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

Clean Cities Peer Exchange (PA) – DOE/AVTA's HEV, NEV, and PHEV Testing Results and Resources

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This presentation does not contain any proprietary or sensitive information

AVTA Background and Goals

- **The Advanced Vehicle Testing Activity (AVTA) is part of DOE's Vehicle Technologies Program**
- **The Idaho National Laboratory (INL) and Electric Transportation Engineering Corporation (ETEC) conduct the AVTA. Argonne National Laboratory performs dynamometer testing**
- **The AVTA goals:**
  - **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 early adaptor vehicle purchase, deployment and operating decisions**

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AVTA Testing by Technology

- Plug-in hybrid electric vehicles (PHEV)
  - 12 models, 168 vehicles, 600,000 fleet test miles
- Hybrid electric vehicles (HEV)
  - 17 models, 45 vehicles, 4.5 million test miles
- Neighborhood electric vehicles
  - 23 models, 200,000 test miles
- Hydrogen ICE (internal combustion engine) vehicles
  - 7 models, 400,000 test miles
- Full-size battery electric vehicles (BEVs)
  - 40 EV models, 5+ million test miles
- Urban electric vehicles
  - 3 models, 1 million test miles

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Hybrid Electric Vehicles (HEVs) in Testing

2001 Honda Insight	6	Completed
2002 Gen I Toyota Prius	6	Completed
2003 Gen I Honda Civic	4	Completed
2004 Chevrolet Silverado (2- & 4-WD)	2	Completed
2004 Gen II Toyota Prius	2	Completed
2005 Ford Escape (front & 4-WD)	2	Completed
2005 Honda Accord	2	Completed
2006 Lexus RX 400h (front & 2 AWD)	3	Completed
2006 Toyota Highlander (AWD)	2	Completed
2006 Gen II Honda Civic	2	Completed
2007 Saturn Vue	2	Ongoing
2007 Toyota Camry	2	Completed
2008 Nissan Altima	2	Ongoing
2008 GM 2-mode Tahoes	2	Ongoing
2010 Toyota Prius	2	Obtaining
2010 Honda Insight	2	Obtaining
2010 Ford Fusion	2	Obtaining
Total	45 to date	

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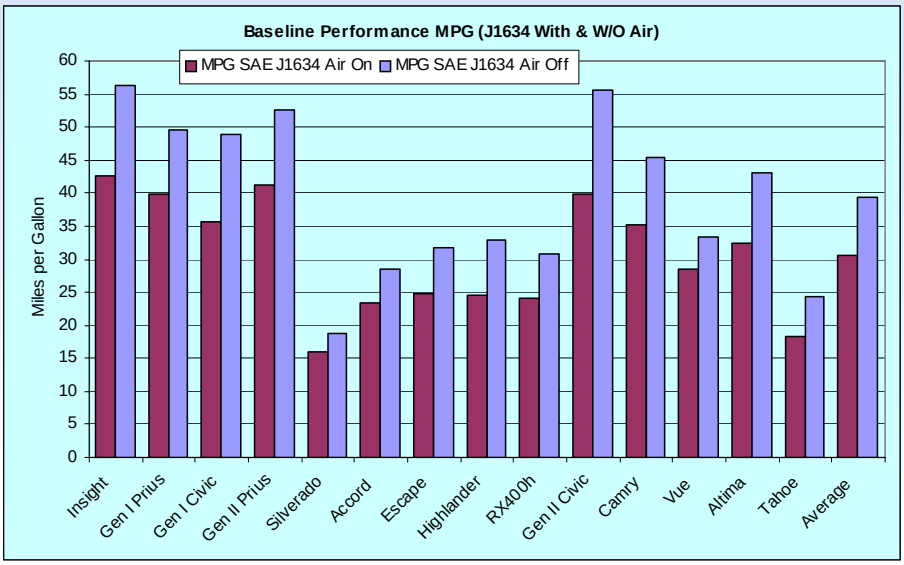
HEVs Dynamometer Testing



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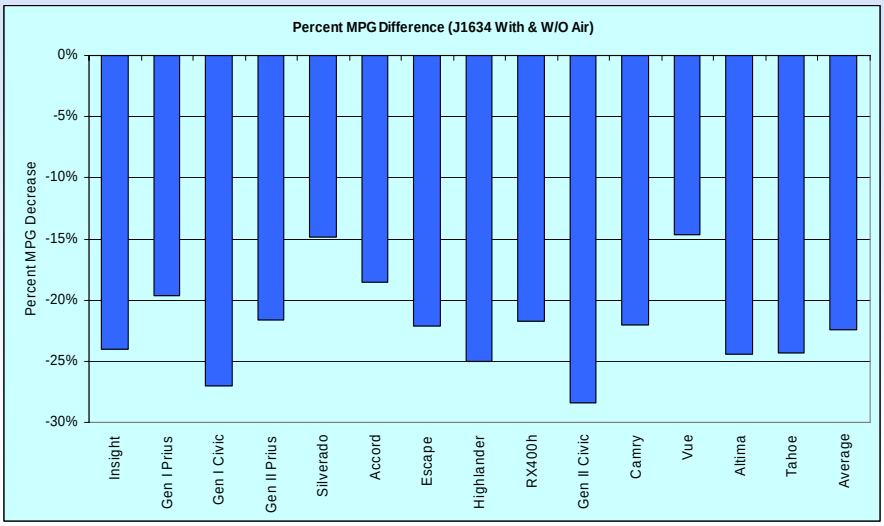
HEV Dynamometer A/C MPG % Decrease



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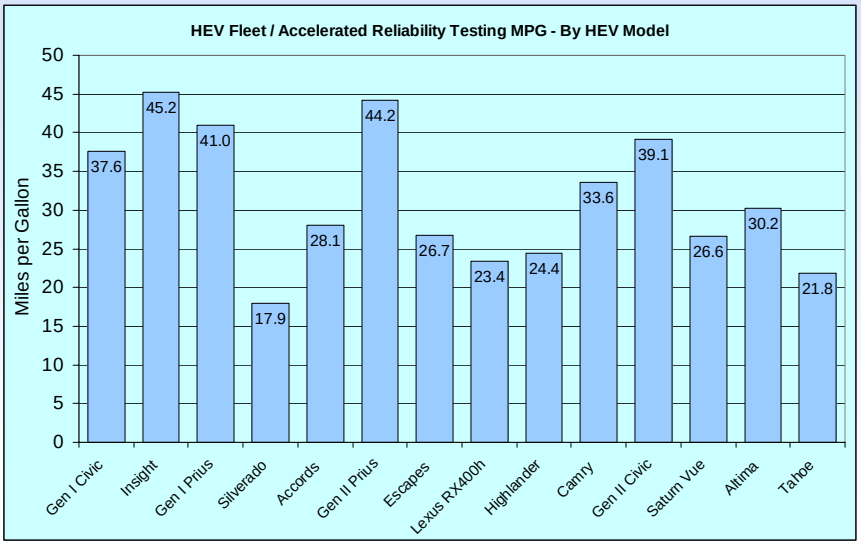
160,000-Mile HEV Accelerated Testing - MPG



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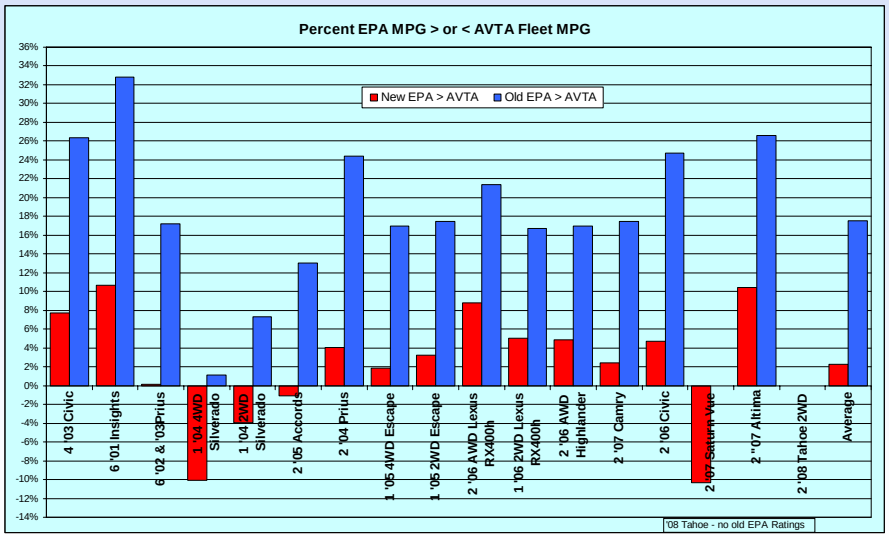
AVTA HEV Fleet MPG and EPA MPG



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HEV Maintenance and Repairs

FREEDOMCAR & VEHICLE TECHNOLOGIES PROGRAM

HEV Fleet Testing

Advanced Vehicle Testing Activities

Maintenance Sheet for 2006 – Highlander

VIN # JTEDW21A160006395

Date	Mileage	Description	Cost
12/14/2005	4,853	Changed oil, rotated tires	$31.99
1/5/2006	9,952	Changed oil, rotated tires	$29.99
1/31/2006	11,709	10K service	$187.00
2/22/2006	20,785	Changed oil, rotated tires	$29.97
3/13/2006	26,497	Changed oil, rotated tires	$28.23
4/17/2006	31,478	30K service	$211.84
4/26/2006	34,482	Changed oil, rotated tires	$28.99
5/18/2006	42,113	Changed oil, rotated tires	$28.99
6/8/2006	47,477	45K interval service, ATE preventative maintenance	$209.97
7/7/2006	53,711	Changed oil	$48.44
7/26/2006	59,633	60K service	$249.86
8/21/2006	65,067	Changed oil	$48.31
9/12/2006	71,099	Changed oil, replaced wiper blades	$57.20
9/14/2006	71,303	Check engine light on - Code P1297 inverter cooling system malfunction inverter coolant low	warranty
9/29/2006	73,013	Replaced transaxle	$3,715.87
10/6/2006	75,449	75K service	$209.97
12/6/2006	80,170	Changed oil	$39.99

U.S. Department of Energy
Energy Efficiency and Renewable Energy

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HEV Per Mile Costs and Per Month MPGs

FREEDOMCAR & VEHICLE TECHNOLOGIES PROGRAM

HEV Fleet Testing

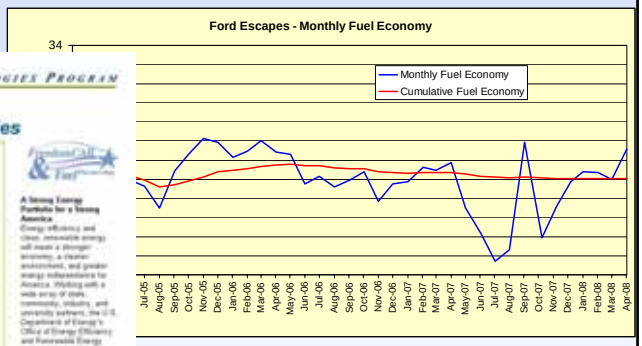
Advanced Vehicle Testing Activities

2005 Honda Accord

Fleet Performance

Vehicle Specifications

U.S. Department of Energy
Energy Efficiency and Renewable Energy



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NEVAmerica Testing – 23 models tested

- CARB requires all Neighborhood Electric Vehicles (NEVs) be AVTA tested in order to receive
  - Incremental funding
  - Partial ZEV credits
- 3 NEVs currently in 2009 testing
  - Roush REV (completed)
  - Advantage van and pickup
- In 2008, 5 NEVs tested
  - 2 Miles Automotive sedan and pickup, 1 Zen sedan, 2 GEMs
- 15 NEVs previously tested:
  - 8 Gems, 2 Th!nk Neighbors, 2 Frazier Nashes, 2 ParCars, 1 Katech

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NEVAmerica Testing Includes

- NEV test variables
  - Acceleration 0 to 20 mph
  - Maximum speed
  - Range per charge at maximum speed
  - Braking from 20 mph
  - Gradeability
  - Charging Efficiency (Wh-AC/mile and cents/mile)
  - Level 1 and 3 (if equipped) charger
    - Maximum AC and DC current and demand
    - Time to recharge to 80%, 100% and complete
- Vehicle specifications
  - Batteries, tires, charger, dimensions, and weights

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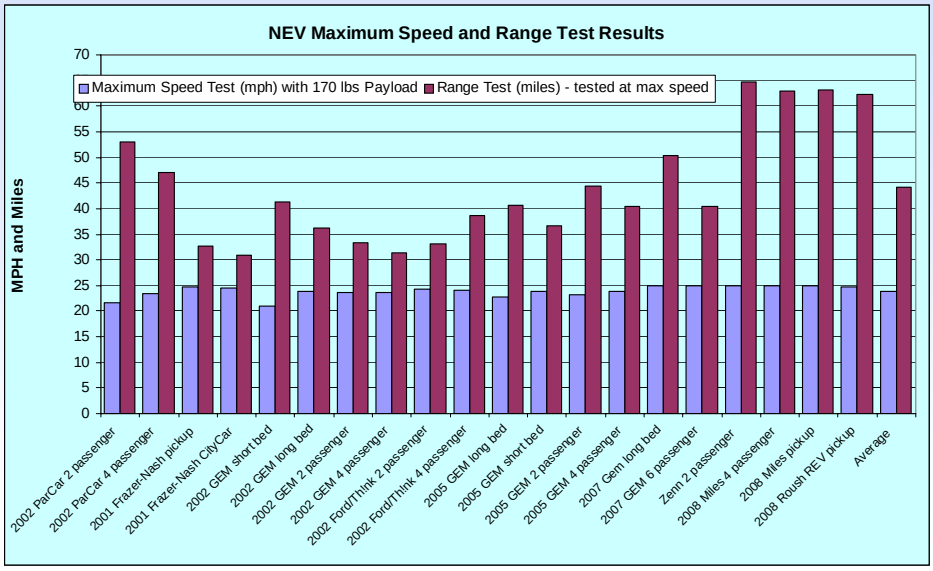
NEV Testing Max Speed & Range per Charge



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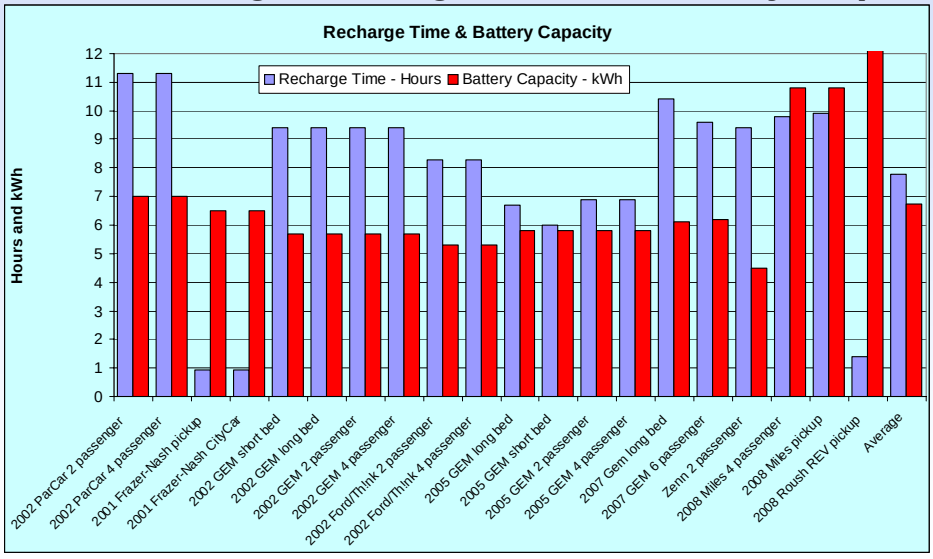
NEV Testing Recharge Time & Battery Cap.



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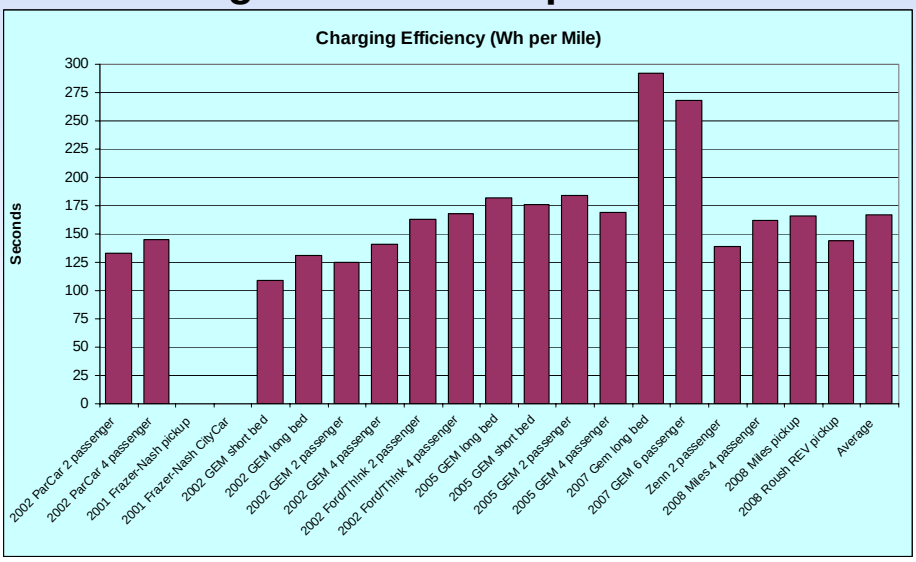
NEV Testing Results – Wh per Mile



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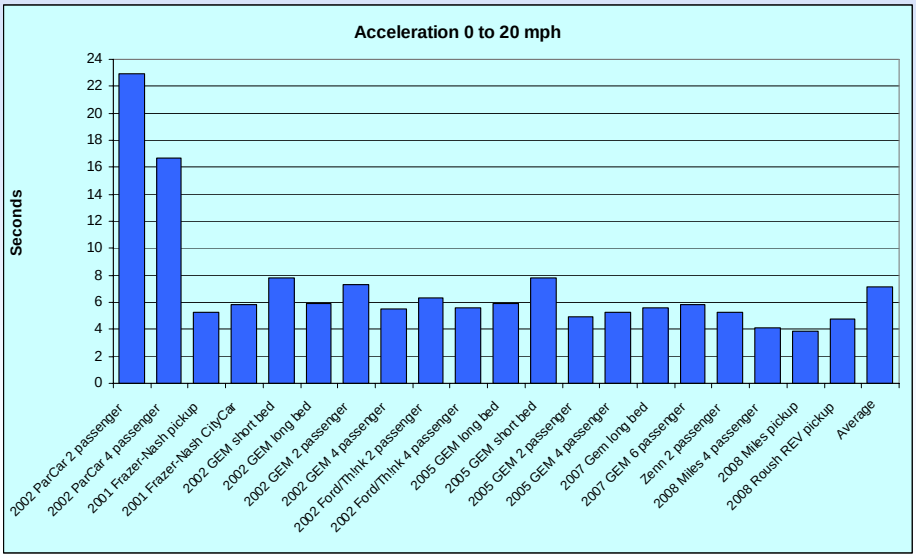
NEV Testing Results – Acceleration



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PHEV Questions

- What are the petroleum savings and electricity demands?
- Will fleets and the public adapt to plugging in (charging) PHEVs to maximize mpg?
- Is a two-fuel scenario a difficult transition?
- What are the charging infrastructure needs, including 110V versus 220V? Fast charging?
- V2Grid – economic and technical benefit or liability to the vehicle operator?
- Are PHEVs technically and economically feasible as a transportation option?
- To answer these questions, the AVTA is testing and demonstrating 12 different PHEV models (by battery), their batteries, and the charging infrastructure

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12 PHEVs Models in Testing/Demonstrations

- Hymotion Prius (A123Systems)
- Hymotion Escape (A123Systems)
- Ford E85 Escape (Johnson Controls/Saft)
- EnergyCS Prius, 2 models (Valance and Altair Nano)
- Electrovaya Escape (Electrovaya)
- Hybrids Plus Escape, 2 models (Hybrids Plus and K2 Energy Solutions)
- Hybrids Plus Prius (Hybrids Plus)
- Manzanita Prius (lead acid)
- Manzanita Prius (Thunder Sky)
- Renault Kangoo (Saft NiCad)
- (All batteries are Lithium unless noted)

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PHEV Testing Methods and Objectives

- Perform independent testing of PHEVs, using:
  - Baseline performance testing: closed test tracks and dynamometers
  - Accelerated testing: dedicated drivers operating on defined onroad loops
  - Fleet testing: everyday unstructured \ non-directed fleet and public use, with onboard data loggers
  - Laboratory testing of PHEV batteries
- Testing used to document:
  - Battery life, charging patterns and profiles
  - Vehicle operations, fuel use (electricity and gasoline) and infrastructure requirements
  - Driver influences on fuel use
  - Individual PHEV models and PHEV concepts
  - PHEV life-cycle costs

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PHEV Operating Modes

- Charge sustaining (CS) mode: from start to finish of a single trip, there is no energy available for electric drive propulsion in the PHEV battery. Therefore, the battery state-of-charge (SOC) is sustained
- Charge depleting (CD) mode – from start to finish of a single trip, there is energy available for partial or full electric drive propulsion in the PHEV battery. Therefore, the battery SOC is being depleted during the trip
- Mixed CD/CS mode – there is energy in the battery pack at the start of a single trip, but the PHEV battery is fully depleted before the trip ends
- Electric propulsion is either in the form of all-electric or electric-assist (the internal combustion engine [ICE] is also providing propulsion power)

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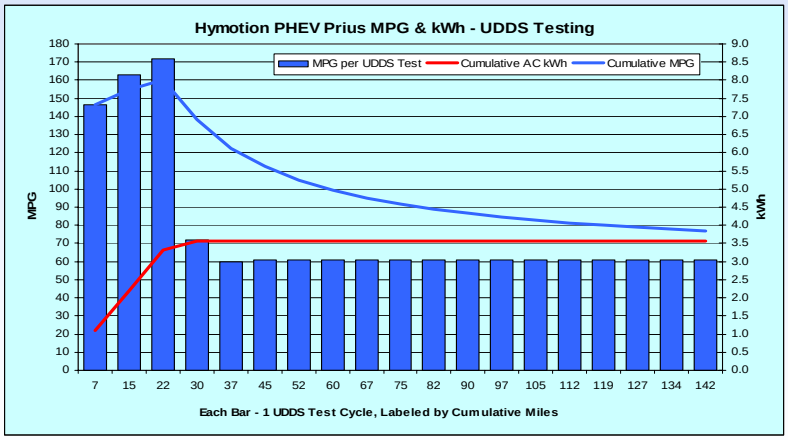
Hymotion Prius Gen I – UDDS Fuel Use

- **5 kWh A123Systems (Li) and Prius packs (AC kWh)**



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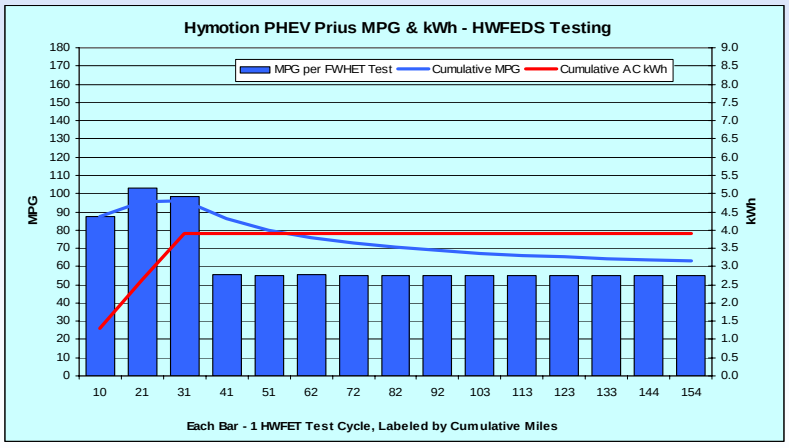
Hymotion Prius Gen I – HWFEDS Fuel Use

- **5 kWh A123Systems (Li) and Prius packs (AC kWh)**



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PHEV Accelerated Testing

- Accelerated testing in Phoenix over 5,440 onroad miles
- GPS units track distance, average and maximum speeds

Cycle (mi)	Urban (10 mi)	Highway (10 mi)	Charge (hr)	Reps (N)	Total (mi)	Reps (%)	Miles (%)
10	1	0	4	60	600	37%	11%
20	1	1	8	30	600	19%	11%
40	4	0	12	15	600	9%	11%
40	2	2	12	15	600	9%	11%
40	0	4	12	15	600	9%	11%
60	2	4	12	10	600	6%	11%
80	2	6	12	8	640	5%	12%
100	2	8	12	6	600	4%	11%
200	2	18	12	3	600	2%	11%
Total	2,340	3,100	1,344	162	5,440		
Average	43%	57%	8.3	18			

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Hymotion Prius Gen I – Accelerated Testing

Cycle	Urban	Highway	Charge	Reps	Total	Electricity	Gasoline	
(mi)	(10 mi)	(10 mi)	(hr)	(N)	(mi)	AC kWh	Gals	MPG
10	1	0	4	60	600	136.33	4.81	127.2
20	1	1	8	30	600	122.02	5.37	115.9
40	4	0	12	15	600	84.10	6.05	101.1
40	2	2	12	15	600	87.22	5.78	106.9
40	0	4	12	15	600	79.82	8.54	73.1
60	2	4	12	10	600	55.33	8.98	68.9
80	2	6	12	8	640	43.99	11.36	58.3
100	2	8	12	6	600	35.98	8.43	73.2
200	2	18	12	3	600	15.0	11.02	54.8
Total	2340	3100	1404	167	5,440	Weighted Average		79.5

Each total distance slightly greater than 600 and 640 miles. HEV version = 44 mpg

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Hymotion Prius Gen II – Accelerated Testing

Cycle	Urban	Highway	Charge	Reps	Total	Electricity	Gasoline	
(mi)	(10 mi)	(10 mi)	(hr)	(N)	(mi)	AC kWh	Gals	MPG
10	1	0	4	60	600	111.43	5.205	117.6
20	1	1	8	30	600	124.50	8.105	80.1
40	4	0	12	15	600	71.28	9.8	62.1
40	4	0	12	15	600	44.97	7.2	84.2
40	2	2	12	15	600	64.36	9.70	64.3
40	2	2	12	15	600	75.14	6.20	99.8
40	2	2	12	15	600	70.98	6.83	90.6
40	0	4	12	15	600	75.18	6.10	103.3
60	2	4	12	10	600	33.38	10.54	58.8
80	2	6	12	8	640	41.38	10.71	61.8
100	2	8	12	6	600	26.48	10.91	56.5
200	2	18	12	3	600	16.01	10.41	57.7
Total	2340	3100	1404	167	6,040	Weighted Average		

Each total distance slightly greater than 600 and 640 miles. HEV version = 44 mpg

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EnergyCS Prius (Valance) – Accelerated Testing

Cycle	Urban	Highway	Charge	Reps	Total	Electricity	Gasoline	
(mi)	(10 mi)	(10 mi)	(hr)	(N)	(mi)	kWh	Gals	MPG
10	1	0	4	60	600	115.58	4.78	128.1
20	1	1	8	30	600	86.21	7.95	77.9
40	4	0	12	15	600	25.00	14.29	42.7
40	2	2	12	5	600	31.52	11.05	56.1
40	0	4	12	5	600	32.44	11.36	55.5
60	2	4	12	10	600	65.00	5.90	103.7
80	2	6	12	8	640	39.04	10.09	65.8
100	2	8	12	6	600	22.67	8.81	70.8
200	2	18	12	3	600	12.98	10.46	57.8
Total	2340	2500	984	147	5440	Weighted Average		66.1

Each total distance slightly greater than 600 miles. HEV version = 44 mpg

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Renault Kangoo – Accelerated Testing

Cycle	Urban	Highway	Charge	Reps	Total	Electricity		Gasoline	
(mi)	(10 mi)	(10 mi)	(hr)	(N)	(mi)	AC kWh	Mi/kWh	Gals	MPG
10	1	0	4	60	600	359.60	1.7	0	
20	1	1	8	30	600	131.96	4.6	0	
40	4	0	12	5	200	35.18	5.6	0	
40	2	2	12	5	200	33.22	6.0	0	
40	0	4	12	5	200	28.60	7.0	0	
60	2	4	12	10	600	57.96	10.4	13.3	45.1
80	2	6	12	8	640	44.62	14.4	16.6	38.6
100	2	8	12	6	600	Deleted*			
200	2	18	12	3	600	Deleted*			
Total	1560	1480	876	123	3,040				

* Testing ended when gasoline engine and inverter failed. Each total distance slightly greater than 600 miles.

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Hymotion Escape – Accelerated Testing

Cycle	Urban	Highway	Charge	Reps	Total	Electricity	Gasoline	
(mi)	(10 mi)	(10 mi)	(hr)	(N)	(mi)	AC kWh	Gals	MPG
10	1	0	4	60	600	198.93	11.52	53.1
20	1	1	8	30	600	163.29	13.51	45.7
40	4	0	12	15	600	57.51	14.91	41.1
40	2	2	12	15	600	76.29	15.99	38.7
40	0	4	12	15	600	114.14	11.92	51.5
60	2	4	12	10	600	97.18	13.70	45.3
80	2	6	12	8	640	77.69	16.05	41.3
100	2	8	12	6	600	58.64	15.69	39.8
200	2	18	12	3	600	26.09	17.72	33.5
Total	2340	3100	1344	162	5440	Weighted Average		42.5

Each total distance slightly greater than 600 miles. HEV version = 27 mpg

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Electrovaya Escape – Accelerated Testing

Cycle (mi)	Urban (10 mi)	Highway (10 mi)	Charge (hr)	Reps (N)	Total (mi)	Electricity AC kWh	Gasoline Gals	Gasoline MPG
10	1	0	4	60	600	135.24	9.55	65.1
20	1	1	8	30	600	101.13	17.54	34.7
40	4	0	12	15	600	71.3	16.42	37.3
40	2	2	12	15	600	69.8	14.34	43.1
40	0	4	12	15	600	55.84	20.73	29.8
60	2	4	12	10	600	44.79	16.64	37.3
80	2	6	12	8	640	42.72	16.30	40.8
100	2	8	12	6	600	20.85	21.17	29.2
200	2	18	12	3	600	13.31	19.01	30.9
Total	2340	3100	1344	162	5440	Weighted Average		36.7

Each total distance slightly greater than 600 miles. HEV version = 27 mpg

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PHEV Fleet Testing Partners

- 75+ testing partners in the U.S. and Canada:
  - 36 Electric utilities and 2 clean-air agencies
  - 10 City, county and state governments
  - 7 Private companies and advocacy organizations
  - 8 Universities and colleges and 4 Canadian provinces
  - 2 PHEV companies 1 sea port and 1 DOD facility
- Testing partners include:
  - A123Systems, EnergyCS, NYSERDA, NRECA, UC Davis, Fairfax County, Google.org, Austin Energy, Central Vt PSC, Duke Energy, Advanced Energy, Progress Energy, SDGE, Basin Electric, Buckeye Power, WI Public Power Inc., Madison GE, SCANA Corp., HCATT, BC Hydro, BC Government, various Washington State groups

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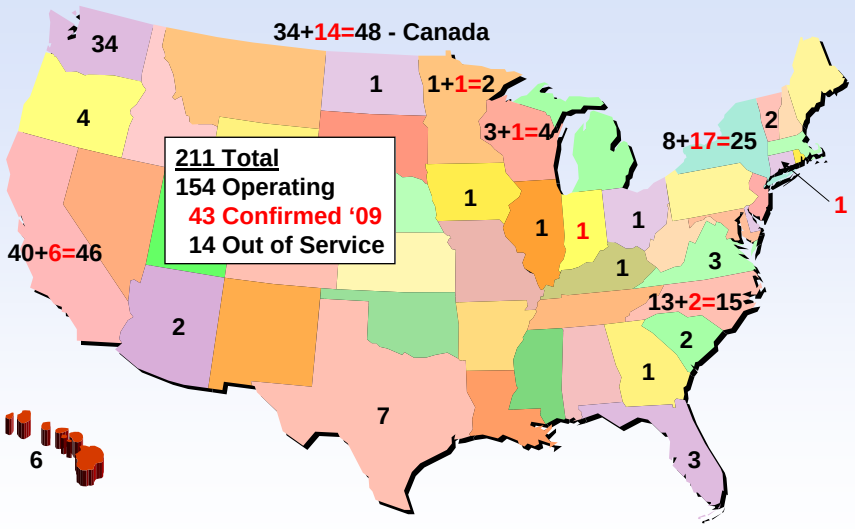
PHEV Fleet Testing



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Why Does PHEV Fleet MPG Vary So Much?

- 26 Hymotion Prius – January thru May 2008

PHEV Operating Mode	Number of Trips	Distance Traveled (Miles)	Miles per Gallon
Charge Depleting (CD)	3,073	14,820	59
Mixed CD / CS	404	11,121	49
Charge Sustaining (CS)	1,358	16,059	40
All trips combined	4,835	42,000	48

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Why Does PHEV Fleet MPG Vary So Much?

- 13 Hymotion Prius - May 2008

PHEV Operating Mode	# Trips	Total Distance (mi.)	Average Trip (mi.)	MPG	DC kWh\mi.
CD	575	3,040	5.3	72.0	0.138
Mixed CD / CS	67	1,840	27.5	52.1	0.050
CS	133	1,411	10.6	40.2	
All-electric	137	127	0.9		0.236
Total	912	6,417	7.0		
CD, CS, CD/CS only total	775	6,291	8.1	55.9	

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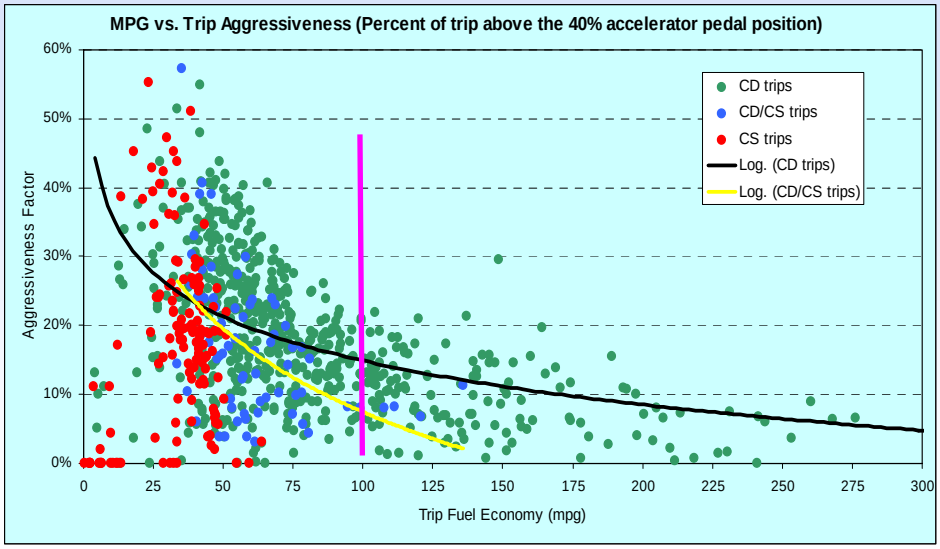
PHEV MPG and Aggressive Driving



13 Hymotion Prius, 775 trips, 6,291 miles, May 2008

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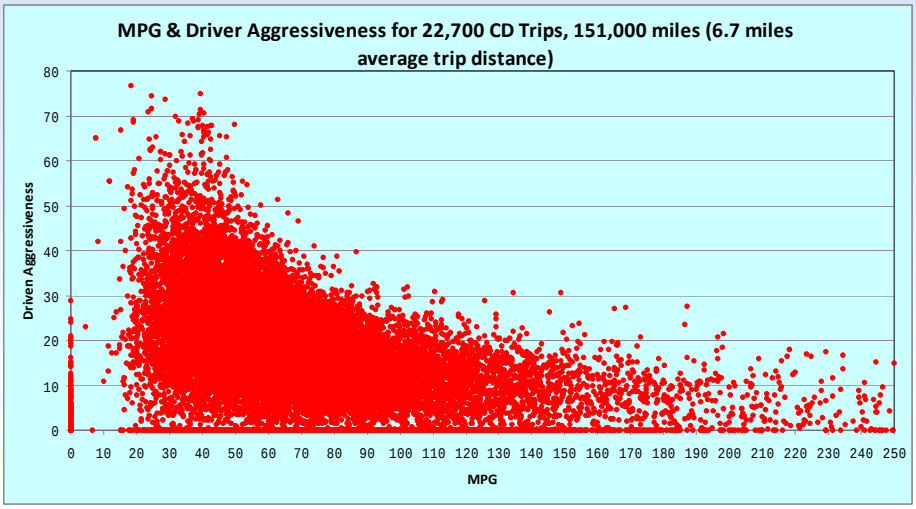
Hymotion Prius PHEVs – CD Trips

- MPG and aggressive driving impacts March '08 – May '09



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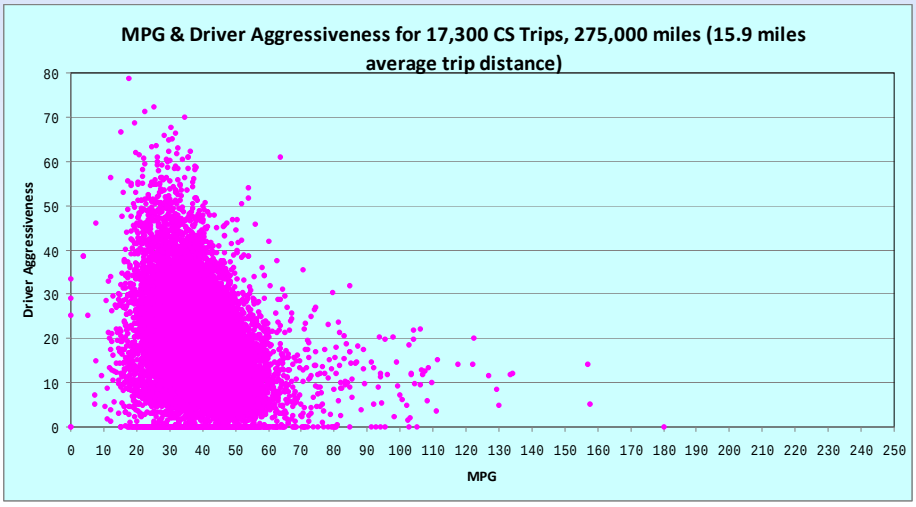
Hymotion Prius PHEVs – CS Trips

- MPG and aggressive driving impacts March '08 – May '09



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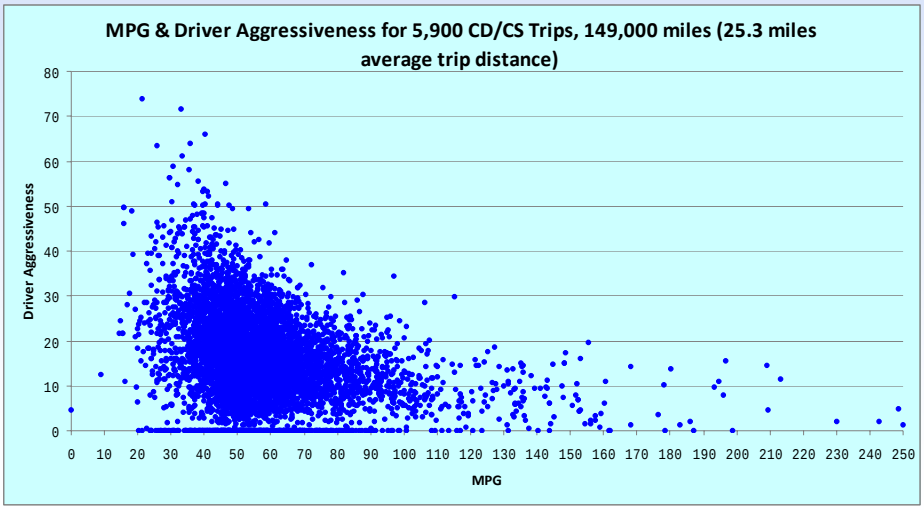
Hymotion Prius PHEVs – CS/CD Mixed Trips

- MPG and aggressive driving impacts March '08 – May '09



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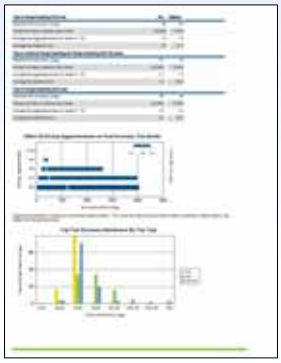
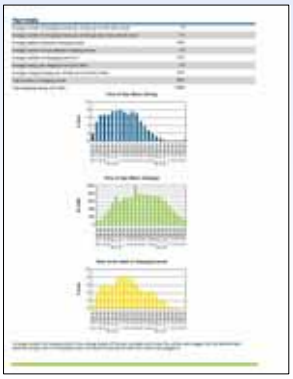
Hymotion Prius PHEV Fleet Testing Reports

- Summary reports posted monthly on web
- Individual vehicle reports only go to the respective fleets each month, 740+ reports to date (April 1, 2009)
- 115 Hymotion Prius PHEVs, 484,682 miles, 50,501 trips, 12,754 charging events, 28,663 kWh used. V2Green and Kvaser data logger reports





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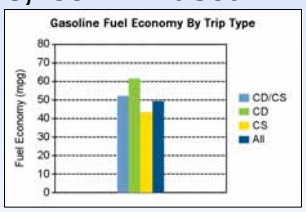
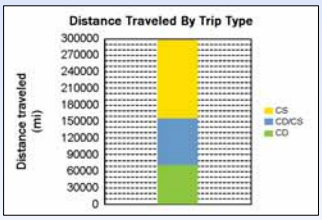
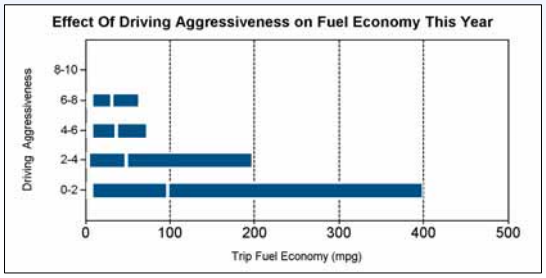
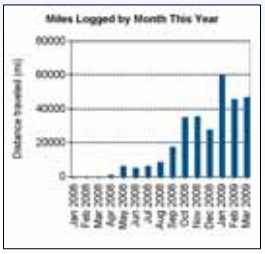
Fleet Testing Results (April 08 to March 09)

- **Hymotion Prius, with V2Green Data Logger. 65 PHEVs, 296,558 miles, 30,099 trips, 7,290 charging events and 118,755 kWh used**









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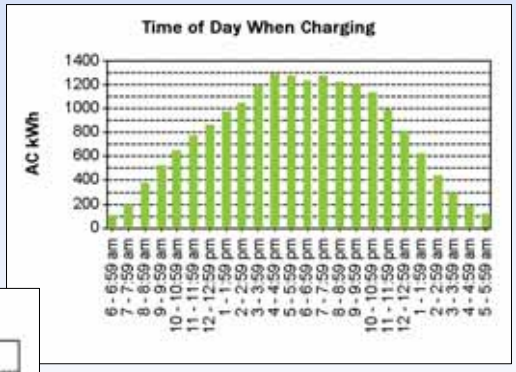
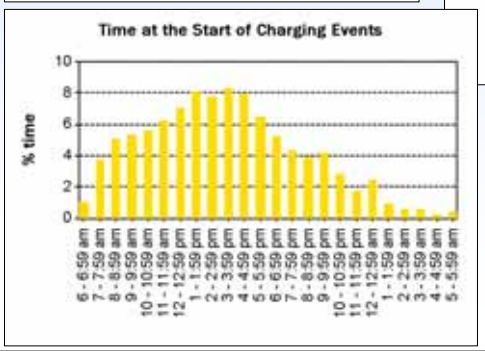
Fleet Testing Results (April 08 to March





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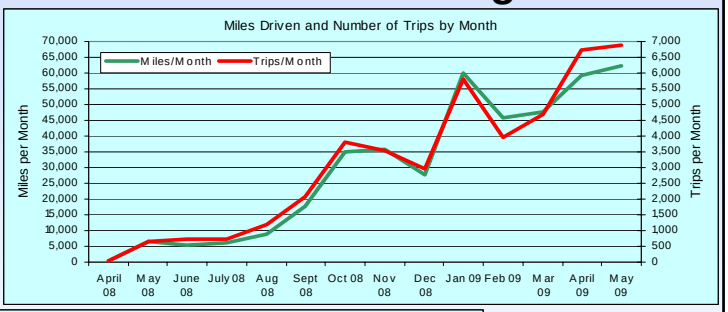
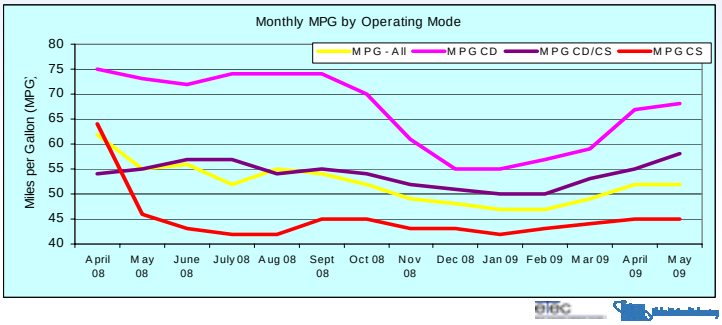
Hymotion Prius PHEV Fleet Testing Trends





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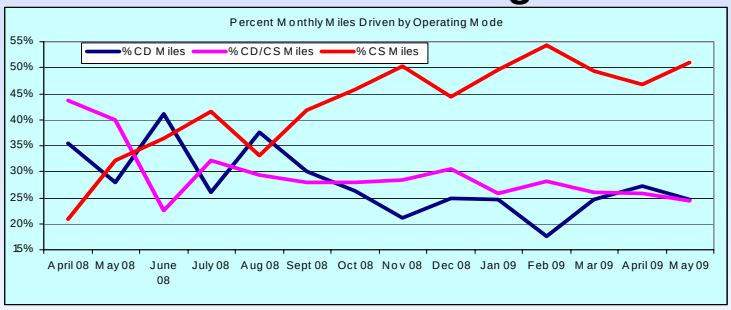
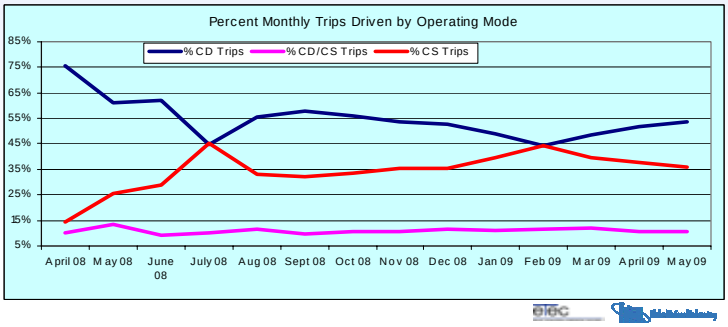
Hymotion Prius PHEV Fleet Testing Trends





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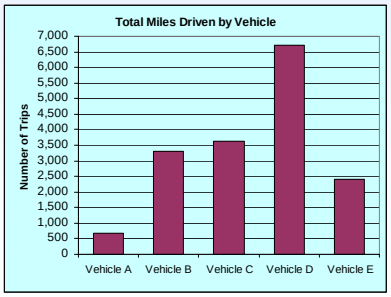
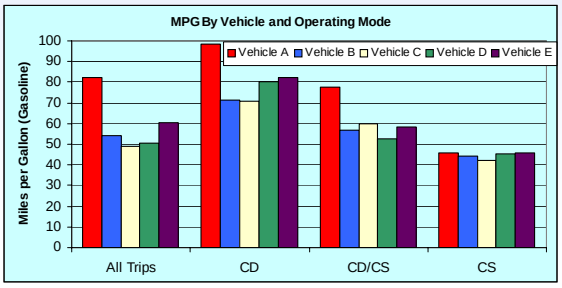
EnergyCS Prius (Valance Battery) Fleet Tests

Trip Type	Fuel Economy (mpg)	Number of Trips	Percent of Trips	Miles Driven	Percent Total Distance
All	53.0	1,966		16,470	
CD	78.1	953	48%	3,911	24%
CD/CS	56.1	184	9%	4,896	30%
CS	44.4	829	42%	7,933	48%





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EnergyCS Prius (Altairnano Bat.) Fleet Tests

Trip Type	Fuel Economy (mpg)	Number of Trips	Percent of Trips	Miles Driven	Percent Total Distance
All	60	915		7,312	
CD	73	475	52%	1,724	24%
CD/CS	68	101	11%	3,156	43%
CS	47	339	37%	2,431	33%

Average number of charging events per vehicle per month when driven	17.2
Average number of charging events per vehicle, per day, when driven	0.6
Average distance between charging event (miles)	33.7
Average number of trips between charging event	4.2
Average energy per charging event (DC kWh)	2.0
Average charging event duration (hours)	21.9
Total number of charging events	217
Total charging energy (AC kWh)	590

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Other PHEV Testing

- Bidirectional vehicle-to-grid (V2G) charging study at 6 kW and 20 kW levels, using two lithium PHEV batteries, V2Green cellular charging control, documenting infrastructure requirements and costs
- City of Seattle \ V2Green time-of-day charging demo on 13 Seattle-area PHEVs. Includes AVTA battery impact analysis. Uses V2Green wireless charging control
- AVTA and Tacoma Power are collecting data on one section of administration building (800 amp, 480 volt, 3 phase load) and PHEV charging infrastructure
  - Document demand and energy profiles of PHEV charging as portion of facility profiles

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Battery Charging Infrastructure Terms

- Level I – 110 / 120 VAC, 15 amp (12 amp continuous). Maximum 1.44 kW continuous. Onboard charger. NEMA5-15R receptacle, with GFCI
- Level II – greater than Level I, with 208-240 VAC and up to 100 amp (80 amp continuous). Maximum 9.6 kW (7.68 kW continuous). Generally onboard charger. EVSE, mated to AC input and SAE J1722 connector to vehicle (the "plug")
- Level III – greater than Level II, generally off-board charger supporting more than one vehicle. Energy to vehicle can be 480 VAC or higher
- DC Charging – similar to Level III, but DC transfer
- Fast Charge – Returns 50% of a battery's capacity in under 30 minutes. For large batteries, usually at Level III
- SAE J1722 – scheduled June 2009 vote. Defines standard connector up to ~70 amps

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PHEV Charging Infrastructure Cost Report

- Analyzes PHEV infrastructure requirements in single and multi-family residential, and commercial facilities as well as driving trends. No site specific costs
- Charging infrastructure equipment/administrative costs:
  - Levels 1 (120V, 15 or 20 amp) and 2 residential
  - Levels 1 and 2 (208/240V ~40 amp) apartment complex
  - Level 2 commercial facility
- Battery sizes & charge times for various PHEV platforms
- Power electronics & battery costs for PHEV platforms

Level 1 Residential	Labor	Material	Permits	Total
EVSE (charge cord)	- -	$250	- -	$250
Residential circuit installation (20A branch circuit, 120 VAC/1-Phase)	$300	$131	$85	$516
Administration costs	$60	$43	$9	$112
Total Level 1 Cost	$360	$424	$94	$878

Report @ http://avt.inl.gov/pdf/phev/phevInfrastructureReport08.pdf

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Lithium Battery Performance

- Applicable to NiMH and Lithium chemistries, the DOE / USABC HEV and PHEV battery goals are listed below
- Most lithium batteries are performing to or near the goals

Temperature	Capacity based on performance at 30°C
0°C (32°F)	50%
-10°C (14°F)	30%
-30°C (-22°F)	10%
+50°C (122°F)	>100%

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PHEV Advantages

- Reduced petroleum consumption and emissions
- Optimized fuel efficiency and performance
- Recover energy during regenerative braking
- Use existing gas station infrastructure
- Minimal electric grid changes needed - add connector and electric vehicle supply equipment (EVSE)
- At home battery charging, well below cost of gasoline
- Zero emission potential (local)
- Lower fuel costs compared to HEVs
- Energy security by displacing imported petroleum with domestically generated electricity
- Potential for off-peak charging
- V2Grid (big maybe)

Primary Source Electric Drive Transportation Association (EDTA)
http://www.electricdrive.org/index.php?ht=d/Articles/cat_id/5599/pid/9673

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PHEV Challenges

- Cost and complexity of two powertrains
- Drivers adapting to dual-fueling scenario
- Component availability - batteries, powertrains, power electronics (early challenge)
- Higher initial capital cost
- Cost of batteries and potential battery replacements
- Added weight
- Probable need for public recharging infrastructure
- Challenge to move charging to off-peak times
- If large PHEV batteries are successful, will BEVs replace PHEVs?

Primary source EDTA
http://www.electricdrive.org/index.php?ht=d/Articles/cat_id/5599/pid/9673

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PHEV Purchase Considerations

- Has the vehicle emissions been certified by CARB or the EPA, or received an exemption?
- Has the vehicle been crashed testing and FMVSS certified per NHTSA reporting requirements?
- Has converter made the vehicle available to DOE's AVTA for testing?
- "Rich" charging environment may be less costly than increasing per vehicle battery size
- Current PHEVs have the potential to provide greater than 100 mpg – but maybe needs a "better" PHEV driver
- Future PHEVs may provide controlled response to power demands
- Match mission to PHEV capabilities
- Consider the vehicle's ambient operating temperature
- Conversions need crash testing – Don't believe "its just another piece of luggage in the trunk"

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Announced PHEV Introductions*

- 2009 Fisker Karma S Plug-in Hybrid (maybe 2010)
- 2010 Saturn VUE Plug-in Hybrid
- 2010 Toyota Plug-in Hybrid (?)
- 2010 Chevrolet Volt Extended Range BEV
- 2010 Kia LPG and Electric "hybrid"
- 2009 Chery (China, Berkshire Hathaway) BYD PHEV in Europe
- 2011 BYD F3DM Plug-in Hybrid
- 2012 Ford Escape Plug-in Hybrid
- 2012 Hyundia PHEV
- ? AFS Trinity SUV
- (* Presenter makes no accuracy claim for the above dates and products. Some info based on media reports)

Primary source: EDTA http://www.electricdrive.org/index.php?ht=d/sp/i/11551/pid/11551

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Announced BEV Introductions*

- 2009 Subaru 4 seat Stella or R1e (2 in New York now)
- 2009 Chrysler EVs (showing concepts)
- 2009 Smart for Two EV
- 2009 ZENN city BEV
- 2009 Chery (China, Berkshire Hathaway) BYD EV in China
- 2009 Tesla / Daimler Smart Car BEV
- 2010 BMW electric Mini (maybe 2009)
- 2010 Chrysler EV
- 2010 Miles EV
- 2010 Mitsubishi \ Peugeot iMiEV BEV
- (* Presenter makes no accuracy claim for the above dates and products. Some info based on media reports)

Primary source: EDTA http://www.electricdrive.org/index.php?ht=d/sp/i/11551/pid/11551

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Announced BEV Introductions* – cont'd

- 2010 Nissan BEV
- 2010 Ford Battery Electric Van
- 2011 Tesla Model S sedan
- 2011 BYD e6 Electric Vehicle
- 2011 Ford Battery Electric Sedan
- 2011 Opel Ampera Extended Range BEV (Europe)
- 2012 Toyota EV sedan
- ? Volkswagen and Toshibia EV develop letter of intent
- (* Presenter makes no accuracy claim for the above dates and products. Some info based on media reports)

Primary source: EDTA http://www.electricdrive.org/index.php?ht=d/sp/i/11551/pid/11551

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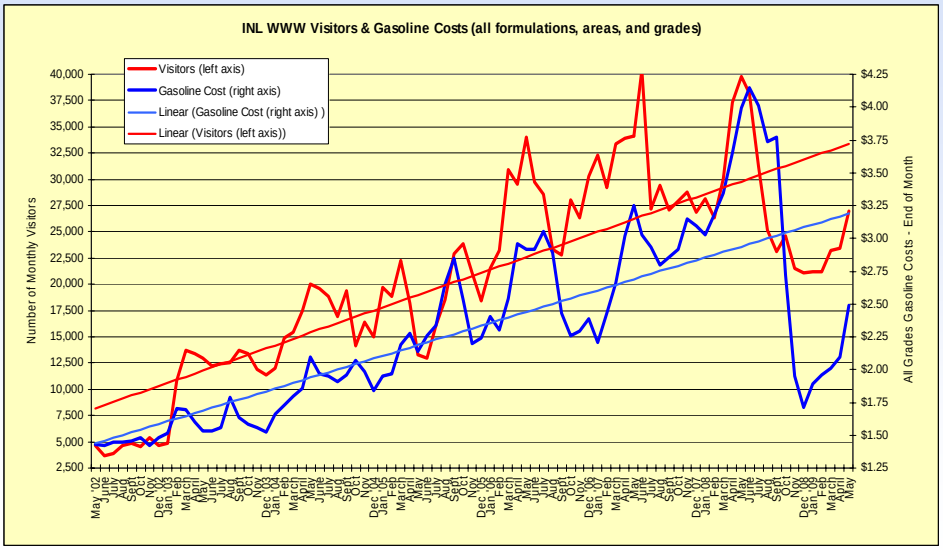
AVTA Webpage Use and Gasoline Costs



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Acknowledgement

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Additional Information

http://avt.inl.gov
or
http://www1.eere.energy.gov/vehiclesandfuels/avta/

INL/CON-09-16262

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