Vehicle & Systems Simulation & Testing

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OVT Program Structure

OVT/PHEV Program Mgmt.

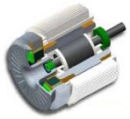
Industry/Gov't Collaboration

Technology Assessment

- Benchmarking
- Analytical Studies
- Risk Assessment

Research & Development

- Energy Storage



- Power Electronics & Electric Motors

- Engines and Fuels

- Vehicle Efficiency Technologies

Testing & Validation

- Standard Procedures
- Lab Testing and Validation
- Field Reliability Testing and Validation
- Field Testing and Demonstration

Deployment Issues

- Grid Interactions
- Automotive-Utility Industry Interactions
- Incentives
- Education and Learning Demonstration
- Codes & Standards

Vehicle & Systems Simulation & Testing Missions

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Focus Area activities provide direct and indirect support for evolution of high efficiency vehicles as real world product offerings

Component /Systems Evaluation
$1.8 m

- Virtual vehicle environment
- Energy management development/practices
- Systems benchmarking/evaluations

Modeling & Simulation
$5.2 m

- Develop & use modeling tools
- Assess technology potential
- Component Interactions
- Goal setting for R&D

Stakeholders & Partners
$23.3 m

Industry Grant Recipients
Original Equip. Manufacturers
Utilities
Consumers & Fleet Owners
VTP Sub Programs
DOE Programs
Policy Makers

Lab & Field Evaluations
$8.3 m

- Performance benchmarking
- Accelerated reliability data
- Modeling tool validation

Vehicle Systems Optimization
$2.7 m

- Reduce auxiliary and parasitic loads
- Enabling Technologies

PEV Codes & Standards
$3.5 m

- Standards Committee Participation
- Develop and Validate
- Technology Development

Note: FY13 full year CR inclusive of SBIR/STTR

Supporting Codes & Standards Development

EVSE-Vehicle Interoperability at defined Charging Levels

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Charging Level	Setting	Supply Power	Representative Example	Where Charging Occurs
AC Level 1	Residential/ Parking Lot 5 mi/hour @ 1.7 kW	120vac/20A (16A continuous)		RESIDENTIAL
AC Level 2 (minimum)	Residential/ Commercial 10 mi/hour @ 3.4 kW	208/240vac/20A (16A continuous)		2/3 of charging
AC Level 2 (maximum)	Commercial (up to) 60 mi/hour @ 19.2 kW	208/240vac/100A (80A continuous)		
DC Level 1	Commercial up to 500v @ 80Adc (up to) 120 mi/hour @ 40 kW	208vac/480vac 3-phase (input current proportional to output power; ~20A-200A AC)		COMMERCIAL
DC Level 2	Commercial up to 500v @ 200Adc (up to) 300 mi/hour @ 100 kW	208vac/480vac 3-phase (input current proportional to output power; ~20A-400A AC)		1/3 of charging

Recovery Act: Transportation Electrification Initiative

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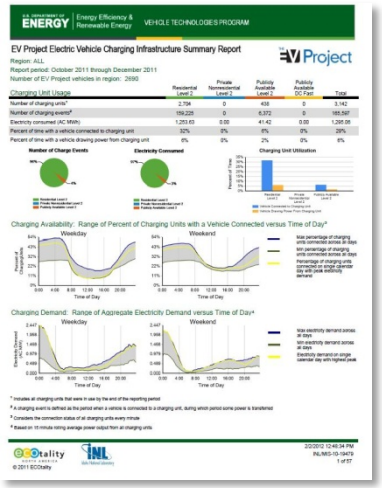
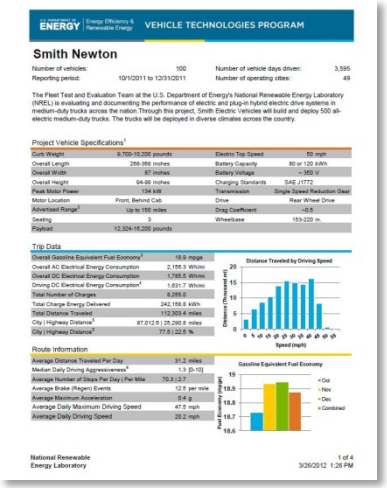
Largest U.S. Electric Vehicle & Infrastructure Deployment Ever

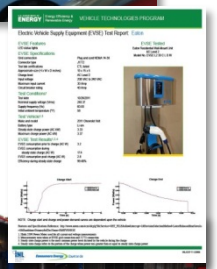
- Approximately $400 million in federal funding to:
  - Automotive and Charging Industry
  - Educational Institutions
- Deploys over 20,000 charging stations to support 13,000 plug-in vehicles
  - LDV - 14,000 EVSE and DCFC, and 7,700 vehicles as of Jan 30, 2013
- Collection of detailed data:
  - LDV: http://avt.inl.gov/
  - M/HD: www.nrel.gov/vehiclesandfuels/fleettest/





Vehicle & Systems Simulation & Testing Accomplishments

- Initiated data collection on thousands of vehicles and EVSEs deployed through Transportation Electrification:
  - 2.7 million LDV PHEV/EV charge events on 14,000 EVSE used 16,140 MWh
  - 165,809 LDV PHEV/EV miles and 7,646 charging events documented *per day*
  - 574,435 Medium Duty EV Truck miles documented for 339 vehicles in commercial service



- Total Advanced Vehicle Testing Activity (AVTA) Experience:
  - Shifted focus from HEV to PHEV/EV
  - 82 million electric drive vehicle test miles accumulated on 11,200 Light Duty vehicles representing 115 different models to date
  - 5.1 million test miles accumulated on 198 different MD/HD vehicles since 2002
  - Testing under varied and extreme thermal conditions
  - Evaluated 13 EVSE and DCFC hardware units
  - Multiple NDAs and CRADAs protect manufacturers' technologies and PII

- Deployed commercialized version of Autonomie vehicle modeling & simulation platform
  - Developed through CRADA between Argonne National Lab and General Motors
  - Distributed through LMS

Vehicle & Systems Simulation & Testing R&D Paths

FY 2013 Emphasis

- Support Electric Drive Vehicle (EDV) Market Transformation
  - Fund Industry Advanced EE RD&D
    - DE-FOA-0000793, AOI 11:"Advanced Climate Control Auxiliary Load Reduction "
      - Significantly reduce the auxiliary loads that support passenger comfort and window defrost/defog for grid connected electric drive vehicles (GCEDVs).
        - Energy Load Reduction and Energy Management
        - Advanced HVAC Technologies
        - Cabin Preconditioning
      - Cost Shared Total = $28 million, Closed 4/29/2013
  - Maximize utility of Transportation Electrification Recovery Act Data Analysis
  - Enhance effectiveness of Technology Program Support
    - Advanced Power Electronics & Electric Motor (APEEM)
    - Increase use of System Level models in Technology R&D Programs
  - Expand EDV Codes & Standards to address key vehicle/infrastructure concerns

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Backup Slides

The Big (Infrastructure) Picture

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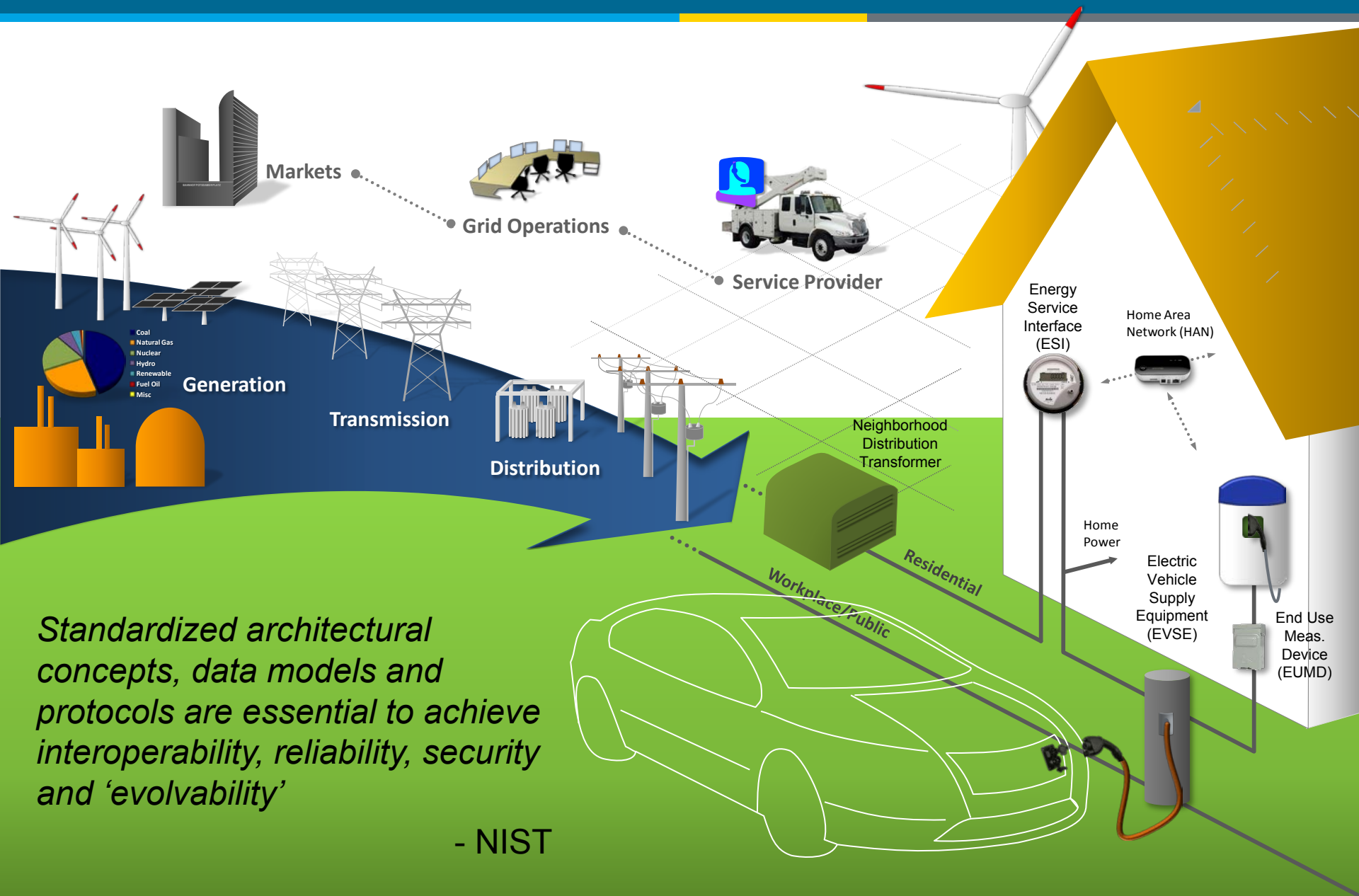
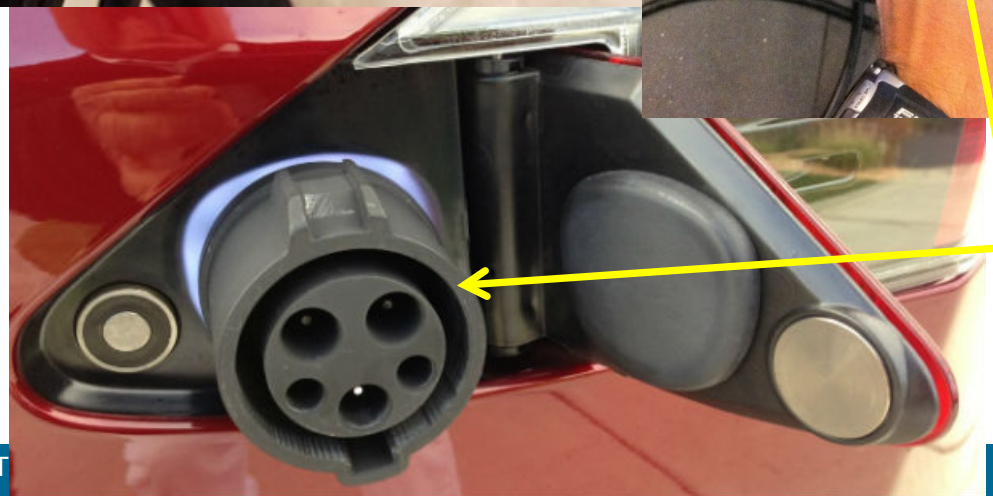


Standardized architectural concepts, data models and protocols are essential to achieve interoperability, reliability, security and 'evolvability'

- NIST

Interoperability of Three Similar But Different DC Charging Methods- Adapters When Possible

Chademo and J1772 Level 2 DC Combo



Consumer choices;
Level 1 DC combo
40kW/43 mm, <$100

SuperCharger to J1772 Adapter