U.S. Department of Energy's Vehicle Technologies Program -

Electric Drive Vehicle and Charging Infrastructure Demonstrations – Greentech Media's *The Networked EV*

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Greentech Media THE NETWORKED EV: Smart Grids and Electric Vehicles San Francisco, CA October 20, 2011

This presentation does not contain any proprietary or sensitive information

Idaho National Laboratory

- Eastern Idaho based U.S. Department of Energy (DOE) Federal laboratory
- 890 square mile site with 4,000 staff
- Support DOE's strategic goal:



- Increase U.S. energy security and reduce the nation's dependence on foreign oil
- Multi-program DOE laboratory
 - Nuclear Energy
 - Fossil, Biomass, Wind, Geothermal and Hydropower Energy
 - Advanced Vehicles and Battery Development
 - Energy Critical Infrastructure Protection
 - Homeland Security and Cyber Security









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AVTA Participants and Goals

- Participants
 - The Advanced Vehicle Testing Activity (AVTA) is part of DOE's Vehicle Technologies Program (EERE)
 - The Idaho National Laboratory (INL) conducts the lightduty vehicle portion of the AVTA per DOE guidance
 - Many of these testing activities are conducted with ECOtality North American
 - 100+ fleet and organization test partners allows for leveraged demonstration activities
 - Support also provided to DOE Clean Cities and FEMP
- The AVTA goal Petroleum reduction and energy security
 - Provide benchmark data to technology modelers, research and development programs, vehicle manufacturers (via VSATT), and target and goal setters
 - Assist fleet managers in making informed vehicle and infrastructure purchase, deployment and operating decisions



Vehicle / Infrastructure Testing Experience

- Plug-in hybrid electric vehicles: 14 models, 430 PHEVs, 5 million test miles
- Extended Range Electric Vehicles: 1 model, 150 EREVs, 400,000 test miles
- Hybrid electric vehicles: 19 models, 50 HEVs, 6 million test miles
- Micro hybrid (stop/start) vehicles: 3 models, 7 MHVs, 200,000 test miles
- Neighborhood electric vehicles: 24 models, 372 NEVs, 200,000 test miles
- Battery electric vehicles: 47 models, 4,000 BEVs, 10 million test miles
- Urban electric vehicles: 3 models, 460 UEVs, 1 million test miles
- 3,000 EVSE and first hydrogen generation/dispensing station in United States
- 23 million test miles accumulated on 5,500 electric drive vehicles representing 111 models

INL Vehicle Data Management Process



Example: Vehicle/Infrastructure Data Sources

	HEV: 12 vehicle models, 1 data logger	
Vehicle	HICE: 1 vehicle model, 1 data logger	
time-history data	Conversion PHEVs: 8 vehicle models, 3 data loggers	
(second-by- second)	Ford Escape PHEV, Ford wireless logger	
	Chrysler Ram PHEV, Chrysler wireless logger	
Vehicle event data	Nissan Leaf, Nissan telematics	
(key-on, key-off)	Chevrolet Volt, OnStar telematics	
Charger event and 15 min	ECOtality Blink networked level 2 EVSE, DC/fast chargers	
time-history data	Coulomb ChargePoint networked level 2 EVSE	

Managing 26 different data models



Data Security and Protection

- All raw vehicle and EVSE data, and personal information protected by NDAs (Non Disclosure Agreements) or a CRADAs (Cooperative Research And Development Agreements), resulting in:
 - Limitations on how the proprietary data can be distributed, stored, and used
 - No raw data can or will be distributed by INL
 - Raw data, in both electronic and printed formats, cannot be shared with DOE in order to avoid exposure to FOIA
- Vehicle and EVSE data collection would not occur unless the above limitations are strictly adhered by INL
- INL can bin data results into usable information formats for analysis in research partnerships
- No raw data can be shared by INL





EV Project Locations (Largest World-Wide PEV and EVSE Data Collection Activity)





EV Project Residential Infrastructure

- Deploy 8,300 battery electric vehicles with data loggers
 - 5,700 Nissan Leaf battery EVs
 - 2,600 Chevrolet Volt extended range EVs
- Install 8,300 level 2 residential EVSE with data loggers











EV Project Commercial Infrastructure

- Install ~5,000 level 2 EVSE with data loggers
 - Retail locations
 - Municipal locations
 - Employer locations
- Deploy 200+ Dual Port DC Fast Chargers with data loggers











EV Project – Data Parameters Collected per Charge Event

- Date/Time Stamp
- Unique ID for Charging Event
- Unique ID Identifying the EVSE may not change
- 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
- And other non-dynamic EVSE information (GPS, ID, type, contact info, etc.)



EV Project – Data Parameters Collected per Start/Stop Event

- Date/Time Stamp
- Vehicle ID
- Event type (key on / key off)
- Odometer
- Battery state of charge
- GPS (longitude and latitude)
- Recorded for each key-on and key-off event



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EV Project Overview Report

Project to Date through June 2011

Charging Infrastructure	Number of EV Project	Number of	Electricity
Region ¹	Installed To Date	Performed	(AC MWh)
Phoenix, AZ Metropolitan Area	111	3,921	25.07
Tucson, AZ Metropolitan Area	29	1,134	6.90
Los Angeles, CA Metropolitan Area	130	4,245	28.50
San Diego, CA Metropolitan Area	332	11,150	87.67
San Francisco, CA Metropolitan Area	239	6,352	44.12
Washington, D.C. Metropolitan Area	0	0	0.00
Oregon	160	4,727	32.76
Chattanooga, TN Metropolitan Area	8	253	1.77
Knoxville, TN Metropolitan Area	17	508	3.60
Memphis, TN Metropolitan Area	4	97	0.73
Nashville, TN Metropolitan Area	35	1,083	7.83
Dallas/Ft. Worth, TX Metropolitan Area	2	21	0.06
Houston, TX Metropolitan Area	0	0	0.00
Washington State	271	8,637	57.57
Total	1.338	42,128	296.58

Vehicles	EV Project	EV Project		
Region*	Nissan Leafs Enrolled to Date ²	Chevrolet Volts Enrolled to Date ²	Number of Trips	Distance Driven (mi)
Phoenix, AZ Metropolitan Area	89	-	15,436	124,044
Tucson, AZ Metropolitan Area	26	—	4,296	33,827
Los Angeles, CA Metropolitan Area	139	0	20,326	150,416
San Diego, CA Metropolitan Area	273	0	51,898	391,122
San Francisco, CA Metropolitan Area	287	-	39,307	321,090
Washington, D.C. Metropolitan Area	<u>0 4</u>	0	0	0
Oregon	121	-	19,255	133,861
Chattanooga, TN Metropolitan Area	7	-	889	8,131
Knoxville, TN Metropolitan Area	14	-	2,243	19,101
Memphis, TN Metropolitan Area	1	-		
Nashville, TN Metropolitan Area	28	-	5,293	37,635
Dallas/Ft. Worth, TX Metropolitan Area		0	0	0
Houston, TX Metropolitan Area	-	0	0	0
Washington State	177	0	30,520	230,635
Total	1,162	0	189,582	1,450,314

Note: EV Project charging units may be used by vehicles that are not part of the EV Project. Likewise, EV Project vehicles may connect to non-EV Project charging units. Therefore vehicle and charging infrastructure usage shown on this report are not directly comparable.

Regions: Oregon region includes the Greater Corvallis, Eugene, Portland, and Salem Metropolitan Areas Washington region includes the Greater Seattle and Olympia Metropolitan Areas

² Vehicle enrollment numbers refer to the EV Project only. Numbers do not reflect total regional or national vehicles sales or production.





V Project





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EV Project – Overview Report

- Vehicles and charging infrastructure deployed to date (June 2011)
- Charging infrastructure
 - 1,338 units installed
 - 42,128 charging events
 - 297 AC MWh
- Vehicles
 - 1,162 Leafs enrolled
 - 189,582 trips
 - 1.45 million miles
- Results provided by EV Project region





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EV Project Nissan Leaf Vehicle Summary Report

Region: ALL

Number of vehicles: 956

Reporting period: April 2011 through June 2011

Vehicle Usage

160,58
1,077,93
6.
31.
4.
30.4
1.0



Project







Charging Event Ending SOC (%)

60%

Charging E %0h

5 20%

EV Project – Nissan Leaf Usage Report

- April June 2011 only
- See following slides
- 1 page nationally
- Plus 1 additional page for each region with more than 10 vehicles
- Subset of 956 vehicles as this report requires matching Leaf and charging data



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Away

from





EV Project – Nissan Leaf Usage Report

- Vehicle Usage 2st quarter 2011
 - Number of Trips 160,588
 - 1,077,931 mi Total distance traveled (miles) 6.7 mi
 - Ave trip distance
 - 31.2 mi Ave distance per day when driven
 - Ave # trips between charging events
 - Ave distance traveled between charging 30.4 mi events
 - Ave # charging events per day when a vehicle was driven
 - Petroleum used 0 gallons



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EV Project – Nissan Leaf Usage – cont'd





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VEHICLE TECHNOLOGIES PROGRAM

EV Project Electric Vehicle Charging Infrastructure Summary Report

Region: ALL

Report period: April 2011 through June 2011

Number of EV Project vehicles in region: 956



Charging Availability: Range of Percent of Charging Units with a Vehicle Connected versus Time of Day³



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day⁴



¹ Includes all charging units that were in use by the end of the reporting period

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which period some power is transferred

³ Considers the connection status of all charging units every minute

⁴ Based on 15 minute rolling average power output from all charging units





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Project

EV Project – EV Charging Infrastructure Summary Report

- Charging unit usage
- Percent charging units with a vehicle connected by time of day
- Range of aggregate electricity demand versus time of day
- 2 pages nationally
- Plus 2 additional pages for each region with more than 10 vehicles

ENERGY





Residential Level 2 Electric Vehicle Supply Equipment (EVSE)

Region: ALL

Report period: April 2011 through June 2011

EVSE Usage	Weekday	Weekend	Overall
Number of charging events	25,222	9,912	35,134
Electricity consumed (AC MWh)	186.67	62.30	248.96
Percent of time with a vehicle connected to EVSE	30%	32%	30%
Percent of time with a vehicle drawing power from EVSE	6%	6%	6%
Average number of charging events started per EVSE per day	0.78	0.79	0.78
Average number of distinct vehicles charged per EVSE per day (EV Project vehicles only)	1.0	1.0	1.0

Vehicles Charged	Nissan Leaf	Chevrolet Volt	Non-EV Project vehicles
Percent of charging events	100%	0%	0%
Percent of electricity consumed	100%	0%	0%

Individual Charging Event Statistics	Weekday (WD)	Weekend (WE)	Overall
Average length of time with vehicle connected per charging event (hr)	9.5	9.2	9.4
Average length of time with vehicle drawing power per charging event (hr)	2.1	1.8	2.0
Average electricity consumed per charging event (AC kWh)	7.4	6.3	7.1







Distribution of Length of Time with a Vehicle Drawing Power per Charging Event



EV Project – EV Charging Infrastructure Summary Report – cont'd

- Detailed charging event breakdowns
- Graphs on next page
- Data shown for residential Level 2 EVSE



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EV Project – EV Charging Infrastructure Summary Report – cont'd

- Power demand range for any time during reporting quarter
- Yellow line is daily profile for the day with quarterly peak demand
- Both graphs in AC MW
- Based on 15 minute rolling average MW demand





EV Project – EV Charging Infrastructure Summary Report – cont'd

- Range of charging units with a vehicle connected
- Yellow line is for day with peak power demand
- Both graphs percent of charging units





EV Project – EV Charging Infrastructure Summary Report – cont'd

- Infrastructure Usage 2st quarter 2011
 - Average time vehicle connected
 - Average time vehicle drawing power
 - Average energy per charge event
 - Percent time with vehicle connected
 - Percent time energy transfer
 - Average charging events per day

9.4 hours 2.0 hours 7.1 kWh 30% 6% 0.78 per day





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EV Project Electric Vehicle Charging Infrastructure Summary Report

Region: San Diego, CA Metropolitan Area

Report period: April 2011 through June 2011

Number of EV Project vehicles in region: 240



Charging Availability: Range of Percent of Charging Units with a Vehicle Connected versus Time of Day³



Charging Demand: Range of Aggregate Electricity Demand versus Time of Day⁴



¹ Includes all charging units that were in use by the end of the reporting period

² A charging event is defined as the period when a vehicle is connected to a charging unit, during which period some power is transferred

³ Considers the connection status of all charging units every minute

⁴ Based on 15 minute rolling average power output from all charging units





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Project

EV Project – Other Reports to date include

- Infrastructure reports by each utility service area
 - Produced by overlaying GIS service area data with EV Project data
- Various billing support reports
- Shown San Diego infrastructure report







EV Project – # EVSE Reporting Data to date





EV Project – # EVSE Charging Events to date





EV Project – Leaf AC MWh Consumed to date





EV Project – Number Leafs Reporting to date





EV Project – Leaf Miles Driven to date





EV Project – Nissan Leaf Trips Driven to date





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The number of Leafs that can be charged at 5.538 kWh per day using a percentage of existing electricity generation

	Total 2009 Generation kWh	Number of Nissan Leafs that can be charged at 5.538 kWh per day (2021.37 kWh per year)
2009 kWh		
generation	3,950,331,000,000	
1% 2009 kWh		
generation	39,503,310,000	19,542,840
2% 2009 kWh		
generation	79,006,620,000	39,085,680
3% 2009 kWh		
generation	118,509,930,000	58,628,519
4% 2009 kWh		
generation	158,013,240,000	78,171,359
5% 2009 kWh		
generation	197,516,550,000	97,714,199

Generation Source: Electric Power Annual with data for 2009. November 23, 2010. http://205.254.135.24/cneaf/electricity/epa/epates.html





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VEHICLE TECHNOLOGIES PROGRAM

Ford Escape Advanced Research Fleet

Number of vehicles:	21	Date range of data r
Reporting period:	Nov 09 - Apr 11	Number of vehicle d

eceived: 11/01/2009 to 04/30/2011 avs driven: 5,425

40

20

300,000

250 000

200.000

100.000 50,000

L (L 150,000

Gasoline Fuel Economy By Trip Type

Distance Traveled By Trip Type

CD CD/CS CS

CS

CD

CD/CS

All Trips Combined

Overall gasoline fuel economy (mpg)	3
Overall AC electrical energy consumption (AC Wh/mi) ¹	10
Overall DC electrical energy consumption (DC Wh/mi) ²	6
Total number of trips	23,54
Total distance traveled (mi)	299,96

Trips in Charge Depleting (CD) mode³

Gasoline fuel economy (mpg)	5
DC electrical energy consumption (DC Wh/mi) ⁴	17
Number of trips	13,20
Percent of trips city highway	84% 169
Distance traveled (mi)	75,99
Percent of total distance traveled	259

Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes⁵

Gasoline fuel economy (mpg)	37
DC electrical energy consumption (DC Wh/mi) ⁶	55
Number of trips	4,506
Percent of trips city highway	38% 62%
Distance traveled (mi)	131,484
Percent of total distance traveled	44%

Trips in Charge Sustaining (CS) mode7

Gasoline fuel economy (mpg)	32
Number of trips	5,831
Percent of trips city highway	65% 35%
Distance traveled (mi)	92,478
Percent of total distance traveled	31%

Notes: 1 - 7. Please see http://avt.inl.gov/pdf/phev/fordreportnotes.pdf for an explanation of all PHEV Fleet Testing Report notes.

Since these vehicles are flex-fuel capable, some driving events are conducted with E-85, which may decrease fuel economy results

"The Ford Escape Advanced Research Fleet was designed as a demonstration of customer duty cycles related to plug-in electric vehicles. The vehicles used in this demonstration have not been optimized to provide the maximum potential fuel economy.

Ford Escape PHEV

- **21 Ford Escape PHEVs**
- 300,000 test miles and 24,000 trips
- All trips, 38 mpg, 101 AC Wh/mi & 66 DC Wh/mi
- Charge Depleting (CD), 52 mpg & 170 DC Wh/mi
- Charge Sustaining (CS), **32 mpg**
- **Plugging in = 63%** increase in overall MPG when comparing CD to **CS** trips
- 56% of miles in CD trips •
- 25% of miles in CS trips



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VEHICLE TECHNOLOGIES PROGRAM

Average trip driving intensity (Wh/mi)

Average trip distance (mi)

Trips in Charge Depleting (CD) mode	City	Highway
Gasoline fuel economy (mpg)	48	57
DC electrical energy consumption (DC Wh/mi)	171	169
Percent of miles with internal combustion engine off	37%	13%
Average trip driving intensity (Wh/mi)	265	305
Average trip distance (mi)	3	17
Trips in Charge Depleting and Charge Sustaining (CD/CS) mode		
Gasoline fuel economy (mpg)	43	36
DC electrical energy consumption (DC Wh/mi)	79	52
Percent of miles with internal combustion engine off	30%	5%
Average trip driving intensity (Wh/mi)	277	325
Average trip distance (mi)	9	41
Trips in Charge Sustaining (CS) mode		
Gasoline fuel economy (mpg)	30	32
Parcent of miles with internal comhustion engine off	23%	4%

266

4

321

38







Ford Escape PHEV

- Highway and city cycle impacts
- CD city, 48 mpg, 171 DC Wh/mi
- CD highway, 57 mpg, 169 DC Wh/mi
- CS city, 30 mpg
- CS highway, 32 mpg
- Plugging in = 60% increase in city MPG and 78% increase in highway MPG (compare CD to CS)
- During CD trips, 50% of miles with engine off
- During CS trips, 27% of miles with engine off



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VEHICLE TECHNOLOGIES PROGRAM

Chrysler RAM PHEV Fleet

Number of vehicles:	37
Reporting period:	July 11 - Aug 11

Date range of data received:

7/1/2011 to 8/31/2011 Number of vehicle days driven: 615

All Trips Combined			
Overall gasoline fuel economy (mpg)			16
Overall AC electrical energy consumption (AC Wh/mi) ¹			162
Overall DC electrical energy consumption (DC Wh/mi) ²			94
Overall DC electrical energy captured from regenerative braking (DC Wh/mi)			53
Total number of trips			3,443
Total distance traveled (mi)			13,911
Trips in Charge Depleting (CD) mode ³			
Gasoline fuel economy (mpg)			20
DC electrical energy consumption (DC Wh/mi) ⁴			282
Number of trips			1,310
Percent of trips city highway	98%	1	2%
Distance traveled (mi)			3,779
Percent of total distance traveled			27%
Trips in both Charge Depleting & Charge Sustaining (CD/C	S) m	od	es ⁵
Gasoline fuel economy (mpg)			20
DC electrical energy consumption (DC Wh/mi) ⁶			121
Number of trips			175
Percent of trips city highway	86%	1	14%
Distance traveled CD CS (mi) 1	,232	1	1,433
Percent of total distance traveled CD CS	9%	1	10%
Trips in Charge Sustaining (CS) mode ⁷			
Gasoline fuel economy (mpg)			13
Number of trips			1 059

		1,958
98%	1	2%
		7,505
		53%
	98%	98%







Notes: 1 - 9. Please see http://avt.inl.gov/pdf/phev/chryslerreportnotes.pdf for an explanation of all PHEV Fleet Testing Report notes

The Chrysler RAM PHEV Fleet was designed as a demonstration program of customer duty cycles related to plug-in electric vehicles and may not necessarily demonstrate optimized fuel economy

Vehicle fuel economy is based on customer usage and may not be representative of maximum potential fuel econom



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Chrysler Ram PHEV Pickups

- 66 Chrysler Ram PHEV pickups
- 32,000 test miles and • 6,400 trips
- All trips, 18 mpg, 151 AC • Wh/mi & 87 DC Wh/mi
- Charge Depleting (CD), 22 mpg & 269 DC Wh/mi
- Charge Sustaining (CS), **15 mpg**
- Plugging in = 47%increase in overall MPG when comparing CD to **CS** trips
- 26% of miles in CD trips
- 53% of miles in CS trips





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Chrysler Ram PHEV Pickups

Percent of Drive Time by Operating Mode



Effect of Driving Aggressiveness on Fuel Economy⁸



• 45% of Ram PHEV driving and stopped time, the gas engine is stopped Time of Day When Charging





Time of Day When Driving time * 10. 10:50 44 F 12. 12.50 PM 10. 10:50 Au [14 000.02 2. 2:50 AM 6. 6:50 AM 8. 8:50 AM 2.2:50 PM NO 95:4. 4 6.6:30 AL Ma 95:9- 8 416-95:4 34 ENERGY Idalia National Laborato

ENERGY Energy Efficiency & Renewable Energy

North American PHEV Demonstration

Fleet Summary Repo	rt: Hymotion Prius (V2Green data logger)
Number of vehicles:	184
Reporting Period:	Apr 08 - May 11

Vehicle Technologies Program

Date range of data received: 4/18/2008 to 5/31/2011 Number of days the vehicles were driven: 1132

Reporting Period. Apr uo - May T

All Trips Combined

Overall gasoline fuel economy (mpg)	47
Overall AC electrical energy consumption (AC Wh/mi) 1	53
Overall DC electrical energy consumption (DC Wh/mi) ²	38
Total number of trips	287,310
Total distance traveled (mi)	2,691,319
Trips in Charge Depleting (CD) mode ³	
Gasoline fuel economy (mpg)	62
DC electrical energy consumption (DC Wh/mi) 4	142
Number of trips	116,236
Percent of trips city / highway	87% / 13%
Distance traveled (mi)	534,289
Percent of total distance traveled	20%
Trips in both Charge Depleting and Charge Sustaining (CD/CS)	modes 5
Gasoline fuel economy (mpg)	53
DC electrical energy consumption (DC Wh/mi) 6	49
Number of trips	20,745
Percent of trips city / highway	47% / 53%
Distance traveled (mi)	541,395
Percent of total distance traveled	20%
Trips in Charge Sustaining (CS) mode 7	
Gasoline fuel economy (mpg)	43
Number of trips	150,320
Percent of trine city / highway	770/ / 230/

Number of trips	150,320	
Percent of trips city / highway	77% / 23%	
Distance traveled (mi)	1,619,064	
Percent of total distance traveled	60%	
Number of trips when the plug-in battery pack was turned off by the vehicle operator ⁸	12479	
Distance traveled with plug-in battery pack turned off by the vehicle operator (mi) ⁹	274,084	



Distance Traveled By Trip Type



Miles Logged by Month This Year



ē

Notes: 1 - 9. Please see http://avt.inl.gov/pdf/phev/ReportNotes.pdf for an explanation of all PHEV Fleet Testing Report notes.

1

Hymotion Prius PHEV Conversion

- CD 62 mpg and 142 DC Wh/mi
- **CS 43 mpg**
- **Plugging in = 44%** increase in overall MPG when comparing CD to **CS** trips
- Only 20% miles in CD trips
- 60% miles in CS trips
- Total to date 3.3 million miles





Trips in Charge Depleting (CD) mode	City	Highway	
Gasoline fuel economy (mpg)	60	66	
DC electrical energy consumption (DC Wh/mi)	165	109	
Percent of miles with internal combustion engine off	32%	15%	
Average trip aggressiveness (on scale 0 - 10)	1.8	1.8	
Average trip distance (mi)	3.0	15.1	
Trips in both Charge Depleting and Charge Sustaining (CD/CS) modes			
Gasoline fuel economy (mpg)	53	53	
DC electrical energy consumption (DC Wh/mi)	79	44	
Percent of miles with internal combustion engine off	26%	9%	
Average trip aggressiveness (on scale 0 - 10)	1.9	1.6	
Average trip distance (mi)	8.7	41.5	
Trips in Charge Sustaining (CS) mode			
Gasoline fuel economy (mpg)	36	46	
Percent of miles with internal combustion engine off	22%	8%	
Average trip aggressiveness (on scale 0 - 10)	2.0	1.7	
Average trip distance (mi)	3.5	35.3	

Effect Of Driving Aggressiveness on Fuel Economy This Year



Aggressiveness factor is based on accelerator pedal position. The more time spent during a trip at higher accelerator pedal position, the higher the trip aggressiveness.

2



Trip Fuel Economy Distribution By Trip Type

Hymotion Prius PHEV Conversion

- CD city, 60 mpg, 165 DC Wh/mi
- CD highway, 66 mpg, 109 DC Wh/mi
- CS city, 36 mpg
- CS highway, 46 mpg
- Plugging in = 67% increase in city MPG and 44% increase in highway MPG when comparing CD to CS trips
- CD trips 37% miles with engine off
- CS trips 30% miles with engine off





Ongoing INL Data Collection Projects

- 20 Lithium PHEV Escape Quantum conversions same format as Ford Escapes
- 150 Chevy Volts data collection
- Development of vehicle-based battery test-bed mule for testing emerging battery technologies
- Developing Nissan Leaf fast charge study
 - Comparison of Fast versus Level 2 charging impacts on battery life in fleets and laboratory









Ongoing INL Data Collection Projects – cont'd

- Coulomb EVSE data collection will be same EVSE parameters as the EV Project, but no vehicle data is being will be collected
 - Coulomb reports 900 DOE funded EVSE installed to date
- Initiated wireless and conductive charging infrastructure testing projects
 - Benchmarking conductive EVSE efficiencies
 - Wireless EVSE energy efficiencies will be benchmarked
 - Cyber security testing of EVSE is being initiated



















Federal Fleet Data Collection Projects

- Five USPS electric long life vehicles (ELLV) conversions track, dynamometer, and fleet testing (with data loggers)
 - Stop & Go Trips (>5 stops/mile)
 - 467 DC Wh/mi
 - 0.2 mile average trip distance
 - 5.3 mph average speed
 - 32.2 average stops per mile
 - 15% regenerative braking energy recovery
 - All trips 1.43 AC / DC Wh/mi ratio = 668 AC Wh/mi for above Stop & Go Trips







Summary

- Ongoing INL/DOE data collection activities will provide 100+ million miles of vehicle operations and charger use
 - Demonstrate charging infrastructure use
 - Demonstration vehicle technology petroleum reduction capabilities
 - Demonstrate vehicle operator use patterns
 - Private versus public charging patterns
 - Level 2 versus fast charging patterns
 - Demonstrate different revenue models
 - Seasonal driving and charging variations
 - Demonstrate SOC recharging level changes over time
 - Document variations in vehicle and charging behavior by time, regions and electric utility service areas
 - Need to collect the data before INL can report it



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More Information http://avt.inl.gov

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