AVTA Participants

- The Advanced Vehicle Testing Activity (AVTA) is the U.S. Department of Energy, Vehicle Technologies Program’s (VTP) singular field, tract, and laboratory based source of testing light-duty whole vehicle systems and subsystems
  - Idaho National Laboratory manages the AVTA for VTP
  - ECOtality provides testing support via a competitively bid NETL (National Energy Testing Laboratory) contract
- For the EV Project, ECOtality is the project lead and INL provides data collection, analysis and dissemination support
- Test partners include electric utilities, Federal, state and local government agencies, private companies, and individual vehicle owners
AVTA Goals

• The AVTA goals
  – Petroleum reduction and energy security
  – Benchmark technologies that are developed via DOE research investments

• Provide benchmark data to DOE, National Laboratories (ANL, NREL, ORNL, PNNL), Federal Agencies (DOD, DOI, DOT, EPA, USPS), technology modelers, R&D programs, vehicle manufacturers (via USCAR’s VSATT, EESTT, GITT), and target and goal setters

• Assist fleet managers, via Clean Cities, FEMP and industry gatherings, in making informed vehicle and infrastructure deployment and operating decisions
Vehicle / Infrastructure Testing Experience

- 77.9 million test miles accumulated on 10,736 electric drive vehicles representing 115 models
- EV Project: 7,317 Leafs, Volts and Smart EVs, 9,493 EVSE and DC Fast Chargers (DCFC), 60.1 million test miles
- ChargePoint: 3,799 EVSE reporting 553,439 charge events
- PHEVs: 14 models, 430 PHEVs, 4 million test miles
- EREVs: 1 model, 150 EREVs, 900,000 test miles
- HEVs: 21 models, 52 HEVs, 6.2 million test miles
- Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 509,000 test miles
- NEVs: 24 models, 372 NEVs, 200,000 test miles
- BEVs: 47 models, 2,000 BEVs, 5 million test miles
- UEVs: 3 models, 460 UEVs, 1 million test miles
- Other testing includes hydrogen ICE vehicle and infrastructure testing

Note: all 4th quarter 2012 data is preliminary and subject to change
INL Vehicle/EVSE Data Management Process

**Process Driven by Disclosure Agreements**

Data quality reports

Individual vehicle reports

Fleet summary

Reports - Public

Focused technical analyses and custom reports

Modeling and simulation input

INL Vehicle Data Management System

Report generator

File server

SQL Server data warehouse

HICEVs

HEVs

PHEVs

BEVs & EREVs

EVSE & Chargers

Parameters range check

Lame data check

Missing/empty parameter check

Conservation of energy check

SOC continuity

Parameters range check

Lame data check

Missing/empty parameter check

Conservation of energy check

SOC continuity

Data quality reports

Individual vehicle reports

Fleet summary

Reports - Public

Focused technical analyses and custom reports

Modeling and simulation input
Data Collection, Security and Protection

- All vehicle, EVSE, and PII raw data is legally protected by NDAs (Non Disclosure Agreements) or CRADAs (Cooperative Research and Development Agreements)
  - Limitations on how proprietary and personally identifiable information can be stored and distributed
  - Raw data, in both electronic and printed formats, is not shared with DOE in order to avoid exposure to FOIA
  - Vehicle and EVSE data collection would not occur unless testing partners trust INL would strictly adhere to NDAs and CRADAs
  - Raw data cannot be legally distributed by INL
EV Project Goal, Locations, Participants, and Reporting

- **Goal**: Build and study mature charging infrastructures and take the lessons learned to support the future streamlined deployment of grid-connected electric drive vehicles.
- **ECOtality** is the EV Project lead, with INL, Nissan and Onstar/GM as the prime partners, with more than 40 other partners such as electric utilities.
- **EV Project** reporting requires INL to blend three distinct data streams from ECOtality, Nissan and Onstar/GM.
- **40 different EV Project reports** are generated quarterly for the general public, DOE, ECOtality, project participants, industry, regulatory organizations, as well as per special requests.
EV Project – EVSE Data Parameters Collected per Charge Event

- Data from ECOtality’s Blink EVSE network
- Connect and Disconnect Times
- Start and End Charge Times
- Maximum Instantaneous Peak Power
- Average Power
- Total energy (kWh) per charging event
- Rolling 15 Minute Average Peak Power
- Date/Time Stamp
- Unique ID for Charging Event
- Unique ID Identifying the EVSE
- And other non-dynamic EVSE information (GPS, ID, type, contact info, etc.)
EV Project – Vehicle Data Parameters Collected per Start/Stop Event

- Data is received via telematics providers from Chevrolet Volts and Nissan Leafs
- Odometer
- Battery state of charge
- Date/Time Stamp
- Vehicle ID
- Event type (key on / key off)
- GPS (longitude and latitude)
- Recorded for each key-on and key-off event

- Additional data is received monthly from Car2go for the Smart EVs
EV Project – Vehicle Deployments / Miles

- 7,346 vehicles reporting data
  - 5,801 Leafs. 79%
  - 1,215 Volts. 17%
  - 330 Smart EVs. 4%

- 60.1 million total miles
- 150,000 test miles per day
EV Project – EVSE Deployment and Use

- 9,493 total EVSE
  - 6,864 (72%) Residential EVSE
  - 2,575 (27%) non-residential EVSE
  - 54 (1%) DCFC

- 1.7 million charge events
  - 1,579,894 (92%) Residential EVSE
  - 131,298 (8%) non-residential EVSE
  - 8,820 (1%) DCFC
EV Project – Total Charge Energy (MWh)

- 14,418 MWh total electricity charged
  - 13,328 MWh (92%) residential
  - 1,029 MWh (7%) non-residential
  - 61 MWh (0.4%) DCFC

- Vehicle efficiency cannot be accurately calculated using total vehicle miles and total energy
  - Non-EV Project vehicles sometimes charge at EV Project EVSE
  - EV Project vehicles may charge at 110V or other 240V non-EV Project EVSE
EV Project Overview Report 4th Quarter 2012

- San Francisco has 17% of all EVSE 30% of all Leafs
- Washington DC has 16% and Texas has 18% of all Volts
## EV Project – National Data

### 4th quarter 2012 Data Only

<table>
<thead>
<tr>
<th></th>
<th>Leafs</th>
<th>Volts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of vehicles</td>
<td>3,696</td>
<td>1,006</td>
</tr>
<tr>
<td>Number of Trips</td>
<td>956,366</td>
<td>362,848</td>
</tr>
<tr>
<td>Distance (million miles)</td>
<td>6.6</td>
<td>3.0</td>
</tr>
<tr>
<td>Average (Ave) trip distance</td>
<td>6.9 mi</td>
<td>8.1 mi</td>
</tr>
<tr>
<td>Ave distance per day</td>
<td>29.2 mi</td>
<td>40.4 mi</td>
</tr>
<tr>
<td>Ave number (#) trips between charging events</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td>Ave distance between charging events</td>
<td>26.3 mi</td>
<td>28.1 mi</td>
</tr>
<tr>
<td>Ave # charging events per day</td>
<td>1.1</td>
<td>1.4</td>
</tr>
</tbody>
</table>

* Note that per day data is only for days a vehicle is driven
EV Project – **Leaf** Operations Trends

- Some decreases in average miles per day and average miles per charge

<table>
<thead>
<tr>
<th>Number of Leafs reporting each quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
</tr>
</tbody>
</table>

![Nissan Leaf Driver Operations Behavior Graph](image-url)
EV Project – Leaf Charging Location Trends

- 9% increase in home charging and 10% decrease in non-home charging as a revenue model is introduced

<table>
<thead>
<tr>
<th>Number of Leafs reporting each quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
</tr>
</tbody>
</table>
EV Project – Volt Operations Trends

- Average quarterly increases in miles per day and per charge have decreased most recently

<table>
<thead>
<tr>
<th>Number of Volts reporting each quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>
EV Project – Volt Charging Location Trends

- 3% increase in home charging and 1% decrease in non-home charging as a revenue model is introduced

![Chevy Volt Driver Charging Behavior Graph](image)

<table>
<thead>
<tr>
<th>Number of Volts reporting each quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>45</td>
</tr>
</tbody>
</table>
EV Project – Residential EVSE L2 Use Trends

- Continued gradual increases in time vehicles connected per charge and in AC KWh transferred per charge event

![Graph showing residential EVSE infrastructure use trends]

<table>
<thead>
<tr>
<th>Number of Residential EVSE Level reporting each quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td>35</td>
</tr>
</tbody>
</table>

Residential EVSE Level 2 = R2, Weekend = WE, Weekday = WD
EV Project – Public EVSE L2 Use Trends

- Increases in kWh per charge and time energy is drawn
- Average time vehicle connected appears to be rising this last quarter

Non-Residential EVSE Infrastructure Use Trends

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Public EVSE Level reporting each quarter</td>
<td>170</td>
<td>438</td>
<td>955</td>
<td>1483</td>
<td>1818</td>
<td>1991</td>
</tr>
</tbody>
</table>

Public EVSE Level 2 = P2, Weekend = WE, Weekday = WD
EV Project – EVSE Infra. Summary Report

- Percent of public L2 EVSE deployed is now 30% of all L2 EVSE

- As measured by kWh use and number of charge events, revenue model may be decreasing public L2 EVSE use
## EV Project – Public Level 2 EVSE Usage

**Contribution of Car Sharing Fleets is significant**

<table>
<thead>
<tr>
<th>All territories</th>
<th>Car sharing fleet</th>
<th>Nissan Leaf</th>
<th>Chevrolet Volt</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles Charged</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of charging events</td>
<td>25%</td>
<td>21%</td>
<td>5%</td>
<td>49%</td>
</tr>
<tr>
<td>Percent of kWh consumed</td>
<td>38%</td>
<td>17%</td>
<td>3%</td>
<td>41%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>San Diego</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles Charged</td>
<td>300 Car2Go fleet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of charging events</td>
<td>59%</td>
<td>16%</td>
<td>2%</td>
<td>23%</td>
</tr>
<tr>
<td>Percent of kWh consumed</td>
<td>72%</td>
<td>11%</td>
<td>1%</td>
<td>16%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Oregon (Car2Go in Portland)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicles Charged</td>
<td>30 Car2Go fleet</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Percent of charging events</td>
<td>5%</td>
<td>29%</td>
<td>4%</td>
<td>61%</td>
</tr>
<tr>
<td>Percent of kWh consumed</td>
<td>11%</td>
<td>27%</td>
<td>4%</td>
<td>58%</td>
</tr>
</tbody>
</table>
EV Project – EVSE Infra. Summary Report

- National Residential and Public Level 2 Weekday EVSE 4th Quarter 2012

- Residential and public connect time and energy use are fairly opposite profiles. Note different scales

![National Residential Connect Time](image1)

![National Public Connect Time](image2)

![National Residential Demand](image3)

![National Public Demand](image4)
EV Project – EVSE Infra. Summary Report

• Residential Level 2 Weekday EVSE 4th Quarter 2012
• San Diego and San Francisco, with residential L2 TOU rates, are similar to national and other regional EVSE connect profiles

San Diego

Los Angeles

San Francisco

Washington State
EV Project – EVSE Infra. Summary Report

- Residential Level 2 Weekday EVSE 3rd Quarter 2012
- TOU kWh rates in San Diego and San Francisco clearly impact when vehicle charging start times are set
EV Project – EVSE Infra. Summary Report

- DC Fast Chargers Weekday 4th Quarter 2012
- 54 DCFCs connected and demand profiles

**Weekday Connected Profile**

- 1.9 average charge events per day per DCFC
- Leafs 39% charge events and 41% energy
- Unknowns other charge events and energy

**Weekday Demand Profile**

- 18.8 minutes average time connected
- 18.8 minutes average time drawing energy
- 7.0 kWh average energy consumed per charge
L2 Access Fees Structure

• 4<sup>th</sup> Quarter is first widespread implementation of simple and low cost access fees

• Blink member
  – Affiliate credit card with free Blink RFID “In Card”
  – Level 2 access fee of $1.00 per hour of connect time

• Guest - No Blink RFID “In Card” required
  – Guest Code using quick reservation code or website
  – Level 2 access fee of $2.00 per hour of connect time

• Future pricing
  – Pricing to reflect regional electricity rates
  – Cover electricity costs in all cases
DC Fast Charge (DCFC) Fees Structure

- Encourage DCFC use with initial free charging
- Implement DCFC access fees by region in 1st Quarter 2013 with beta testing currently underway
- Initial fee structure simple and low cost
  - Accommodate varying vehicle charge rates
  - Accommodate select limitation of charging output power
- Blink member
  - $25 per month unlimited use or $5.00 per session
- Guest
  - $8.00 per session
Residential Lessons Learned

- Permit timeliness has not been a problem
- Majority are over-the-counter
- Permit fees vary significantly - $7.50 to $500.00

<table>
<thead>
<tr>
<th>Region</th>
<th>Count of Permits</th>
<th>Average Permit Fee</th>
<th>Minimum Permit Fee</th>
<th>Maximum Permit Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>66</td>
<td>$96.11</td>
<td>$26.25</td>
<td>$280.80</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>109</td>
<td>$83.99</td>
<td>$45.70</td>
<td>$218.76</td>
</tr>
<tr>
<td>San Diego</td>
<td>496</td>
<td>$213.30</td>
<td>$12.00</td>
<td>$409.23</td>
</tr>
<tr>
<td>San Francisco</td>
<td>401</td>
<td>$147.57</td>
<td>$29.00</td>
<td>$500.00</td>
</tr>
<tr>
<td>Tennessee</td>
<td>322</td>
<td>$47.15</td>
<td>$7.50</td>
<td>$108.00</td>
</tr>
<tr>
<td>Oregon</td>
<td>316</td>
<td>$40.98</td>
<td>$12.84</td>
<td>$355.04</td>
</tr>
<tr>
<td>Washington</td>
<td>497</td>
<td>$78.27</td>
<td>$27.70</td>
<td>$317.25</td>
</tr>
</tbody>
</table>
Residential Lessons Learned

- **Average residential installation cost ≈$1,375**
- **Individual installations vary widely**
- **Some user bias to lower costs**

<table>
<thead>
<tr>
<th>Marlets In Ascending Order Of Residential Installation Cost</th>
<th>Number of Installations</th>
<th>Average Installation Cost</th>
<th>Variation From Project Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tennessee (entire State)</td>
<td>542</td>
<td>$1,113.07</td>
<td>-19.0%</td>
</tr>
<tr>
<td>Arizona (Phoenix &amp; Tucson)</td>
<td>357</td>
<td>$1,148.88</td>
<td>-16.4%</td>
</tr>
<tr>
<td>Washington DC</td>
<td>3</td>
<td>$1,197.44</td>
<td>-12.9%</td>
</tr>
<tr>
<td>Oregon (Portland, Eugene, Coralvls &amp; Salem)</td>
<td>465</td>
<td>$1,229.06</td>
<td>-10.6%</td>
</tr>
<tr>
<td>Washington (Seattle &amp; Olympia)</td>
<td>730</td>
<td>$1,289.56</td>
<td>-6.2%</td>
</tr>
<tr>
<td>Maryland</td>
<td>39</td>
<td>$1,311.75</td>
<td>-4.5%</td>
</tr>
<tr>
<td>Washington</td>
<td>80</td>
<td>$1,321.36</td>
<td>-3.8%</td>
</tr>
<tr>
<td>Virginia</td>
<td>38</td>
<td>$1,341.01</td>
<td>-2.4%</td>
</tr>
<tr>
<td>San Fransisco</td>
<td>1254</td>
<td>$1,386.13</td>
<td>0.9%</td>
</tr>
<tr>
<td>Texas (metro Houston &amp; Dallas)</td>
<td>128</td>
<td>$1,422.77</td>
<td>3.5%</td>
</tr>
<tr>
<td>San Diego</td>
<td>726</td>
<td>$1,593.91</td>
<td>16.0%</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>415</td>
<td>$1,791.64</td>
<td>30.6%</td>
</tr>
</tbody>
</table>
Commercial Lessons Learned

- **ADA significantly drives cost**
  - Accessible charger
  - Van accessible parking
  - Accessible electric and passage routes to facility

- **Permit fees and delays can are significant**
  - Load studies
  - Zoning reviews
Commercial Lessons Learned

- Commercial permits range $14 to $821

<table>
<thead>
<tr>
<th>Region</th>
<th>Count of Permits</th>
<th>Average Permit Fee</th>
<th>Minimum Permit Fee</th>
<th>Maximum Permit Fee</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arizona</td>
<td>72</td>
<td>$228</td>
<td>$35</td>
<td>$542</td>
</tr>
<tr>
<td>Los Angeles</td>
<td>17</td>
<td>$195</td>
<td>$67</td>
<td>$650</td>
</tr>
<tr>
<td>San Diego</td>
<td>17</td>
<td>$361</td>
<td>$44</td>
<td>$821</td>
</tr>
<tr>
<td>Texas</td>
<td>47</td>
<td>$150</td>
<td>$37</td>
<td>$775</td>
</tr>
<tr>
<td>Tennessee</td>
<td>159</td>
<td>$71</td>
<td>$19</td>
<td>$216</td>
</tr>
<tr>
<td>Oregon</td>
<td>102</td>
<td>$112</td>
<td>$14</td>
<td>$291</td>
</tr>
<tr>
<td>Washington</td>
<td>33</td>
<td>$189</td>
<td>$57</td>
<td>$590</td>
</tr>
</tbody>
</table>
Commercial Lessons Learned

- Demand and energy costs are significant for some utilities
  - 25¢/kWh
  - $25/kW
- Some utilities offer commercial rates without demand charges
- Others incorporate 20 kW to 50 kW demand thresholds
- Nissan Leaf is demand charge free in some electric utility service territories

<table>
<thead>
<tr>
<th>No Demand Charges - Nissan Leaf</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA Pacific Gas &amp; Electric</td>
</tr>
<tr>
<td>City of Palo Alto</td>
</tr>
<tr>
<td>Alameda Municipal Power</td>
</tr>
<tr>
<td>Silicon Valley Power</td>
</tr>
<tr>
<td>AZ Tucson Electric Power</td>
</tr>
<tr>
<td>OR Eugene Water &amp; Electric Board</td>
</tr>
<tr>
<td>Lane Electric Co-op</td>
</tr>
<tr>
<td>TN Middle Tennessee Electric</td>
</tr>
<tr>
<td>Duck River Electric</td>
</tr>
<tr>
<td>Harriman Utility Board</td>
</tr>
<tr>
<td>Athens Utility Board</td>
</tr>
<tr>
<td>Cookeville Electric Department</td>
</tr>
<tr>
<td>Cleveland Utilities</td>
</tr>
<tr>
<td>Nashville Electric Service</td>
</tr>
<tr>
<td>EPB Chattanooga</td>
</tr>
<tr>
<td>Lenoir City Utility Board</td>
</tr>
<tr>
<td>Volunteer Electric Cooperative</td>
</tr>
<tr>
<td>Murfreesboro Electric</td>
</tr>
<tr>
<td>Sequachee Valley Electric Cooperative</td>
</tr>
<tr>
<td>Knoxville Utility Board</td>
</tr>
<tr>
<td>Maryville</td>
</tr>
<tr>
<td>Fort Loudoun Electric</td>
</tr>
<tr>
<td>Memphis Light Gas and Water Division</td>
</tr>
</tbody>
</table>
Commercial Lessons Learned

- **Recurring Nissan Leaf DC fast charge demand charges are significant in many utility service territories**

<table>
<thead>
<tr>
<th>Utility Demand Charges - Nissan Leaf</th>
<th>Cost/mo.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA Glendale Water and Power</td>
<td>$16.00</td>
</tr>
<tr>
<td>Hercules Municipal Utility:</td>
<td>$377.00</td>
</tr>
<tr>
<td>Los Angeles Department of Water and Power</td>
<td>$700.00</td>
</tr>
<tr>
<td>Burbank Water and Power</td>
<td>$1,052.00</td>
</tr>
<tr>
<td>San Diego Gas and Electric</td>
<td>$1,061.00</td>
</tr>
<tr>
<td>Southern California Edison</td>
<td>$1,460.00</td>
</tr>
<tr>
<td>AZ TRICO Electric Cooperative</td>
<td>$180.00</td>
</tr>
<tr>
<td>The Salt River Project</td>
<td>$210.50</td>
</tr>
<tr>
<td>Arizona Public Service</td>
<td>$483.75</td>
</tr>
<tr>
<td>OR Pacificorp</td>
<td>$213.00</td>
</tr>
<tr>
<td>WA Seattle City Light</td>
<td>$61.00</td>
</tr>
</tbody>
</table>
ChargePoint America ARRA Project

- Conducted by Coulomb
- Project to Sept. 2012
- 3,799 EVSE installed and reporting data
  - 1,743 Residential
  - 179 Private / commercial
  - 1,868 Public
  - 9 unknown
- 553,439 charge events
- 3,856 AC MWh
ChargePoint America ARRA Project

- July – Sept. 2012 data
- 3,361 units
- Percent time vehicle connected
  - Residential 45%
  - Private/com 28%
  - Public 8%
- Percent time drawing power
  - Residential 9%
  - Private/com 6%
  - Public 2%
- EVSE data only
• Public is open access. Commercial are limited access
• Public and commercial reflect at work charging
• Residential reflects end of day return-to-home charging
• Note difference in scales
EVSE Testing

- AC energy consumption at rest and during Volt Charging benchmarked
- Steady state charge efficiency benchmarked

Most EVSE consume 13 W or less at rest. Higher watt use tied to more EVSE features

Most EVSE under 30 W during charge

Most EVSE 99+% efficient during steady state charge of a Volt
Hasetec DC Fast Charging Nissan Leaf

- 53.1 AC kW peak grid power
- 47.1 DC kW peak charge power to Leaf energy storage system (ESS)
- 15.0 Grid AC kWh and 13.3 DC kWh delivered to Leaf ESS
- 88.7% Overall charge efficiency (480VAC to ESS DC)
Conductive System Benchmarking

Entire report can be found at: http://avt.inel.gov/pdf/phev/EfficiencyResultsChevroletVoltOnBoardCharger.pdf
Additional Battery Testing

- Initiated field and lab DC Fast Charge and Level 2 charging study of impacts on battery life in 6 Nissan Leafs
  - Two vehicles driven on road and L2 charged
  - Two driven identical routes DCFC charged
  - One L2 and 1 DCFC in battery lab
  - At 10k miles each vehicle similar minimal capacity fade

- Battery mule test vehicle provides field testing of traction battery packs at any power and efficiency level
  - Current test pack is EnerDel Li-ion 345 V rated 70 Ah
  - 8,600 miles of on-road driving and L2 charging has resulted in 10% capacity fade (63.2 Ah to 56.8 Ah) per EVPC and C/3 lab tests
Summary

- EV Project vehicles connected much longer than needed to recharge - opportunities to shift charging times
- Significant residential Level 2 EV Project charging occurs off-peak with charge-starts at midnight per TOU rates indicates consumers are price sensitive
- Revenue models for public charging are currently being introduced – long term impacts?
- Only about 60% of EV Project data collected to date
- DCFC charge events have significant demand impacts but this is an electric utility policy decision
- How, where, when we measure EVSE and vehicle system charging efficiencies results in significantly different results
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More Information
http://avt.inl.gov

This presentation will be posted in the publications section of the above website

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