VIA Motors On-Road Analysis Results

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VSATT Meeting

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Project Overview

- VIA Motors deployed ~150 VTRUX pickup trucks and vans to government and utility fleets
  - Nation-wide deployment, specific fleets unknown

- EPRI designed and instrumented data loggers

- Vehicle data provided to INL for analysis and reporting

- Data collection period December 2014 – June 2015
Vehicle Specifications

- Based upon 2014 Chevrolet Silverado 1500 and 2014 Chevrolet Express 2500
  - Van available in passenger, cargo, and utility configurations

**Payload Capacity**
- Truck: 1000 lbs
- Van: 2800 lbs

**Export Power**
- 120V and 240V up to 14.4 kW

**Electric Generator**
- Truck: 115 kW
- Van: 110 kW

**Battery Pack**
- 23 kWh Li-ion Liquid Cooled

**Electric Drive Motor**
- 190 kW

**Gasoline Engine**
- Truck: 4.3L V6
- Van: 4.8L V8

Photo: VIAMotors.com
Normal Vehicle Operation

- Traditional EREV control strategy
Battery “hold” mode

- Driver can put vehicle in “hold” mode to conserve battery energy
  - Manually selected by driver
Charging on-the-fly

- Can use engine to charge the battery while driving
  - Manually selected by driver

![Graph showing battery SOC and engine speed](chart.png)
Export Power Function

- Vehicle can be used as a mobile electricity generator
Data Collection Method

- EPRI designed a low-cost data logger based on an Apple iPhone
- iPhone locked in glove compartment for entirety of data collection period
Results: Vehicles providing data

- First trucks delivered in April 2015
- Not every vehicle reported data each month
Results: Mileage accumulation

- Data received for ~70,000 miles of driving
  - 13,500 miles in EV mode
- Data set used is a subset of total miles driven
  - Data accounts for ~60% of miles indicated by odometers
Results: Trip distance distribution

- Most common trips <10 miles
- Some vehicles being used for very long trips
**Overall fuel and energy consumption**

<table>
<thead>
<tr>
<th>Operating Mode</th>
<th>Overall Operation</th>
<th>EV Operation</th>
<th>ERM Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vehicle Type</td>
<td>Vans</td>
<td>Trucks</td>
<td>Vans</td>
</tr>
<tr>
<td>Total Distance Driven, miles</td>
<td>54170</td>
<td>15579</td>
<td>11053</td>
</tr>
<tr>
<td>Fuel Economy, MPG</td>
<td>16.5</td>
<td>18.4</td>
<td>--</td>
</tr>
<tr>
<td>Electric Energy Use, DC Wh/mile</td>
<td>126</td>
<td>72</td>
<td>640</td>
</tr>
</tbody>
</table>

- **Base vehicle EPA rated fuel economy**
  - 2014 Silverado: 20 mpg combined
  - 2014 Chevrolet Express: 13 mpg combined

- **Overall equivalent observed fuel economy**
  - Trucks: 17.6 mpge*
  - Vans: 15.4 mpge*

- **EV equivalent observed fuel economy**
  - Trucks: 58.0 mpge*
  - Vans: 47.4 mpge*

*Assuming 90% AC to DC charger efficiency
Results: EV Driving Range

- Driving events that started with 100% SOC and ended in ERM
  - Represent many different conditions/use cases
Future Analysis

• Get data into format that is easy to analyze
• Find and fix issues with data
  – Lots of quality assurance checking required
• Understand inconsistencies in collected data
  – Charging and export power data does not always make sense
• Determine how to deal with incomplete data

Will publish overall fleet summaries for trucks and vans
Energy use at temperature

- No cold weather driving for trucks
  - Began reporting in April
- Most efficient at mild temperatures: 10 to 20 deg C
- Extreme temperatures less efficient