

# *Drive Oregon: Idaho National Laboratory Overview & EV Activities*



**Jim Francfort**

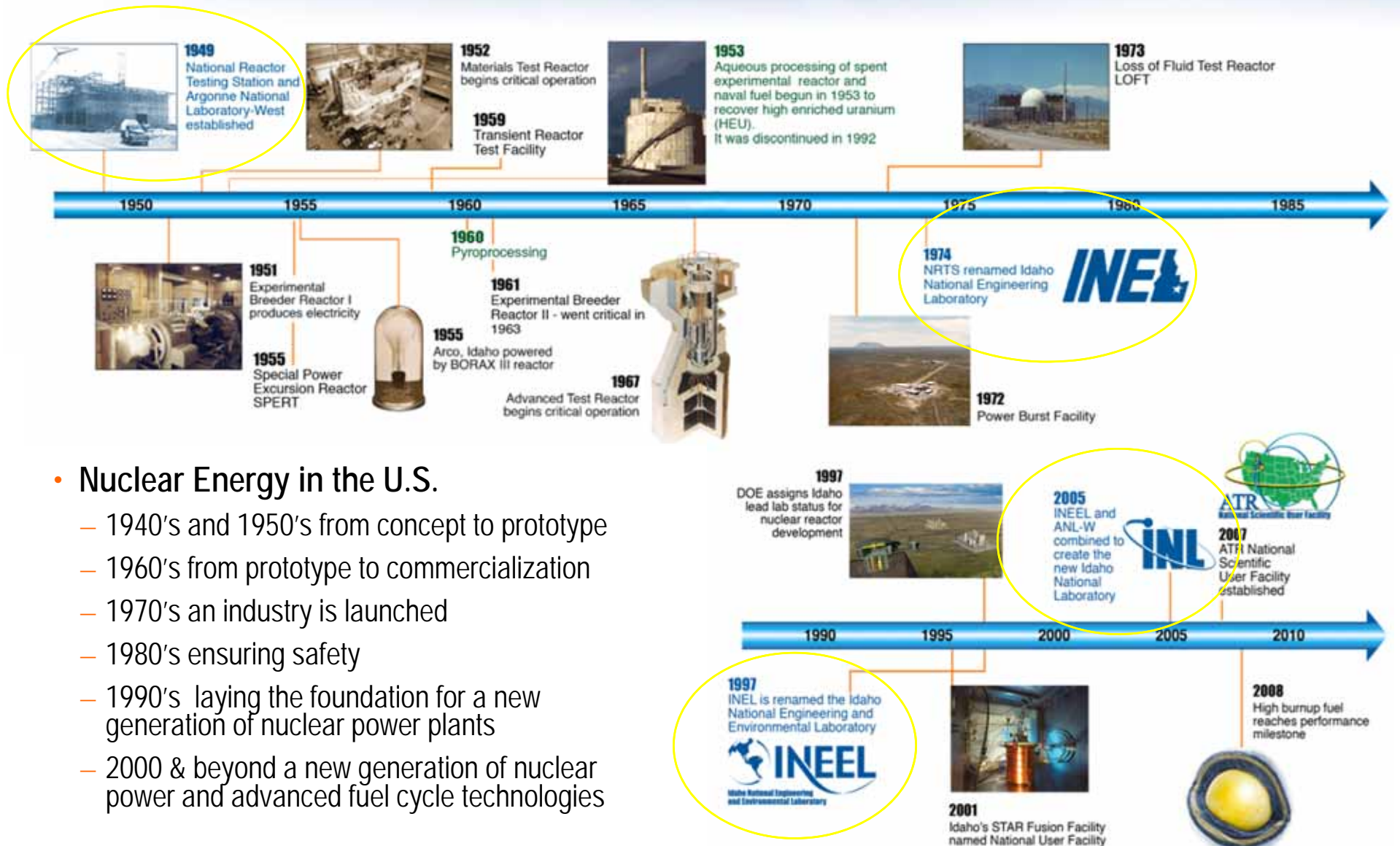
Drive Oregon  
Kells  
Portland, OR  
November 7, 2013



[www.inl.gov](http://www.inl.gov)



# Our History



- Nuclear Energy in the U.S.
  - 1940's and 1950's from concept to prototype
  - 1960's from prototype to commercialization
  - 1970's an industry is launched
  - 1980's ensuring safety
  - 1990's laying the foundation for a new generation of nuclear power plants
  - 2000 & beyond a new generation of nuclear power and advanced fuel cycle technologies

# *Idaho National Laboratory is a **Government-Owned, Contractor Operated (GOCO)** Institution*



## *Nuclear University Consortia*





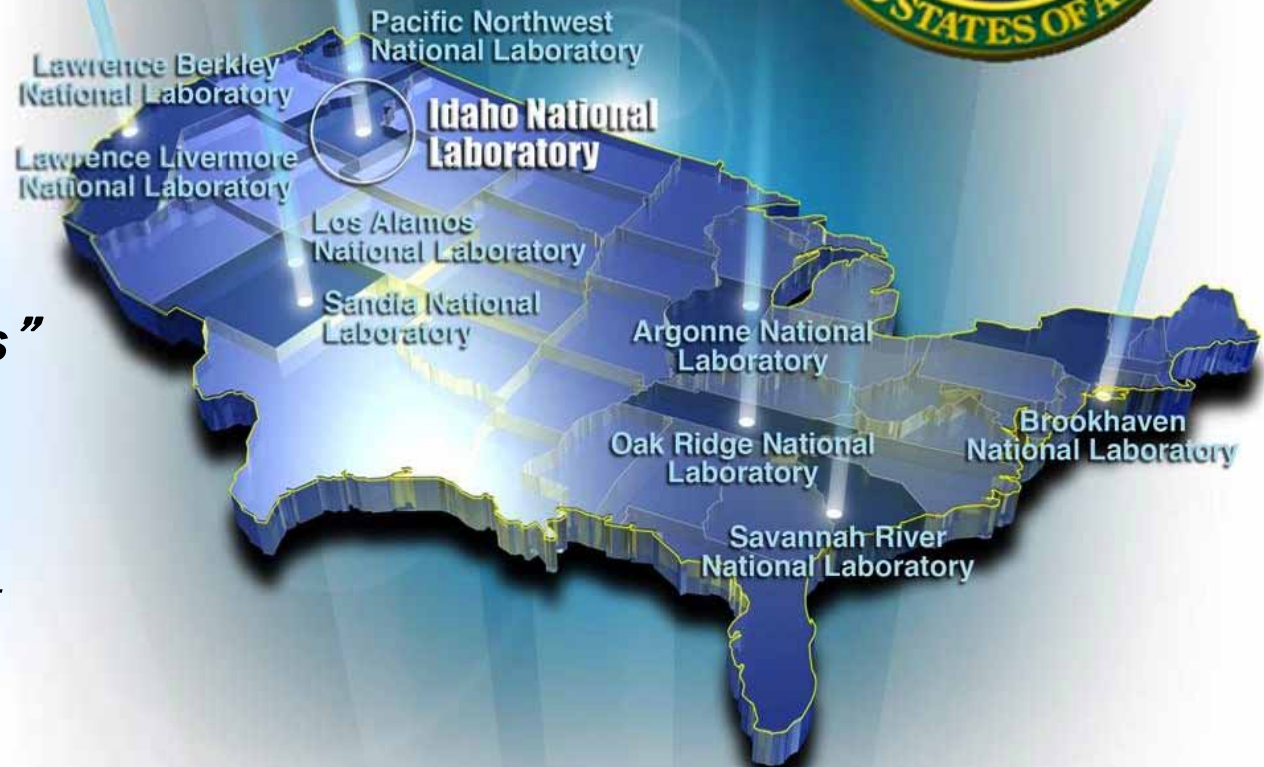
## ***INL's Position – Nationally***

- ✓ *One of 10 large DOE multi-program labs*
- ✓ *DOE's lead lab for nuclear energy*



### ***National Labs are "Capability Machines"***

*They do what  
Universities and  
Industry Can't, Won't  
or Shouldn't do*



# ***The Idaho National Laboratory Site***

## **We Maintain –**

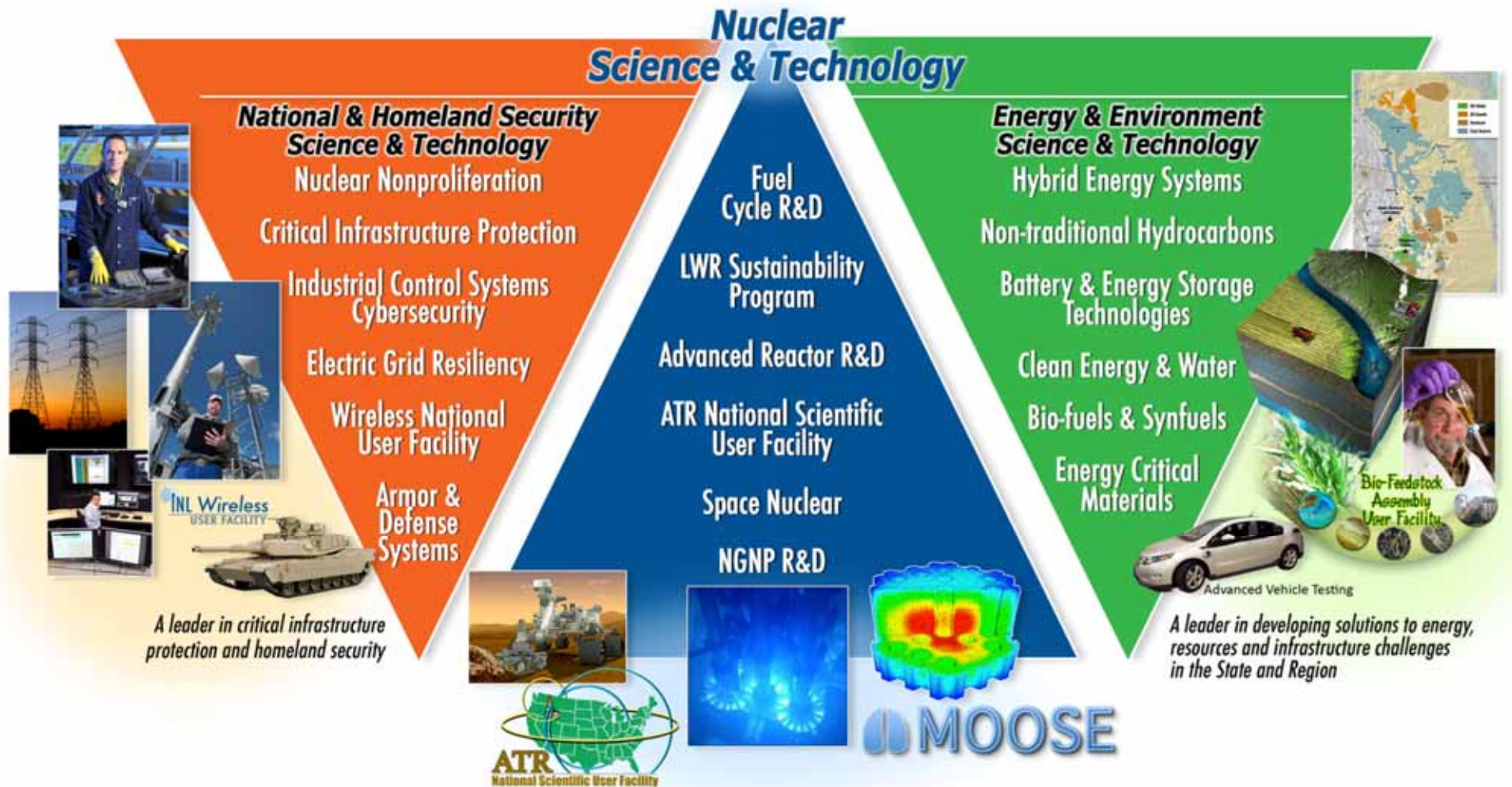
- 890 square miles
- 111 miles of electrical transmission and distribution lines
- 579 buildings
- 177 miles of paved roads
- 14 miles of railroad lines
- 3 reactors
- 2 spent fuel pools
- Mass transit system
- Security
- Museum
- “Landfills”
- 300 metric tons of used fuel
- Educational and research partnerships – CAES



***...the National Nuclear Laboratory***



# INL Programs of National Importance



Research – Development – **Demonstration** – Deployment

# INL Energy & Environment – Research, Development, Demonstration and Deployment Capabilities



Energy Conversion  
& Transmission  
Design, Modeling &  
Validation



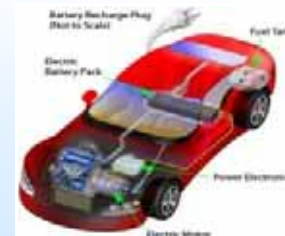
Materials &  
Chemical Process  
Technologies



Geoscience



Nuclear &  
Radiological  
Materials Science &  
Engineering



Systems and  
Materials  
Performance  
Analyses



Applied Computing,  
Visualization, Intelligent  
Control

CAES



Energy Systems Laboratory  
*Biomass Processing, Battery Testing, Hybrid Systems*

Energy  
Storage  
Testing Lab



\* Synergistic with our nuclear mission

National Laboratories are **Capability Machines**



# ***INL National & Homeland Security – Research, Development, Demonstration and Deployment Capabilities***



**Industrial  
Control Systems  
Cyber Security**



**Wireless  
Communications**



**Explosives  
Detection & Testing**



**Armor  
Development**



**Nonproliferation /  
Safeguards & Security**



**Unmanned  
Systems**

**INL Wireless  
USER FACILITY**



*\* Our nuclear laboratory infrastructure provides N&HS capabilities*

**National Laboratories are Capability Machines**

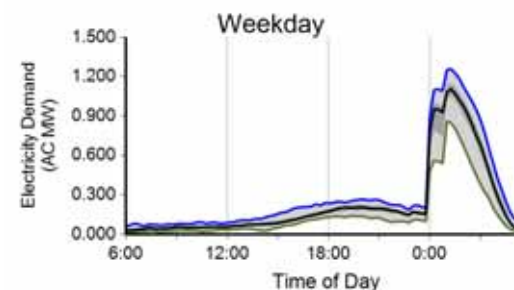
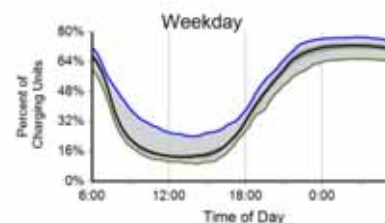


## ***EV / Infrastructure Testing Experience***

- **122 million test miles accumulated on 11,600 electric drive vehicles and 16,300 EVSE and DCFC**
- **EV Project: 8,113 Leafs, Volts and Smarts, 12,065 EVSE and DCFC, reporting 3.5 million charge events, 103 million test miles. 1 million miles every 6 days**
- **Charge Point: 4,253 EVSE reporting 1.5 million charge events**
- **PHEVs: 15 models, 434 PHEVs, 4 million test miles**
- **EREVs: 2 model, 156 EREVs, 2.3 million test miles**
- **HEVs: 24 models, 58 HEVs, 6.4 million test miles**
- **Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 608,000 test miles**
- **NEVs: 24 models, 372 NEVs, 200,000 test miles**
- **BEVs: 48 models, 2,000 BEVs, 5 million test miles**
- **UEVs: 3 models, 460 UEVs, 1 million test miles**

## EV Project Infrastructure Reporting

- 20,000 discrete data sources (Vehicles, EVSE and DC Fast Chargers) from DOE's/ECOTality's EV Project. INL analyzes grid use and vehicle data for reporting
  - Supports the what, when, and where of grid infrastructure deployment decisions
  - Document impact when public EVSE costs money
  - Document economic incentives to shift charge times
  - Document drivers' real-world grid-use decisions
  - Document BEV versus PHEV grid use
  - Document regional grid-use variations
  - Provide electric utilities with service territory specific grid demand information

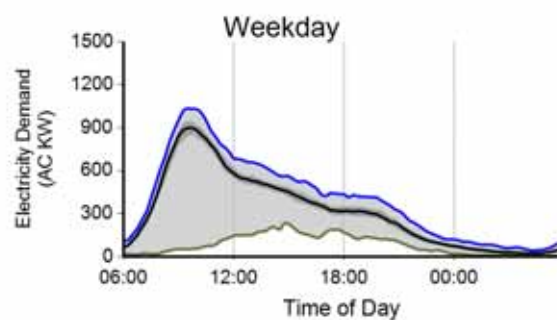




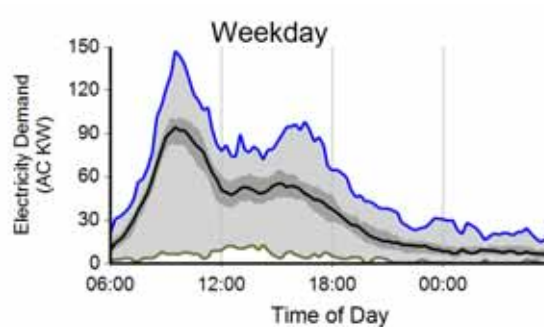
# ChargePoint Infrastructure Reporting

- **4,250 ChargePoint EVSE demonstration**
  - Demonstrates residential, private commercial and public grid use
  - Supports what kind of and where grid infrastructure should be placed
  - Document regional grid-use variations

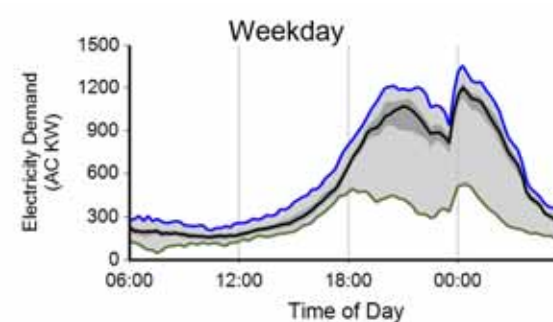
**Public Demand**



**Commercial Demand**

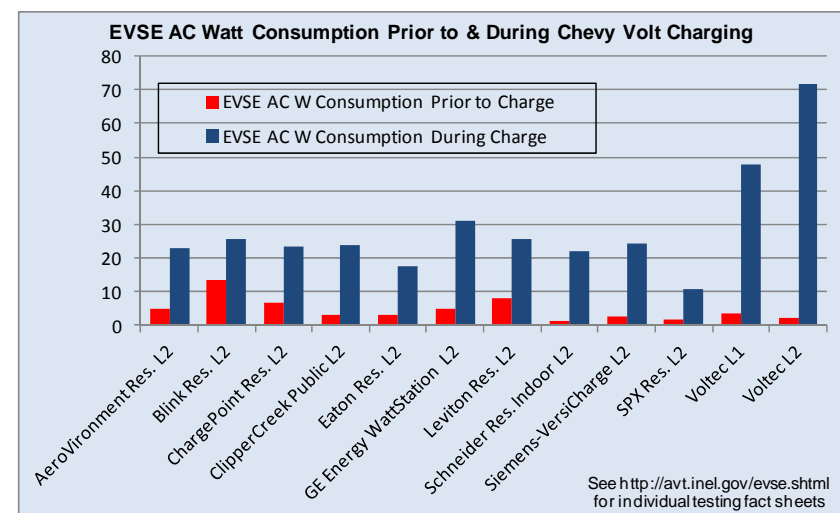


**Residential Demand**



## Conductive EVSE & DCFC Testing

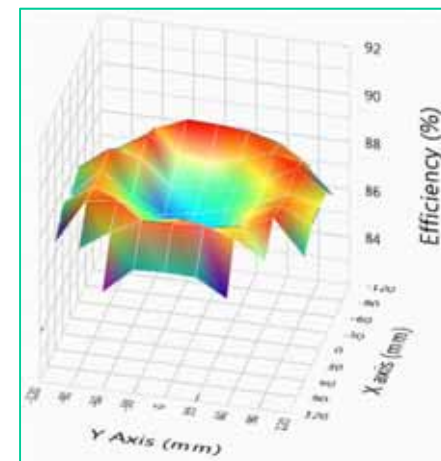
- Tested and reported 14 Levels 1 & 2 EVSE, and DC Fast Chargers (DCFC), with additional units in the test queue
- Developing with SAE multi EVSE, DCFC and PEV compatibility testing regime
  - Benchmarks grid-to-vehicle and grid-to-battery efficiencies, standby power requirements, power quality feedbacks
  - Reduces SAE J1772 incompatibility problems





## Wireless Charging Testing

- Testing two lab and vehicle based Wireless Charging systems with additional NDA's being signed
- Developing with SAE wireless charging testing procedures
  - Benchmark grid-to-vehicle and grid-to-vehicle wireless efficiencies, standby power requirements, power quality, FCC compliance, and safety
  - Supports SAE's development testing procedures
  - Independent assessments of alternative charging technology



## ***Other Grid Infrastructure Activities***

- **Fleet grid demand reduction demonstration in AZ**
  - **Demonstrate DCFC grid demand reduction use at existing test fleet with distributed energy storage**
- **EVSE Grid Study for DOE Office of Electricity**
  - **Time of use rate impacts on pricing elasticity**
- **Cyber security testing of 5 Level 2 Grid Smart EVSE**
  - **Examines vulnerabilities from EVSE to back office operations, and potentially connected utilities**
  - **Benchmark efficiencies and standby power unit use**
- **Eventual cyber security testing wireless charging**
  - **Will examine wireless vulnerabilities**



## ***Other Grid Infrastructure Activities – cont'd***

- **New York City electric taxi and infrastructure study**
  - For the NYC Taxi and Limousine Commission and DOE, document BEV taxi travel and EVSE and DCFC grid use in highly congested environment
  - Supports inner city EVSE and DCFC planning
- **Dublin Ireland electric taxi study**
  - Signing NDA to document BEV taxi travel and EVSE and DCFC grid use in EU congested environment
  - Supports US/EU partnership and comparison to NYC



## ***Other Grid Infrastructure Activities – cont'd***

- **Singing NDA for I-5 DCFC travel corridor study**
  - For DOTs of Oregon and Washington, document DCFC use for multi-leg and single-leg trips
  - Supports USDOT and state DOTs: where to place interstate travel corridor EVSE & DCFC quandary
- **NYSERDA 580 EVSE L2 data collection. 6+ Manufacturers**
  - Demonstrates private commercial and public grid use in challenging environments in New York State
  - Supports the where of grid infrastructure
- **Grid and vehicle study at three DOD bases. Fourth base EVSE deployment and data collection**
  - Determines DOD base grid suitability to support new EVSE and DCFC based on travel patterns
  - Supports DOD's petroleum reduction and DOE/DOD MOU

## ***Other Grid Infrastructure Activities – cont'd***

- **Nissan Leaf DCFC Testing**
  - Grid and battery impacts from DCFC charging
  - Probable secondary use distributed storage study
- **Battery Mule Testing of advanced batteries**
  - Traction battery testing will provide secondary use battery for distributed energy study
- **Chevy Volt and other OEM demonstrations**
  - Demonstrates BEV, PHEV and EREV grid use
- **Grid Interaction Technical Team**
  - Project(s) selection and execution as team member





## ***Partnering Opportunities & The Future(?)***

- **INL's AVTA is a testing activity that does not develop new technologies. We are unbiased, independent testers**
- **ODOT and various Oregon fleets already work with AVTA**
- **Other INL programs perform CRADA and Work for Others research activities**
- **INL does a significant amount of energy storage (batteries, etc.) development and testing with other organizations, including Federal, university and private organizations**
  - **650 energy storage data collection channels currently on button cells to full size packs**
- **The EV Future?**
  - **Every vehicle will be at least partially electric, it is the only option**
- **INL has already introduced electric transportation on Mars**

