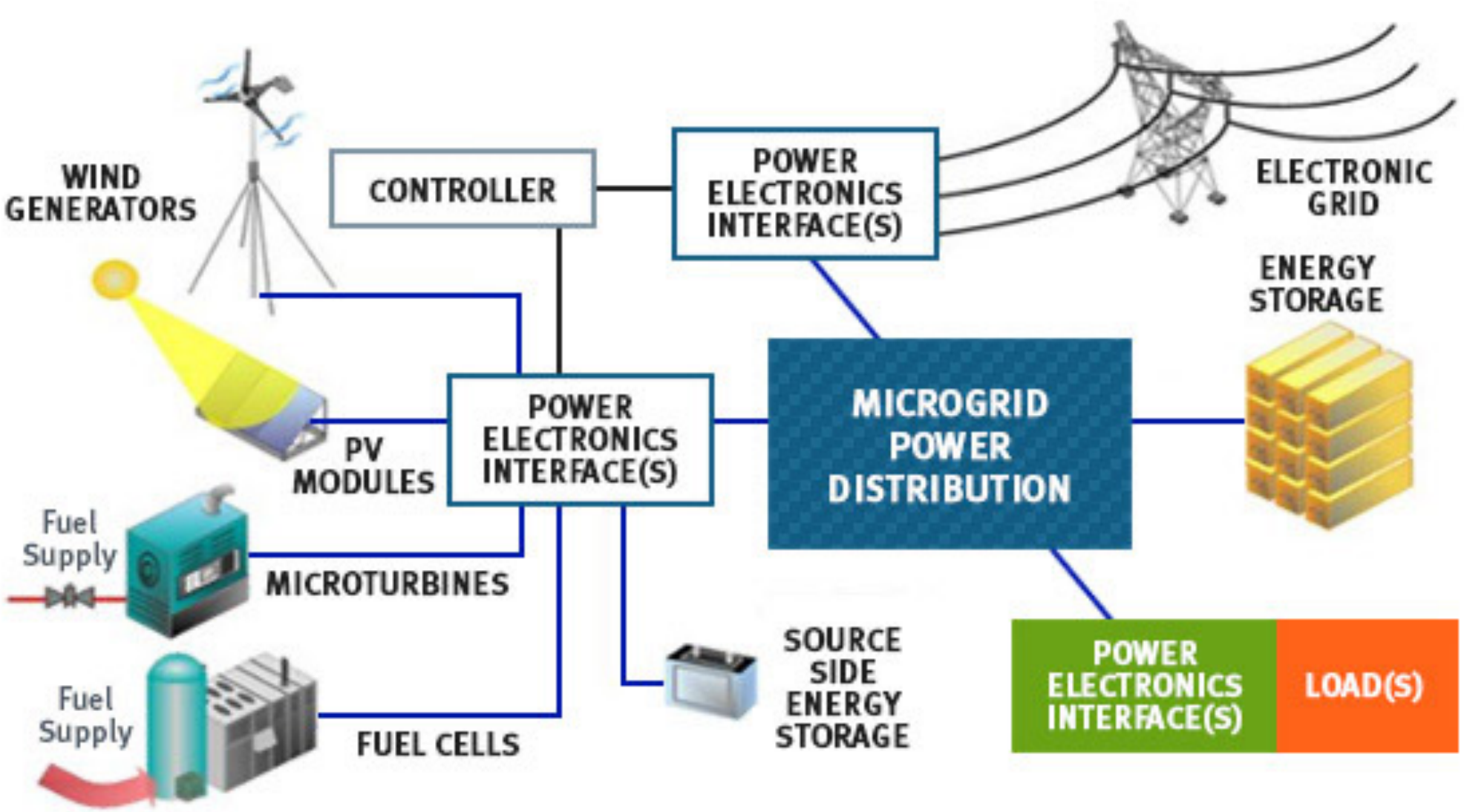
Expanding Charging Infrastructure

- Existing grid is aging and inadequate in many areas.
- Expanded installation of renewable energy sources.
- Expanded use of energy storage is going to be necessary.
- Expanded installation and operation of microgrids.

Meeting Energy Use Reduction Laws

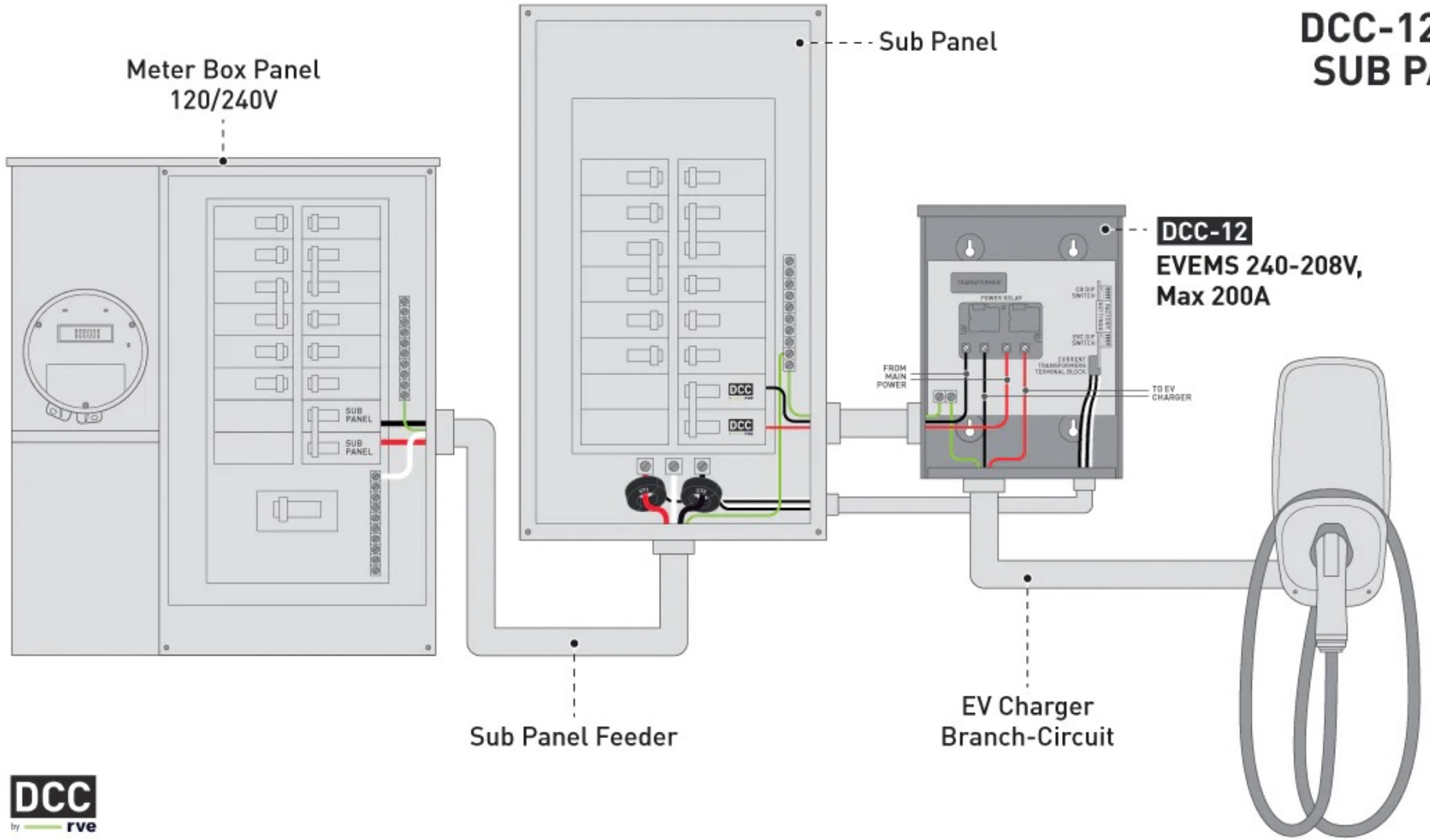
- Energy Codes are being adopted into law at the state and local levels.
- Currently there are exceptions in the energy codes the exempt electric vehicle charging systems (not for long)
- Electrical contractors can provide EV charging installation services and energy management system installation services.

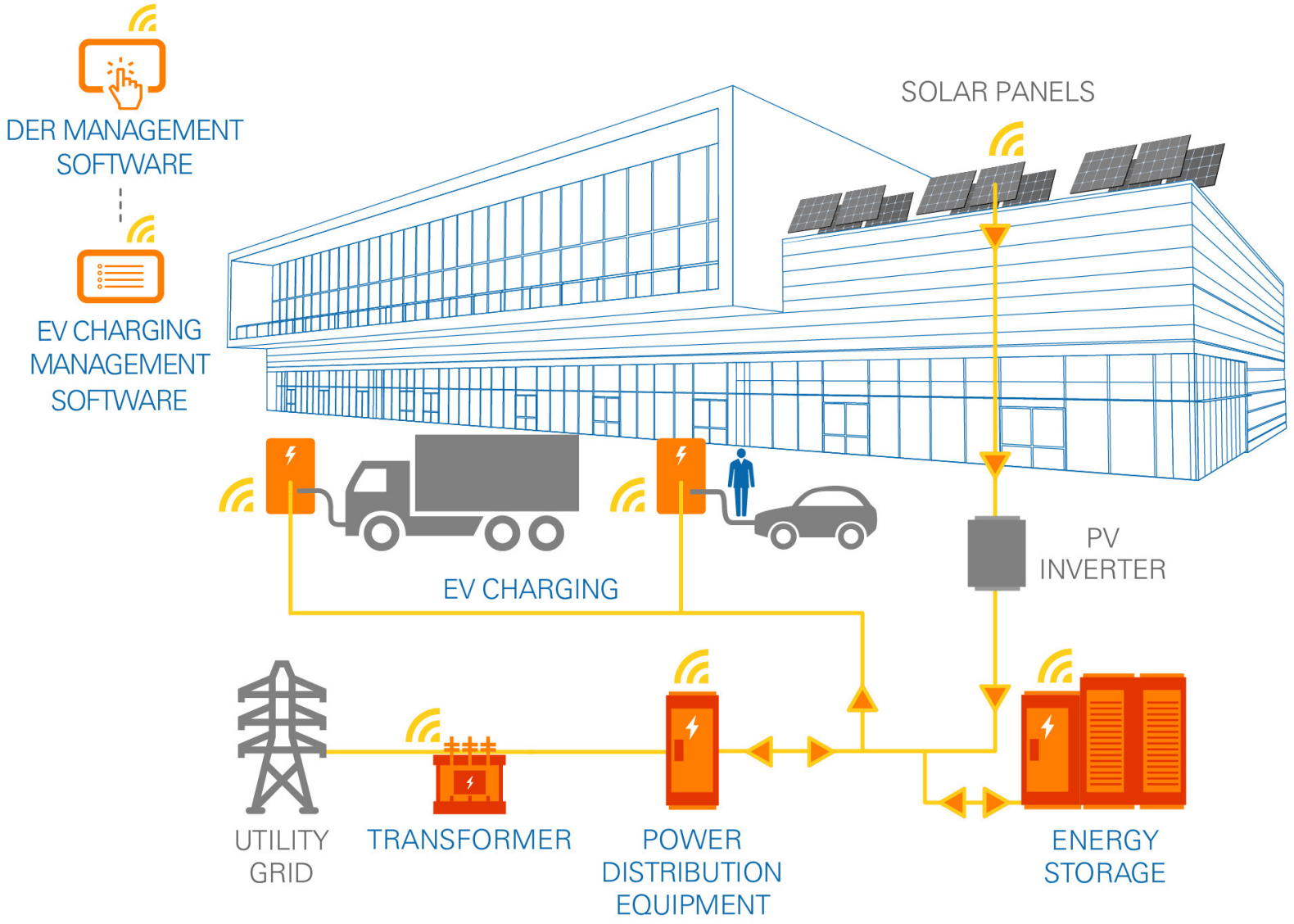

Generation sources
CHP, fuel cells, local generators
Solar energy
Critical site loads
Power Xpert™
microgrid controller
Utility grid
Battery energy storage
EV charging


WIND GENERATORS
CONTROLLER
POWER ELECTRONICS INTERFACE(S)
ELECTRONIC GRID
ENERGY STORAGE
PV MODULES
POWER ELECTRONICS INTERFACE(S)
MICROGRID POWER DISTRIBUTION
Fuel Supply
MICROTURBINES
SOURCE SIDE ENERGY STORAGE
POWER ELECTRONICS INTERFACE(S)
LOAD(S)
Fuel Supply
FUEL CELLS

Energy Management Systems

- Purpose of energy management
- Reduce and limit energy use residential, commercial, and industrial
- Compliance with energy codes and laws
- Control energy cost for customers
- Limit electrical connected load on new and existing electrical service, feeders, and systems.
- Provide alternatives in lieu of service changes or upgrades


DCC-12 with
SUB PANEL
GENERATION 3
Meter Box Panel
120/240V
Sub Panel
DCC-12
EVEMS 240-208V,
Max 200A
FROM MAIN POWER
TO EV CHARGER
SUB PANEL
SUB PANEL
DCC
DCC
Sub Panel Feeder
EV Charger
Branch-Circuit
DCC
by rve


DER MANAGEMENT SOFTWARE
EV CHARGING MANAGEMENT SOFTWARE
SOLAR PANELS
EV CHARGING
PV INVERTER
UTILITY GRID
TRANSFORMER
POWER DISTRIBUTION EQUIPMENT
ENERGY STORAGE