On-road Data Collection and Analysis: 12 Volt Auxiliary Load

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Advanced Vehicle Testing Activity (AVTA)

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Introduction

• Non-electrified vehicle 12V Auxiliary Load measured
  – Individual accessory load benchmark measurement
  – Benchmark testing over standardized drive cycles
    • Dynamometer testing (Argonne’s APRF)
    – On-road operation in fleet application

• Study supports automotive manufacturers
  – Baseline data for potential off-cycle fuel economy credits for advanced technologies used to reduce the energy consumption from vehicle auxiliary loads
  – Other characteristics are quantified from on-road operation (avg. idle time, city/hwy percent, etc.)

• Quarterly and summary fact sheets are published
• SAE World Congress paper in progress
Vehicles Evaluated

• 4 of each model
  – 2012 Honda Civic CNG
    • No fuel pump
    • No electric power steering
    • No heated seats
    • No rear defroster
    • 95 Amp Alternator
  – 2013 Volkswagen Jetta TDI
    • Turbo diesel and dual clutch trans.
    • 140 Amp alternator
  – 2014 Chevrolet Cruze Diesel
    • Turbo diesel and automatic trans.
    • 140 Amp alternator
  – 2014 Mazda 3 i-ELOOP
    • 25V Capacitor system and variable voltage generator (12 – 25V)
Data Collection

- **Leveraged:** 16 AVTE vehicles, data acquisition, data transfer system, data storage, and data analysis process
  - Many signal already collected (at 1 Hz): 12V voltage, vehicle speed, ambient temp., A/C on/off, fuel flow, accel pedal position, etc.

- **New:** Added two current sensors
  - Alternator current
  - 12V Battery current
Individual Accessory Load Benchmarking

- Baseline load, Accessories OFF

<table>
<thead>
<tr>
<th>Vehicle Model</th>
<th>Steady State Auxiliary Load with Engine Idling and All Accessories Off (watts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013 VW Jetta TDI</td>
<td>257.9</td>
</tr>
<tr>
<td>2014 Chevy Cruze Diesel</td>
<td>255.6</td>
</tr>
<tr>
<td>2012 Honda Civic CNG</td>
<td>135.6</td>
</tr>
<tr>
<td>2014 Mazda 3 i-ELOOP</td>
<td>206.0</td>
</tr>
</tbody>
</table>

- Individual accessory auxiliary loads were measured during steady state operation
  - Results shown are the difference from “baseline: all accessories OFF”

- Not all vehicles have all accessories
Quarterly Average Accessory Load

- Vehicle data collection over a 12 month period
- Highest auxiliary load occurred during Summer for all vehicles

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<th>Vehicle Model</th>
<th>Average Auxiliary Load over one year (watts)</th>
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<tr>
<td>2013 VW Jetta TDI</td>
<td>608.0</td>
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<tr>
<td>2014 Chevy Cruze Diesel</td>
<td>570.2</td>
</tr>
<tr>
<td>2012 Honda Civic CNG</td>
<td>309.8</td>
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Auxiliary Load - Histogram

- Histogram shows results from one year of on-road operation
Auxiliary Load – Impact of Temperature

- Histogram shows results from one year of on-road operation

![Temperature Impact on Auxiliary Load](image)
Temperature Impact: Correlation between Dyno & On-road operation

- Results shown only for: Jetta TDI

- Slight difference between On-road and Dyno results
  - Accessories chosen by driver differ from dyno accessory settings

- Similar comparison is under way for the other vehicle model types in this study

*Dyno test results from Argonne’s APRF*
City / Hwy Driving Impact on Average Idle Time

- As expected, increasing the percent of city driving, increases average idle time percent
Fact Sheets Published Quarterly

http://avt.inel.gov/ice.shtml
Summary:

• Continue data collection on the 4 models through a minimum of one year of data collection and analysis

• Continue to publish:
  – Quarterly fact sheets
  – Project to Date fact sheets

• Evaluate additional vehicles (non-electrified) as available through AVTE
  – Chevy Impala Bi-fuel (CNG and gasoline)
Acknowledgement

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More Information

http://avt.inl.gov