ANSI Electric Vehicle Standards Roadmap

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May 17, 2012

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Project ID # VSS093

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Overview

Timeline

- Start: Oct 2010
- Finish: Apr 2012
- Phases 1 and 2 - 100% complete

Barriers Addressed

- Safety
- Interoperability
- Performance
- Cost

Budget

- Total project funding
  - DOE: $165K
  - Private Sector Cost:$216K
- DOE Funding received in FY11: $108K
- DOE Funding for FY12: $57K

Partners

- American National Standards Institute (ANSI)
- Energetics
- Project Lead: Jim McCabe, ANSI; Partner: Fred Wagner, Energetics

Objectives – Consistent with Objectives of DOE Vehicle Technologies Program

- Foster coordination and collaboration among public and private sector stakeholders working on standards and codes for EVs and charging infrastructure
- Achieve policy objectives – reduce petroleum consumption, enhance economic growth, and lower greenhouse gas emissions
- Foster dissemination of safe / interoperable technology for EVs and charging infrastructure
- Respond to consumer expectations regarding safety, interoperability, performance, cost, environmental impact

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Milestones

- Phase 1: Oct 2010 – Aug 2011, DOE / INL contract ANSI to convene *ANSI Workshop on Standards and Codes for Electric Drive Vehicles*
  - Report / proceedings of April 5-6, 2011 workshop available at www.ansi.org/edv
- Phase 2: Jul 2011 – Apr 2012, DOE provides in-kind support via Energetics for ANSI Electric Vehicles Standards Panel (ANSI EVSP)
  - *Standardization Roadmap for Electric Vehicles, Version 1.0*, released April 2012. Free download at www.ansi.org/evsp.
  - *ANSI EVSP Standards Compendium*, a searchable spreadsheet of standards related to issues identified in the roadmap, also released

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Approach / Strategy for Deployment

- Identify, inventory and assess standards, codes and regulations, conformance and training programs, needed to enable safe, mass deployment of EVs and charging infrastructure in the U.S., with an eye toward international activities and harmonization
- Ascertain gaps and recommend solutions
- Identify prioritized timeframes for needed standards, and organizations that may be able to perform the work
- Focus is on-road plug-in EVs, both battery electric and plug-in hybrids, charging systems and associated support services
- 3 Domains: Vehicle, Infrastructure, Support Services
  - 7 Working Groups: Energy Storage Systems, Vehicle Components, Vehicle User Interface; Charging Systems, Communications, Installation; Education and Training

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Technical Accomplishments and Progress

- 36 gaps or partial gaps identified
  - 22 are near-term priorities (0-2 years)
  - 12 are mid-term priorities (2-5 years)
  - 2 are long-term priorities (5+ years)
- 16 issues where no gap identified
- 365 standards identified from 34 organizations
- Many SDOs (both U.S. based and non-U.S. based) produce globally relevant standards following an open, consensus-based process
  - SAE, UL, NFPA, IEEE, ISO, IEC et al.
- Some identified near-term gaps discussed on next several slides

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Progress: Battery Safety

- SAE J2464:2009, Electric and Hybrid Electric Vehicle Rechargeable Energy Storage System (RESS) Safety and Abuse Testing
- SAE J2929:2011, Electric and Hybrid Vehicle Propulsion Battery System Safety Standard Lithium-based Rechargeable Cells (under revision)
- **Near-term gap:** Address delayed battery overheating events in future revisions of J2929
- Current tested failure modes of battery systems are “real time”
  - J2464 uses European Council for Automotive R&D (EUCAR) hazard rating system
- Concern over faults that create EUCAR level 2 or higher events that do not surface for days or weeks
  - Internal partial pack circulating currents that escalate over time to dangerous thermal states

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Progress: Battery Storage, Packaging, Transport, and Handling

- **Near-term gap:** No standards address safe storage of lithium-ion batteries specifically, whether at warehouses, repair garages, recovered vehicle storage lots, auto salvage yards, or battery exchange locations
- Develop a standard on safe storage practices for both new and waste EV batteries including when battery separated from host vehicle. Potential Developers: SAE, NFPA, ICC, IEC/TC 69
- **Near-term gap:** Current standards / regulations do not adequately cover transportation of *waste* batteries (damaged, aged, sent for repair, end-of-life)
- Develop a harmonized approach toward communication, labeling, packaging restrictions, criteria for when a battery is waste. Potential Developers: ISO/TC 22/SC21, SAE or UL

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Progress: Vehicle as Supply

- **Near-term gap:** Standards to address communications and safety aspects of reverse power flow in non driving applications are still in development
- Vehicle to Grid (V2G) – EV provides reverse power flow to the grid, acting as a distributed energy resource to provide frequency regulation
- Vehicle to Home (V2H) - emergency backup power to home following loss of grid power (non grid application)
- Vehicle to Load (V2L) – powering loads at a remote site
- Vehicle to Vehicle (V2V) - jump starting another EV
- Complete work to address communications and safety aspects of reverse power flow in SAE J2836/3™ and SAE J2836/5™, and SAE J2847/3 and SAE J2847/5. Address reverse power flow safety aspects in IEEE 1547 series of standards

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Progress: Use of Alternative Power Sources

- Use of solar photovoltaic array, small wind turbine, facility battery bank, or even another EV with reverse power flow capability to provide power for charging an EV
- **Near-term gap:** The National Electrical Code® does not specifically address the integration of the EV and EVSE with a facility high voltage DC power distribution system for either charging or reverse power flow
- Develop NEC® requirements for high voltage DC power distribution systems and the integration of distributed energy resources and DC loads with the system
- Potential Developer: NFPA

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Progress: Infrastructure Communications

- Charging-related communication between EV and EVSE for conductive charging standardized in SAE J1772™ and IEC 61851-1
  - Signals readiness of EV to accept energy and EVSE to supply energy, etc.
- SAE et al. developing standards for utility communications, DC charging, reverse power flow, diagnostics, customer-to-EV/Home Area Network/Neighborhood Area Network, wireless charging
- **Near-term gap:** Develop back end requirements as well as an interface standard that supports charging of roaming EVs between EV Services Providers. Potential Developers: NEMA, IEC
  - Authentication of EV/driver, authorization for a certain quality of service, relaying of accounting records related to charging session, billing settlement

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Progress: Infrastructure Communications (contd.)

- **Near-term gap:** Develop data definition and messaging standards for communicating access control at charging stations. Potential Developers: NEMA
  - Would facilitate access control across EVSE vendors, e.g., for scenarios where use of charging station is restricted to certain times
- **Near-term gap:** Continue work to develop standards for communication of standardized EV sub-metering data. Potential Developers: ZigBee Alliance, North American Energy Standards Board
  - Where end use measurement device (EUMD) is located on a branch circuit from premises meter
  - Communications depend on whether EUMD is utility provided or not
  - Mobile sub-metering within EVs or portable cord sets another scenario

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Progress: Safe Battery Discharge / Recharge in Emergencies

- **Near-term gap:** Standards and/or guidelines for safe battery discharge / recharge in emergencies are needed. Would help emergency responders remove vehicle from scene possibly under its own power
- Directions / procedures for safe discharging / recharging of EV batteries following an incident may depend upon type of EV involved, electrical control circuits in the vehicle, and size and nature of battery
  - Need to identify benchmarks to evaluate if a battery can be discharged in the field and a support system to allow it to be done in a timely manner
- Opportunity for standardization might also be location of on-board fast recharging instructions and/or standardized performance requirements
  - Hazard lights/signals (such as LED lights) and interlocks might be used to prevent fast recharging attempts when battery is not safe to recharge due to damage or deterioration

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Collaboration / Coordination with Other Institutions

- 80 private and public sector organizations involved from automotive, utility, electrotechnical industries, standards developing organizations (SDOs), government agencies
  - Representatives of DOE national labs participated in working groups
- Coordination with NIST Smart Grid Interoperability Panel
- External presentations
  - EPRI Infrastructure Working Council
  - Project Get Ready
  - U.S. National Committee of IEC Technical Management Committee
  - SAE / NFPA EV safety standards summit
  - ANSI European Standards Organizations, German Standards Body
  - EVS26

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Proposed Future Work
Phase 3: FY12 and FY13

- Promote / Maintain the roadmap as a “living” document
  - Presentations confirmed to NHTSA (5/18), TABD (6/20), EPRI IWC (6/27-28)
  - Produce roadmap Version 2.0 in 12-15 months
- Broaden engagement and participation by public and private sector stakeholders not involved to date
- Convene workshops to explore issues (TBD) in greater depth
- Influence policy and technical discussions in other national, regional, and international standards and conformance bodies
  - Planning TransAtlantic E-Mobility Standardization Roundtable 4 qtr
  - Reporting on progress to TransAtlantic Economic Council

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Summary

- *Standardization Roadmap for Electric Vehicles – Version 1.0* is available
  - Identifies standards, codes, and regulations that exist or that are in development, gaps where new / revised standards are needed, conformance and training programs, harmonization efforts
  - Includes prioritized timelines for when standardization should occur and identifies organizations that may be able to do the work
- Work to maintain / update roadmap will continue to foster ongoing coordination and collaboration among public / private stakeholders
- More info: www.ansi.org/evsp and evsp@ansi.org

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Technical Back up Slides

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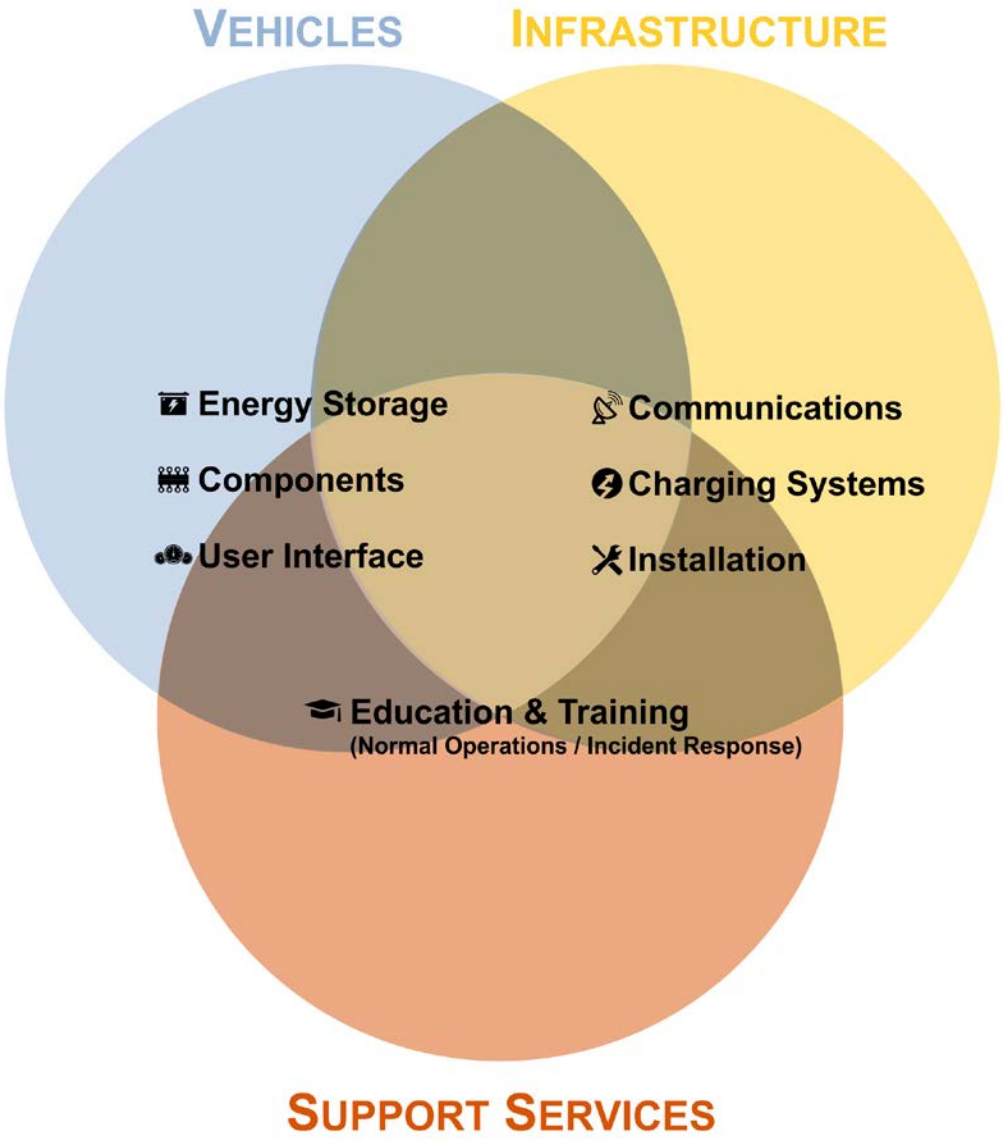
Approach



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Vehicle Domain Issues

Energy Storage Systems

- Power Rating Methods
- Battery Safety
- Battery Testing – Performance and Durability
- Battery Storage, Packaging, Transport, and Handling
- Battery Recycling
- Battery Secondary Uses
- Crash Tests / Safety

Vehicle Components

- Internal High Voltage Cables, On-Board Wiring, Component Ratings, and Charging Accessories
- Vehicle Diagnostics – Emissions
- Audible Warning Systems

Vehicle User Interface

- Graphical Symbols
- Telematics – Driver Distraction
- Fuel Efficiency, Emissions and Labeling

Terminology

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Infrastructure Domain Issues

Charging Systems

- Wireless Charging
- Battery Swapping
- Electric Vehicle Supply Equipment (EVSE)
- Electromagnetic Compatibility
- Vehicle as Supply
- Use of Alternative Power Sources

Infrastructure Communications

Infrastructure Installation

- Site Assessment/Power Capacity Assessment
- EV Charging and Parking – Urban Planning
- Charging Station Permitting
- Environmental and Use Conditions
- Ventilation – Multiple Charging Vehicles
- Guarding of EVSE
- Accessibility for Persons with Disabilities to EVSE
- Cable Management
- EVSE Maintenance
- Workplace Safety Installation

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Support Services Domain Issues

Education and Training

- Vehicle Emergency Shutoff, Including Labeling of High Voltage Batteries, Power Cables, and Disconnect Devices
- Labeling of EVSE and Load Management Disconnects
- OEM Emergency Response Guides
- Safe Battery Discharge/Recharge in Emergencies
- Workforce Training

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Reviewer Only Slides

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Publications and Presentations

- *ANSI Workshop Report, Standards and Codes for Electric Drive Vehicles*
- *Standardization Roadmap for Electric Vehicles, Version 1.0*
- *ANSI EVSP Standards Compendium*
- Presentations to:
  - EPRI Infrastructure Working Council
  - Project Get Ready
  - U.S. National Committee of IEC Technical Management Committee
  - SAE / NFPA EV safety standards summit
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  - EVS26

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Critical Assumptions and Issues

- Current landscape very favorable to EV deployment but critical challenges must be addressed on safety, affordability, interoperability, performance, and environmental impact
  - ANSI EVSP roadmap provides direction on EV and infrastructure issues that must be addressed to ensure technologies are safe and effective and meet consumer needs and expectations
- International solutions may be a challenge in some cases given national or regional requirements and competition among standards developing organizations (SDOs)
  - Though SDOs are protective of their “turf,” there is much cooperation / harmonization activity taking place in the EV space

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Critical Assumptions and Issues

- ANSI EVSP must engage broad and diverse participation from EV, EVSE and component manufacturers, as well as SDOs and government, to achieve its mission
  - Priorities determined by which organizations participate
  - ANSI EVSP's role as a neutral, coordination forum differentiates it from SDOs and positions it well to foster the public private partnership needed to achieve success
  - Attending conferences, promoting roadmap, direct outreach are employed to help identify new participants and issues