

## Smith Newton Vehicle Performance Evaluation – 1st Quarter 2013

The Fleet Test and Evaluation Team at the U.S. Department of Energy's National Renewable Energy Laboratory is evaluating and documenting the performance of electric and plug-in hybrid electric drive systems in medium-duty trucks across the nation. U.S. companies participating in this evaluation project received funding from the American Recovery and Reinvestment Act to cover part of the cost of purchasing these vehicles. Through this project, Smith Electric Vehicles is building and deploying 500 all-electric medium-duty trucks that will be deployed by a variety of companies in diverse climates across the country.

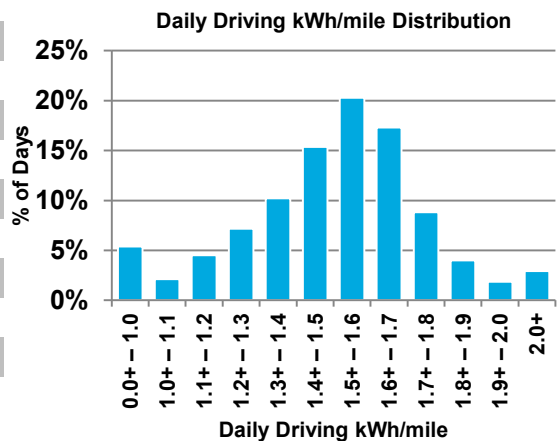
Number of vehicles:	204	Number of vehicle days driven:	8,952
Reporting period:	1/1/2013 to 3/31/2013	Number of operating cities:	68

### Project Vehicle Specifications<sup>1</sup>

Curb Weight	9,700–10,200 pounds	Electric Top Speed	50 mph
Overall Length	268–368 inches	Battery Capacity	80 or 120 kWh
Overall Width	87 inches	Battery Voltage	~ 350 V
Overall Height	94–99 inches	Charging Standards	SAE J1772
Peak Motor Power	134 kW	Transmission	Single speed reduction gear
Motor Location	Front, behind cab	Drive	Rear wheel drive
Advertised Range <sup>2</sup>	Up to 150 miles	Drag Coefficient	~ 0.5
Seating	3	Wheelbase	153–220 inches
Payload	12,324–16,200 pounds		

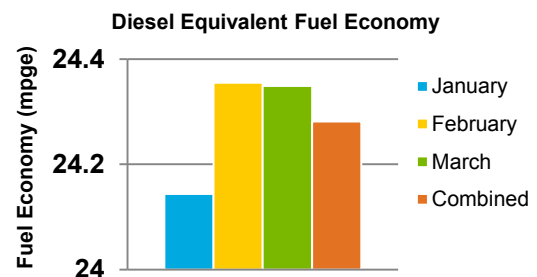
### Trip Data

Overall Diesel Equivalent Fuel Economy <sup>3</sup>	24.3 mpg
Overall AC Energy <sup>4</sup>	2,025.8 Wh/mi
Overall DC Electrical Energy Charged	1,811.7 Wh/mi
Overall DC Electrical Energy Discharged	1,548.5 Wh/mi
Driving DC Electrical Energy Consumption <sup>5</sup>	1,447.2 Wh/mi
Total Number of Charges	16,506
Total Charge Energy Delivered	446,404 kWh
Total Distance Traveled	220,925 miles
City   Highway Distance <sup>6</sup>	143,450   77,475 miles
City   Highway Distance <sup>6</sup>	64.9   35.1 %

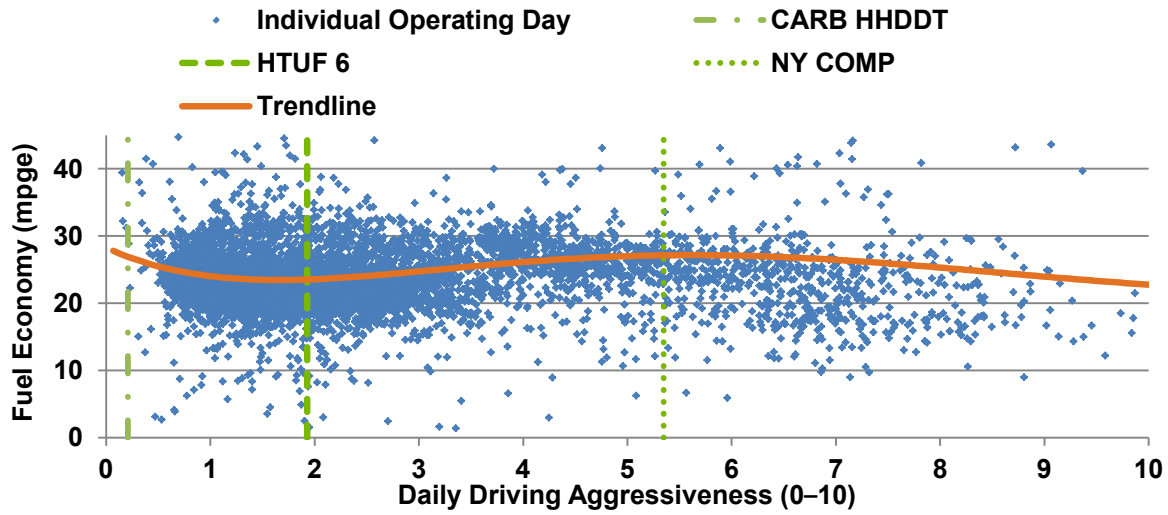


### Route Information

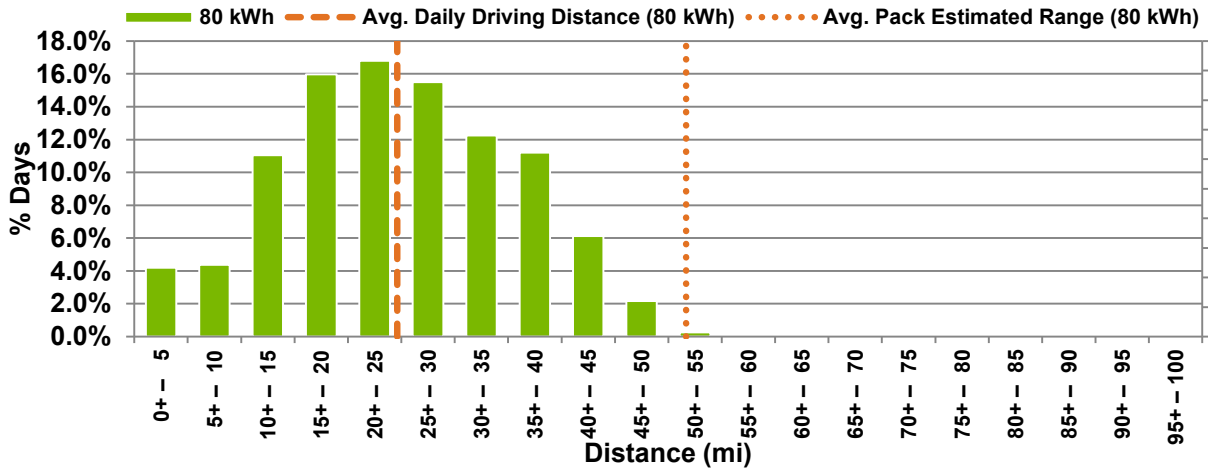
Average Distance Traveled per Day	24.6 miles
Median Daily Driving Aggressiveness <sup>7</sup>	1.7 [0–10]
Average Number of Stops per Day   per Mile	50.0   2.5
Average Brake (Regen) Events	9.3 per mile
Average Maximum Acceleration	0.32 g
Average Daily Maximum Driving Speed	51.1 mph
Average Daily Driving Speed	21.3 mph



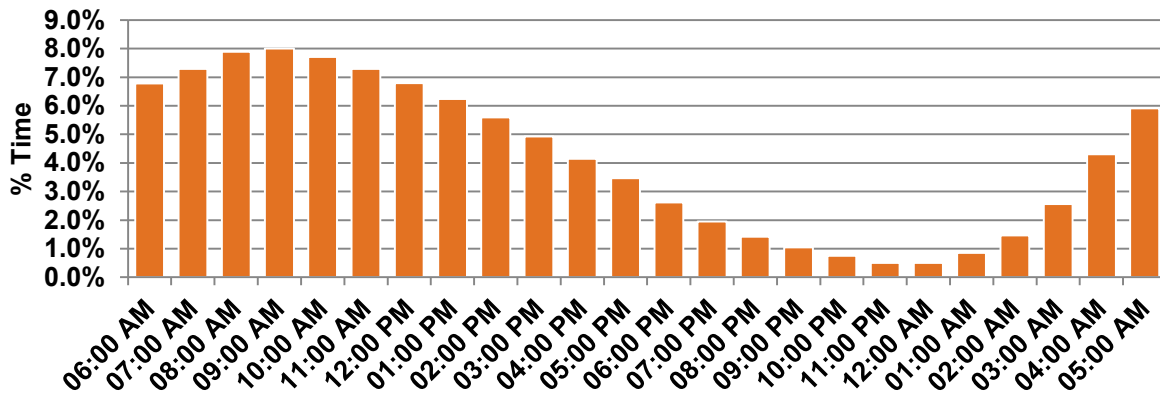
### Effect of Daily Driving Aggressiveness on Fuel Economy<sup>8</sup>



### Daily Driving Distance<sup>9</sup>

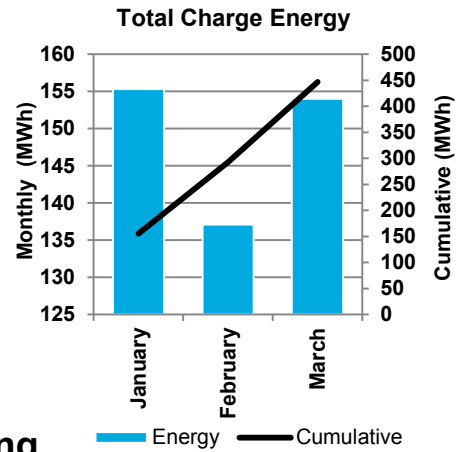


### Time of Day When Driving

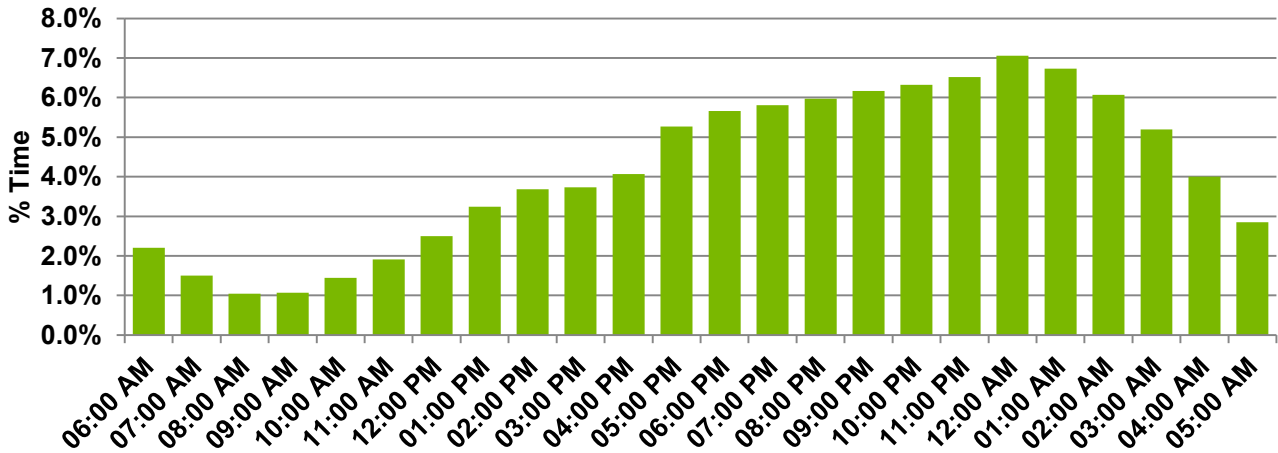


### Plug-In Charging

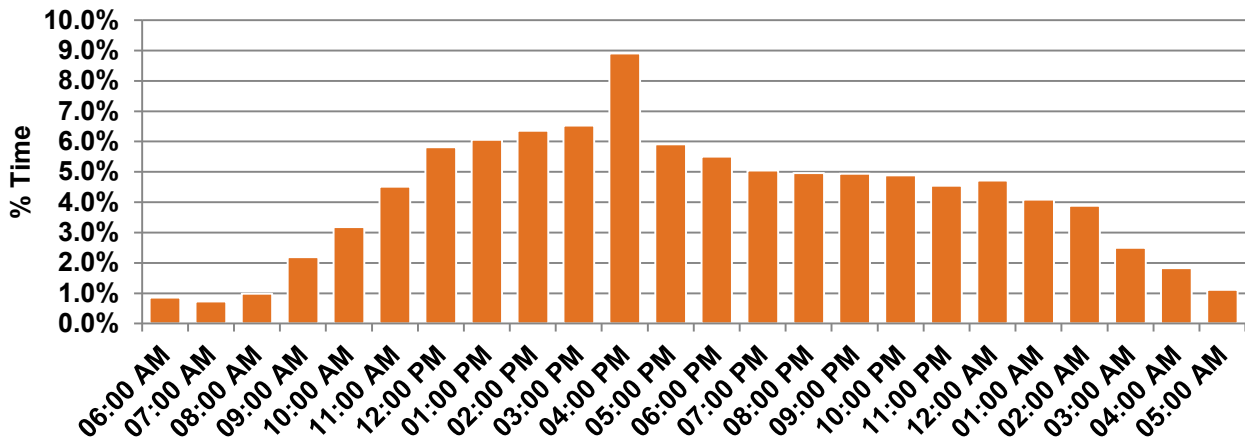
Average Fleet Charging Frequency	5,502.0 charge events per month
Average Fleet Charge Energy per Month	133,071.8 kWh/month
Average Vehicle Charging Frequency	1.8 per day each
Average Vehicle Charge Energy per Day	44.6 kWh/day
Average Energy Delivered per Charge	24.2 kWh
Average Duration of Charge Event <sup>10</sup>	6.6 hours
Average Distance between Charges	13.4 miles



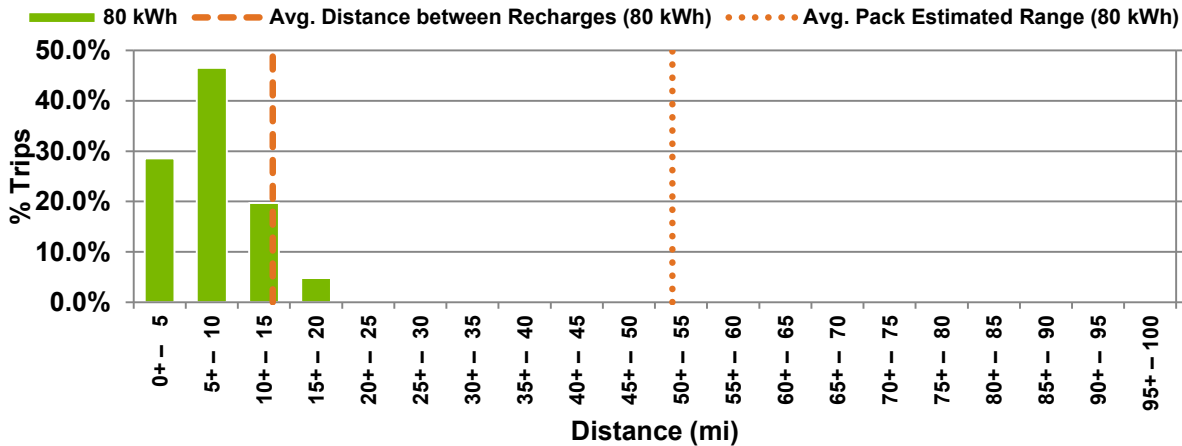
### Time of Day When Charging



### Time of Day When Plugging In



## Distance between Recharges<sup>9,11</sup>



1. Vehicle specifications provided by Smith Electric Vehicles.
2. Actual electric range will vary based on drive cycle and vehicle configuration.
3. Miles per gallon diesel equivalent (mpge) is calculated based on a 128,450 Btu/gallon energy density provided by U.S. Department of Energy's Alternative Fuels Data Center. Using this information, diesel fuel mpge equates to 37.6 kWh.
4. Assumed charger efficiency of 90%.
5. Total in-motion energy consumption averaged per mile. These figures cover multiple vehicle configurations, in multiple cities, with multiple environments, topologies, and load profiles. These numbers are averages of a diverse fleet of vehicles and can not be used to predict the efficiency of any particular Smith vehicle.
6. City and highway distance classifications are distinguished by a 35-mph trip speed. Trips classified as "highway" achieved a maximum driving speed in excess of 35 mph, while trips classified as "city" do not.
7. Daily driving aggressiveness is kinetic intensity scaled by a factor of two. Kinetic intensity measures hybrid advantage. For more information on kinetic intensity, please refer to O'Keefe, M., Simpson, A., Kelly, K., and Pedersen, D., "Duty Cycle Characterization and Evaluation Towards Heavy Hybrid Vehicle Applications," SAE Technical Paper 2007-01-0302, 2007, doi:10.4271/2007-01-0302.
8. Selected test cycles for comparison: Hybrid Truck Users Forum class 6 (HTUF 6), California Air Resources Board Heavy Heavy-Duty Diesel Truck (CARB HHDDT), and New York Composite (NY COMP). For more information please visit: <http://www.dieselnet.com/standards/cycles/>
9. Average pack estimated range calculated based on battery energy storage capacity (80 kWh or 120 kWh) and average overall DC electrical energy consumption. Data are being collected for both 80 kWh and 120 kWh battery capacity vehicle configurations. Previous data collected from 120 kWh configurations are unusable.
10. Current charge time information is calculated based on time spent while energy is being delivered to the battery.
11. All recharges occurring with less than 0.5 miles traveled were excluded from the chart for visual clarity.



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