The EV Project Update

Infrastructure Working Council
San Diego, CA
March 2011

Kevin Morrow

OBJECTIVES:

- Collect & analyze data on EV use & charging patterns
- Evaluate effectiveness of charge infrastructure
- Commercially test various revenue systems
- Establish a scalable & viable infrastructure model

www.TheEVproject.com

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EV Project Overview

PROJECT MANAGER:	*ECOtality North America (eTec)*	
PROJECT SCOPE:	*~15,000 Charging Stations*	
	8,300 Nissan LEAFs & GM Volts	
TOTAL VALUE:	*$245.6 million* *($122.8m Private match)*	
PROJECT SCHEDULE:	Initial Infrastructure	Q4 2010
	Vehicle Launch	Q4 2010
	Final Infrastructure	Q4 2011
	Evaluation Ends	Q4 2012
	Completion	Q2 2013

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Deployment Detail

Total Chargers: ~15,000

- *8,300 residential EVSE (L2)*
- *6,350 public/commercial (L2)*
- *310 fast-charge ports (DCFC)*

Total ER/EVs: 8,300

- 2,600 Chevrolet Volts
- 5,700 Nissan LEAFs

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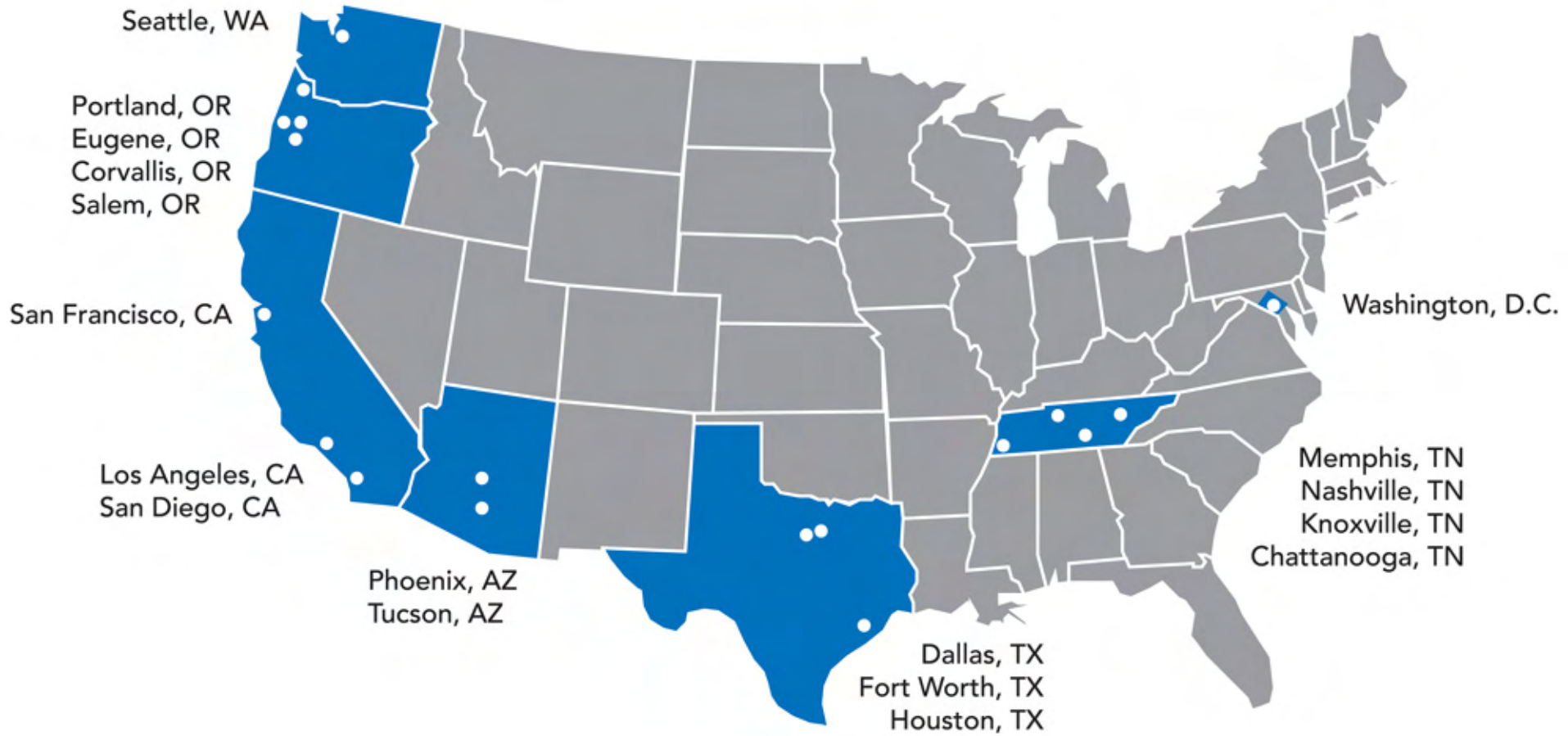
18 Major Cities



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50+ Project Partners

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EV Micro-Climates

Structured program to make regions “plug-in ready”

1)Community Planning

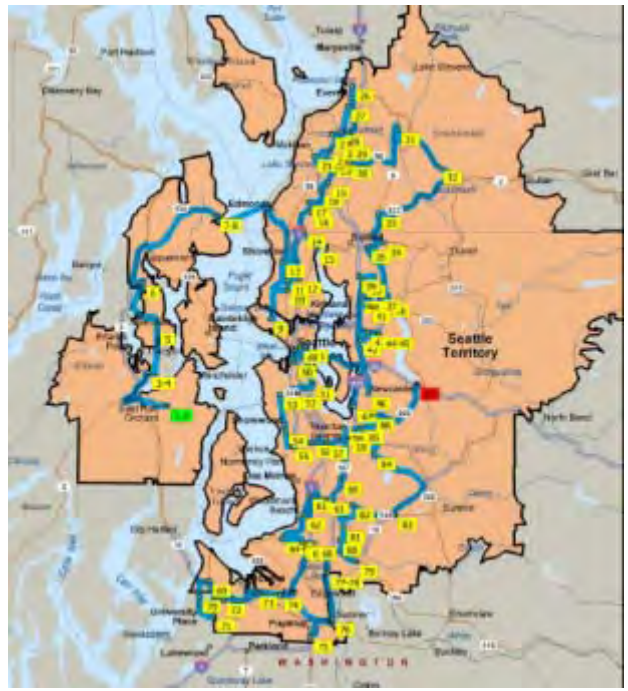
- Deployment Guidelines & Stakeholder Organization
- Long Range Plan (10 years)
- Micro-Climate Plan (1-3 years)

2) Road Mapping

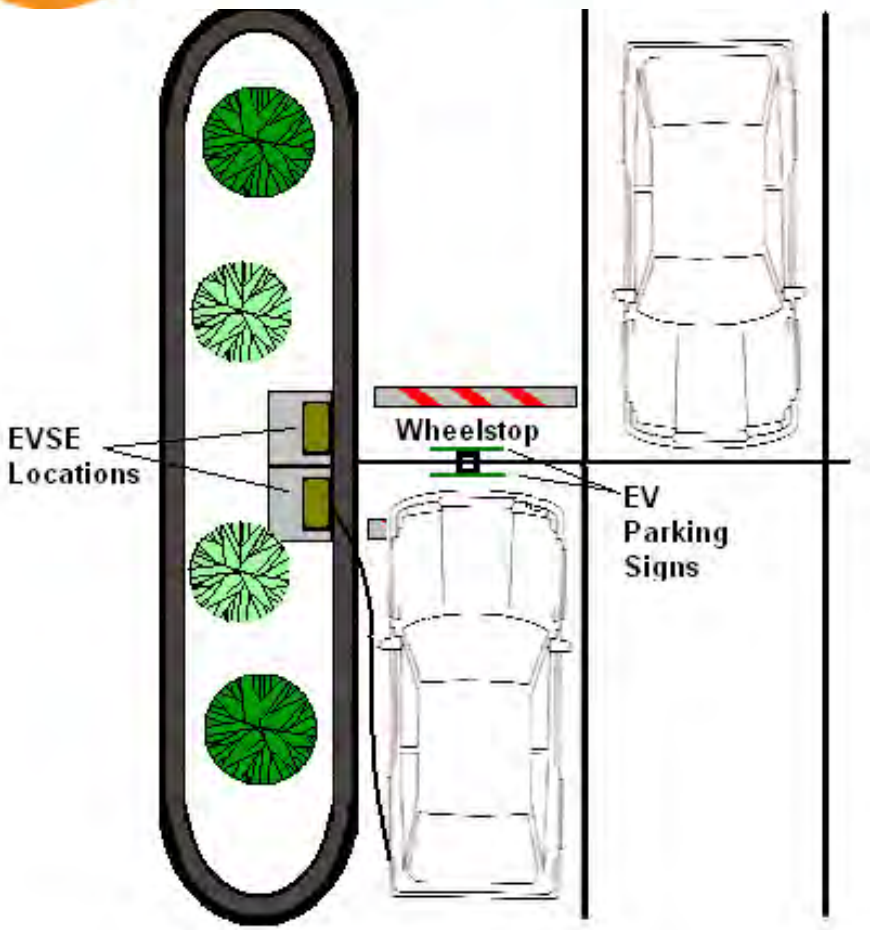
- 1-3 year action plan
- Systematic GIS mapping

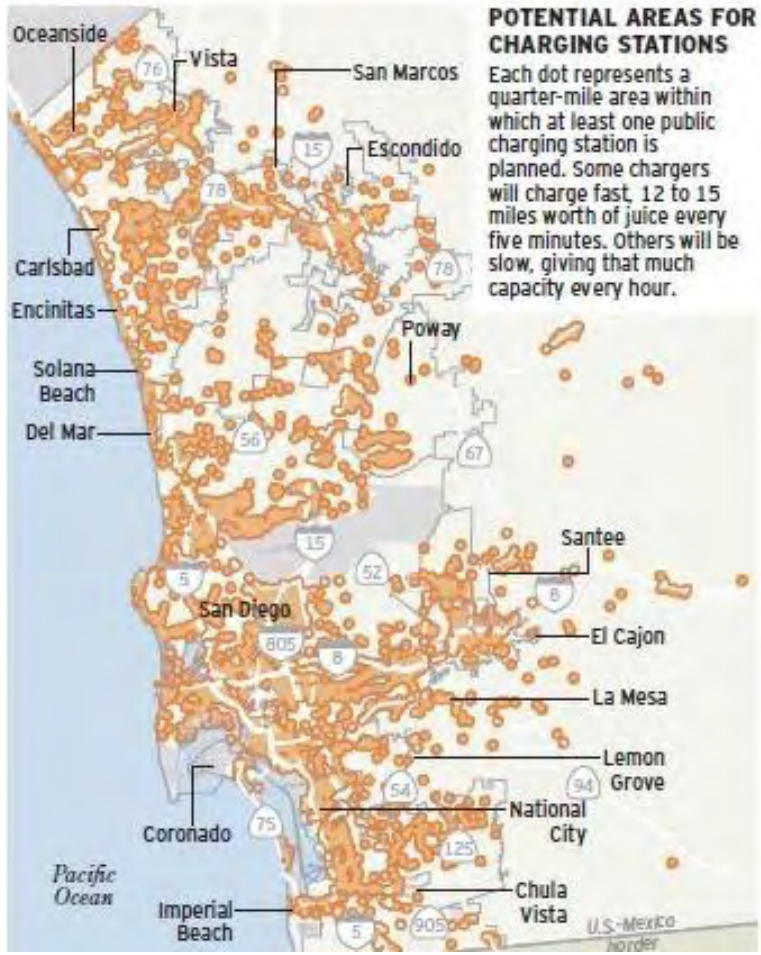
3) Infrastructure Implementation

- Deployment of EV charge stations
- Targets scalable national accounts
- Implement sustainable business models



EV Micro-Climates©





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- Level 2 – SAE J1772™ Compliant
- U.L. and U.Lc Certified to UL2594
- Interactive color touch screen
- Real time communications
  - LAN
  - CDMA
  - Wireless 802.11
  - AMI (smart meter capable)
- Certified Electric Meter
- Programmable charge time
- Simplifies installation
- Smart phone & internet controls
- ADA compliant
- Designed for 10,000+ cycles

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- Level 2 - SAE J1772™ Compliant
- Undergoing UL 2594
- RFID Access Control
- Color touch screen
- Real time communications
  - LAN, CDMA, 802.11, AMI
- Certified electric meter
- Reservation capable
- Smart phone & web controls
- Host web portal
- 360º beacon light
- ADA compliant
- Cord management
- Specified advertising space


BEST BUY


FINEST
COFFEE

blink

DC Fast Charger

(3 phase 480 VAC)


blink
clean.
blink


blink
clean.
blink
blink

blink

- 60kW Max Output Power
- 42” Color Monitor (optional)
- Color touch screen
- Dual port dispenser design
- Real time communications
  - LAN, CDMA, 802.11, AMI
- Certified utility meter
- CHAdeMo Connectors
- Reservation capable
- Smart phone & web controls
- Host web portal
- ADA compliant
- Specified advertising space


shop
unleaded 1029
diesel 1049
autoGas 59.9
electric 9.49
electric
clean.
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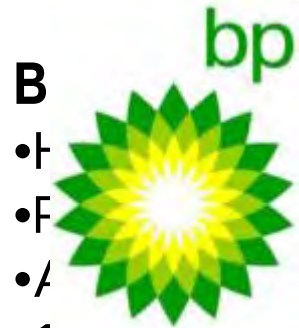
National Accounts

STRATEGY: *Target leaders in various retail markets to host & retail EVSE to establish a scalable national solution.*



B

- H DC Fast Chargers at 45 BP/ARCO sites
- F ets: AZ, CA, OR, TN & WA
- A e selection & dispenser design
- 1st EV partnership with international oil company.

Best Buy

- mmercial L2 at 12 locations.
- f a total of 36 charging stations
- o expand program

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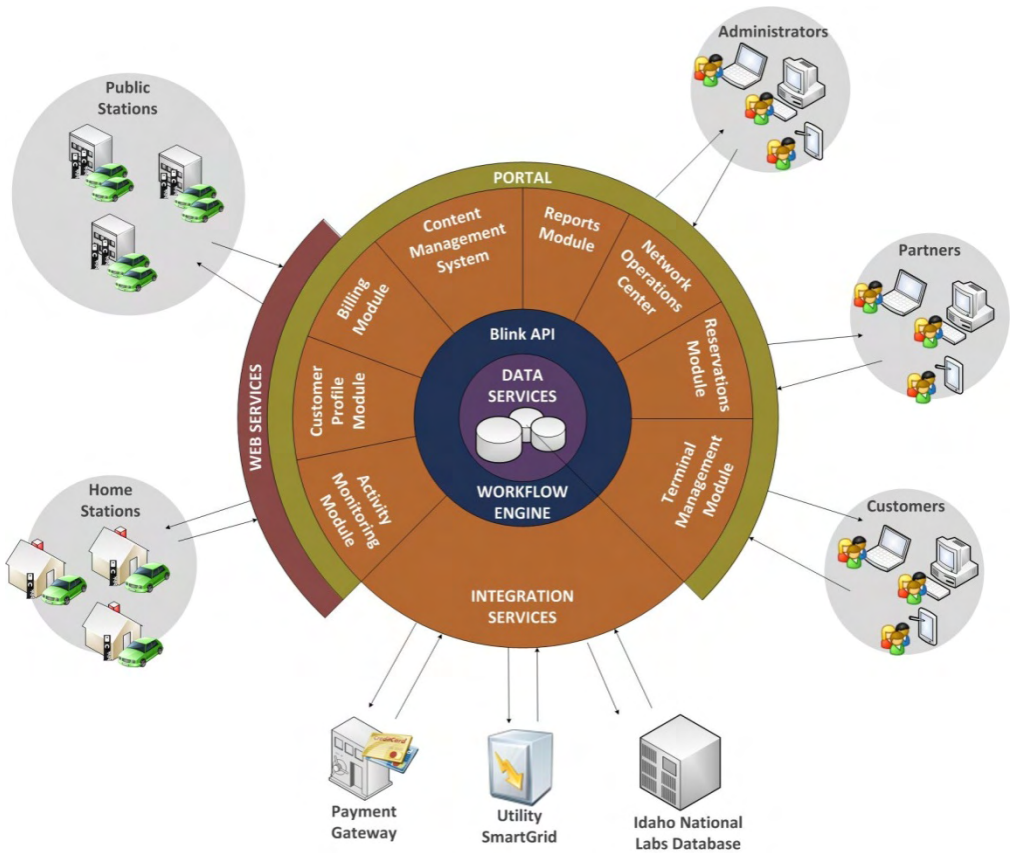
Back Office System

BLINK BACK OFFICE SUCCESS CRITERIA



- Fast and efficient to find information
- Wealth of data and resources
- Positive user experience
- Targeting information to the user profile
- Blink Back Office will set the bar and differentiate from the competition
- Potential for worldwide marketability
- Flexibility in where and how the product is hosted
- Not encumbered with expensive and restrictive commercial licenses

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Back Office System

BLINK BACK OFFICE AUDIENCE

Public User

This is the anonymous user. Most likely they will be at the site to get information about Blink. They can access the project information pages and the charger locator.

Residential Customer

A residential customer has access to a wealth of information and services by logging into the system. They can also manage their charger online.

Commercial Customer

The commercial customer will be able to see an aggregated view of their charging stations to monitor activity.

Advertiser / Partner

Advertisers and partners will be able to get metrics and reports for their data through the dashboard interface.

Administrator

There is a set of tools for managing data on the system for the administrator. These tools are designed to be efficient and powerful.

ECOTality Management

Management will have access to an array of reports in the dashboard to monitor the performance and activity of the enterprise.

Customer Service

Customer service users will be able to access and manage the knowledgebase, as well as manage user accounts.

Network Operations

Network operations will be able to manage the website and view the status of the servers and database.

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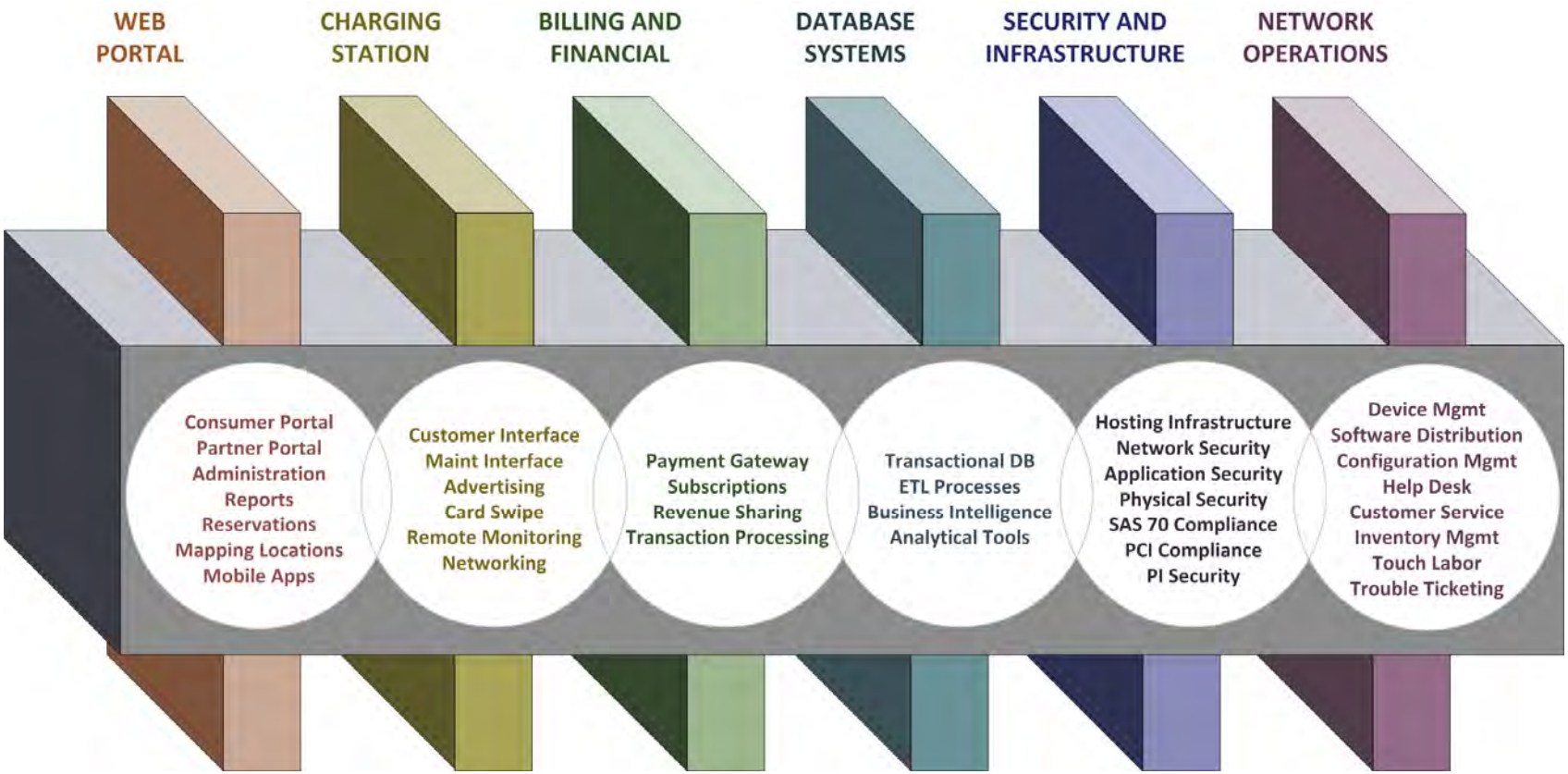
Back Office System

BUSINESS FUNCTIONAL REQUIREMENTS



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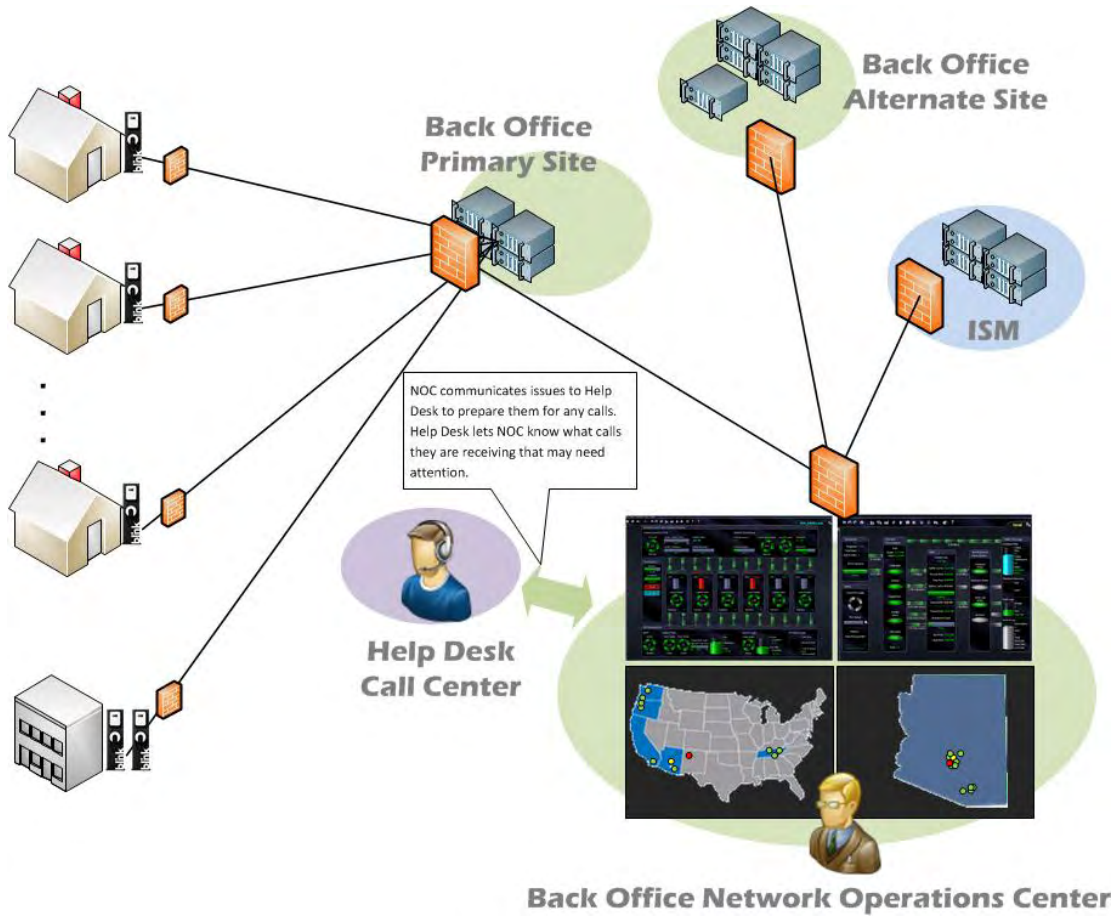
Back Office System

NETWORK OPERATIONS CENTER



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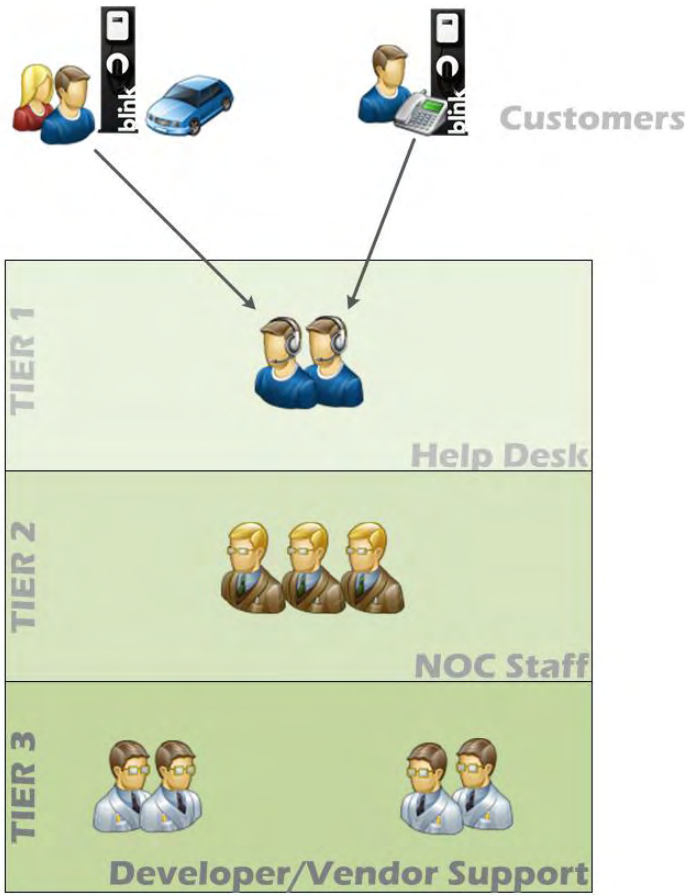
Back Office System

THREE TIER SUPPORT SYSTEM



- Tier 1
  - Call center staffed Help Desk
  - Provided with scripts for most frequently asked questions
  - Provide basic technical troubleshooting
  - Captures information about each trouble call in a ticket
- Tier 2
  - Network Operations Center (NOC) staff
  - Technically knowledgeable of Back Office infrastructure
  - Provide more advanced troubleshooting
- Tier 3
  - The most knowledgeable staff
  - Expert depth of knowledge for various systems and tools
  - Able to resolve issues or enter as bugs

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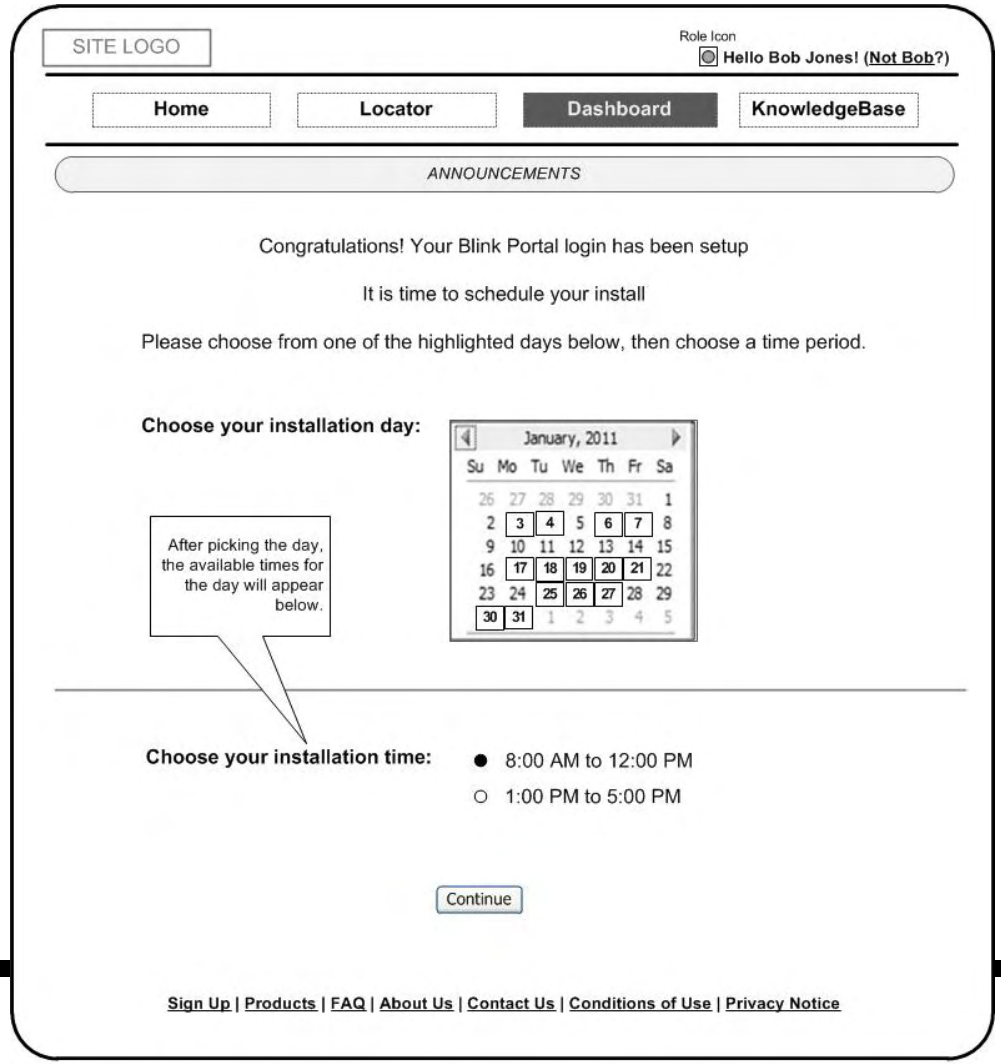
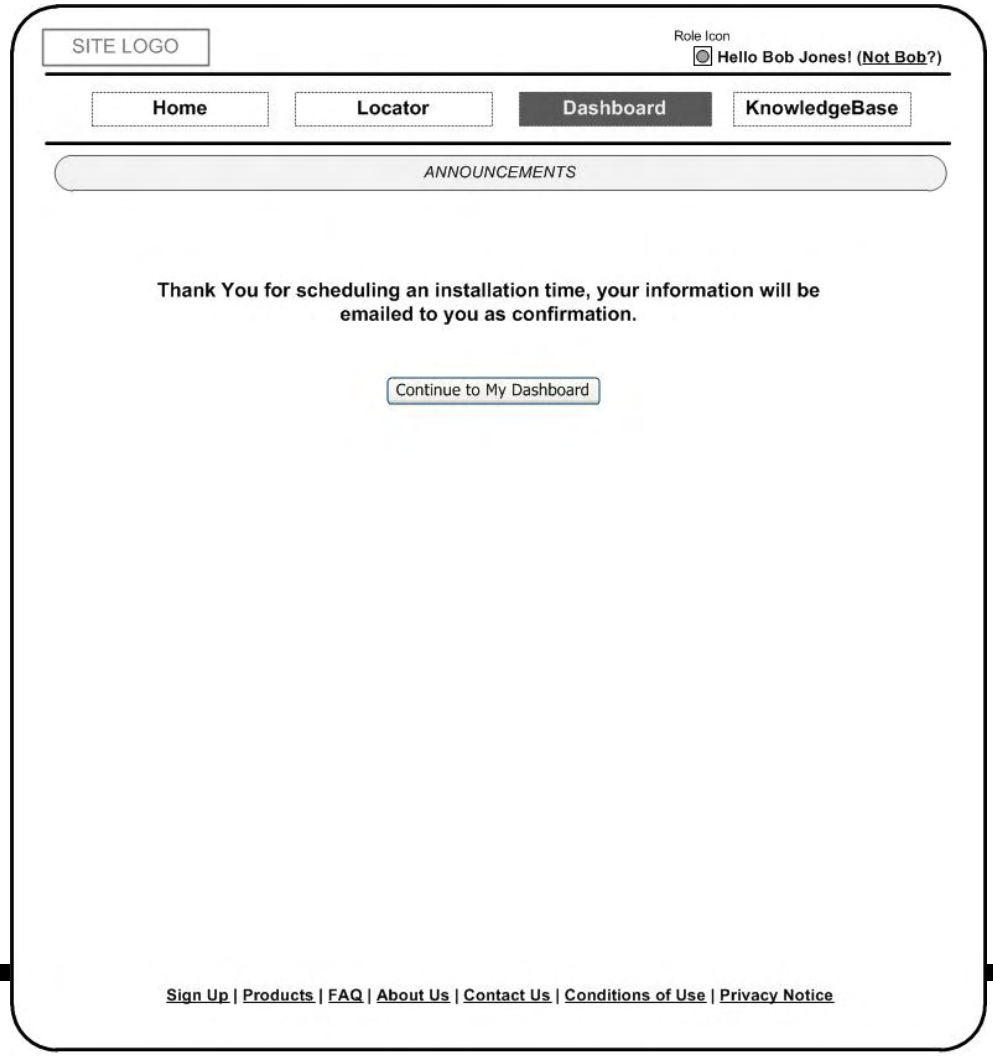
BLINK BACK OFFICE – SCHEDULE INSTALLATION



BLINK BACK OFFICE – SCHEDULING SUCCESS



Utility Smart Grid Demonstration

- Evaluation of EV Rates
- Demand Response
- Control Strategies
- Energy Storage
- Integration with HEC

Contact Info

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Underwriters Laboratories: Electric Vehicle and Infrastructure Installation Training Programs

March 2011

UL EVI Installation Training Programs: Overview

1. The programs were developed in collaboration with participants from the utility industry, infrastructure equipment industry, inspectors and installers during the summer of 2010

2. The programs include training for various stakeholders who will be involved in the design, construction, installation and inspection of electric vehicle charging equipment.

3. These programs have been developed with a training module as well as a testing component which will allow for participants to demonstrate their understanding of the relevant National Electric Code (NEC) articles, the various installation requirements, the UL electric vehicle safety standards and the emerging electric vehicle infrastructure technology.

UL EVI Installation Training Programs: Installer Course

1. UL's Electric Vehicle Infrastructure Installer program was launched in December 2010. The link to the course can be found at http://www.uluniversity.us/catalog/display.resource.aspx?resourceid=303396.

2. This is an on-line certification training course which allows for electricians and other qualified professionals to demonstrate their knowledge of the relevant National Electric Code (NEC) articles, the various installation requirements, the UL electric vehicle safety standards and the emerging electric vehicle infrastructure technology in order to obtain certification through passing the on-line exam. Credential records will be available for verification purposes through UL's electronic database available on-line for public use.

3. UL is currently working on a hands on training program whereby electricians and other qualified professionals will be able to receive training in an classroom type setting.

UL EVI Installation Training Programs: Inspector Course

1. UL's Electric Vehicle Infrastructure Inspector program will be launched in the 2nd Quarter of 2011.

2. This will be an on-line training course which will allow for Authorities Having Jurisdiction (AHJ), city inspectors and other city and municipality officials to grow their knowledge of the relevant National Electric Code (NEC) articles, the various installation requirements, the UL electric vehicle safety standards and marks and the emerging electric vehicle infrastructure technology in order to properly assess the installation of the equipment.

3. In addition to the on-line training course, UL is currently working on a hands on training program whereby Authorities Having Jurisdiction (AHJ), city inspectors and other city and municipality officials will be able to receive training in an classroom type setting.

UL EVI Installation Training Programs: Designer Course

1. UL's Electric Vehicle Infrastructure Designer course will be launched in the 3rd Quarter of 2011.

2. This will be an on-line training course which will allow various stakeholders (Contractors, Engineers, Cities/Municipalities, Utilities, Property Owners, etc.) to expand their knowledge and skills in order to advise their clients on electric vehicle charging systems technology and design charging solutions according to the NEC, UL electric vehicle safety standards and other local requirements.

3. UL anticipates that this course will be a supplement to the installer course previously launched and is designed for public infrastructure and multi-unit deployments rather than single private infrastructure installments.

UL EVI Installation Training Programs: International Courses

1. UL's anticipates developing courses for other countries patterned around the 3 courses indicated on the previous slides with country and in some cases province/city derivations.

2. UL anticipates launching the first international training course by the 3rd Quarter of 2011.

Thank you!

Please feel free to reach out to me with any questions:

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(C) (312) 391 6575

National Electric Transportation Infrastructure Working Council – March 2, 2011
Publicly Available Infrastructure Siting Process

Making History

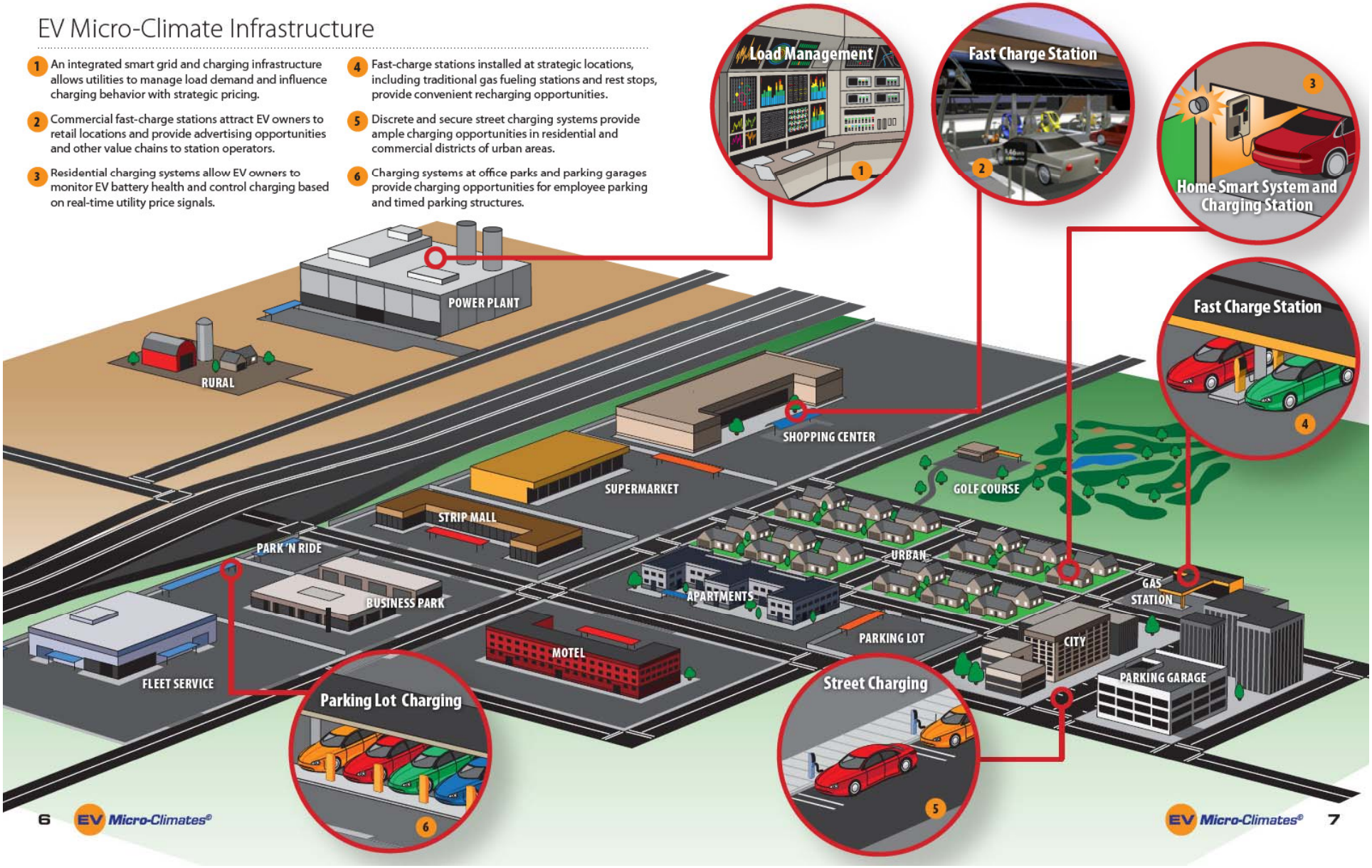
- **ECOtality NA: Project Manager for The EV Project**
  - January 2010 – December 2012
  - **Planning 2010; Implementation 2011**; Study 2011/2012
  - Will support the 2011 launch of Battery EVs
    - GM Volt
    - Nissan Leaf
    - Mitsubishi i-Miev

  - Making cities and regions plug-in ready
  - Providing charging to allow EV drivers to extend their daily mileage range
  - Purpose to build and then study EV infrastructure use in distinct regions

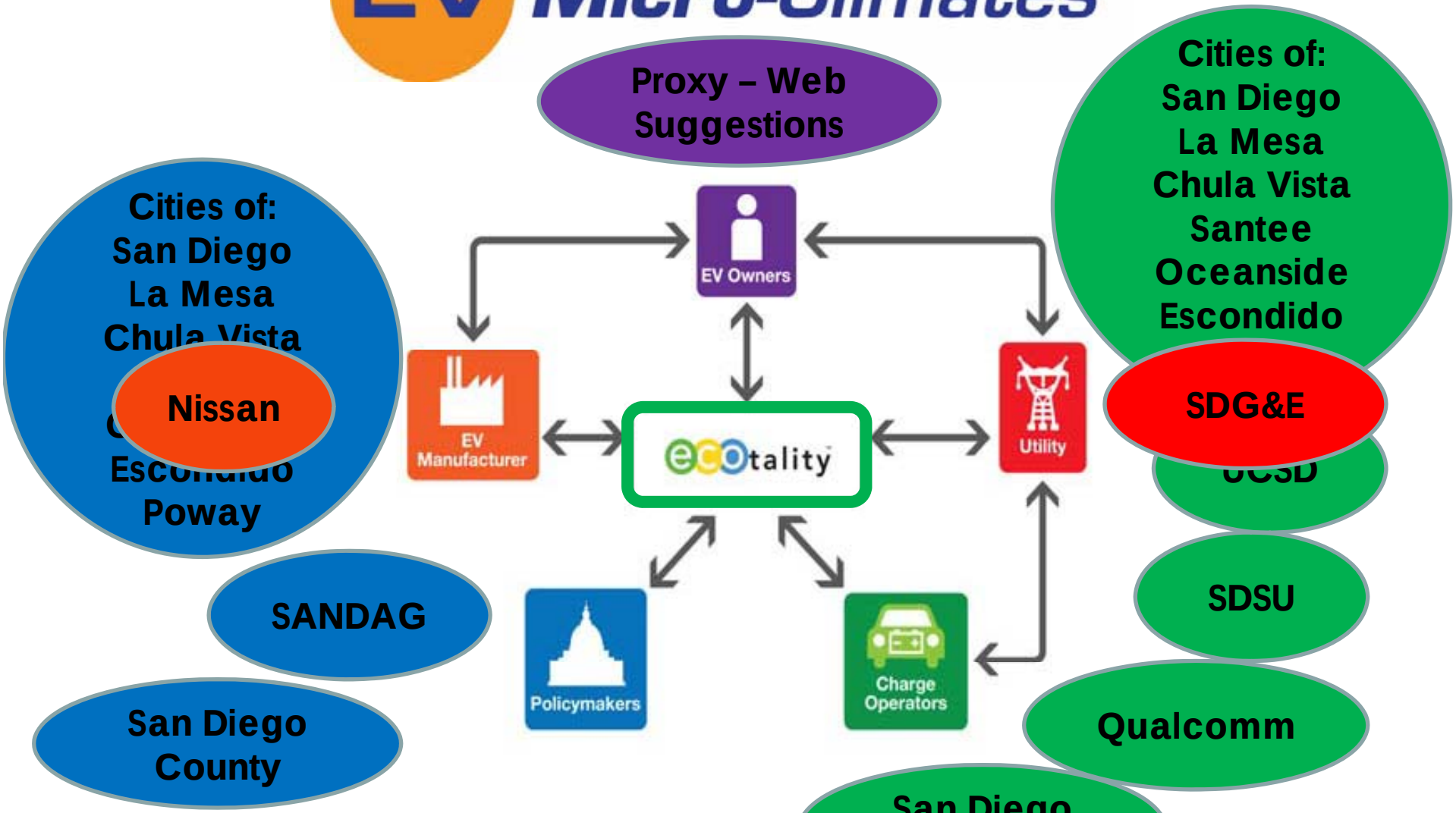
For more info on The EV Project, please visit www.theEVproject.com

EV Micro-Climate Infrastructure

1. An integrated smart grid and charging infrastructure allows utilities to manage load demand and influence charging behavior with strategic pricing.
2. Commercial fast-charge stations attract EV owners to retail locations and provide advertising opportunities and other value chains to station operators.
3. Residential charging systems allow EV owners to monitor EV battery health and control charging based on real-time utility price signals.
4. Fast-charge stations installed at strategic locations, including traditional gas fueling stations and rest stops, provide convenient recharging opportunities.
5. Discrete and secure street charging systems provide ample charging opportunities in residential and commercial districts of urban areas.
6. Charging systems at office parks and parking garages provide charging opportunities for employee parking and timed parking structures.



EV Micro-Climates©



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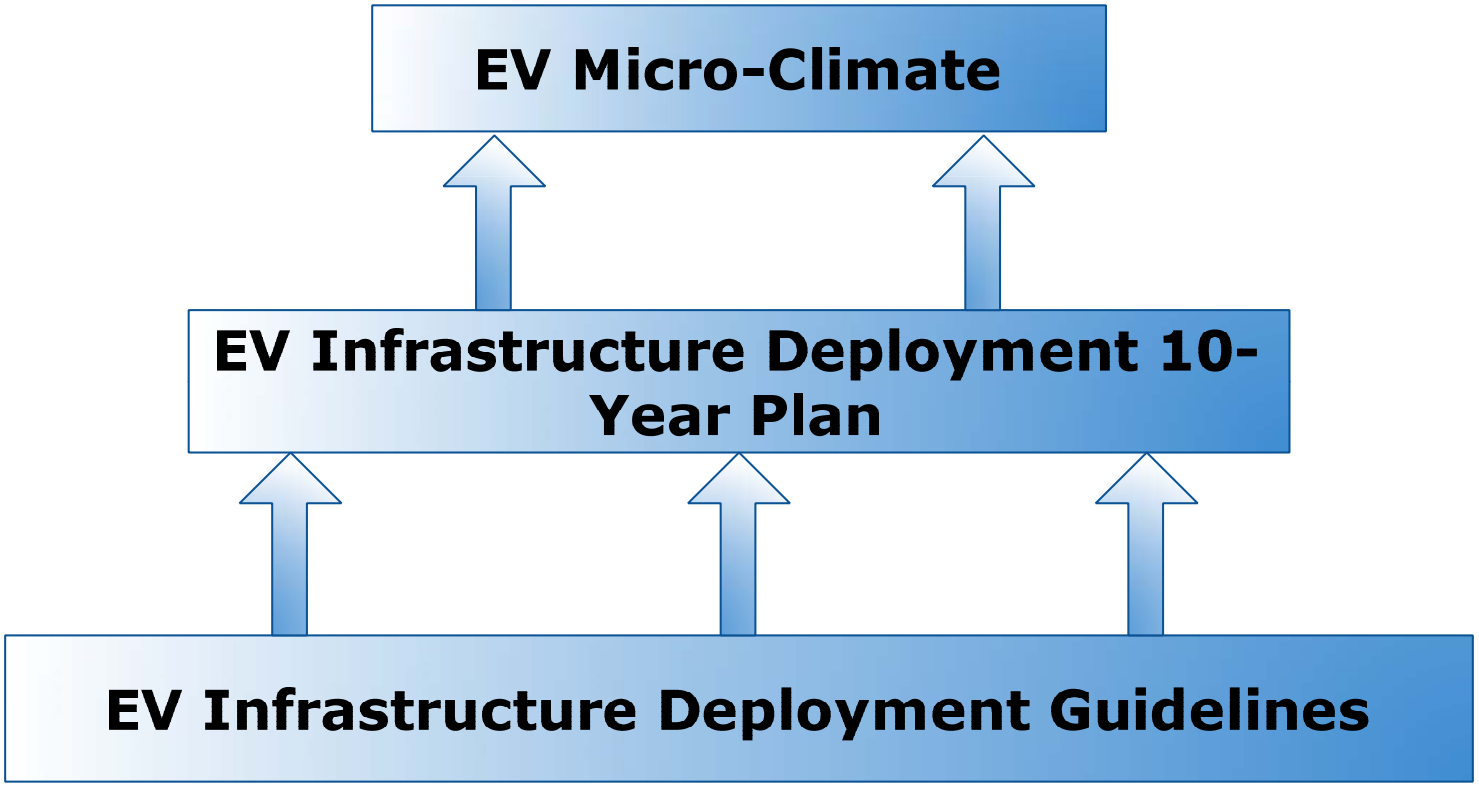

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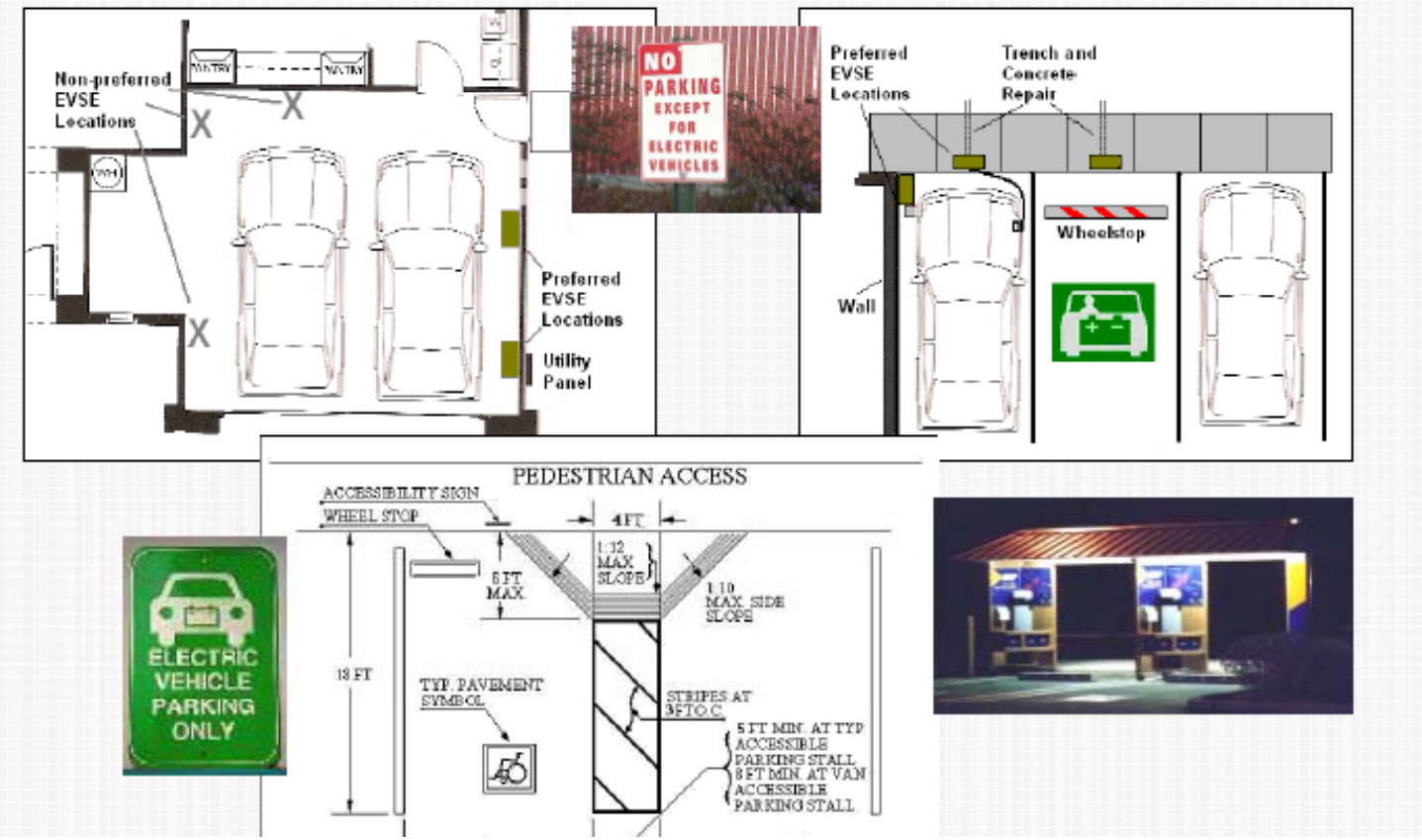
Deployment Guidelines



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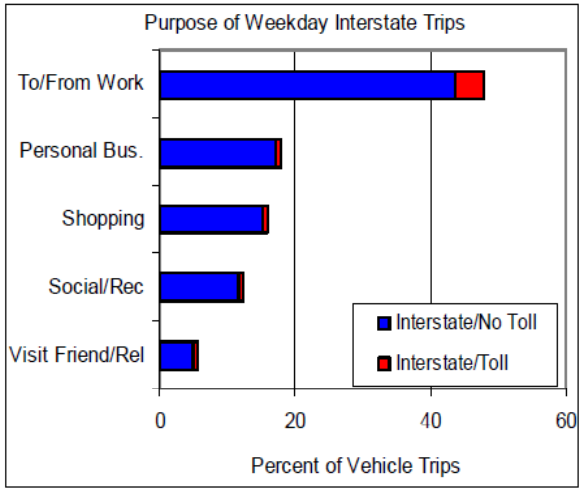
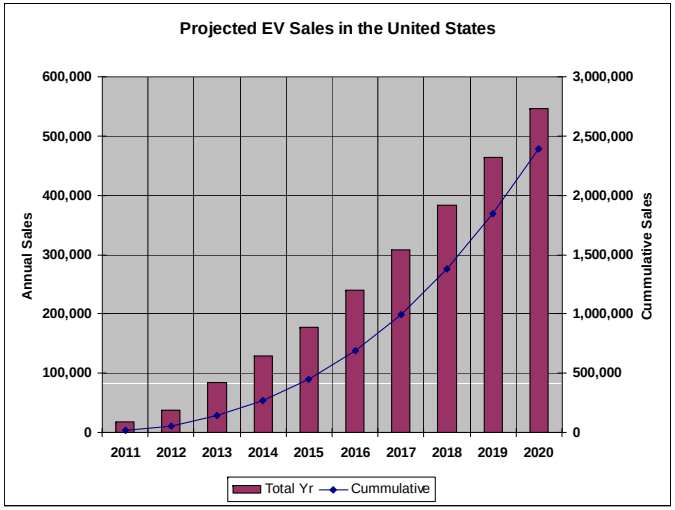
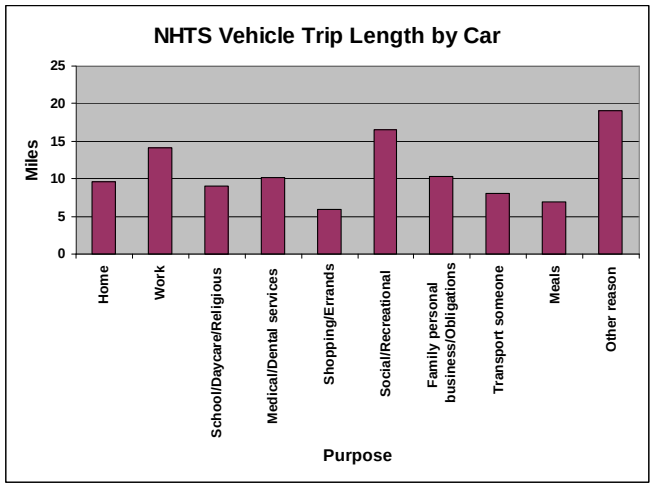
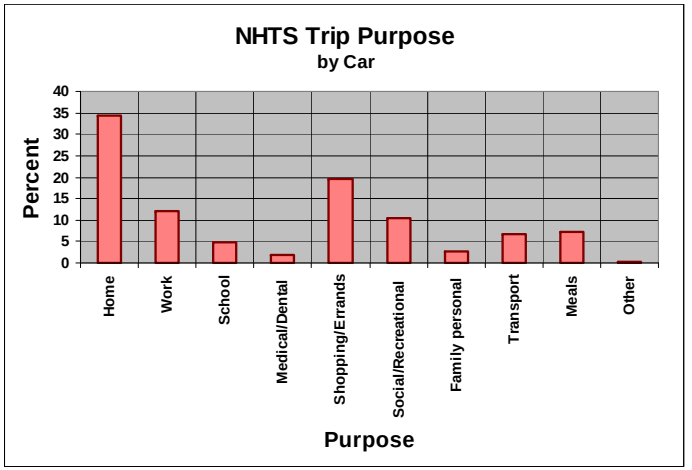
Long-Range Plan









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Long-Range Plan

EV Configuration	Battery Size (kWh)	Circuit Size and Power in kW Delivered to Battery				
		120 VAC, 15 amp	120 VAC, 20 amp	240 VAC, 20 amp	240 VAC, 40 amp	480 VAC, 85 amp
		1.2 kW	1.6 kW	3.2 kW	6.5 kW	60kW
PHEV-10	4	3 h 20 m	2 h 30 m	1 h 15 m	35 m	n/a
PHEV-20	8	6 h 40 m	5 h	2 h 30 m	1 h 15 m	n/a
PHEV-40	16	13 h 20 m	10 h	5 h	2 h 30 m	16 m
BEV	24	20 h	15 h	7 h 30 m	3 h 40 m	24 m
BEV	35	29 h 10 m	21 h 50 m	10 h 40 m	5 h 20 m	35 m
PHEV Bus	50	n/a	n/a	n/a	7 h 40 m	50 m

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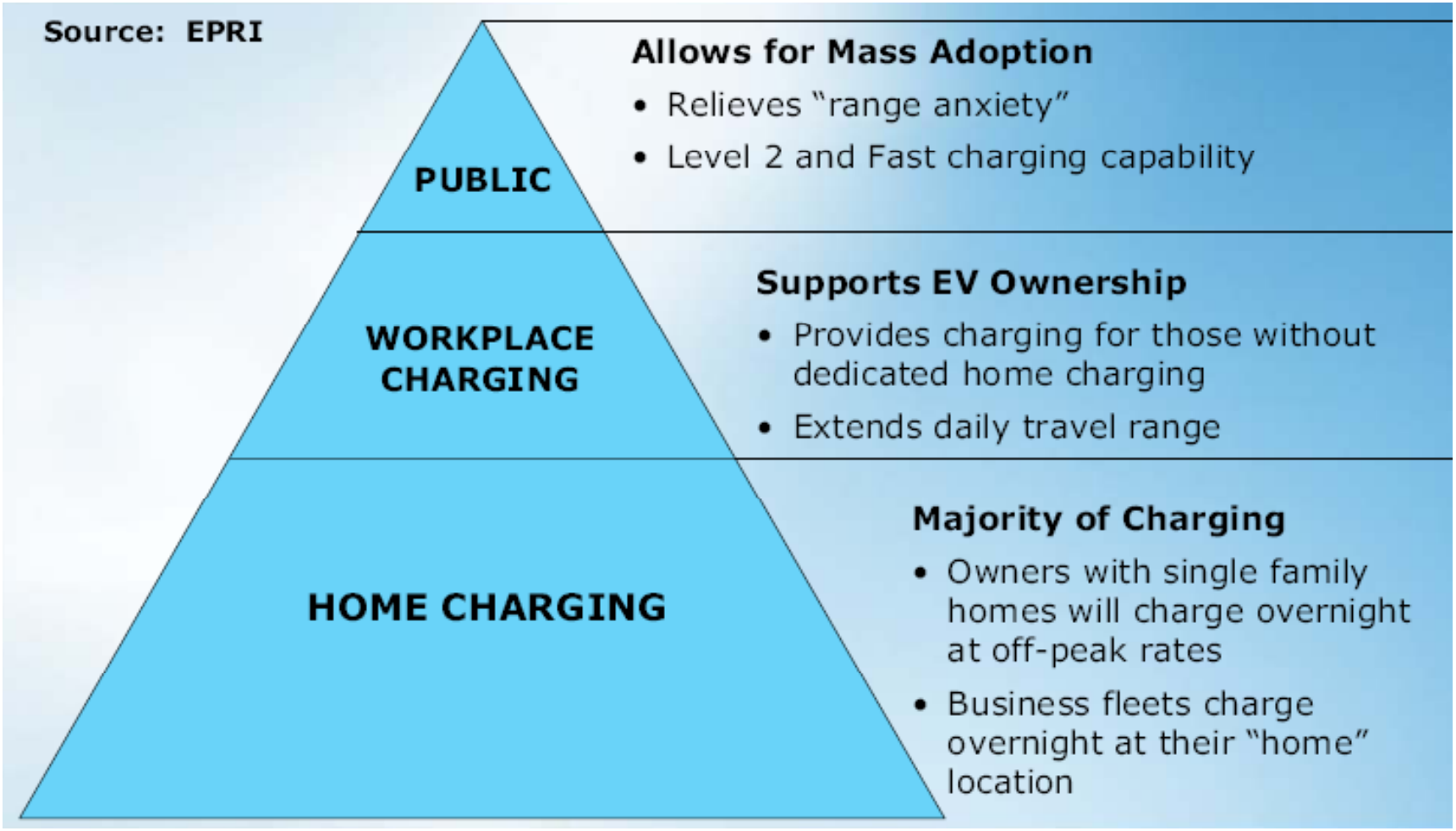

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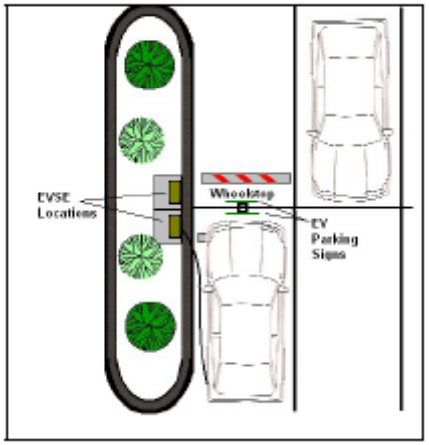
Micro-Climate

- **Goals / Objectives**
  - **(San Diego) Primary: Maximize data gathering opportunities through ensuring widespread public availability of EVSE (meeting EVP goals)**
  - **(San Diego) Secondary: Lay foundation for long-range plan and widespread EV use in San Diego (meeting needs beyond EVP)**



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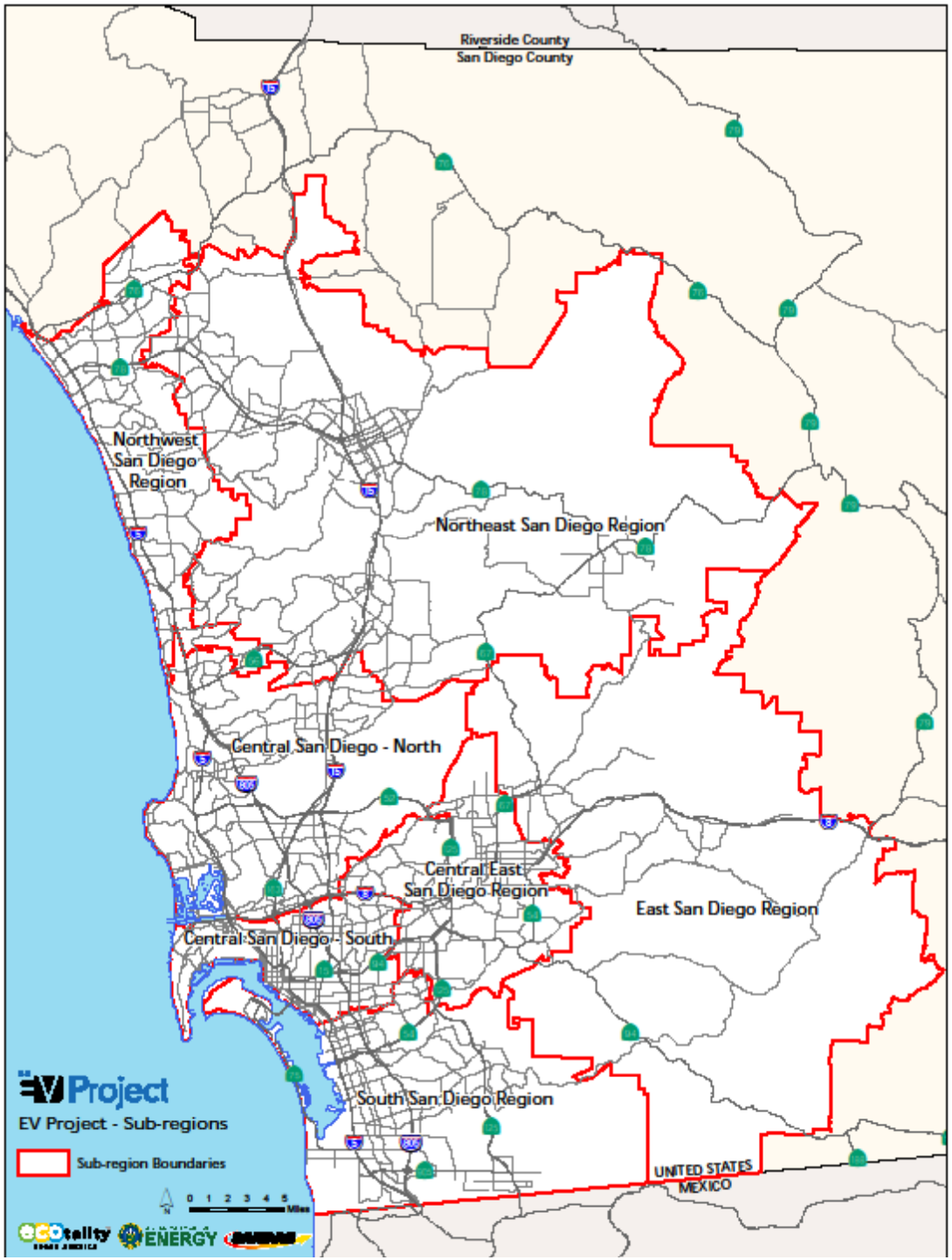
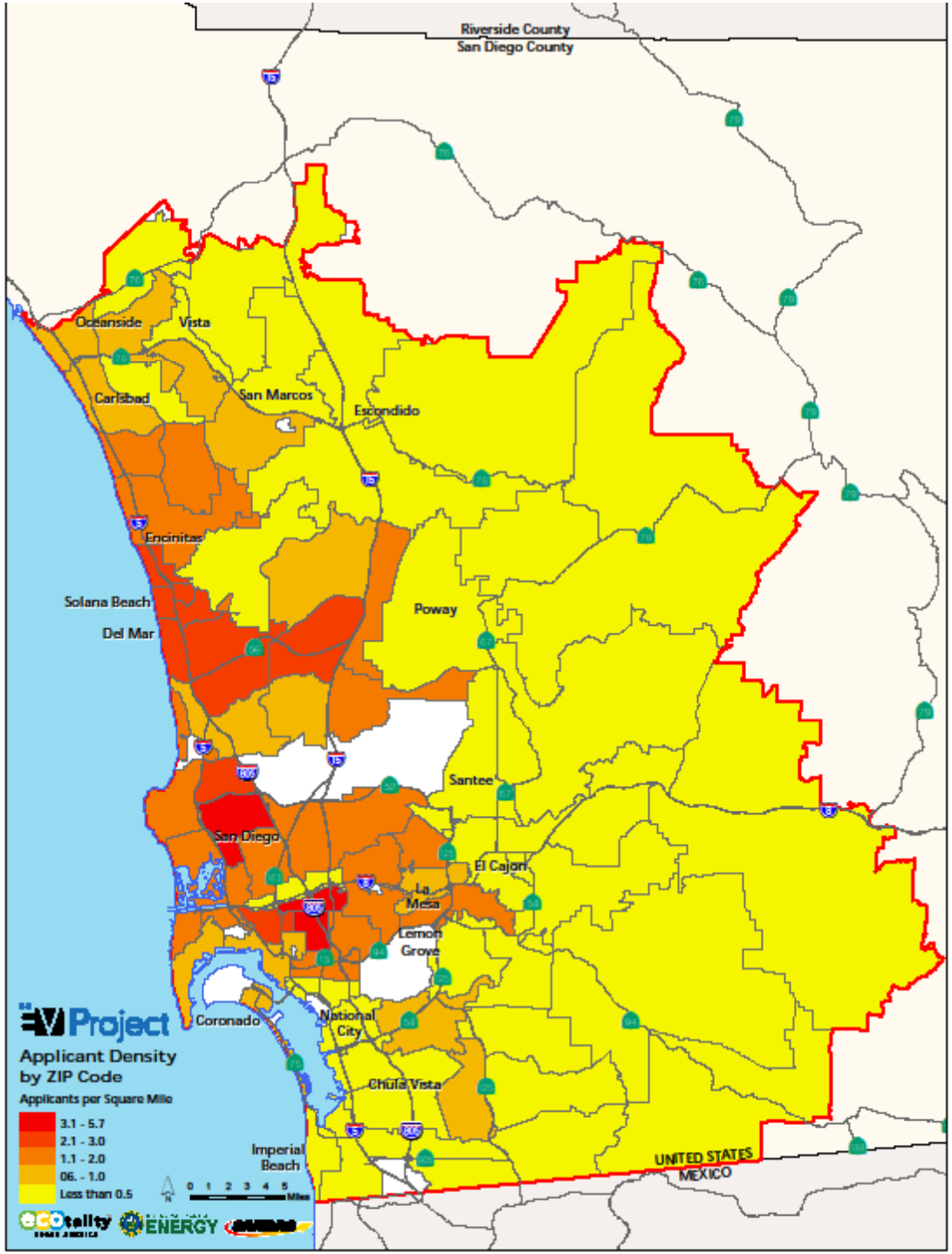

Riverside County
San Diego County
Northwest San Diego Region
Northeast San Diego Region
Central San Diego - North
Central East San Diego Region
East San Diego Region
Central San Diego - South
South San Diego Region
UNITED STATES
MEXICO
EV Project
EV Project - Sub-regions
Sub-region Boundaries
0 1 2 3 4 5
Miles
ECOtality
ENERGY


Riverside County
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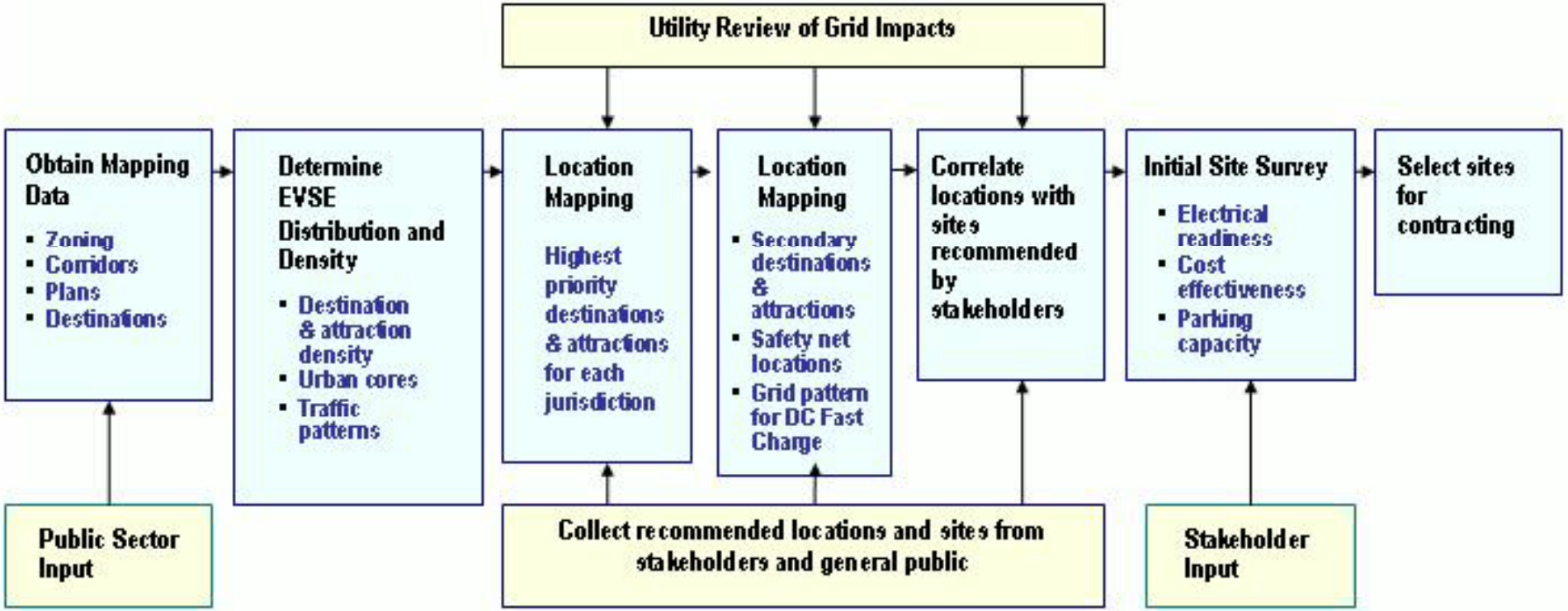
Del Mar
Poway
Santee
San Diego
El Cajon
La Mesa
Lemon Grove
Coronado
National City
Chula Vista
Imperial Beach
UNITED STATES
MEXICO
EV Project
Applicant Density by ZIP Code
Applicants per Square Mile
3.1 - 5.7
2.1 - 3.0
1.1 - 2.0
06. - 1.0
Less than 0.5
0 1 2 3 4 5
Miles
ECOtality
ENERGY

Location Process for EVSE Installation in San Diego Area



Definitions

Destination/attraction: a place where people regularly gather or visit and vehicles will be parked for about 2 hours

Location: where EVSE is situated within a ¼-mile diameter circle

Site: an EVSE installation site defined by address or tax lot

Micro-Climate

- **Research to date**
  - *Characterizing Consumer's Interest in and Infrastructure Expectations for Electric Vehicles: Research Design and Survey Results*. EPRI, Palo Alto, CA and Southern California Edison, Rosemead, CA: 2010. 1021285

    Nearly all would charge at home
    Strong interest in public charging stations…work, gas stations, shopping centers/malls
    PHEV interest highest among hybrid owners
    Public fast-charging may have strong influence on PHEV adoption
    First wave PHEVs may be judged on how little inconvenience they cause

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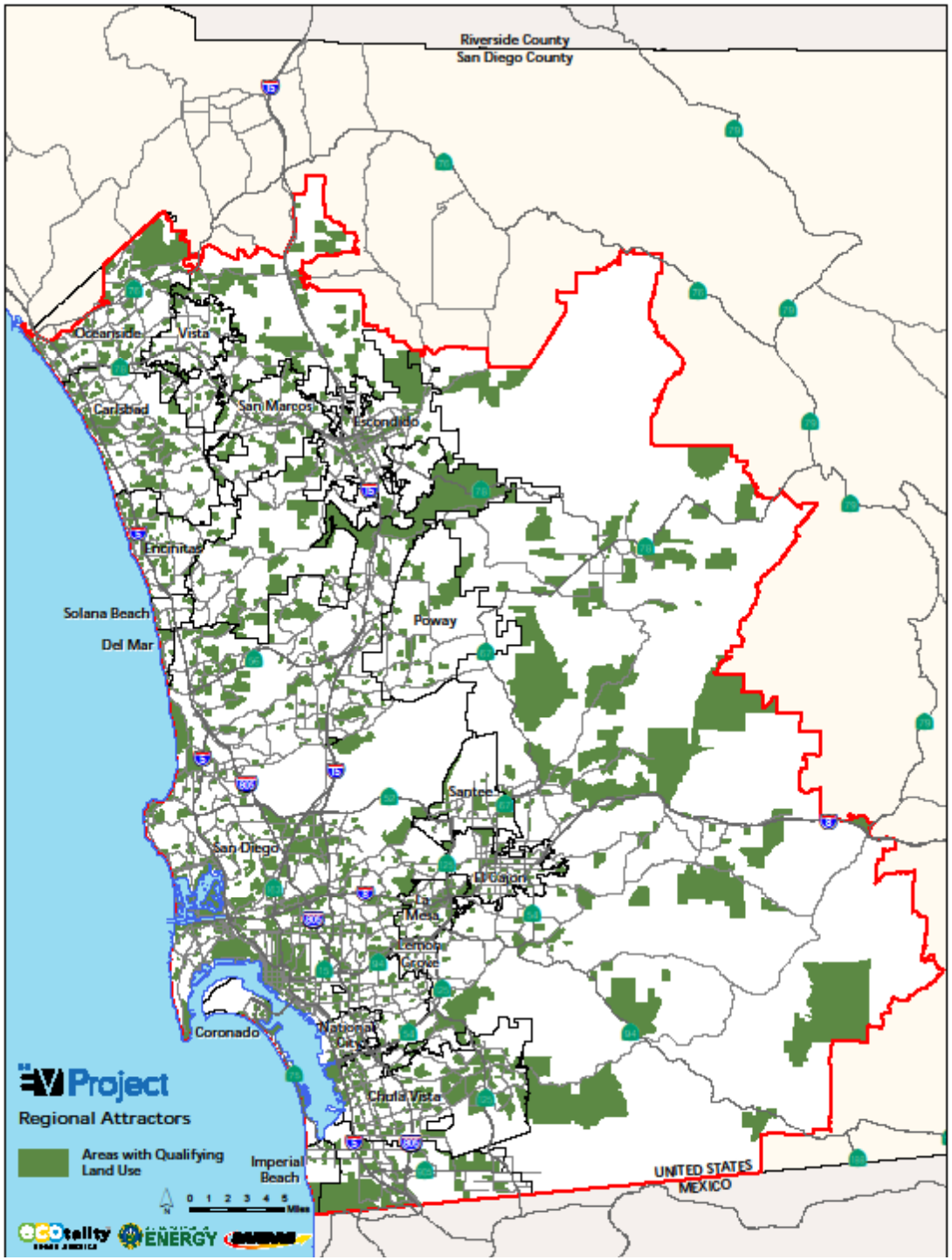
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El Cajon
La Mesa
Lemon Grove
National City
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MEXICO
Project
Regional Attractors
Areas with Qualifying Land Use
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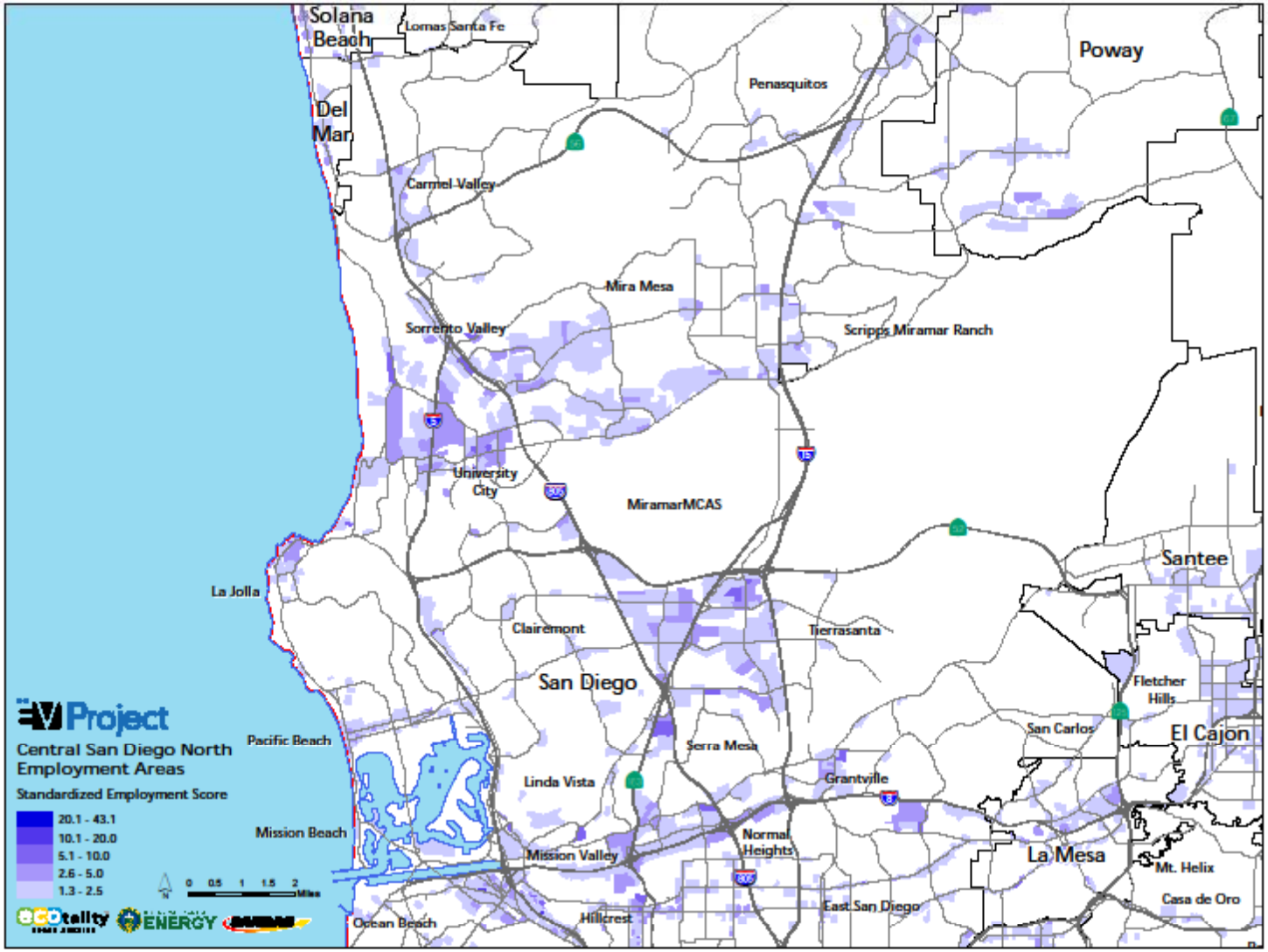
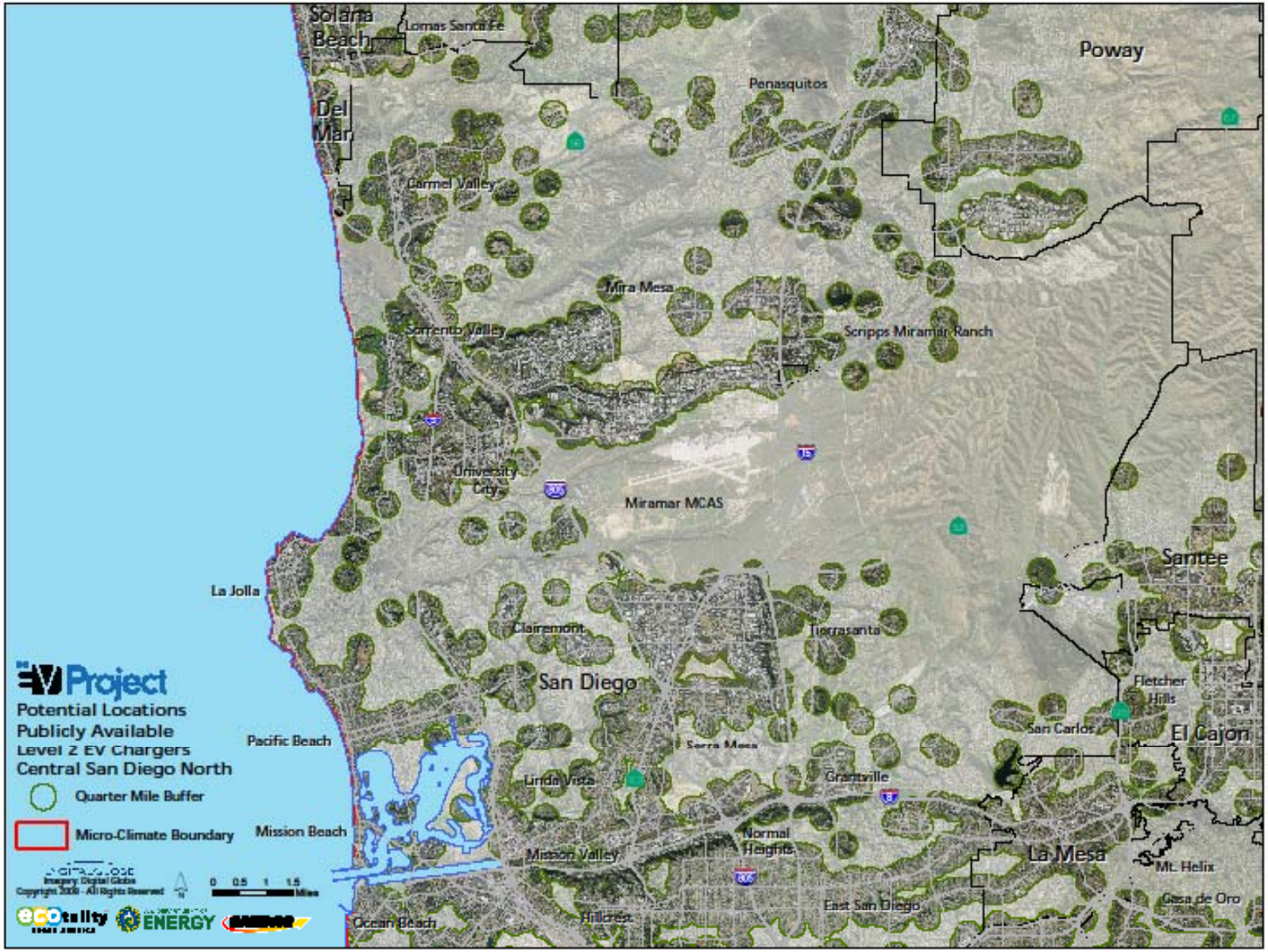
Miles
ENERGY


Solana Beach
Lomas Santa Fe
Del Mar
Penasquitos
Poway
Carmel Valley
Mira Mesa
Sorrento Valley
Scripps Miramar Ranch
University City
MiramarMCAS
Santee
La Jolla
Clairemont
Tierrasanta
San Diego
Fletcher Hills
San Carlos
El Cajon
Pacific Beach
Serra Mesa
Linda Vista
Grantville
Mission Beach
Normal Heights
Mission Valley
La Mesa
Mt. Helix
Casa de Oro
East San Diego
Hillcrest
Ocean Beach
EV Project
Central San Diego North Employment Areas
Standardized Employment Score
20.1 - 43.1
10.1 - 20.0
5.1 - 10.0
2.6 - 5.0
1.3 - 2.5
0 0.5 1 1.5 2 Miles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University City
Miramar MCAS
Santee
La Jolla
Clairemont
Tierrasanta
San Diego
Fletcher Hills
San Carlos
El Cajon
Pacific Beach
Serra Mesa
Linda Vista
Grantville
Mission Beach
Normal Heights
Mission Valley
La Mesa
Mt. Helix
Casa de Oro
East San Diego
Hillcrest
Ocean Beach
EV Project
Potential Locations
Publicly Available
Level 2 EV Chargers
Central San Diego North
Quarter Mile Buffer
Micro-Climate Boundary
0 0.5 1 1.5 Miles
ECOtality
ENERGY


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clean.
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ahoskinson@ecotality.com

619-559-2118

www.ECOtality.com ● www.theEVproject.com ● www.blinknetwork.com

blink

A Charger on Every Corner?

The Parking Industry's Role in EV Infrastructure

Forest Williams

VP Sales and New Business Development
Liberty PlugIns, Inc.

LIBERTY PLUGINS INC
Electric Vehicle Charging Solutions for the Parking Industry

Charging IS Parking

- The Home Filling Station reduces the need for a ubiquitous EV charging infrastructure.
- Most public EV charging will be done in off street parking lots and structures.
- Pay By Phone Parking and Charging will become a preferred billing option.
- Public/Private FastDC networks needed

The Home Filling Station

- **EVs start everyday with a full tank**
  - **Recharging needs are dictated by destination and distance.**
    - Local businesses are in the "home zone"
    - EV owners will not need significant local charging infrastructure
    - Trips of +30mi will need EVSE at destination

Who Drives 30 miles to go to the Grocery Store?

Location, Location, Location

- **Charging time determines location.**
  - L2 charging periods (2hrs – 6hrs) will dictate off-street locations (i.e. parking lots).
  - FastDC charging will be the primary on-street solution.
  - Commercial parking lots will eventually offer both.

Charging IS Parking

- **Off street parking lots will be EV charging locations of choice.**
  - Office Buildings, Hospitals, Airports, Shopping and Dining.
  - Train/Bus/Ride Share lots.
  - Usually 20+ miles away from suburbs
  - Parking Payment Systems in place

The PARC Revolution

- **Parking Access and Revenue Control systems dominating the industry.**
  - Counters rising labor costs.
  - Increased revenue accuracy and accountability.
  - Advanced services (prepay, reservations, etc).

The PARC Revolution

- **Integrated EV Charging and PARC systems.**
  - Eliminates the need for billing and networking hardware in the EVSE
  - Charging revenues accounted on the existing revenue control system.
  - Lot owners do not want to share revenue

PARC Enabled EV Charging

Pedestal Charger

Wall Charger

Light Pole Charger

Parking Pay Systems

Like buying a car wash at a gas station

liberty enabled™

PARC Enabled EV Charging

- The customer receives an authorization code from Pay Station or Cell Phone.
- The code is entered into the keypad located on the EVSE
- The charger is unlocked and the charging session commences

Pay By Phone Parking and Charging

- Customer texts the charger ID and receives an authorization code.
- Provides no cost, non-proprietary billing system for EVSE owners.
- Permits sharing of EVSE between different organizations or fleets.

A Solution for MDUs

- Apartment and Condo dwellers (MDUs) will buy EVs
  - But no garage!!
- Property owners purchase EVSE with Synchronous Code secure access.
- Install EVSE in selected parking spaces and offer these to EV owning tenants.
- Issue access codes to tenants every month

Public/Private EV Charging

- Public FastDC charging is needed!
  - Accidents, Emergencies, unplanned route changes will require in-the-field quick charging.
- FastDC Charging is Expensive!
  - Hardware, Installation and Power Requirements

Synchronous Codes Facilitate Multi-Agency, Public/Private EVSE Networks.

- Drivers receive codes via cell phone
- Server tracks usage by agency
- Subsidy to lot owners?

The Role of Utilities

- Marketing/Sales
  - EVSE is not a “consumer” item.
  - Utilities own the customer base!
- Facilitator
  - A “neutral” third party for public and private EVSE efforts
- Legislative Advocate
  - Work with Government agencies to smooth the blending of the transportation and power grids.

Non Network Secure Access EVSE

- No networking hardware or access fees.

  = Lower cost of operation.
- Authorization Codes delivered by phone or assigned to key personnel.

  = Flexible implementation.
- Less complicated hardware means higher reliability.

  =Lower Total Cost of Ownership.

Non Network Secure EV Charging

Contact Us!

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LIBERTY PLUGINS INC
Electric Vehicle Charging Solutions for the Parking Industry

SAE J1772™ Update for IWC PHEV WG

Gery Kissel
SAE J1772™ Task Force Lead
March 2, 2011

Contents

- Charging Configurations and Ratings
- Document Status
  - Coupler Compatibility Testing
  - Revision Plan
- DC Fast Charge Standardization
  - DC Fast Charge Coupler Summary
  - Combo Coupler Design Status
    - IEC Proposal
    - Potential Combo Design Improvements
- Other Items
  - China
  - Korea
  - ACEA

SAE J1772™ Update for IWC PHEV WG

- Charging Configurations and Ratings

Proposed SAE Charging Configurations and Ratings Terminology

- AC L1: 120V AC single phase
  - Configuration current 12, 16 amp
  - Configuration power 1.44, 1.92kw
- AC L2: 240V AC single phase
  - Rated Current ≤ 80 amp
  - Rated Power ≤ 19.2kw
- AC L3:TBD
  - AC single or 3ϕ ?

- DC L1: 200 – 450V DC
  - Rated Current ≤ 80 amp
  - Rated Power ≤ 36kw
- DC L2: 200 – 450V DC
  - Rated Current ≤ 200 amp
  - Rated Power ≤ 90kw
- DC L3: TBD
  - 200 – 600V DC ?
  - Rated Current ≤ 400 amp?
  - Rated Power ≤ 240kw?

Voltages are nominal configuration operating voltages, not coupler rating.

Rated power is at nominal configuration operating voltage and coupler rated current.

SAE J1772™ Update for IWC PHEV WG

- Document Status

Coupler Compatibility Testing Background

- Testing to be conducted by the manufacturers
- Coupler samples will be exchanged
- Participating manufacturers will provide inlets
- Inlets to be equipped with thermocouples for temperature measurements during electrical tests
- Test criteria developed and agreed to
- Results to be consolidate and summary presented to SAE Task Force

Original Coupler Compatibility Testing Plan

SAE J1772™ Inter-Compatibility Evaluation

EVALUATION TIME LINE					
Description	August	September	October	November	December
Test Procedure Development	Posted on SAE Website				
Fit-Up "Round Table"					
Exchange Components					
Level 1 - Mechanical					
Level 2 - Temp Rise					
Level 3 - Cycle Test					
Final Report to Task Force					

* Test procedure is posted on SAE Website, please review and submit comments/questions to T. Rose

* Participating manufacturers:
  - Amphenol
  - Delphi (ODU)
  - ITT
  - REMA
  - Yazaki

* Fit-Up "Round Table" held 8/24/2010 -- all connector and inlet combinations verified for mechanical fit and electrical continuity

Presented by: T. Rose, REMA USA, LLC

August 24, 2010

Coupler Compatibility "Fit-Up" Results

SAE J1772™ Inter-Compatibility Fit-Up "Round Table" Results

INLET MANUFACTURER	CONNECTOR MANUFACTURER: Amphenol	Delphi(ODU)	ITT	REMA	Yazaki
Amphenol	n/a	M	M / C	M / C	M / C
Delphi (ODU)	M	n/a	M	M	M
ITT	M / C	M	n/a	M / C	M / C
REMA	M / C	M	M / C	n/a	M / C
Yazaki	M / C	M	M / C	M / C	n/a

Notes: M = Mechanical compatibility confirmed with acceptable mating and un-mating force (subjective)
C = Electrical continuity confirmed for each conductor -- L1, L2, GND and Control Pilot
n/a = not evaluated

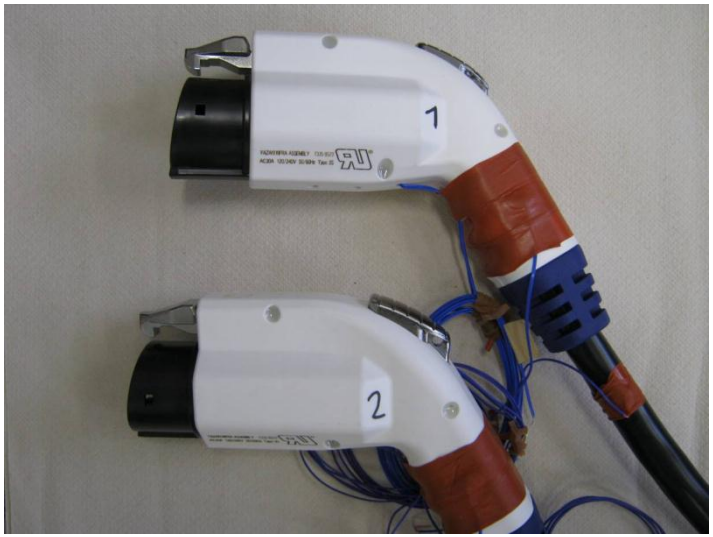
Prepared by: T. Rose, REMA USA, LLC

August 25, 2010

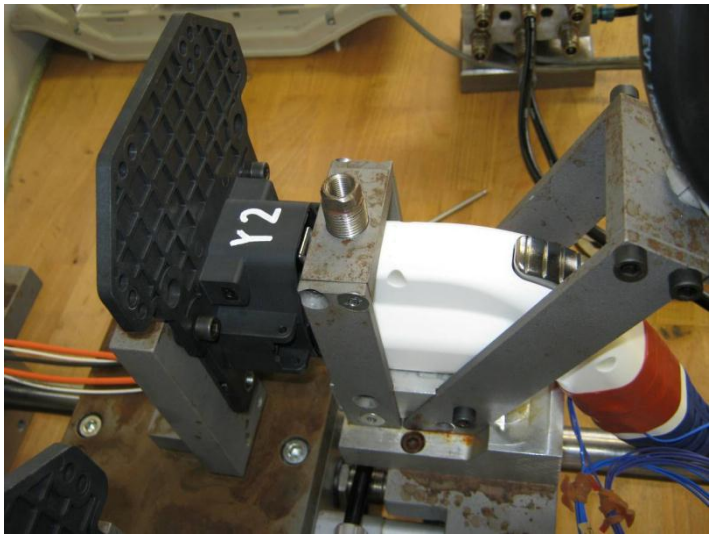
Coupler Compatibility Testing Status

- After “Fit-up” testing all suppliers except REMA and Yazaki backed out of remaining tests
- Testing was completed in February. No compatibility issues discovered between Yazaki and REMA components.
- Detailed reports located on SAE J1772™ SAE website

Coupler Compatibility Testing Status



Yazaki Connectors Provided to REMA



Yazaki Connector / REMA Inlet Insertion Force Measurement

Coupler Compatibility Testing Status

REMA Connector Provided to Yazaki

REMA Connector / Yazaki Inlet Insertion Force Measurement

J1772™ Revision Plan

- Workgroup has been meeting via WebEx
- Workgroup has completed reviewing proposal list
- Final workgroup meeting will be on March 18, 2011
- Workgroup approved proposals will be incorporated into the document
- Draft document will be surveyed for a minimum of 2 weeks
- Draft document will be reviewed with Hybrid Committee March 22, 2011
- Targeted publication, 2Q11

J1772™ Revision Plan

- Revision to include:
  - Editorial corrections
  - Technical corrections
  - Charging configurations and ratings definitions
  - EVSE compatibility test (new Appendix)

SAE J1772™ Update for IWC PHEV WG

- DC Fast Charge Standardization

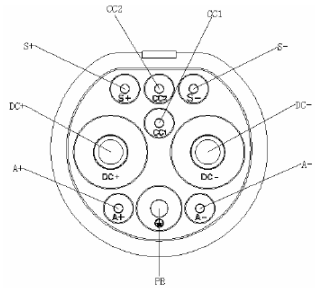
DC L2 Charge Coupler Summary

DC Connector: IEC 62196-3 CARMEQ EU

DC Connector: SAE J1772™ NA

DC Connector: CHADEMO Japan

DC Connector: China



DC Connector: Korea

Working to harmonize:

- Type 1 or Type 2 “core”, adding DC contacts
- Common control signals

DC L2 Charge Coupler Summary

- IEC 62196-3 and SAE J1772™ Have Common Control Signals and Overall Physical Shape
- Japan CHADEMO Has Unique Control Signals and Unique Overall Physical Shape
- China Standard Has Unique Control Signals and Unique Overall Physical Shape
- Korea has recently indicated that they are using the CHADEMO system with a unique Korean coupler

DC L2 Charge

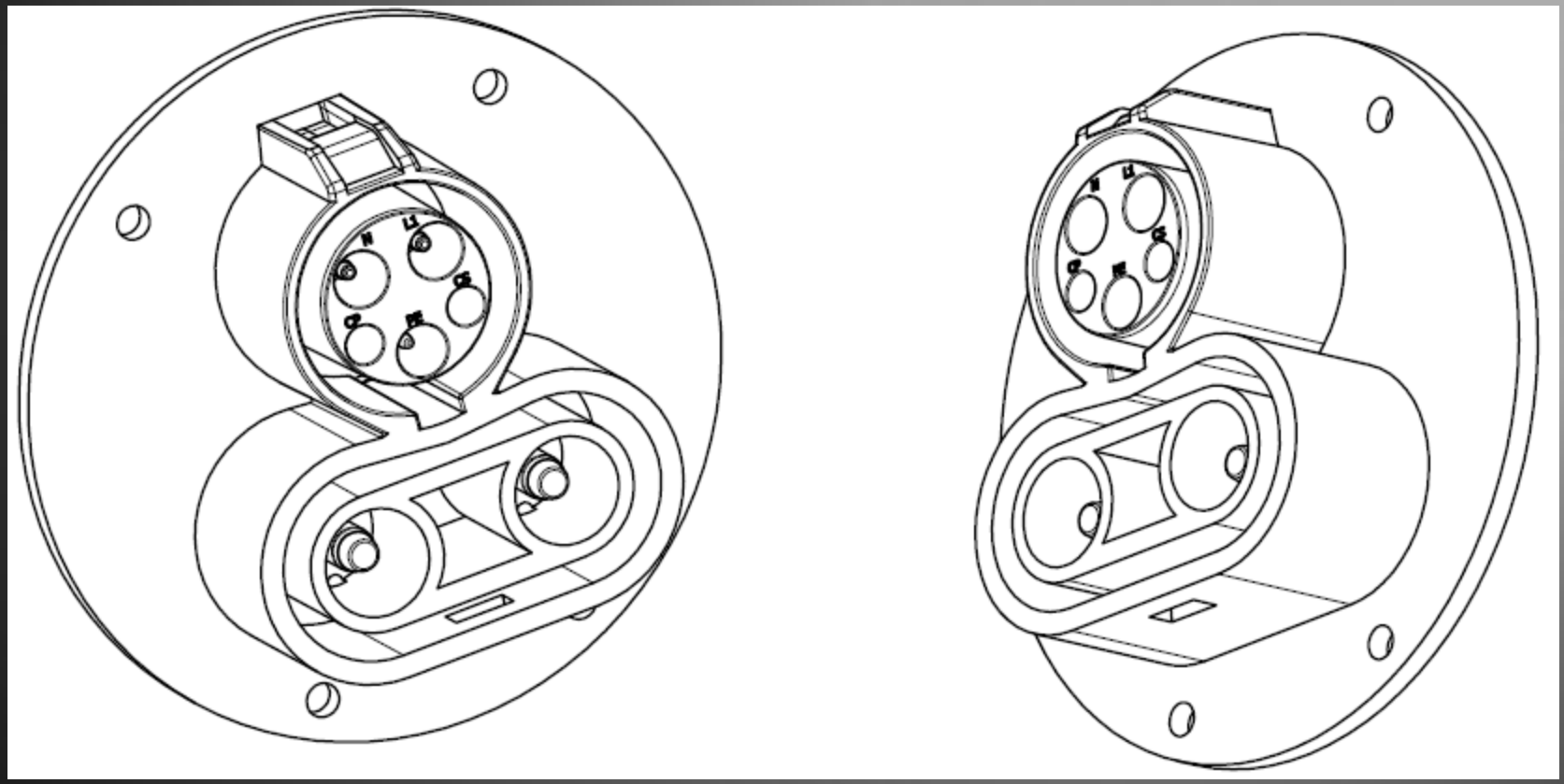
"Combo" Coupler Design

- US TAG to IEC worked with CARMEQ (Audi, BMW, Daimler, Porsche, Volkswagen) to provide Working Draft (WD) of IEC 62196-3 and related documents on January 14, 2011
- Combine AC L1, L2 and DC L1, L2 in one coupler.
- Add DC pins, 200 amp capacity
- Provide provision for 2 optional data pins (plan to remove once communications strategy is resolved)
- Reuse ground, control pilot and proximity circuit pins from AC L1, L2

DC L2 Charge

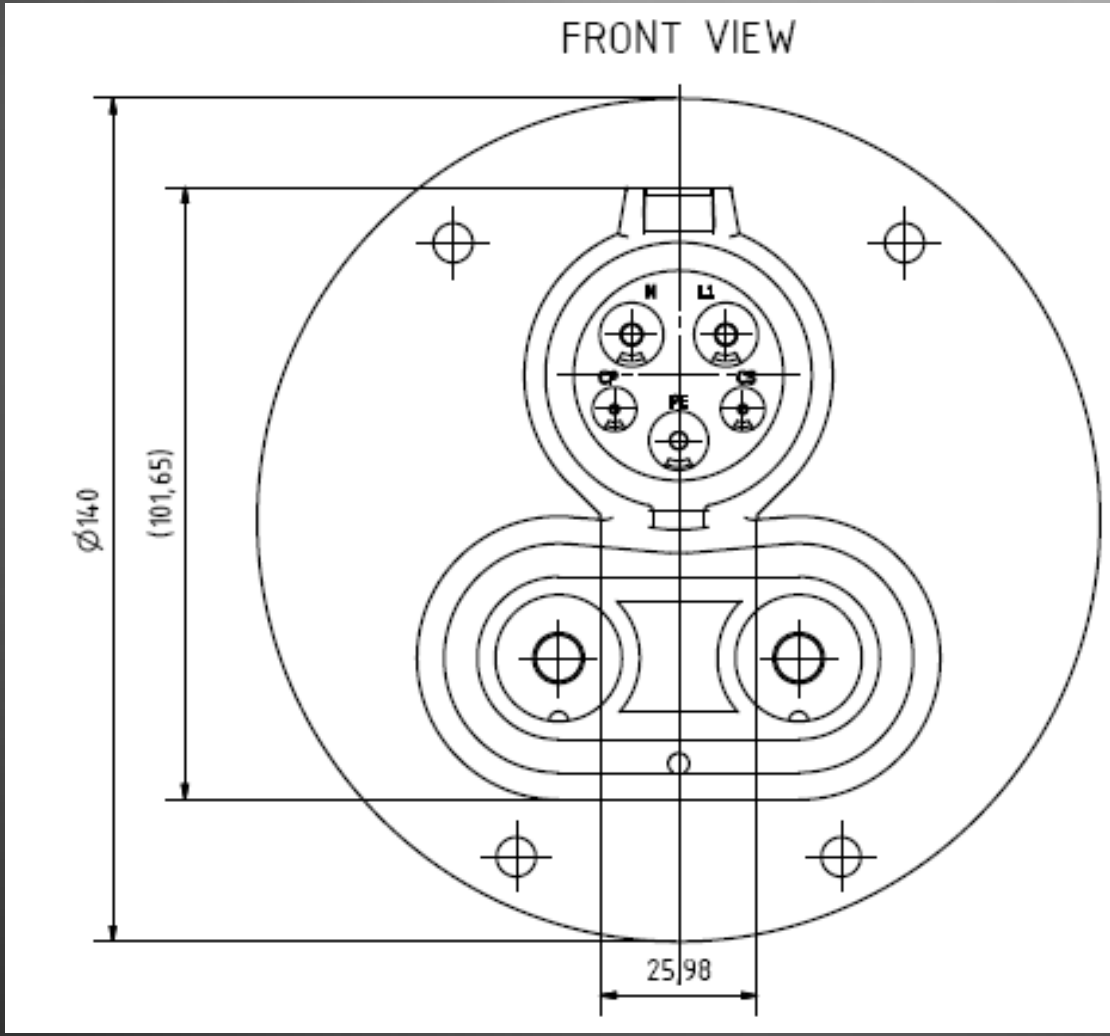
- Working Draft (WD) proposal will include use of either IEC Type 1 (SAE J1772™) or Type 2 (Mennekes) “core”
- Strategy maximizes commonality between SAE and IEC DC L2 hybrid couplers

DC L2 Charge



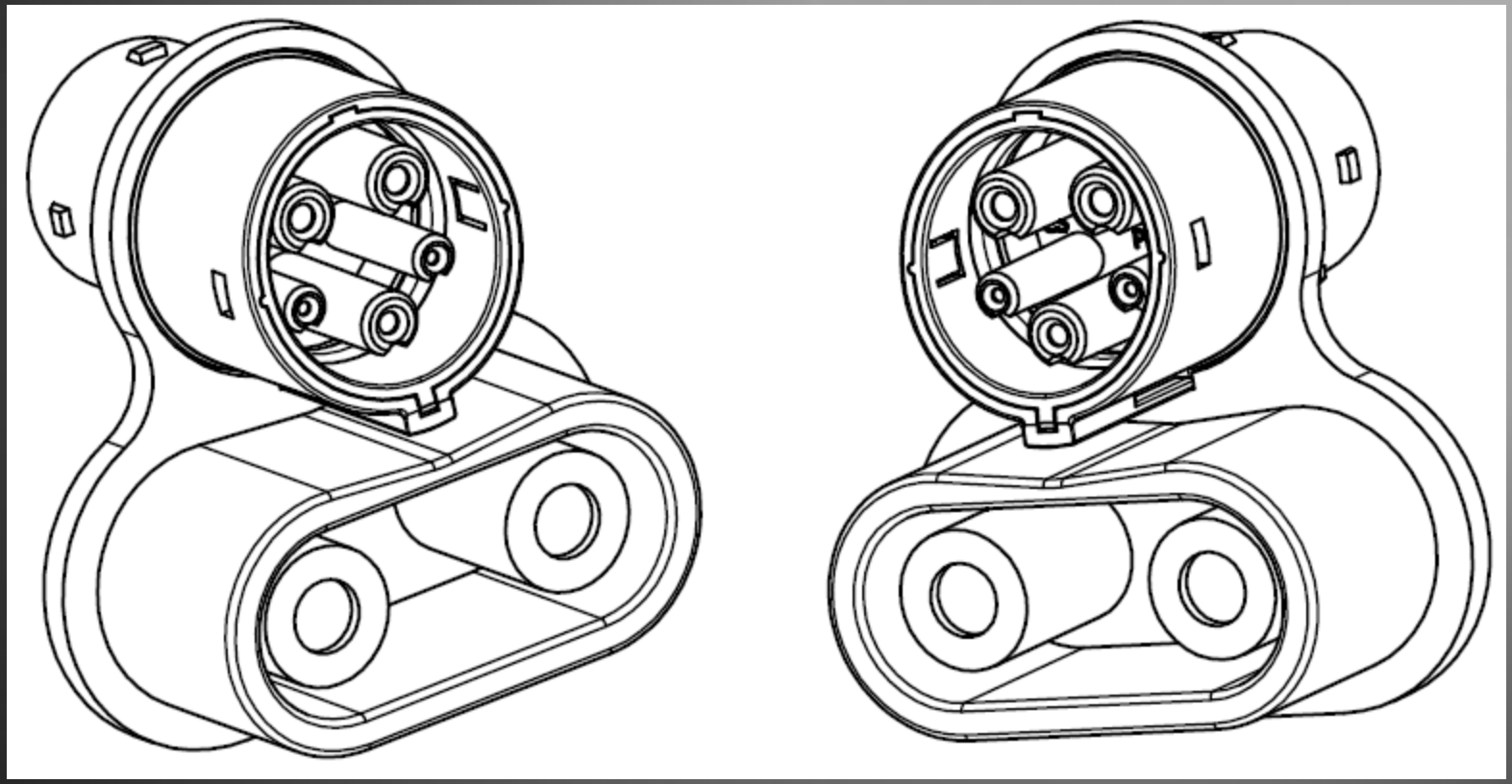
Type 1 Combo Vehicle Inlet

DC L2 Charge



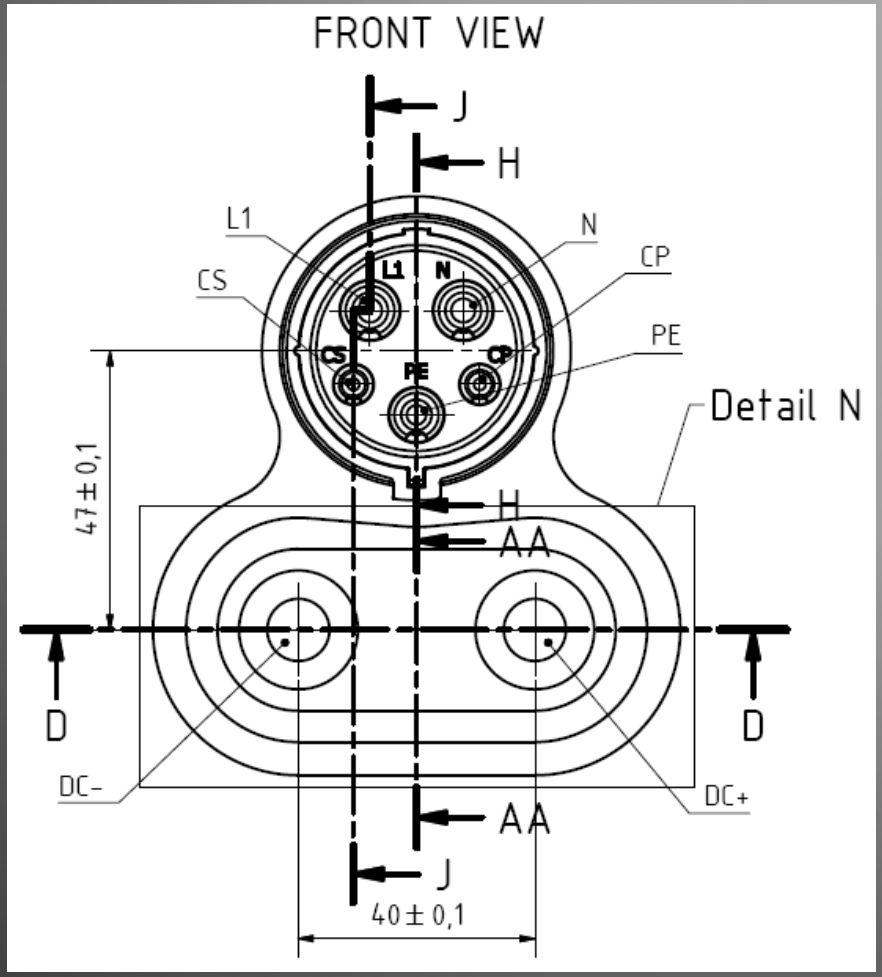
Type 1 Combo Vehicle Inlet

DC L2 Charge



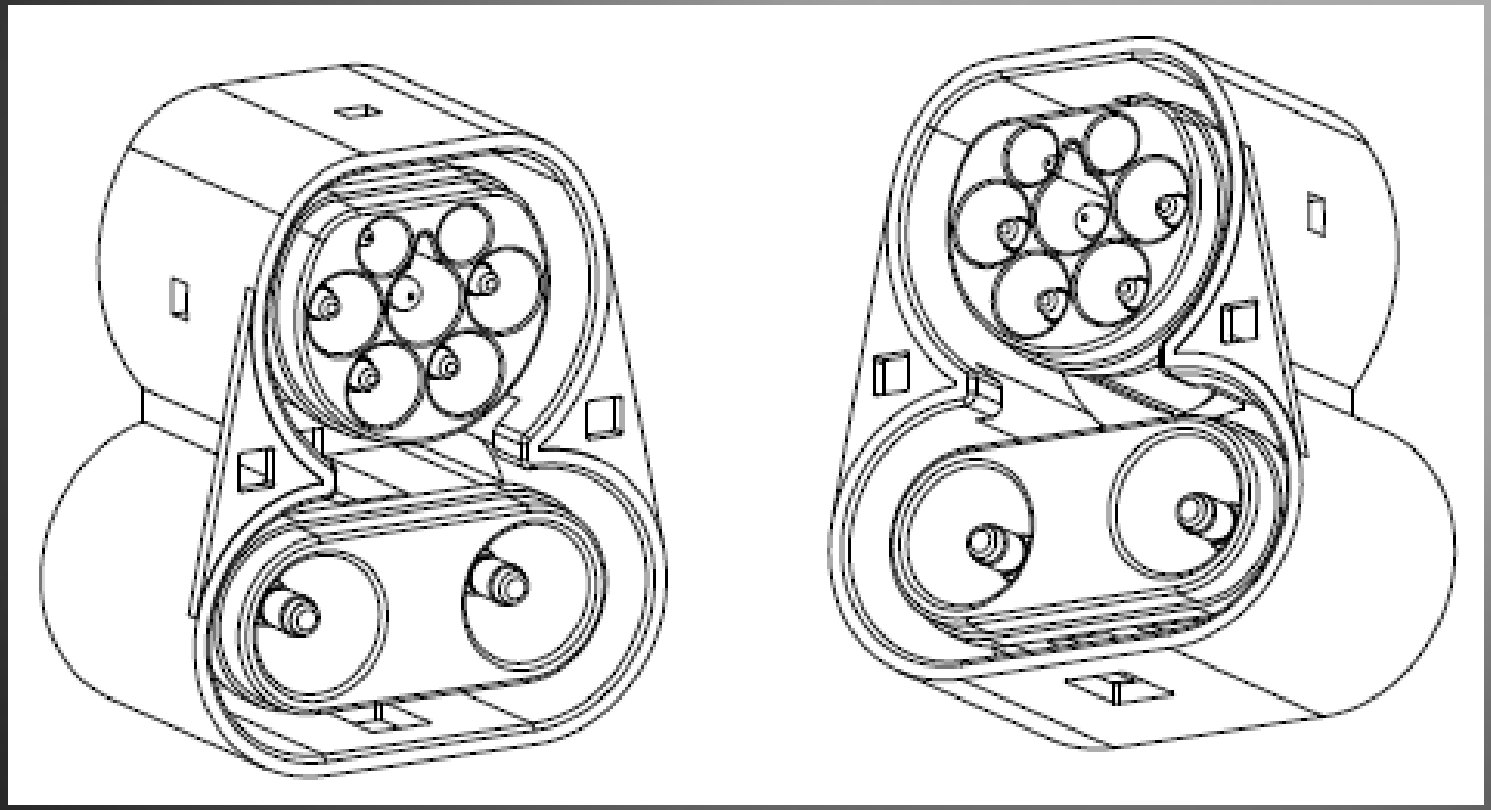
Type 1 Combo Connector

DC L2 Charge



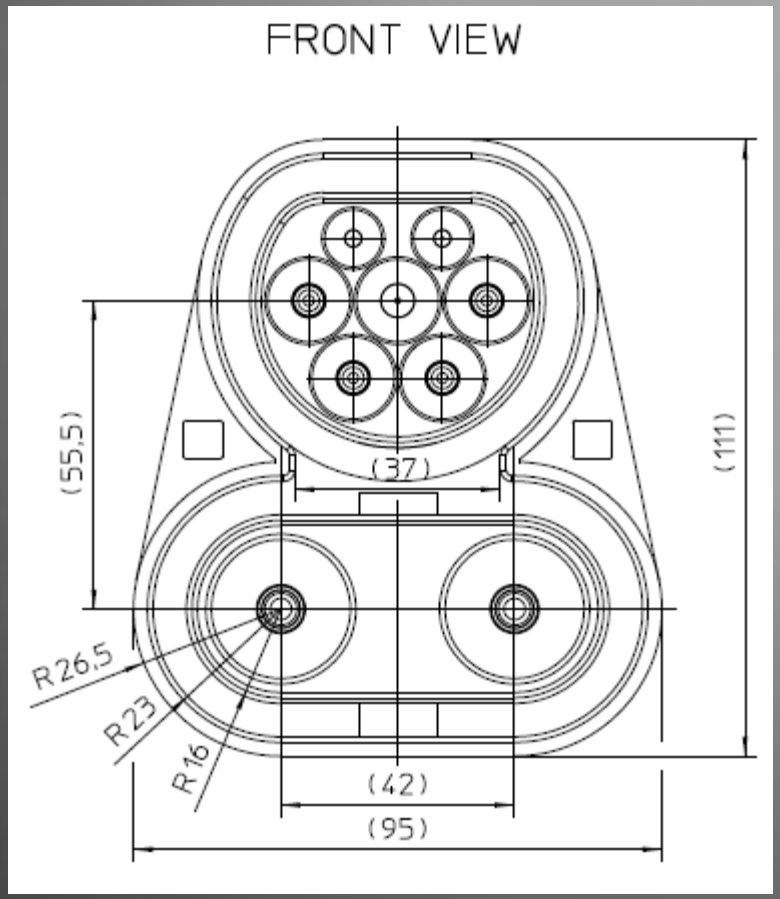
Type 1 Combo Connector

DC L2 Charge



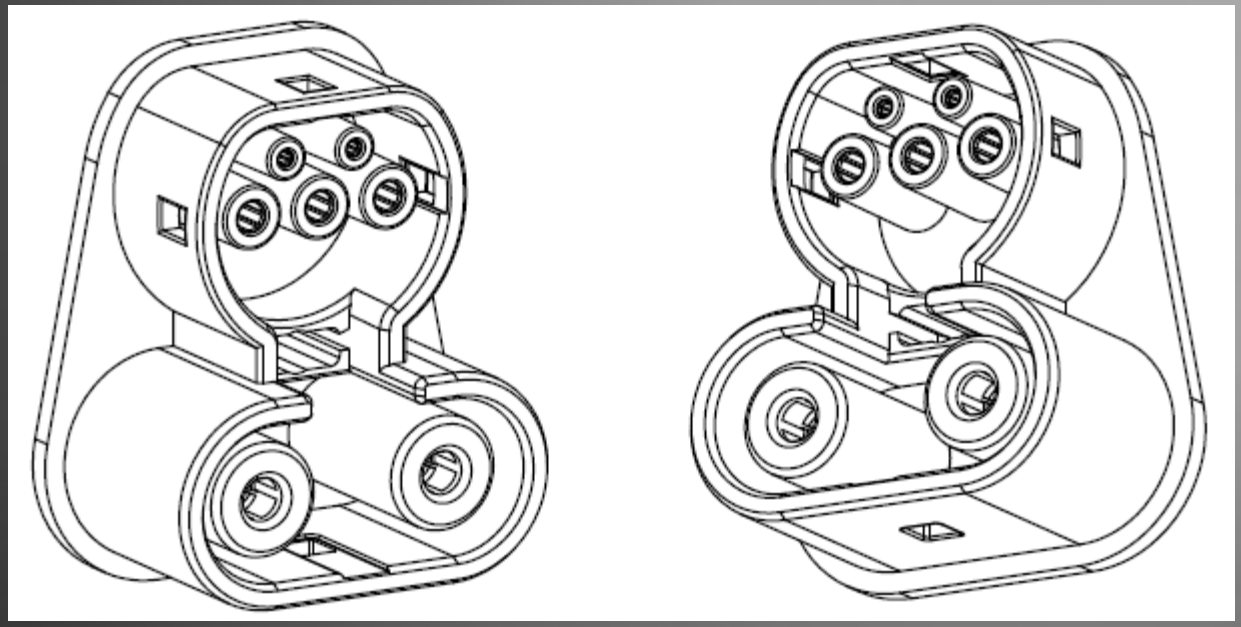
Type 2 Combo Vehicle Inlet

DC L2 Charge



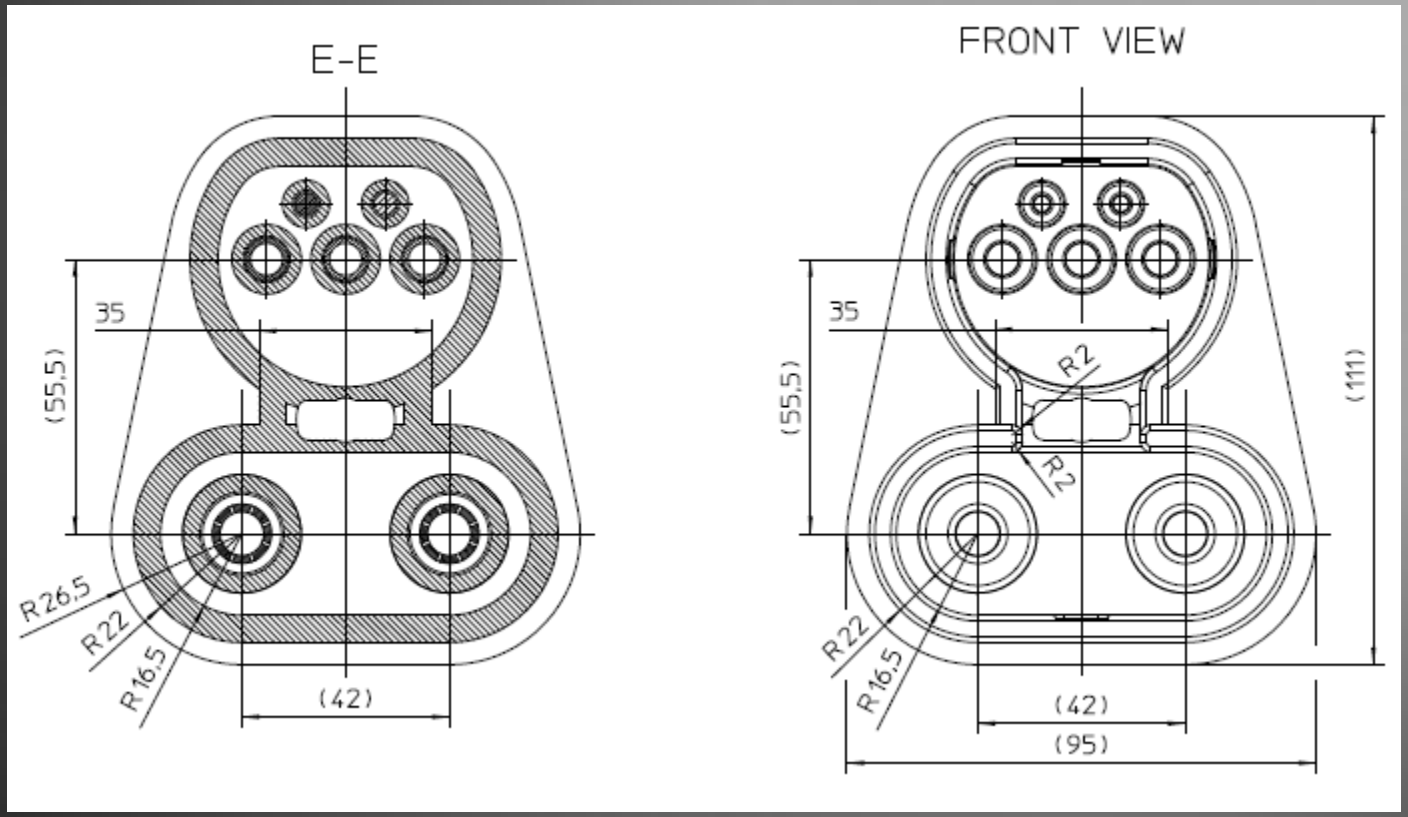
Type 2 Combo Vehicle Inlet

DC L2 Charge



Type 2 Combo Connector

DC L2 Charge



Type 2 Combo Connector

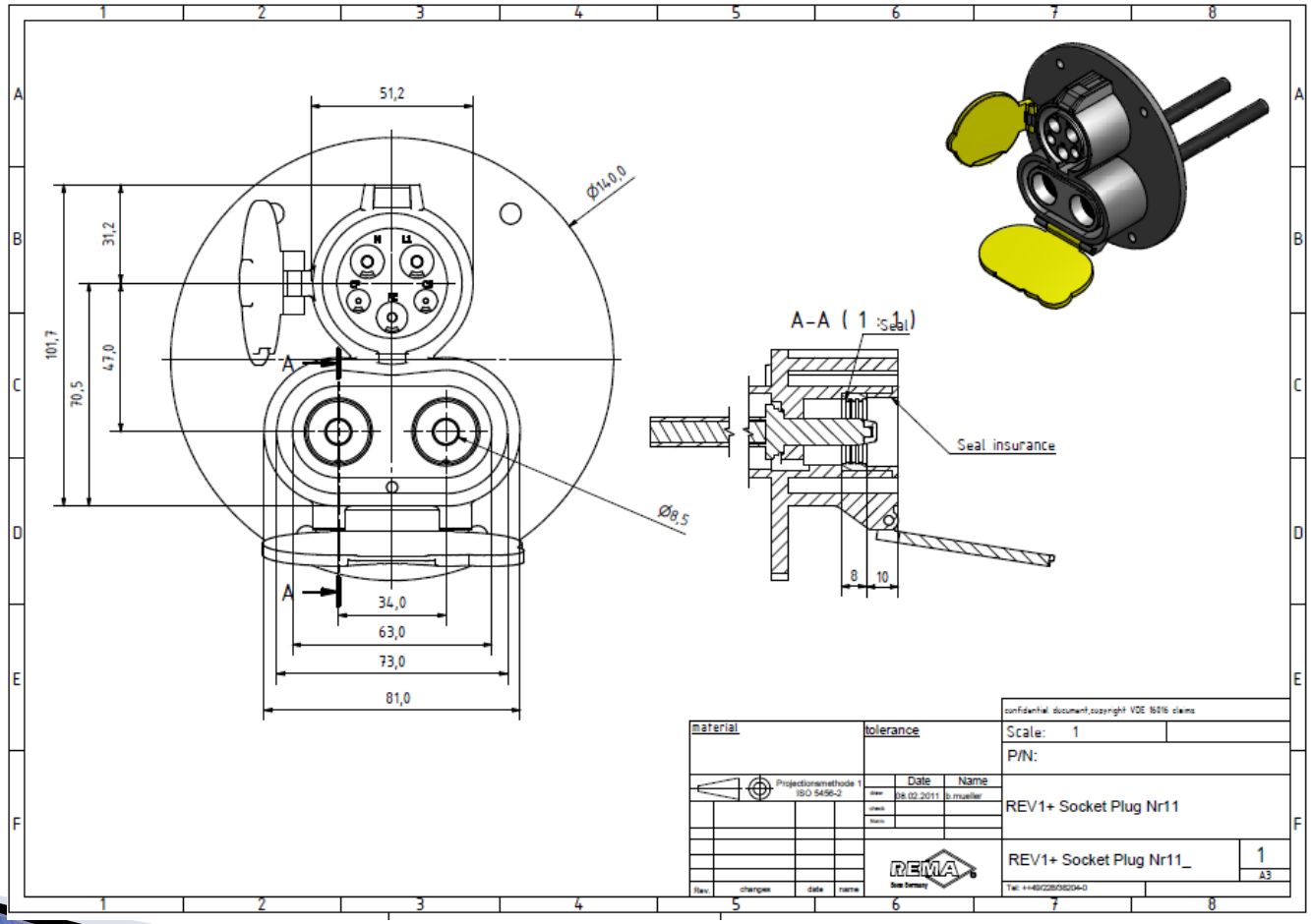
Potential Combo Design Improvements

- The proposed combo couplers include design compromises that, if addressed, may reduce the size of the coupler and may eliminate the need for mechanical mating assist
  - Communication pins
  - Continuous current rating (6mm vs. 8.5mm DC pins)
- Rich Scholler from Ford has conducted terminal temperature rise tests and mating force tests
- Connector suppliers have been asked to comment on the test result accuracy by March 8, 2011

Potential Combo Design Improvements

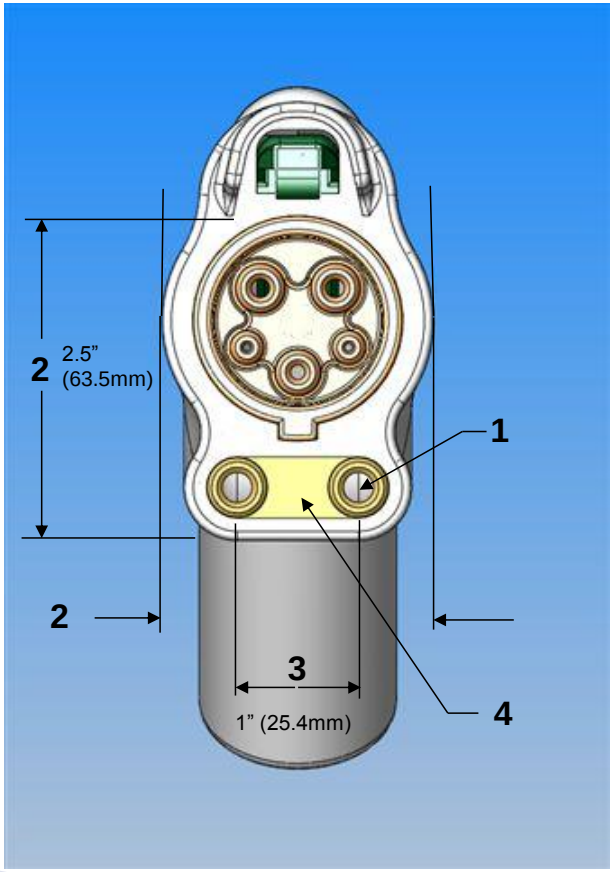
- A survey will be conducted at SAE to obtain input from vehicle OEMs on the necessity of communication pins (vs. PLC) and battery charge current vs. time
- Results of survey will determine the value to each OEM of the above items vs. reduced vehicle inlet size and reduced mechanical complexity of the connector
- Results will be shared with CARMEQ in a continued effort to harmonize

Potential Combo Design Improvements



Potential Combo Design Improvements

DC Hybrid – Coupler

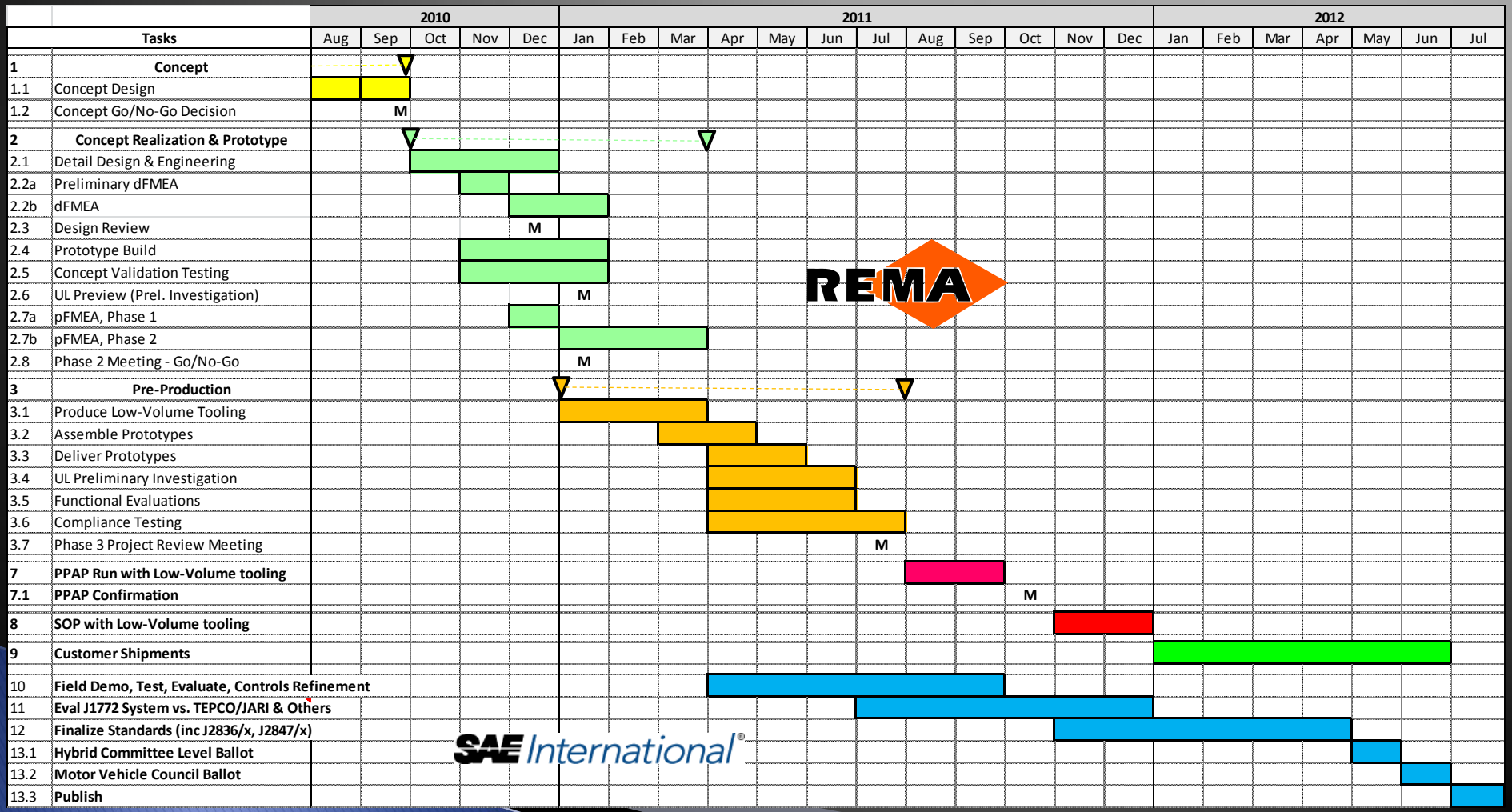


Design Concepts

1. This design is based around 6mm contacts –
   - Should carry current and not require mechanical assist.
2. Utilizing 6mm contacts also allows us to keep the package as compact as possible.
   - The width required for the DC pins can easily fall within the 1772 envelope.
3. As shown this dimension is 1" (25.4mm) but we feel that we can bring it in even closer.
4. The DC pins are presently depicted as 2 separate towers without any protective oval frame around them.
   - As such they may be susceptible to damage from UL driveover test.
   - However, we could fill in the yellow area to make 1 solid structure and increase strength.
   - This will keep size compact vs. oval frame.

Hybrid Coupler Timing

The additional design study is resulting in a delay to the timing below but the potential improvements are worth the extra time!



SAE J1772™ Update for IWC PHEV WG

- Other Items

China

- No update
- Continue to publish their own version of AC and DC charging standards
- Vehicles that plan to use public infrastructure are expected to comply to these National Standards

Korea

- Korean standards recently published (draft?) show SAE J1772™ coupler for AC charging
- DC standard uses the CHADEMO system with unique coupler

ACEA

- ACEA is a European automotive alliance
- ACEA has been tasked to recommend a single EU charge coupler for 2017 and beyond
- ACEA was to provide this input to the EC this month but will announce a 6 month delay (August)
- For the vehicle coupler, it is expected that both the Type 1 and Type 2 couplers will be allowed (need to verify in ACEA meeting minutes)

NECA
NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

NECA 413: National Electrical Installation Standard™ for EVSE

NECA

NECA Position

- The National Electrical Contractors Association (NECA) strongly supports the development of a market in electric vehicles and the requisite infrastructure for their use for personal, business, and public transportation.

- Providing a new infrastructure for electric vehicles represents a wide range of opportunities for NECA contractors and the electrical industry.

- The installation of electric vehicle supply equipment (EVSE) is *indisputably electrical work* and is routine and inherent to the services that electrical contractors currently provide.

NECA's Network

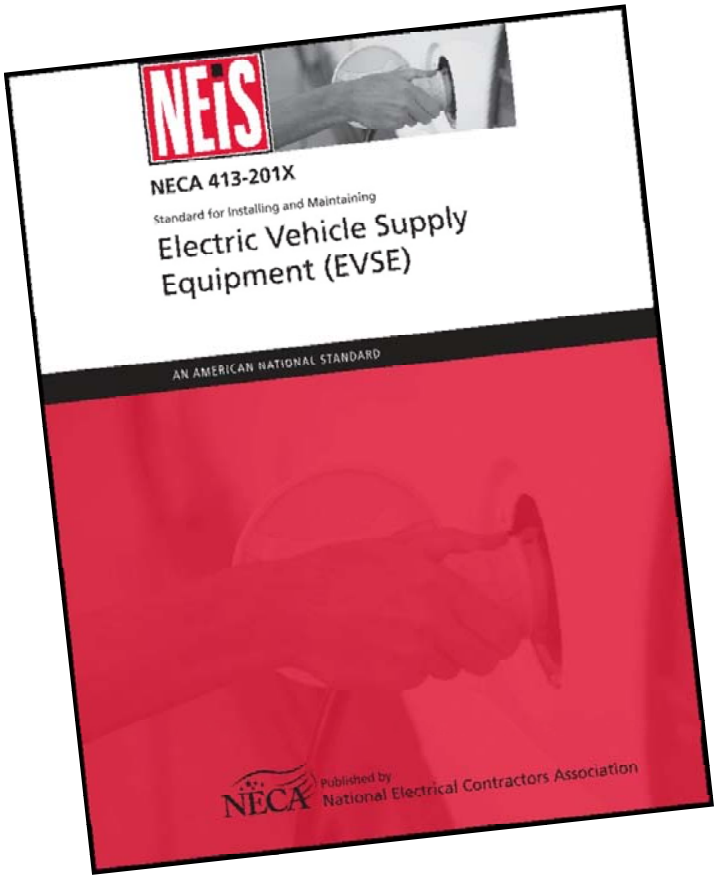
- National office (Bethesda, MD) and four regional offices.
- 119 local chapters in 50 states and over 4000 members across the United States.
- NECA and its members are qualified and positioned to provide efficient EVSE installation service.
- The term *electrical contractor* used in this presentation is intended to mean *qualified electrical contractor* and *licensed* as required in many states or local jurisdictions.

Overview

- National Electrical Installation Standard™ on Installing and Maintaining EVSE
- Other NECA EV Market Activity
  - NECA “Managing EVSE” Workshop
  - NECA and the 2014 NEC©
  - Electric Vehicle Infrastructure Training Program (EVITP)

NECA 413 Installation Standard

- NECA 413 is the *Standard for Installing and Maintaining Electric Vehicle Supply Equipment (EVSE)*
- NECA 413 is currently in the ANSI approval process.
- This installation standard addresses installation quality and performance above the minimum safety rules in the *NEC*.



Arrangement of NECA 413

- Standard for Installing and Maintaining Electric Vehicle Supply Equipment
  - Scope
  - Definitions
  - Overview
  - Product Regulation, Codes and Standards
  - Safety programs, safe workers
  - Pre-Installation Considerations
  - Installation
  - Maintenance and Commissioning
  - Reference Standards

Scope: Included

- This standard describes the procedures for installing and maintaining Level 1, Level 2 and Level 3 Electric Vehicle Supply Equipment (EVSE).

- This standard covers Electric Vehicle Supply Equipment (EVSE) that complies with applicable local, state and federal regulations, codes and standards for Level 1, Level 2 and Level 3 EVSE intended for transferring energy between premises wiring systems and electric vehicles (EVs).

Scope: Excluded

- This standard does not apply to other than Code compliant Level 1, Level 2 and Level 3 EVSE, as well as to off-road, self-propelled electric vehicles, such as industrial trucks, hoists, lifts, transports, golf carts, airline ground support equipment, tractors, boats, and the like.

Regulatory Requirements

- All information in this publication is intended to conform to the National Electrical Code® (ANSI/NFPA Standard 70). Installers should always follow the NEC®, applicable state and local codes, and manufacturer's instructions when installing and maintaining Electric Vehicle Supply Equipment (EVSE).
- Only qualified persons familiar with the construction and operation of Electric Vehicle Supply Equipment (EVSE) should perform the technical work described in this Standard.
- All work should be performed in accordance with NFPA 70E, *Standard for Electrical Safety in the Workplace,* in addition to applicable OSHA regulations.

Definitions

- **Authority Having Jurisdiction (AHJ)**. An organization, office or individual responsible for enforcing the requirements of a code or standard, or ….
- **Battery.** An electrochemical device that transforms stored chemical energy into electric energy during discharge. Batteries for electric vehicles (EVs) ….
- **Battery Electric Vehicle (BEV).** An automotive-type vehicle that is powered solely by the battery energy storage system available on-board the vehicle…. Also see Plug-in Hybrid Electric Vehicle (PHEV).

EV & EVSE Overview

- Electric vehicles EVs) are automotive-type vehicles designed for on-road use, such as passenger automobiles, buses, trucks, ….
- Battery systems and battery technology have improved in recent years. Modern EV batteries ….
- The electric vehicle supply equipment (EVSE) consists of the cords, connector, attachment plugs, and all other ….

Product Regulations, Codes and Standards

- Society of Automotive Engineers (SAE) Standards
- Nationally-Recognized Testing Laboratory (NRTL) Listing
- Americans with Disabilities Act (ADA) Requirements
- State and Local Codes and Ordinances
- National Electrical Code (NEC)
- Leadership in Energy and Environmental Design (LEED)

NECA

Safety

- Only qualified persons familiar with the construction and operation of Electric Vehicle Supply Equipment (EVSE) should perform the technical work described in this Standard. See NEC Article 100 for the definition of a qualified person.
- Do not work on energized equipment.
- Use appropriate Personal Protective Equipment (PPE) and established safety procedures when working on or near energized electrical equipment, anticipating that equipment will fail when operated.

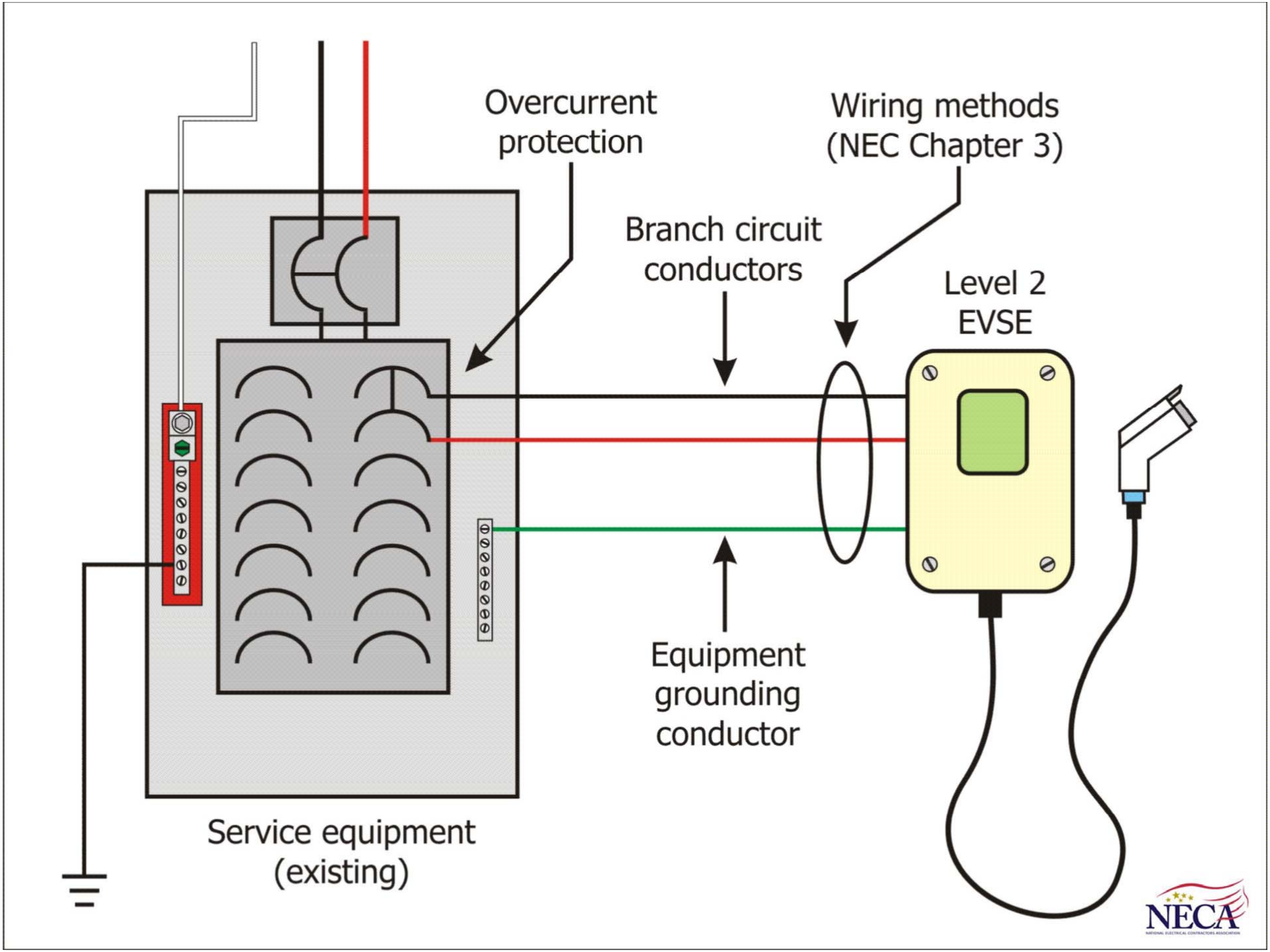
Pre-Installation Considerations

- Battery Operating and Charging Temperature Limitations
- Smart Chargers
- Charging Power
  - Level 1 Charging
  - Level 2 Charging
  - Level 3 Charging
- Conductive and Inductive EV Charger Technologies
  - Conductive Charging
  - Inductive Technologies

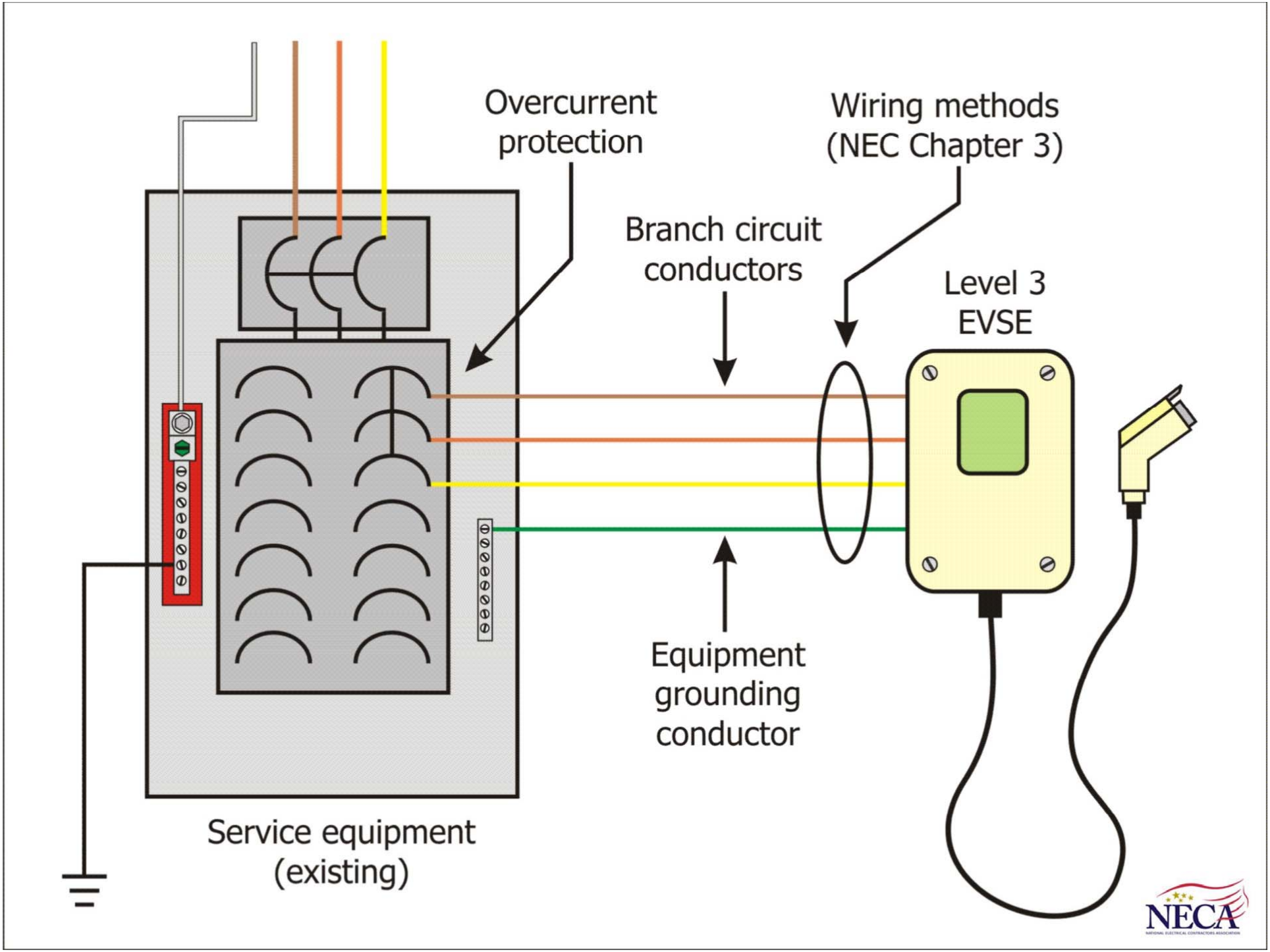
Courtesy of Pass and Seymour Legrand

Courtesy of Leviton

NECA


Overcurrent protection
Wiring methods (NEC Chapter 3)
Branch circuit conductors
Level 2 EVSE
Equipment grounding conductor
Service equipment (existing)
NECA

Courtesy of Eaton Corporation


Overcurrent protection
Wiring methods (NEC Chapter 3)
Branch circuit conductors
Level 3 EVSE
Equipment grounding conductor
Service equipment (existing)
NECA

Pre-Installation (continued)

- Communication and Data Requirements
  - Communication Between the EV and EVSE
  - Communication Between the EV and the Power Supplier
- EVSE Equipment and Siting Requirements
  - Electrical Load Calculations
  - Site Selection and Preparation
  - Commercial Fleet Lots
- Electric Utility Interconnection Requirements

Installation (General)

- Install EVSE in accordance with manufacturer recommendations and in accordance with applicable local, state and federal codes and regulations.
- If trenching or boring, consider providing a minimum of one additional raceway for future growth, expansion or upgrade.
- Consider providing a minimum of one spare power conductor for single-phase 208 VAC and 240 VAC circuits for future use as a neutral conductor, if needed.
- Connect the EVSE to either the branch circuit or feeder equipment grounding conductor in accordance with NEC Article 250.

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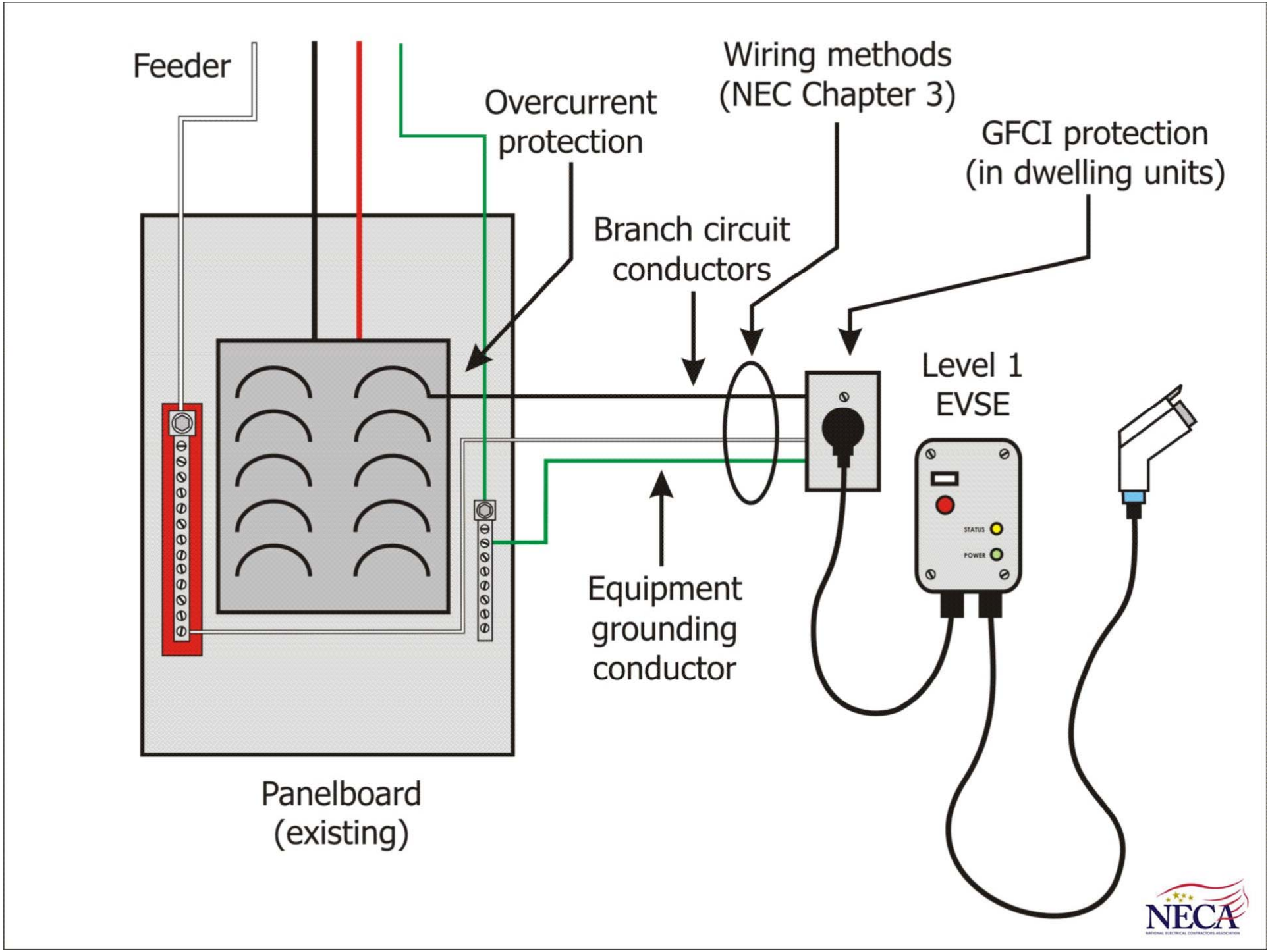
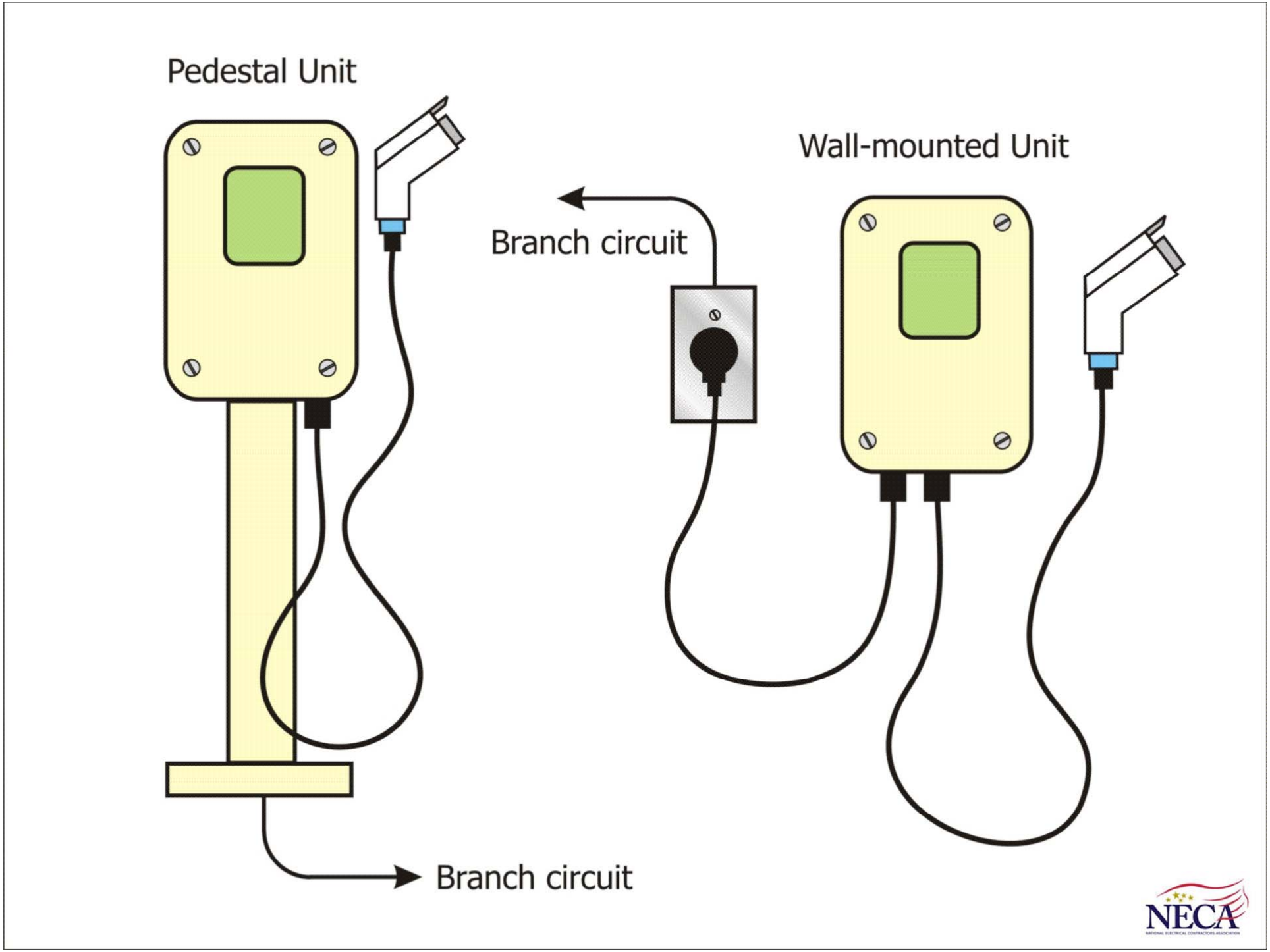

Feeder
Overcurrent protection
Wiring methods (NEC Chapter 3)
GFCI protection (in dwelling units)
Branch circuit conductors
Level 1 EVSE
STATUS
POWER
Equipment grounding conductor
Panelboard (existing)
NECA

Installation (Specific)

- Free Standing EVSE
- RFID or Antenna and Parking Bumper or Wheelstop Installation
- EVSE Start-up and Commissioning


Pedestal Unit
Wall-mounted Unit
Branch circuit
Branch circuit

Maintenance

- Clean EVSE in accordance with manufacturer recommendations using recommended materials and methods.
- Check all usable parts for wear, and conduct periodic inspections to ensure that all parts remain in good working order.
- Inspect cables and conductors for signs of wear, abrasion, damaged or worn insulation, etc.

NECA
NATIONAL ELECTRICAL CONTRACTORS ASSOCIATION

Managing Electric Vehicle Supply Equipment (EVSE) Installations

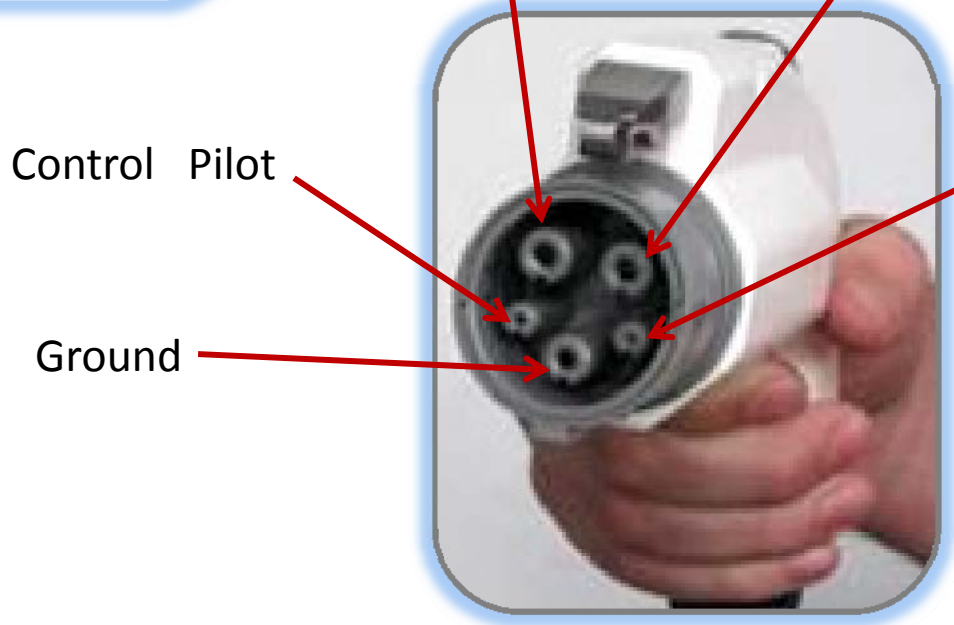
NECA

Objectives of the Workshop

- Examine the process of coordinating and facilitating the installation of electric vehicle supply equipment (EVSE)
  - Types of EVSE equipment and charging stations
  - Determining typical EVSE customer electrical supply needs
  - Performing accurate site assessments of existing power services
  - Equipment and essential electrical circuit installations
  - Permit application process and coordination of the inspection process
  - Commissioning and operation training

J1772 Architecture

Courtesy of General Motors



Electric Vehicle Supply Equipment (EVSE)

Courtesy of Schneider Electric

EV Supply Equipment Connections

- Level 1 cord-and-plug connected (portable)
- Level 2 wired to individual branch circuit
- Level 3 wired to individual branch circuit

Courtesy of General Motors

NECA

Cord-and-Plug Connections

- Electric vehicle supply equipment rated at 125 volts, single phase, 15 or 20 amperes or part of a system identified and listed as suitable for the purpose and meeting the requirements of *NEC* 625.18, 625.19, and 625.29 shall be permitted to be cord-and-plug-connected.

- This equipment shall have no exposed live parts.

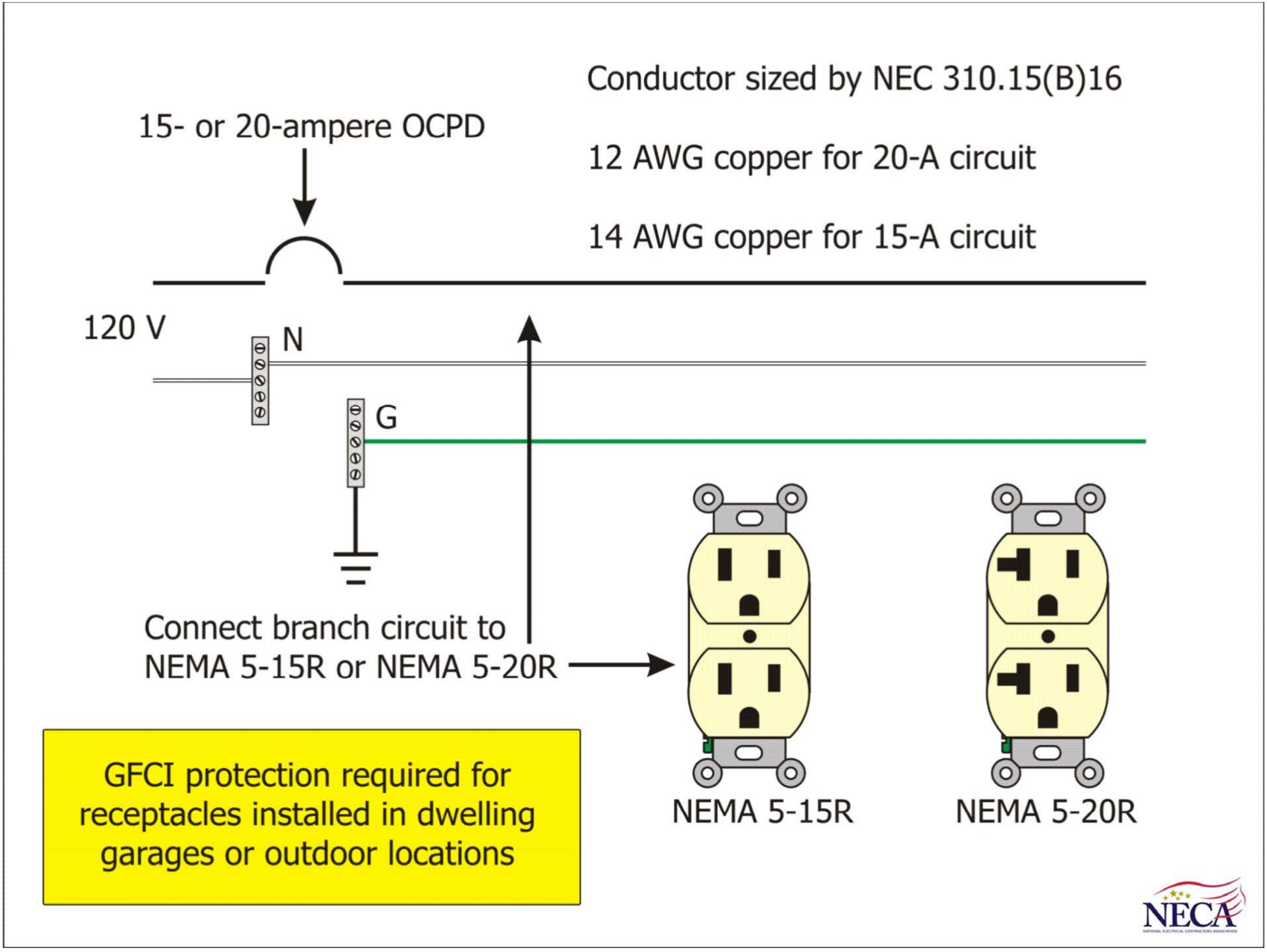
- Other than Level 1, non-portable equipment must be mounted and permanently wired.

Courtesy of Leviton

Courtesy of PEP

Level 1 Charging

- Electric vehicle (EV) charging that employs cord-and-plug connected portable electric vehicle supply equipment (EVSE) that is transported with the EV and is used specifically for EV.
- Level 1 EVSE is rated single-phase, nominal 120 VAC, 16 A maximum, and is suitable for connection to NEMA 5-15R or 5-20R receptacles.
- GFCI protection is required for 125-V, 15- and 20-ampere receptacles installed at dwelling garages and outdoor locations.
- NECA recommends installing an individual branch circuit for all EVSE, including level 1.


Conductor sized by NEC 310.15(B)16
15- or 20-ampere OCPD
12 AWG copper for 20-A circuit
14 AWG copper for 15-A circuit
120 V
N
G
Connect branch circuit to
NEMA 5-15R or NEMA 5-20R
NEMA 5-15R
NEMA 5-20R
GFCI protection required for receptacles installed in dwelling garages or outdoor locations

Typical Current for Level 1 and 2

- Maximum electrical current for level 1 and level 2 electric vehicle supply equipment (EVSE).
  - AC Level 1 – 120 V Single-phase, 16 A
  - AC Level 2 – 240 V Single-phase, 80 A

Branch Circuit Limitations

- The *NEC* limits branch circuit current to 80% of the overcurrent device rating. [*NEC* 210.19(A)(1)]
- Level 1 charging from a NEMA 5-15 conventional outlet is limited to 12 amps, the current of a 1440 watt unit supplied by 120 volts.
- This current level can result in tripped breakers in a typical residence as multiple outlets are installed on general purpose branch circuits.

Level 2 Charging

- Level 2 power is approximately 3300 watts, so the 240-volt charge time should be about 42% of the 120-volt charge time.
- Level 2 EVSE requires higher voltage and ampacity to operate.
- Capacity of the existing power system must be verified through an accurate site assessment.

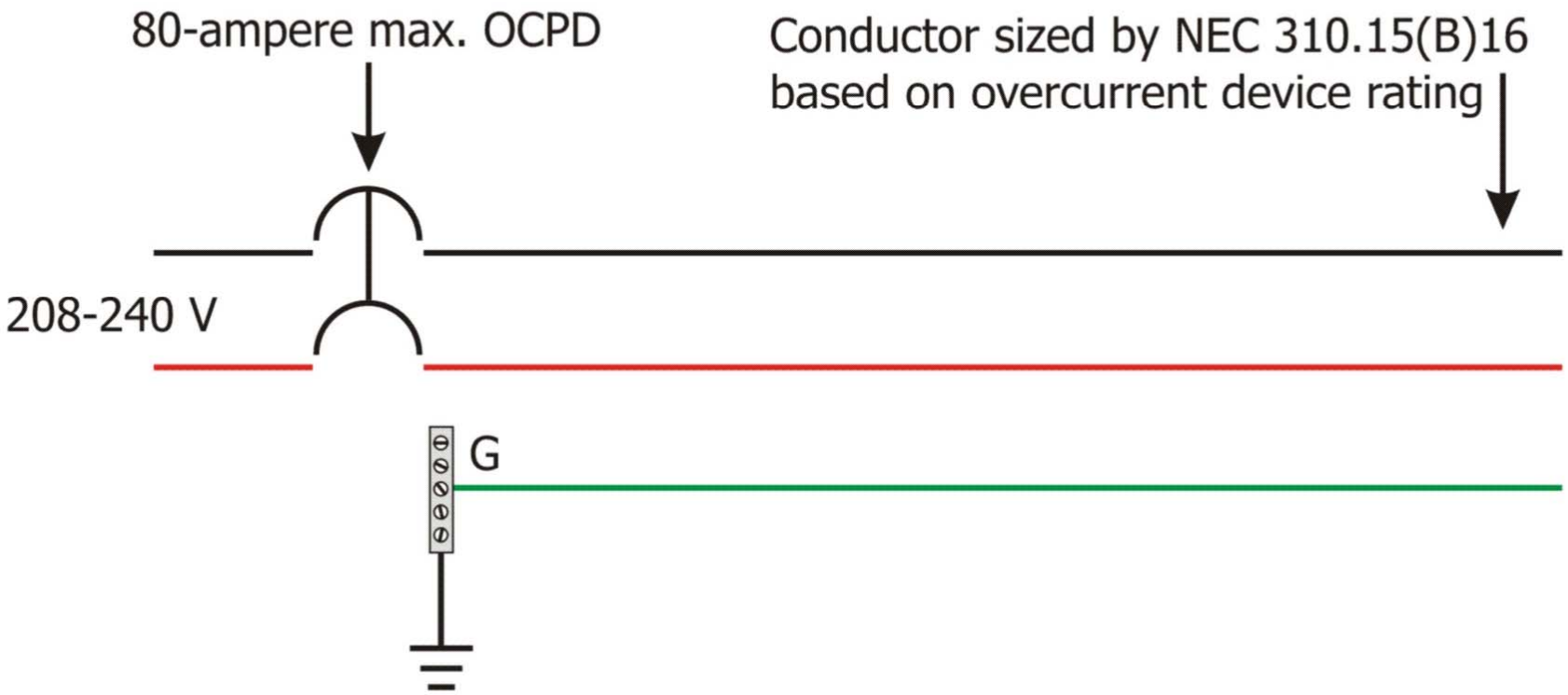
Charging Power Levels

- Example: 3.3 kW/240V and higher charging typically requires a one-time investment to upgrade the garage with an individual (dedicated) branch circuit 240V circuit
- Full charge in 3 to 6 hours – very acceptable and desirable to many
- Fast charging is a customer value and desired option in many cases.

Level 2 Charging

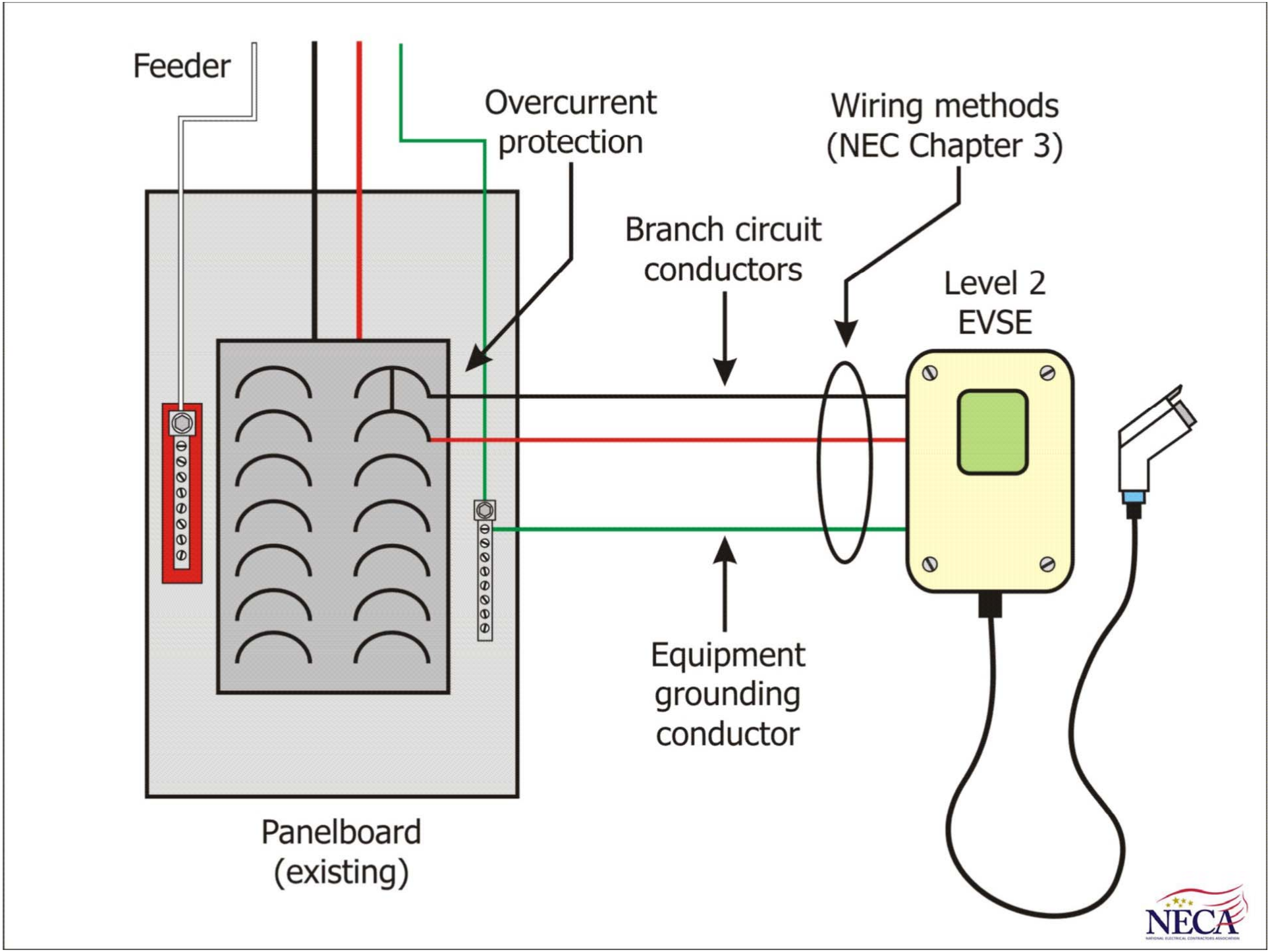
- Electric vehicle (EV) charging that employs permanently wired electric vehicle supply equipment (EVSE) that is operated at a fixed location and is used specifically for EV charging.
- Level 2 EVSE is rated single-phase, nominal 208 VAC or 240 VAC, 80 A maximum, with branch circuit overcurrent protection as required.
- Level 2 EVSE is wired directly to an individual branch circuit.

Level 2 Branch Circuit Requirements



Note: NEC provides general requirements for overcurrent protection. The equipment nameplate may specify maximum overcurrent device ratings and minimum conductor size.

Courtesy of Leviton


Feeder
Overcurrent protection
Wiring methods (NEC Chapter 3)
Branch circuit conductors
Level 2 EVSE
Equipment grounding conductor
Panelboard (existing)
NECA

Courtesy of Eaton Corporation

Courtesy of Pass and Seymour Legrand

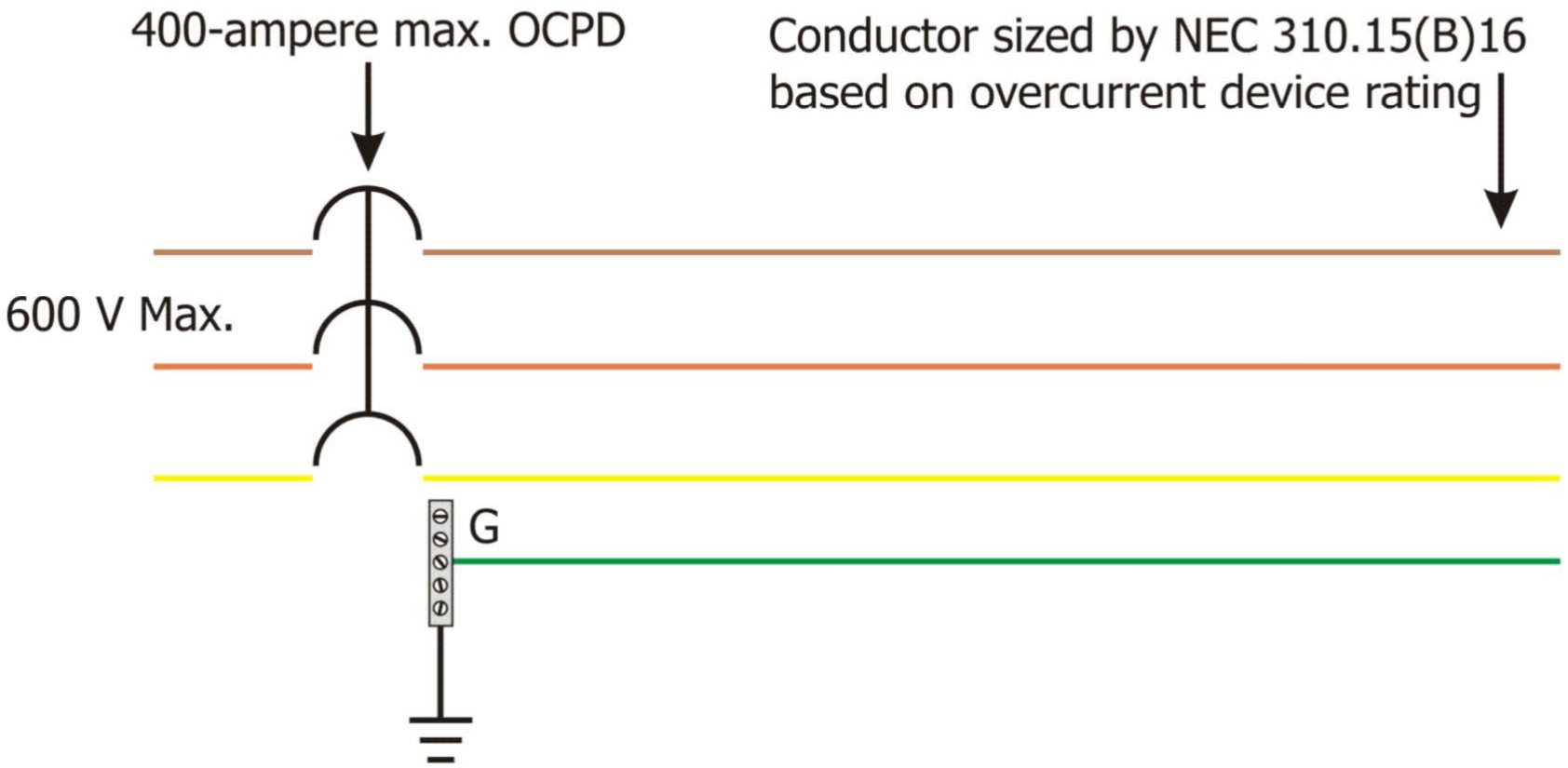
NECA

Level 3 Charging

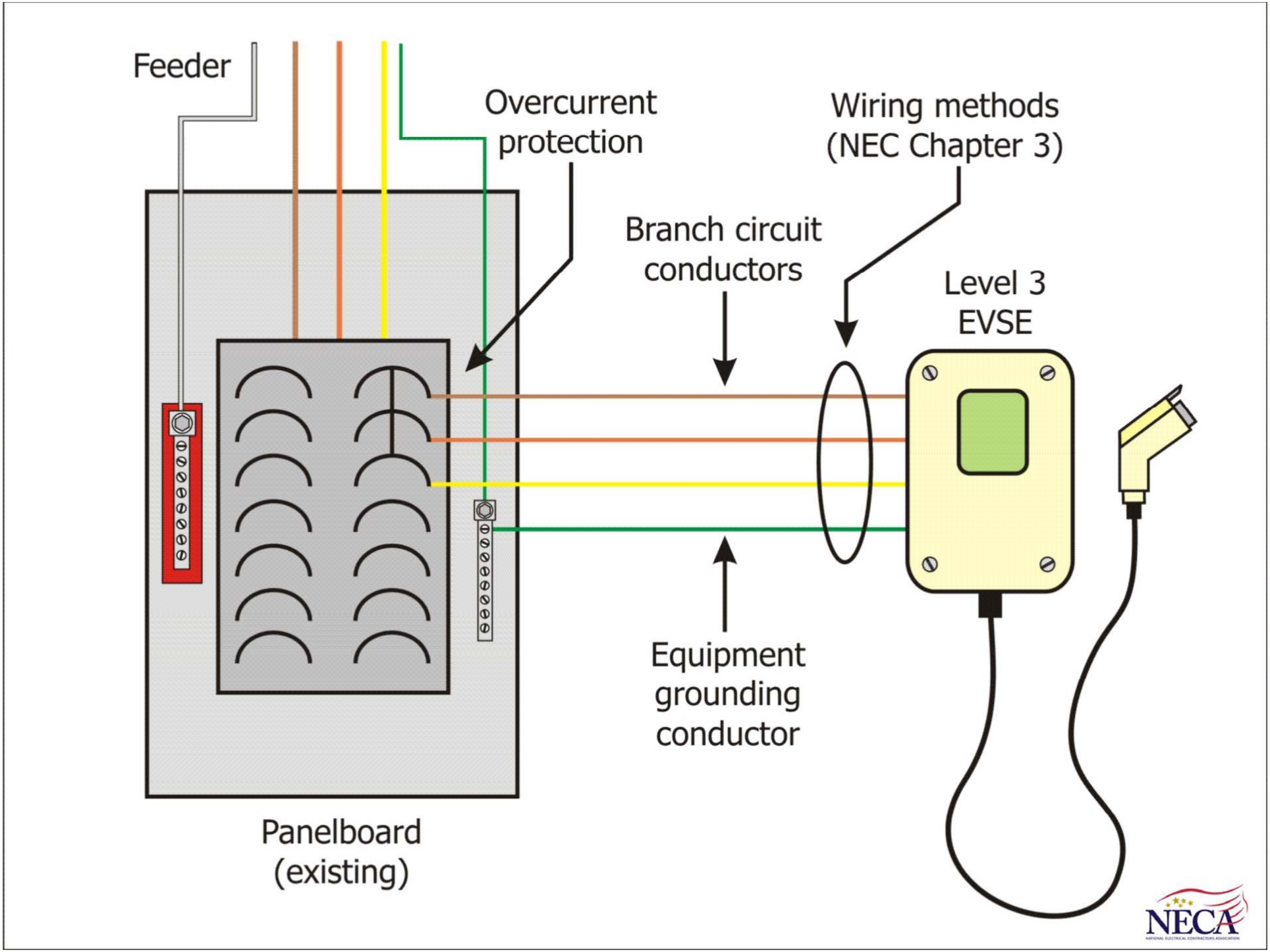
- Electric vehicle (EV) charging that employs permanently wired electric vehicle supply equipment (EVSE) that is operated at a fixed location and is used specifically for EV charging.

- Level 3 EVSE is rated 400 A maximum, and 600 VAC maximum, with branch circuit overcurrent protection as required. Level 3 charging is also known as DC fast charging.

Level 3 Branch Circuit Requirements



Note: NEC provides general requirements for overcurrent protection. The equipment nameplate may specify maximum overcurrent device ratings and minimum conductor size.


Feeder
Overcurrent protection
Wiring methods (NEC Chapter 3)
Branch circuit conductors
Level 3 EVSE
Equipment grounding conductor
Panelboard (existing)
NECA

Typical Contractor Site Assessment

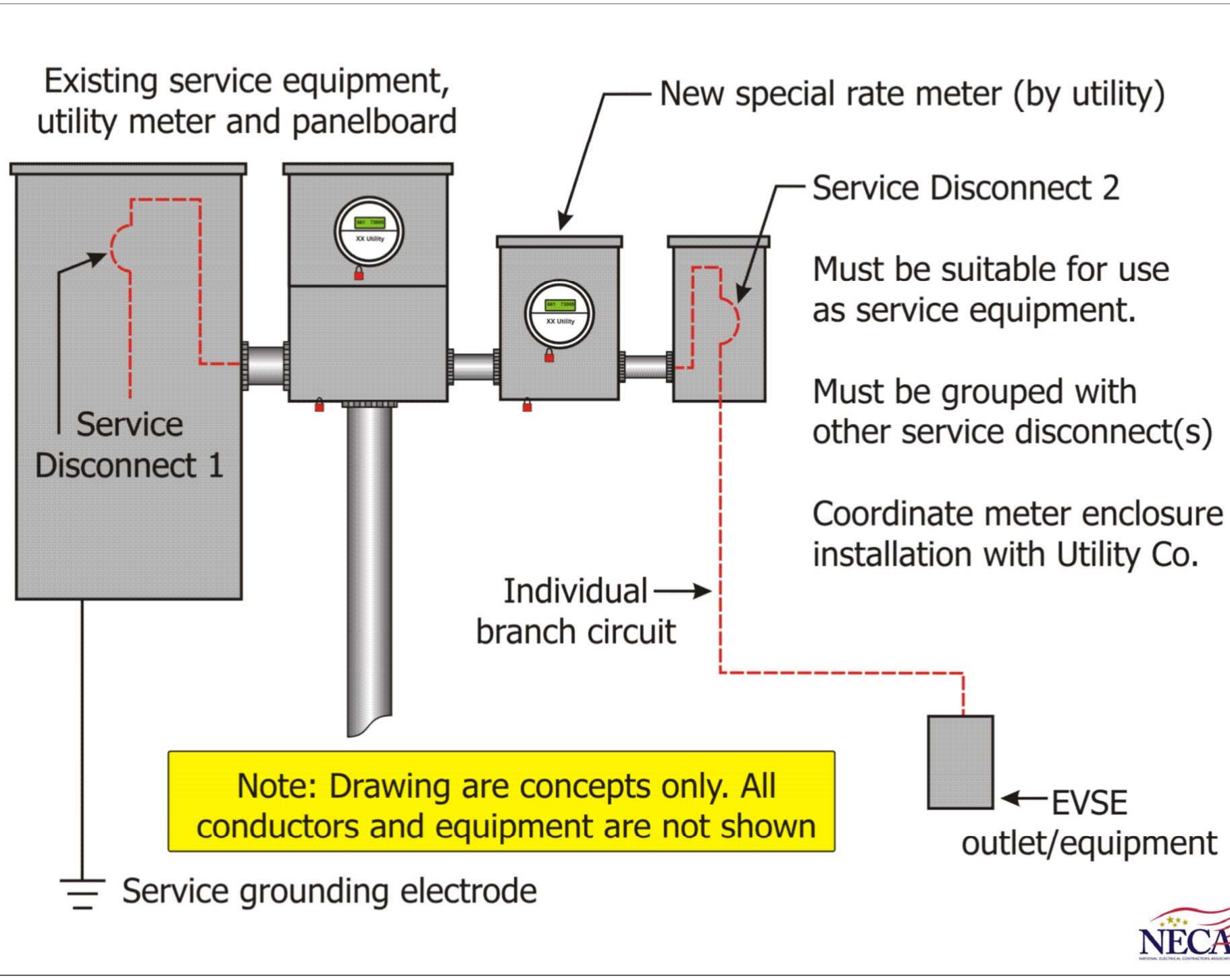
- Types of Occupancies (Residential, Commercial, Institutional, Industrial)
- Contractor site evaluation for installation of EVSE and required individual branch circuit
- Coordinate and determine the EVSE installation location (garage typical) with customer
- Determine branch circuit requirements (based on L-1, L-2, L-3)
- Verify the existing service/source and equipment capacity
- Determine necessary upgrades or additional wiring (if needed)

Existing Service/Source Capacity

- Verify existing service or source capacity
- Verify the type of electrical equipment (manufacturer)
- Breaker space within existing equipment
- Use checklist (provided handout) to determine if load calculation is necessary
- Verify the load on the existing system or service

Utility Metering (off-peak)

- Off-peak or time-of-use (TOU) metering option(s).
- Additional meter socket enclosures and associated wiring.
- Specific utility regulations regarding meter installation.
- Smart meters


Existing service equipment, utility meter and panelboard
New special rate meter (by utility)
Service Disconnect 2
Must be suitable for use as service equipment.
Must be grouped with other service disconnect(s)
Coordinate meter enclosure installation with Utility Co.
Service Disconnect 1
Individual branch circuit
Note: Drawing are concepts only. All conductors and equipment are not shown
EVSE outlet/equipment
Service grounding electrode
XX Utility
XX Utility

Establishing EVSE Location

- Occupancy type where the EVSE will be installed.
- Overnight parking location for the vehicle.
- Locate the EVSE outlet (minimum 18 in. and maximum 48 in. above finished floor)
- Verify from manufacturer what type of connection is required (receptacle or hard-wired)
- Determine circuit routing and wiring methods necessary for the circuit (fished or surface installation).

Branch Circuit Requirements

- The EVSE load is continuous (maximum load is for 3 hours or more).
- Determine minimum wires size and rating of overcurrent device for branch circuit (based on manufacturer nameplate rating and requirements).
- NECA recommends installing an individual branch circuit (20-ampere) for all level 1 applications (draws between 10 and 16 amperes).

Power Capacity Checklist

- What is the size (main) of the electrical service?
- Is the service overhead or UG?
- What size conductors are installed (if overhead)?
- Which level EVSE is being installed?
- Will space for a 1-pole device or 2-pole device be needed?
- Is there breaker space available in the existing equipment?
  - Use of listed tandem/half-size breakers to create space
  - Installation of subpanel to create space

Sample Load Profile

Load Factors			Quantity	VA Ungrounded	VA Neutral
General Lighting [Sq Ft x 3 watts 220.42]			2,100	6,300	
General Lighting Circuit Amps @ 120 V [220.42]	15 Amp Circuits	20 Amp Circuits			
Small Appliance Circuits [Minimum of 2 - 220.52(A)]			2	3,000	
Laundry Circuit [Minimum of 1 - 220.52(B)]			1	1,500	
		Total General Lighting		10,800	
		First 3000 VA at 100%		3,000	
		Total VA - 3000 = 7,800 VA at 35%		2,730	
Appliance Loads		Net General Lighting		**5,730**	**5,730**
Dishwasher			1	1,500	1,500
Disposal (½ hp)			1	1,176	1,176
Compactor			1	600	600
Fan (VA @120 ea)			2	240	240
Water Heater			1	4,500	
		3 or less Appliances Total		0	
		220.53 (4 or more Appliances Total at 75%)		**6,012**	**2,637**
Other Loads					
Range [Table 220.55, Neutral at 70%]			11,200	8,000	5,600
Cook top [Table 220.55, Neutral at 70%]			0	0	
Oven [Table 220.55, Neutral at 70%]			0	0	
Dryer [Section 220.54, Neutral at 70%]			4,500	5,000	3,500
Furnace 1			16,176	16,176	
Furnace 2			0	0	
Air-Conditioner 1 (21.4 Amps)			5,136	0	
25% of Largest Motor [430.24]			1,176	294	294
Electric Vehicle Supply Equipment [3.3 KW on Nameplate at continuous load]			3,300	4,125	
		Total Volt-Amperes		**45,337**	**17,761**
		VA ÷ 240 Volts = Amperes		188.9	74
		Minimum Size Conductors		2/0 AWG (CU)	4 AWG (CU)
		Minimum Size Conductors		4/0 AWG (AL)	2 AWG (AL)

Branch Circuit Sizing

- Branch-circuit conductors shall have an ampacity not less than the maximum load to be served.

- Where a branch circuit supplies continuous loads or any combination of continuous and non-continuous loads, the conductor size must have an allowable ampacity not less than the non-continuous load plus 125 percent of the continuous load. [*NEC* 210.19(A)(1)]

  - 15 ampere breaker limited to 12 amperes
  - 20 ampere breaker limited to 16 amperes

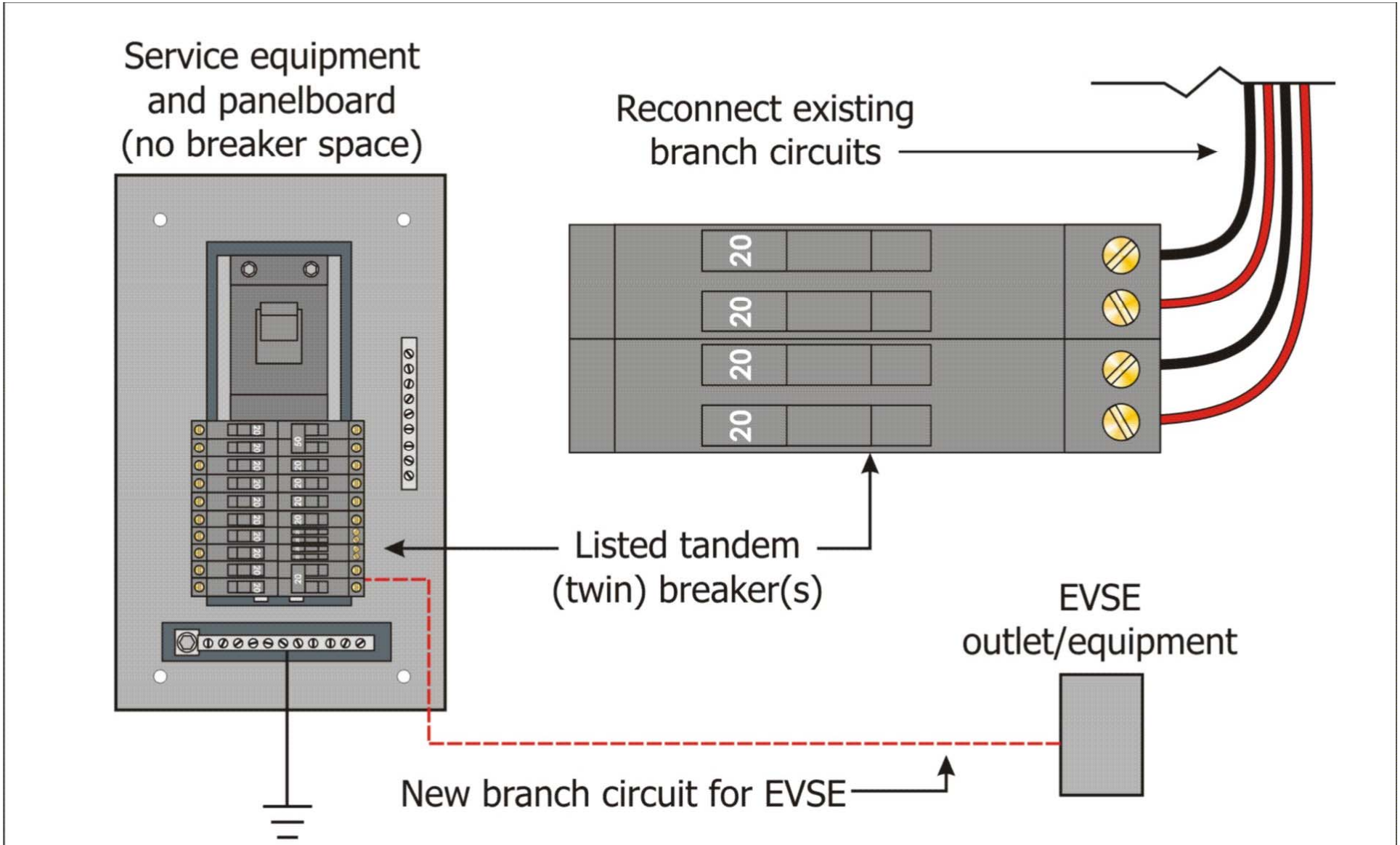
Feeder Conductor Sizing

- Feeder conductors shall have an ampacity not less than required to supply the load as calculated in Parts III, IV, and V of Article 220. [*NEC* 215.2(A)(1)]

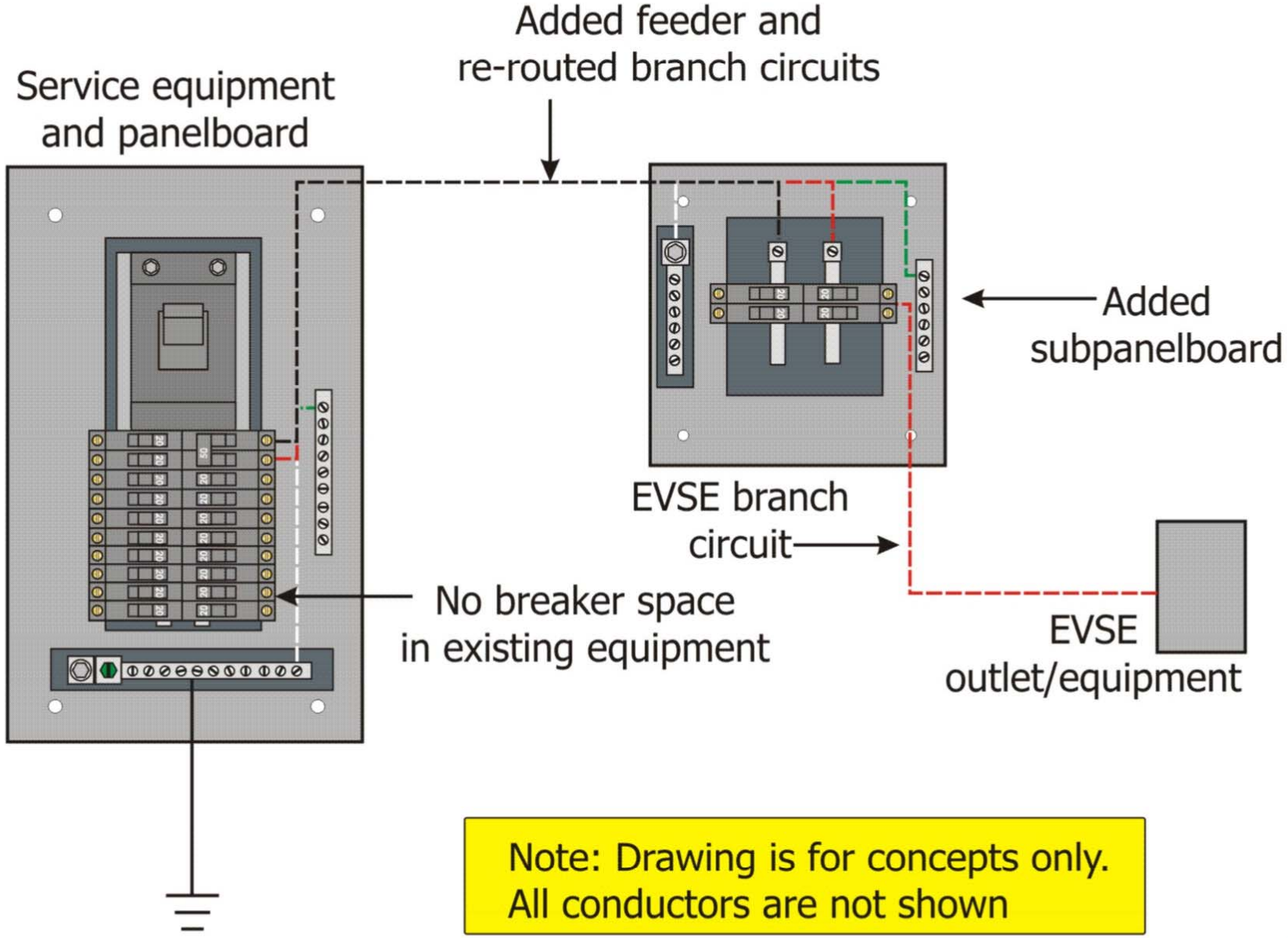
- The minimum feeder-circuit conductor size, before the application of any adjustment or correction factors, shall have an allowable ampacity not less than the non-continuous load plus 125 percent of the continuous load. [*NEC* 215.2(A)(1)]

Site Assessment

- What is the size of the existing source or service equipment?
- What are the connected loads? (use the circuit directory in the panelboard and verify with the homeowner)
- Example 1: If the type of EVSE is Level 1, there is usually capacity to add an additional individual 20-ampere branch circuit for EVSE use.
- Example 2: If the type of EVSE is Level 2, and the existing service capacity is 100 amperes or less, a calculation should be performed to determine the existing load on the service and if adding a level 2 would overload the service.



Important: Do not exceed the maximum permitted tandem breakers within listed equipment. Comply with manufacturer's installation instructions in accordance with NEC 110.3(B).


Added feeder and
re-routed branch circuits
Service equipment
and panelboard
Added
subpanelboard
EVSE branch
circuit
No breaker space
in existing equipment
EVSE
outlet/equipment
Note: Drawing is for concepts only.
All conductors are not shown

The Electrical Permit Process

- Determine and contact the applicable Authority Having Jurisdiction (AHJ)
- Determine the applicable *NEC* edition and other codes adopted and enforced by the AHJ
- Verify if there are specific local amendments to the *NEC* rules.
- Verify the specific inspection procedures/processes
- Verify utility company requirements (separately metered or off-peak metering and any applicable permits or applications)

The Electrical Permit Process

- Apply for the permit and disclose the description and plan of the work being performed
- The permit process might require a load calculation (especially for installations in other than dwelling units)
- Determine the field inspection process (how and when to schedule an inspection).
- Obtain a contact phone number for questions.
- Post the permit at the jobsite as required by the AHJ.

Role of the Inspector

- Issuing of construction/installation permits
- Enforcement of the *NEC* and other applicable standards
- Verify compliance with the *NEC* and other codes adopted within their jurisdiction
- Review of plans and specifications for code compliance
- Conduct field inspections
- Issuing of non-compliance reports/inspectors notices
- Notifying utility for connection or meter clearances
- Issue approvals upon completion of project

Coordination of the Installation

- Safety programs and practices are implemented by the contractor's employees
  - Contractor Safety Program
  - NECA has a Standing Policy on Safety
  - Safety-related work practices for electricians
- Installation of EVSE and Supply Circuits (Electrical Contractor and Electrician)
- Facilitate delivery of tools and materials for the project.
- Installation/system testing/identifying branch circuits in equipment

Installation Instructions

- Ensure conformance to all specific EVSE installation instructions. [*NEC* 110.3(B)]
- Section 625.5 requires all materials devices, fittings, and other equipment for EVSE to be listed.
- EVSE nameplates must be used to determine the load being added to the service or system.
- Location of EVSE will determine any specific installation mounting requirements other than ordinary.
- Once EVSE location is established, determine potential expose to physical damage and if additional protection may be necessary.

Codes and Standards

- *NEC* rules (Chapters 1 through 4, Article 625, 230, others)
- Applicable IBC (Building Codes)
- Equipment Product Listing and Certification
- NECA 1, NECA 413 National Electrical Installation Standards
- Requirements in EVSE product standards
  - ADA requirements (other than dwellings)
  - OSHA Regulations
  - NFPA 70E- Standard for Electrical Safety in the Workplace

2011 National Electrical Code®

- Chapters 1 through 4, Article 625, 220, 230, and others
  - Article 110 – Requirements for Electrical Installations
  - Article 210 – Branch Circuits
  - Article 220 – Branch-Circuit, Feeder and Service Calculations
  - Article 230 – Services
  - Article 240 – Overcurrent Protection
  - Article 250 – Grounding and Bonding
- Chapter 3 Wiring Methods and Materials

2011 National Electrical Code®

- Article 625 – Electric Vehicle Charging Systems
  - Part I General
  - Part II Wiring Methods
  - Equipment Construction
  - Control and Protection
  - Electric Vehicle Supply Equipment Locations

Summary of Workshop

- A high level review of the basic steps and responsibilities of electrical contractors related to installing electric vehicle supply equipment (EVSE).
- Focus is facilitating an effective efficient installation of EVSE and related wiring.
- NECA's goal is to assist in the safe, sound and successful growth of the electric vehicle market.

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2014 NEC© Activity

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2014 NEC© Activity

- NECA's Michael Johnston chairs the NEC Technical Correlating Committee (TCC)
- A EVSE Task Group has been formed that includes key members of NEC CMP-12
- Task Group is exploring potential proposals for 2014 NEC
  - Add Individual branch circuit requirements in 625 all levels of EVSE
  - Clarify NEC 625.13 as to cord-and-plug connected EVSE
- Proactive preparations for possible tentative interim amendment (TIA)

Electric Vehicle
EVITP
Infrastructure Training Program

Working Group

- Industry allies from local NECA chapters and IBEW/NECA training centers are working across industry lines with automakers, EVSE manufacturers, utility companies, inspector associations, and standards developing organizations to develop the *Electric Vehicle Infrastructure Training Program* (EVITP).
- Partner Advisory Board members have provided content and input to curriculum.
- To insure a ready force of trained electricians and electrical contractors that are familiar with the unique characteristics of EVSE technology.

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Electric Vehicle EVITP Infrastructure Training Program

Advisory Partners

AeroVironment	Clipper Creek	Commonwealth Edison	DTE
Duke Energy	ExergoniX	GE	GM
Hubbell	IAEI	Kansas City Power & Light	Leviton
Legrand/P&S	NFPA	Orlando Utilities Commission	PEP Stations
Schneider Electric	Smith Vehicles	SCE	UC Davis
	More joining all the time …		

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NECA 413: National Electrical Installation Standard™ for EVSE

NECA