



The Association of Electrical and
Medical Imaging Equipment Manufacturers



ETRA Special Briefing Series: Electric Vehicle Supply Equipment: Clean Energy Charging the Future of Transportation

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Subcommittee for NEMA

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Who is NEMA?

NEMA is the trade association of choice for the electrical manufacturing industry. Founded in 1926 and headquartered near Washington, D.C., its approximately 450 member companies manufacture products used in the generation, transmission and distribution, control, and end-use of electricity.



NEMA Activities

-  **Standards**
 - Publish over 500 standards
-  **Government Relations**
 - Legislative and regulatory advocacy
-  **Collection and Analysis of Economic Data**
 - NEMA Business Information Services



Electric Vehicle Supply Equipment Section

Purpose

- Support the development of the electric vehicle supply equipment market
- Educate the market on the features and value of the electric vehicle supply equipment infrastructure around the world
- Develop, in association with other related NEMA sections, the technology and application and product standards.

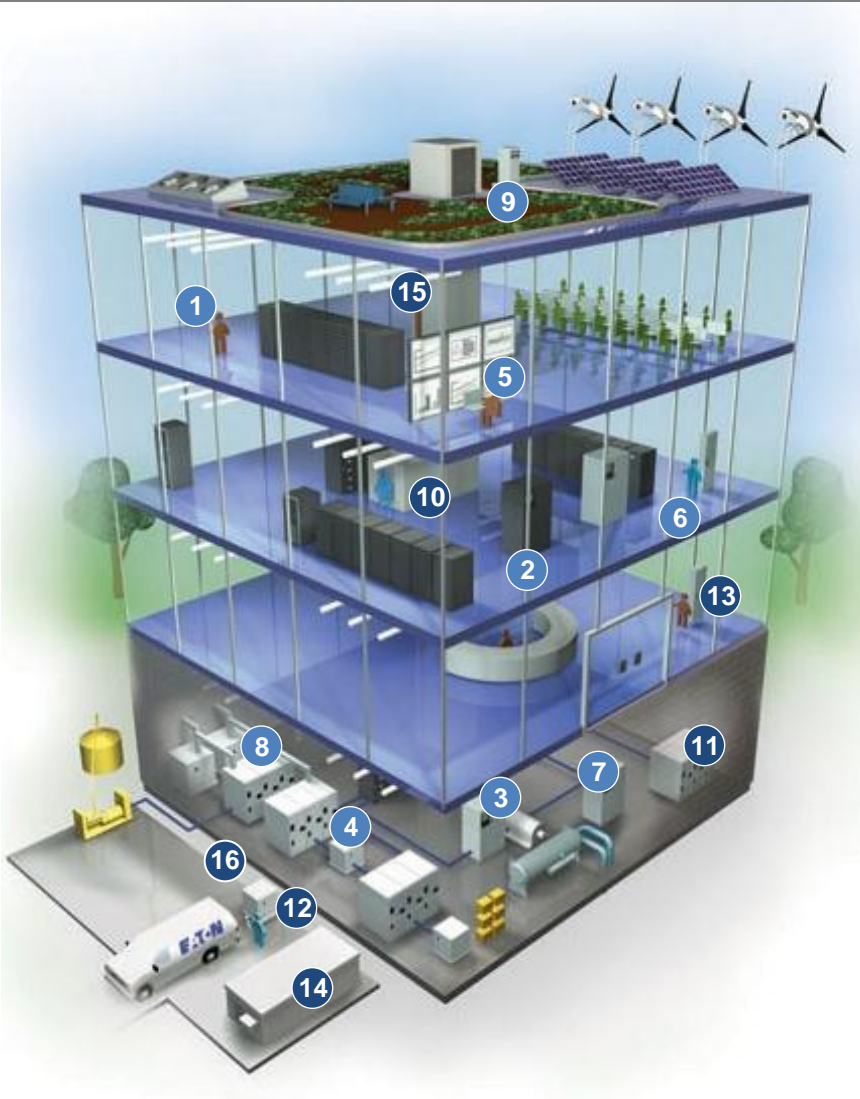


EVSE Section Members





NEMA focus on comprehensive electrical power solutions



| Save Energy | Protect the Environment |
|-------------|-------------------------|
|-------------|-------------------------|

- | | | |
|--|--|---|
| <p>1 Pow-R-Command Lighting Control</p> <p>2 Uninterruptible Power Systems</p> <p>3 Variable Frequency Drives and Soft Starters</p> <p>4 Energy Efficient and Harmonic Mitigating Transformers</p> <p>5 Power Xpert Software and Meters</p> | <p>6 Energy Audits</p> <p>7 Power Factor Correction Capacitors and Filters</p> <p>8 Paralleling Switchgear</p> <p>9 Automatic Transfer Switches</p> <p>10 Integrated Facilities Systems</p> | <p>11 Medium Voltage Switchgear</p> <p>12 Refurbishing Services</p> <p>13 Circuit Breakers</p> <p>14 Integrated Power Assemblies</p> <p>15 Busway</p> <p>16 EVSE</p> |
|--|--|---|



Electric Vehicle Supply Equipment

EVSE

- Electric Vehicle Supply Equipment

- General term used for all of the equipment used to supply electricity to the car

 Can be found in residential, commercial or industrial settings

 “Along the way” and “destination” charging

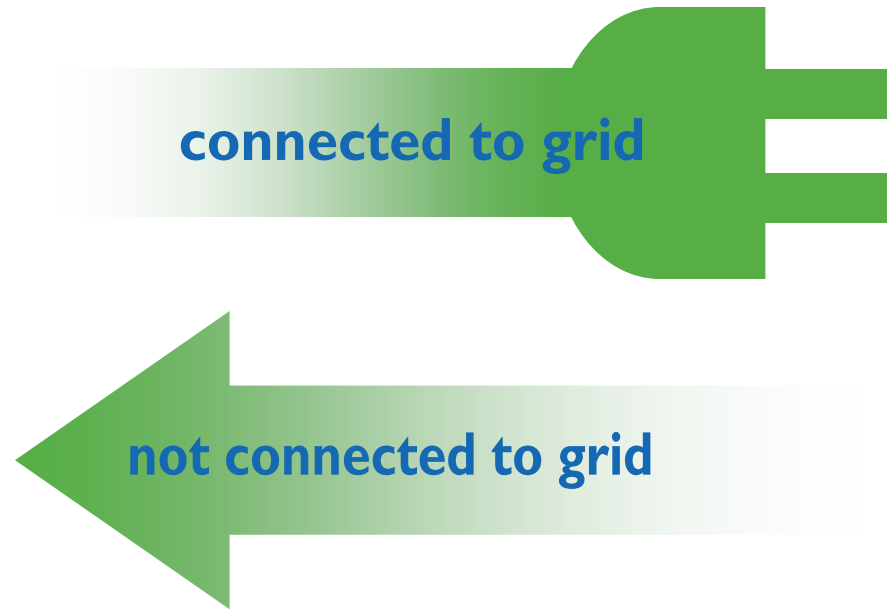


What is Electric Drive?

Electricity moves the Wheels – all or in part

- All-Battery electric
- Plug-in Hybrid Electric

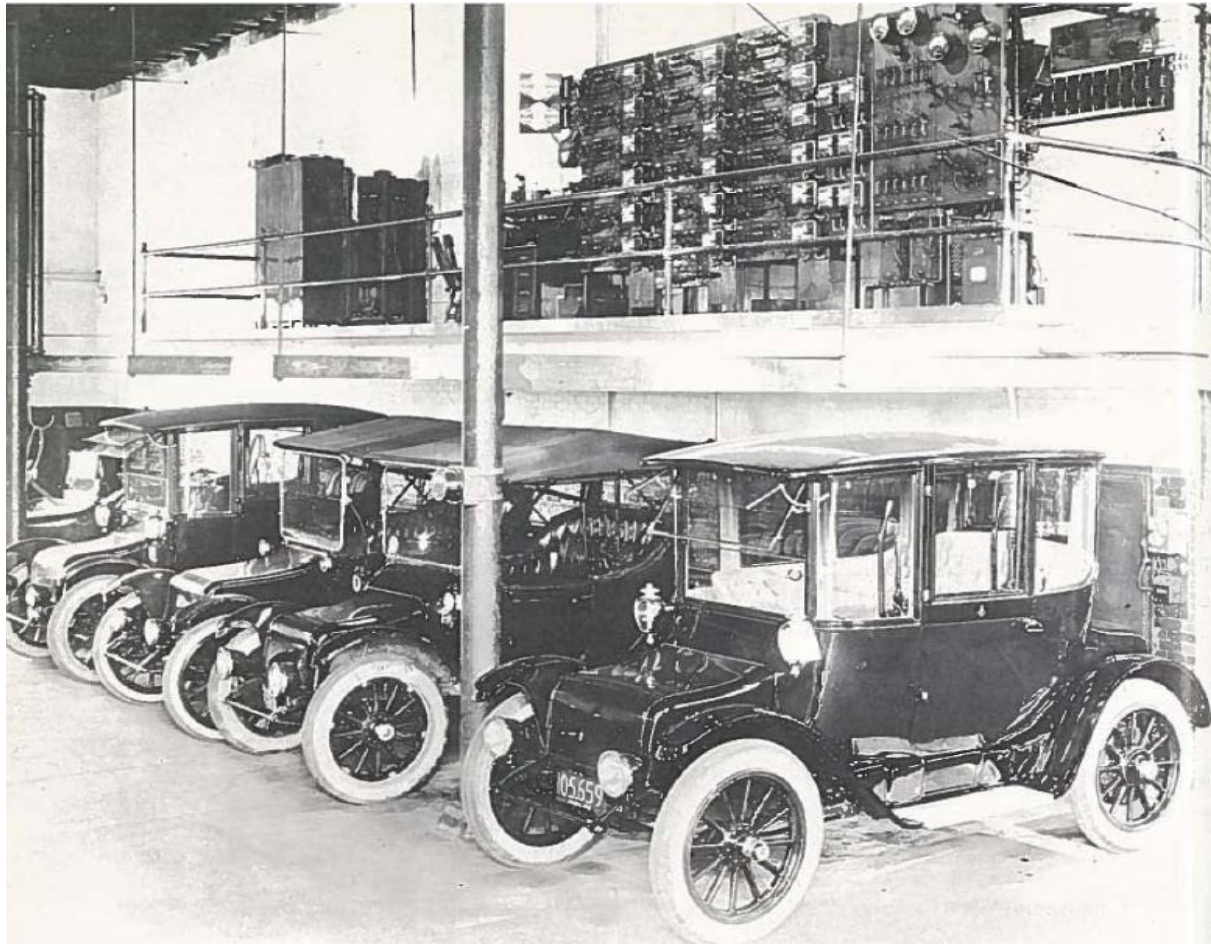
- Hybrid Electric
- Fuel Cell Electric





The First Electric Vehicles - Cutler-Hammer was there!

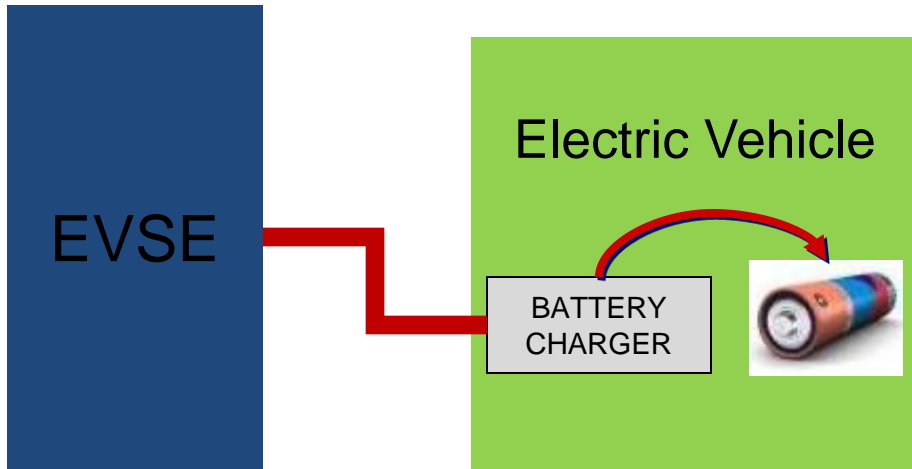
Introducing **Eaton's** First **Electric Vehicle Charging Station** for Fleets...



An excerpt from the **1907** Cutler-Hammer Product Catalog



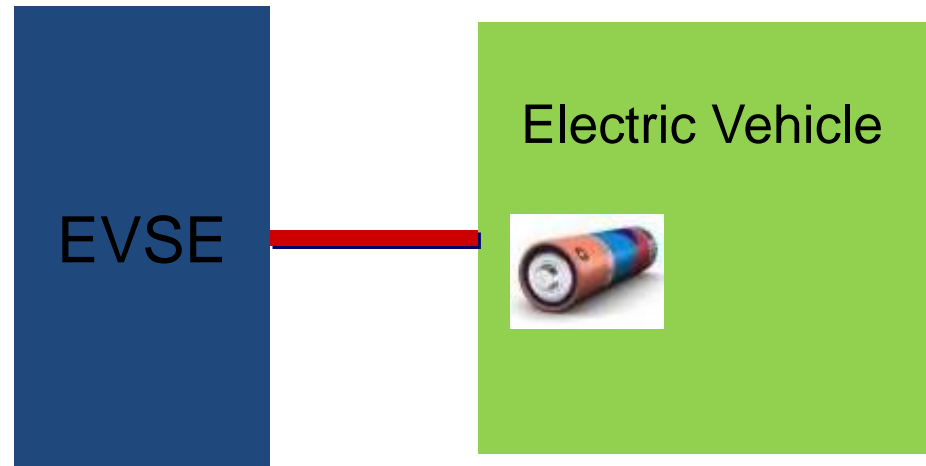
How does it work?



DC Charging

Direct charge to
the car's battery

AC
Charging
Powers the
car's onboard
battery charger





Vehicle Announcements

Hybrid Electric Vehicles

2011 Mercedes E Class Hybrid
2011 Porsche Cayenne S Hybrid
2011 Toyota Camry Hybrid
2011 Toyota Prius Hybrid
2011 Audi A8 Hybrid (likely introduction)
2011 BMW 5-Series ActiveHybrid
2011 Honda CR-Z sport hybrid coupe
2011 Lexus CT 200h Hybrid Hatchback
2011 Peugeot Diesel Hybrid*
2011 Suzuki Kizashi Hybrid
2011 Audi Q5 Crossover Hybrid
2011 Hyundai Sonata Hybrid
2012 Infiniti M35 Hybrid
2014 Ferrari Hybrid

Plug-in Hybrid Electric Vehicles

Fisker Karma S
2010 Toyota PHEV
2011 BYD F3DM PHEV
2012 Toyota Prius PHEV
2012 Bright Automotive IDEA PHEV
2012 Ford Escape PHEV
2012 Volvo V70 PHEV*
2012 Ford C-MAX Energi
2013 BMW Vision



Vehicle Announcements

Battery Electric Vehicles

2010 Mitsubishi i - **ARRIVED!**
2010 Nissan LEAF - **ARRIVED!**
2010 Ford TRANSIT connect electric - **ARRIVED!**
2010 Tesla Roadster Sport 2.5 - **ARRIVED!**
2010 BYD e6 Electric Vehicle* - **ARRIVED!**
2011 TH!NK City - **ARRIVED!**
2011 Coda Automotive Sedan
2011 Peugeot Urban EV*
2011 Renault Kangoo Z.E.*
2011 Renault Fluence Z.E.*
2011 Tesla Model S
2011 Ford Focus
2011 Opel Ampera Extended Range BEV*
2012 Fiat 500 minicar
2012 Renault Twizy Z.E.*
2012 Renault Zoé Z.E.*
2012 Audi e-tron
2013 Volkswagen E-Up*
2016 Tesla EV

Extended Range Electric Vehicles

2010 Chevy Volt Extended Range EV - **ARRIVED!**

Fuel Cell Electric Vehicles

Honda FCX Clarity
GM Hydro-GEN3
Chevy Equinox Fuel Cell
Ford Fuel Cell EV
2012 Hyundai Tucson ix35 Fuel Cell



Which comes first?





EV Charging Applications

HOME

- 💡 Majority of vehicles will charge primarily at home
- 💡 Convenient and affordable
- 💡 110 v or 220v charging options
- 💡 Programs to charge off-peak



Work and Public

- 💡 Charging stations at workplaces, retail and public garage locations
- 💡 Apps for charging locations
- 💡 Fast charging options





Chevy Volt

- 💡 December 13, 2010 - 160 Customers in California, Texas, Washington D.C. and New York started receiving the first batch of the Chevy Volt





Nissan LEAF

- 💡 December 11, 2010 - 19 customers in Arizona, California, Tennessee, Oregon and Washington received their LEAF
- 💡 Shipment of about 90 cars arrived at the Port of Los Angeles before the New Year and are now at dealerships





Growth Predictions

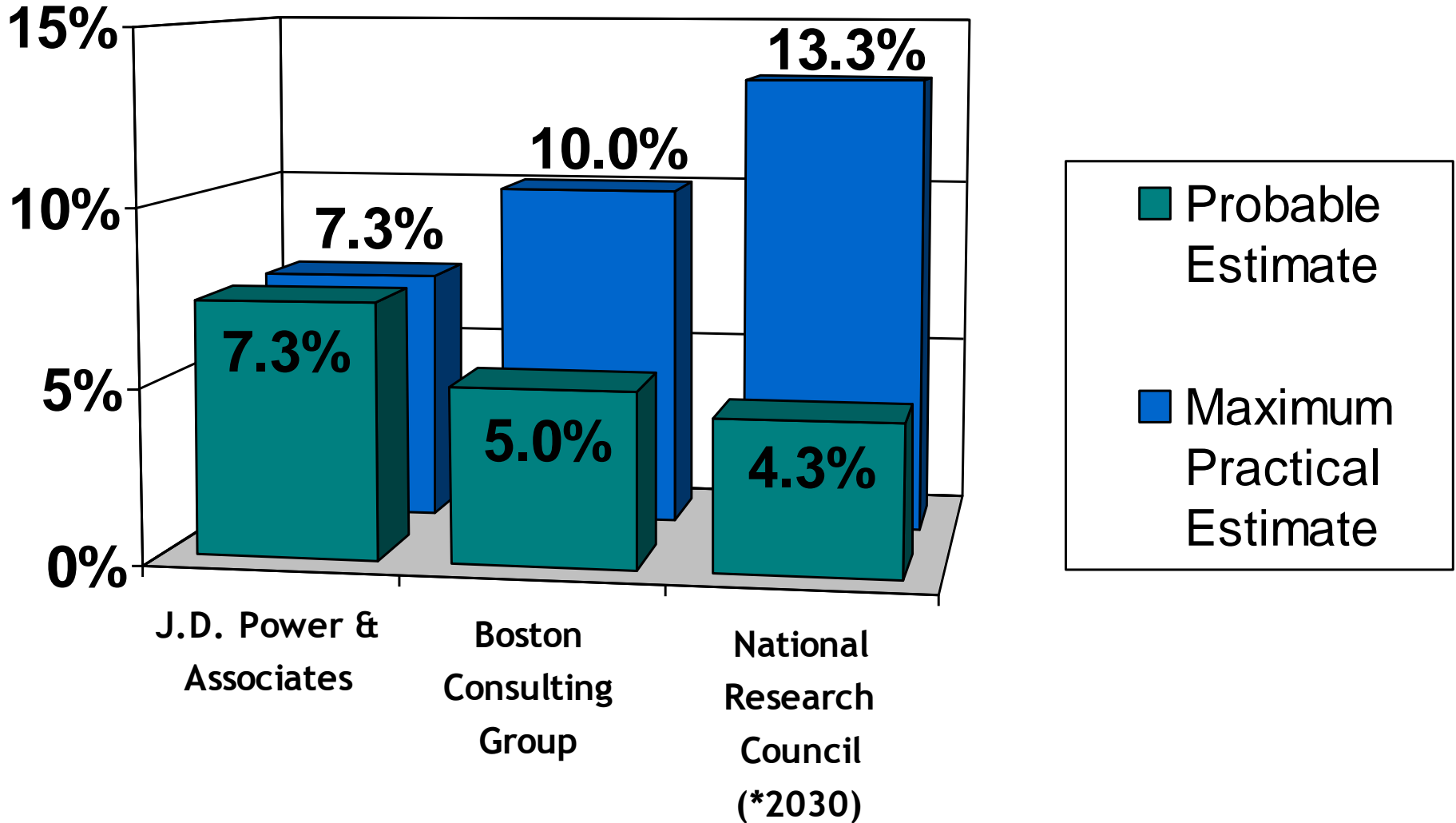
Projections vary

- **J.D. Power & Associates, 2010₁**
- **Boston Consulting Group, 2010₂**
- **National Research Council, 2010₃**

 **Common Findings: Policy support and economic drivers change business-as-usual estimates in the near term**

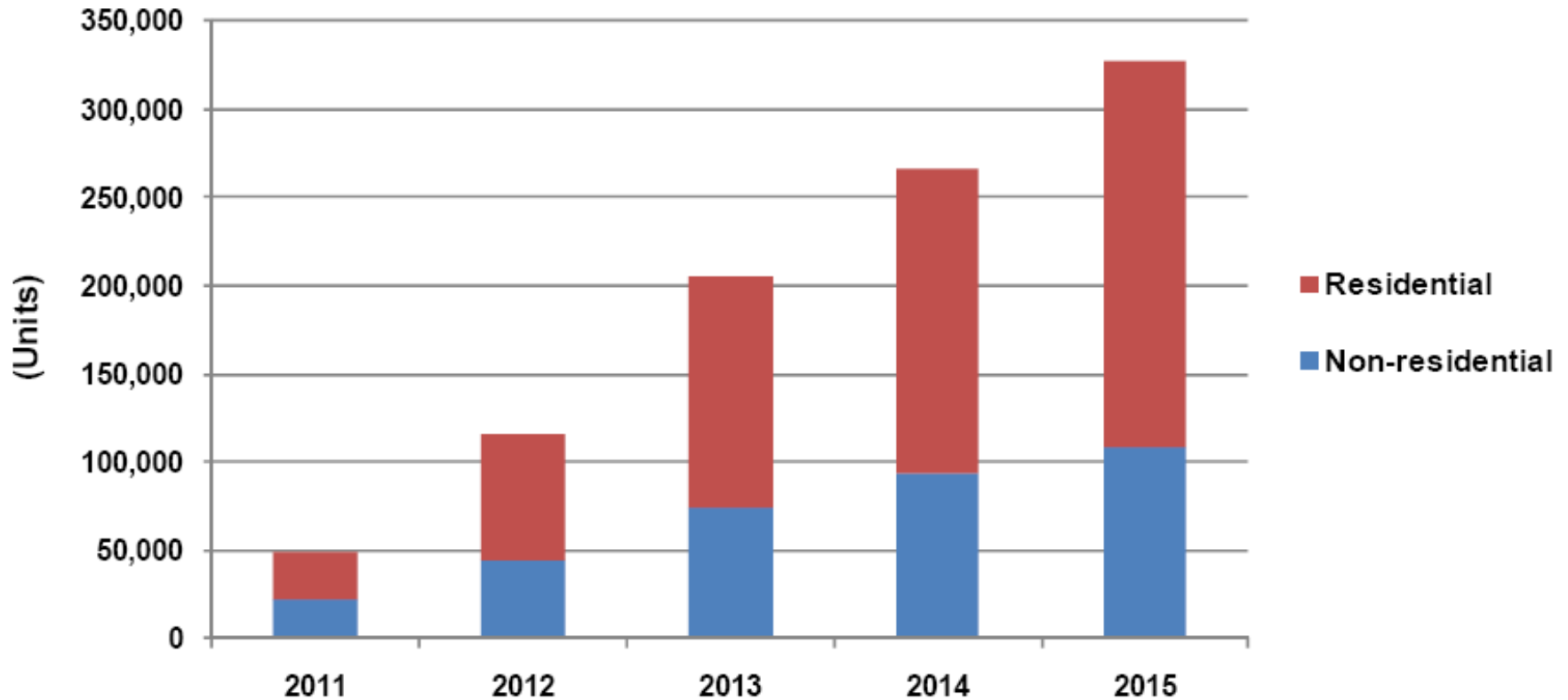


Percent of EV Market Penetration by 2020*





Annual EV Charging Equipment Sales, United States: 2011-2015





Market Factors

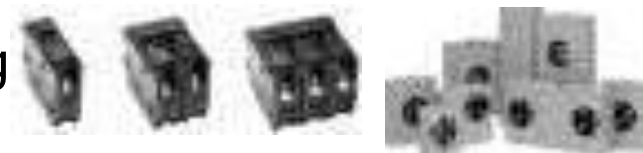
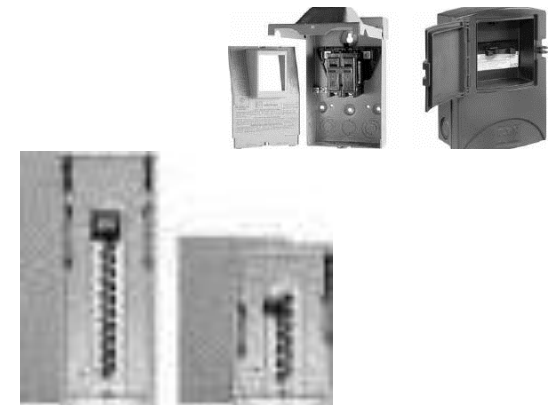
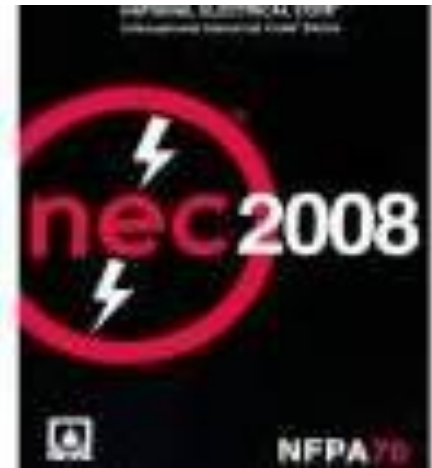
- 💡 Oil prices are on the rise
- 💡 Component costs - battery and components
- 💡 Infrastructure deployment
- 💡 DOE programs and budget concerns
- 💡 Emission regulations: air quality and vehicle fuel economy/emissions
- 💡 Major companies investing in EV
 - Vehicles and Infrastructure
- 💡 Incentives - tax credits expire at end of 2011
 - Vehicle - \$7500
 - Alternative Fuel Vehicle Refueling Property
 - Up to \$30,000 for businesses
 - Up to \$1,000 for residences



EVSE Infrastructure Impact

EVSE - an extension of the distribution system

- 💡 Enabling a premise for EV charging is **more than just installing an EVSE**
- 💡 NEC 625 delineates that an EVSE be installed on a **dedicated circuit** with 125% over-current protection
- 💡 Installation scenarios **will vary significantly** from customer to customer
- 💡 For some customers it may be **simple**
 - Install a new two-pole circuit breaker, wiring, and the EVSE
- 💡 For other customers it can get **complex**
 - Upgrade of service, new load center, getting up to code, long wiring distances, conduit through walls, transformer upgrades etc.





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Public Policy and Incentives



DOE ARRA Grants for EV and EV Infrastructure

Heavy-Duty Truck and Passenger
Vehicle Efficiency

\$106.6 Million (15%)

Alternative Fueled Vehicles Pilot
Grant Program (Clean Cities)

\$298.5 Million (18%)

Advanced Battery and Electric
Drive Component Manufacturing
Grants

\$1.99 Billion (26%)

Transportation Electrification
Projects

\$386 Million (16%)

SEP and EECBG Funds are also being invested in vehicles and Infrastructure

DOE ARRA funding update



EV Infrastructure Credit

- 💡 ARRA increased value of the tax credit.
- 💡 Commercial refueling property 50% with \$50,000 cap.
- 💡 \$2,000 for residential property.
- 💡 Expired on December 31, 2010

- 💡 The existing tax credit for commercial refueling property is 30% with a \$30,000 cap.
- 💡 \$1,000 for residential property
- 💡 Tax credits for all fueling infrastructure expires on December 31, 2011

Extension is vital to deployment






Policy and Political Drivers in 112th

- New Congressional imperatives
 - Priorities and Bipartisan support
 - Budget Concerns and “smaller government”
 - Energy policy investments in current environment
- Regulatory and/or incentives approaches to carbon and fuel economy
- Price & supply of oil - potential agreement due high gas prices
- How do first plug-in market entrants perform
 - Sales
 - Technology
 - Performance
 - Acceptance



NEMA Principles for Deployment

-  Rapid deployment of electric vehicles requires robust market penetration of charging infrastructure—at home, at the office, and on the road, from coast to coast.
-  Through its Electric Vehicle Supply Equipment and Systems (EVSES) section, NEMA represents manufacturers of products or assemblies installed for the purpose of safely delivering and managing electrical energy between an electric vehicle and an electrical source.
-  These products put the consumer in control of their recharging needs. With various payment methods, voluntary interaction with the electric grid, and the ability to charge the vehicle when power is at its cheapest, EVSES makes owning and operating an electric vehicle cost-effective, safe, and convenient.



POLICY POSITIONS

- 💡 Multi-year Extension of and Expansion of Section 30C Alternative Fuel Vehicle Refueling Property tax credit, currently set to expire in 2011
- 💡 50% credit capped at \$2,000 for individuals and \$50,000 for businesses (up from 30%/\$1,000/\$30,000)
- 💡 Clarification of eligible expenses in Section 30C Alternative Fuel Vehicle Refueling Property tax credit
- 💡 IRS should expressly allow for all necessary electrical equipment, infrastructure, and installation costs that are necessary to deliver power to charge the electric vehicle
- 💡 Transferability (from the buyer to the seller) of the \$7,500 tax credit for purchase of a qualified electric vehicle
- 💡 To ensure that electric vehicle charging is done safely and effectively, federal incentives should require that equipment and installation be in compliance with the National Electrical Code
- 💡 Legislation that establishes and incentivizes first deployment communities; facilitates fleet adoption of EVs and EVSE; and enables utilities to respond to necessary infrastructure investments as a result of EV deployment

For more information, please contact Jim Creevy,
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Legislation in 112th Congress



S. 298, Charging America Forward Act (Sen. Stabenow)

- Extends Section 30C EVSE Credit through 2014
 - Raises amount of credit from 30% to 50%
 - \$50K for businesses
 - Raises cap to \$2K for individuals
 - Eligible: “electrical panel upgrades, wiring, conduit, trenching, pedestals, related equipment.”

- EV Tax Credit
 - Transferable to dealer or financier
 - Refundable
 - Per manufacturer cap raised to 500K





President's Goal - 1 million by 2015

- 💡 **\$7,500 rebate at point of sale**
 - Cash for Clunkers approach
- 💡 **R&D in energy storage, electric drive tech**
 - 30% increase in FY2012 Budget
- 💡 **Grants to Early Adopting Communities**
 - \$10 million each for 30 communities who invest in EV infrastructure





Legislation in 112th Congress (cont'd)

- 💡 **S. 232 (Sen. Levin/Rep. Levin)**
 - EV tax credit per manufacturer cap raised to 500K

- 💡 **TBD: Reps. Biggert/Markey, Sens. Merkley/Alexander**
 - National Plan...Deployment communities...Federal fleet pilot...bonding authority for EVSE infrastructure...



Regulatory Imperatives

- **Automotive CAFE/GHG rulemakings 2012 - 2016**
 - Overarching efficiency requirements
 - Treatment of PHEVs
 - Impact of Cap:
 - For manufacturers that produce fewer than 25,000 of the vehicles in 2012, they are able to claim credit for the first 200,000 vehicles; For manufacturers who produce more than 25,000 in 2012 are able to claim credit for the first 300,000 vehicles.
 - For production levels above the advanced vehicle caps, the rule states that ‘EPA will take into consideration the net increase in "upstream" emissions from an advanced vehicle compared to the gasoline vehicle it replaces when determining how the advanced vehicle aids a manufacturers' compliance with the rules broader mandates.’
 - **2017 and beyond:** uncertainty about metrics going forward - 60 mpg push
 - EPA/NHTSA moving forward on similar combined approach for med and heavy duty segment



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Standards and Codes



EVSE Communication

1. RFID communications for authentication
2. Vehicle Communications – SAE and ISO
3. Utility AMI Communications
4. Network Management communication
 - a. Billing and authentication
 - b. Station Management and Status
 - c. Roaming and Billing Reconciliation



EVSE Codes and Standards

Hardware interoperability

- EVSE to Vehicle
 - Voltage/current (Level I: 120V/12-16Amp; Level II: 240V/80A; Level III: 3x 380VAC or DC - in development)
 - Connectivity (SAE J1772 in US for Levels I & II)
- EVSE to Supply
 - Connectivity (hardwired or plug/receptacle) NEC & NEMA



Safety

- EV and EVSE: UL 2594, UL 2231-1, UL2231-2, UL 1998
- Supply: NFPA/NEC





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