



## Chrysler PHEV Pickup Demonstration in San Francisco



**PHEV Research Symposium  
December 15, 2011**

**Dr. Kevin Nesbitt**



### Budget

- **Total Project Funding**
  - DOE: \$48,000,000 (American Recovery and Reinvestment Act)
  - Chrysler \$49,408,996
- **Timeline**
  - Project Start: September 2009
  - Vehicle Deployment: July 2011 → ?
  - Project End: June 2014

### Chrysler Objectives

- Prove product viability in “real-world” conditions
  - 116 pickup trucks in 13 fleets across U.S. (140 pickups built)
  - Various terrain and climates
  - Diverse drive cycles and usage patterns
- Verify charging performance, AC power generation, and bi-directional charger interface
- Support creation of green technology jobs and advance PHEV technology for future production
- **Develop understanding of customer acceptance and usage patterns**
- **Quantify the benefits to customers and the nation**



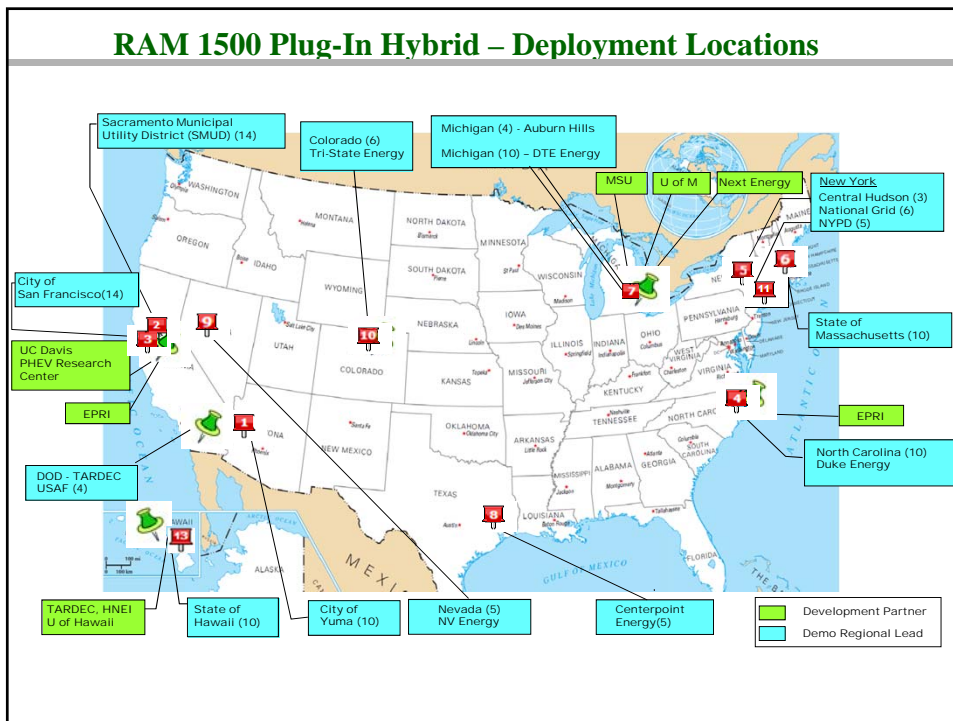
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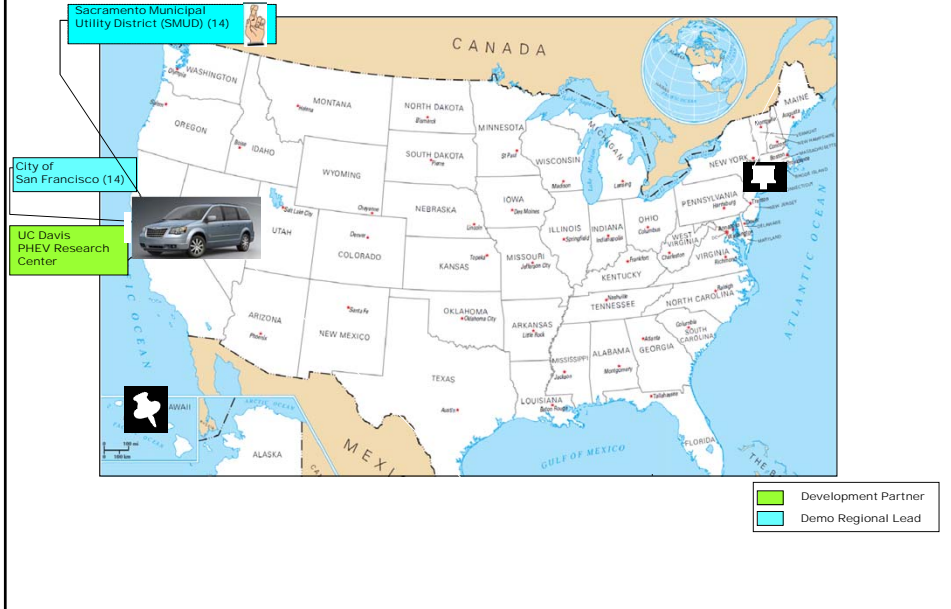
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**RAM 1500 Plug-In Hybrid – Deployment Locations**



## RAM 1500 Plug-In Hybrid – UC Davis Project



## RAM 1500 Plug-in Hybrid – Technical Specifications

RAM CREW 1500



• Available on-board AC power could eliminate need for a generator

### Battery

- 12.9 kWhr, liquid cooled Li ion
- **Charge Times**
- 2-3 hrs at 220V
- 7-8 hrs at 110V
- Functions as hybrid w/o plug-in

### Fuel Economy (City)

- Charge Depleting 32 MPG

### Electric Drive Range (City)

- 20 mile EAER

### E-drive "capable"

### Range

- 655 miles

### Drivetrain

- 2 mode hybrid technology

### Brakes

- Regenerative Brake System

### Auxiliary Power

- 6.6kW Continuous

### Power Panels

- 2 – 120V, 20A duplex

- 1 – 240V, 30A plug

### Cabin

- Center Console

- 1 – 120V, 20A plug

### Silent Mode

- 120V / 240V, 60Hz AC

### Powertrain

- 5.7L Hemi V8

### Maximum Power

- 359 Horsepower

- +40 HP from 2 motors

### Maximum Torque

- 390 ft-lb @ 4300 rpm

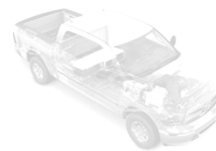
### Transfer Case

- 4x4

- Front axle disengages

### MDS

- Shuts down 4 cylinders



- 6000 pounds towing and 32% grade capability
- ATPZEV - Only full size truck mtg Advanced Technology Partial Zero Emissions std.
- Large side box storage in bed (but locked storage box reduces bed capacity)
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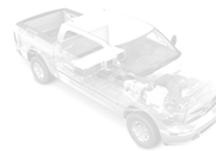
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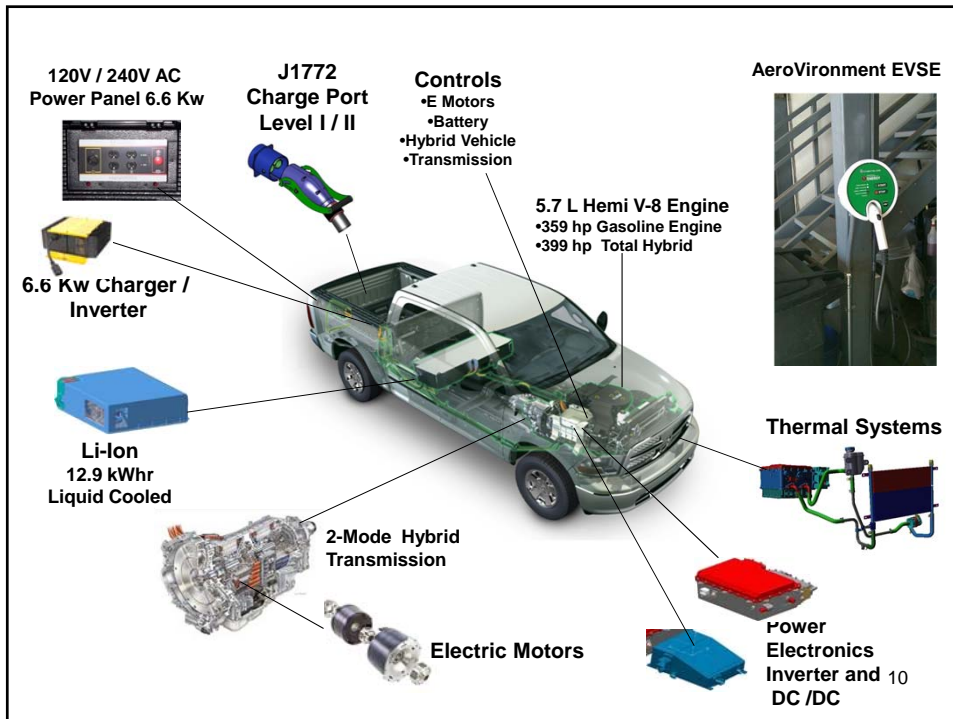
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### **PH&EV Research Center Objectives**

- **Support Chrysler's testing, demonstration and verification objectives**
- **Based on field observations under real-world conditions, the Center will assess PHEV attributes and impacts of:**
  - In-field auxiliary power
  - Human-machine interface (HMI) feedback
  - Life-cycle costs
  - Environmental benefits
  - Charging logistics and charging infrastructure needs
  - Vehicle design optimization
- **Determine factors most likely to affect fleet community acceptance and utilization of PHEV technology**

### Research Questions

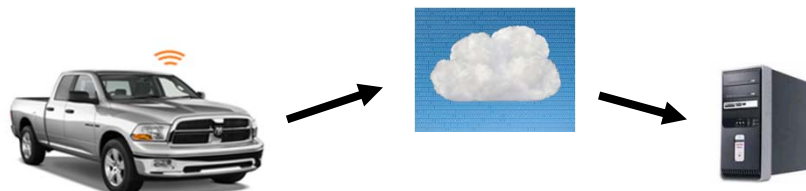
- What fleet practices and usage patterns optimize the use and benefits of PHEVs?
- What factors most influence the wide-scale acceptance of PHEVs in fleet operations?
- How do institutional and cultural perceptions shape fleet PHEV purchase and use decisions?
- How do fleets value and use non-motive energy?
- Where, when and how often will fleets charge a PHEV? Where would they like to see chargers located?
- How and to what extent do fleet vehicle drivers use the human-machine interface (HMI) display? How do they want info conveyed?
- What efficiency and functionality gains can be made through different PHEV battery size configurations and operating architectures?

### Data Collection Methods

- Information and user impressions collected from drivers and fleet managers through **interviews, surveys, and focus groups.**



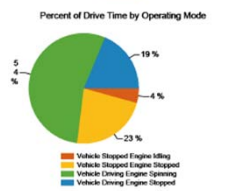
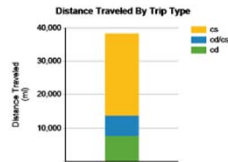
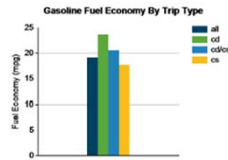
- Instrumentation onboard the vehicles will be used to collect detailed data for analyzing vehicle performance, charging activities and driver behavior **collected through onboard instrumentation.**



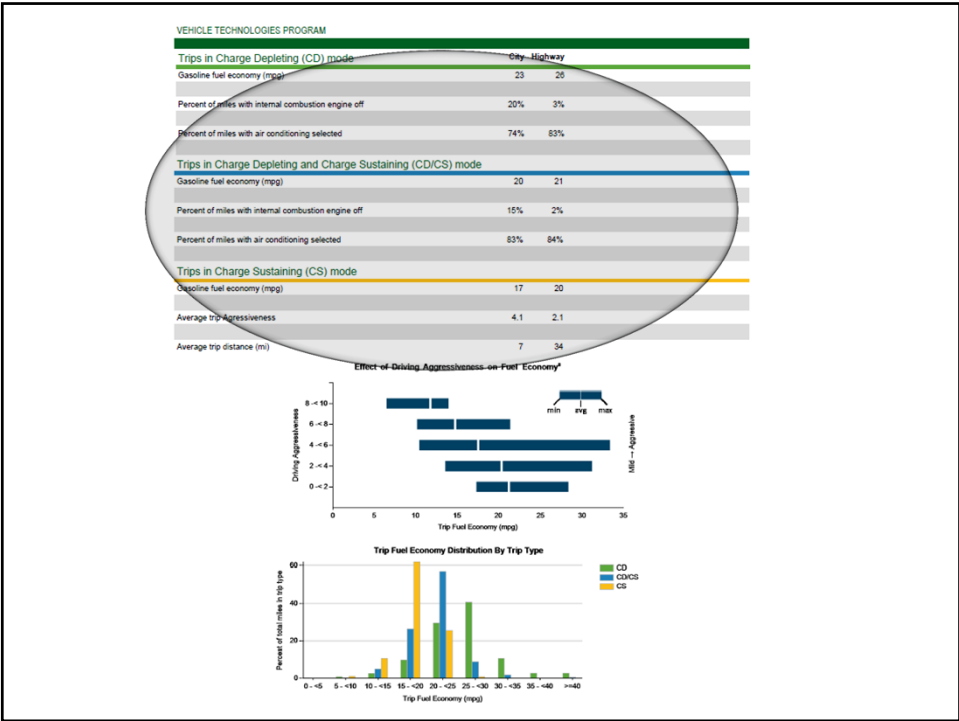
**Chrysler RAM PHEV Fleet**

Number of vehicles: 69 Date range of data received: 10/1/2011 to 10/31/2011  
 Reporting period: October 2011 Number of vehicle days driven: 835

All Trips Combined		
Overall gasoline fuel economy (mpg)		19
Overall AC electrical energy consumption (AC Wh/mi) <sup>1</sup>		85
Overall DC electrical energy consumption (DC Wh/mi) <sup>2</sup>		54
Overall DC electrical energy captured from regenerative braking (DC Wh/mi)		50
Total number of trips		4,546
Total distance traveled (mi)		38,335
Trips in Charge Depleting (CD) mode <sup>3</sup>		
Gasoline fuel economy (mpg)		24
DC electrical energy consumption (DC Wh/mi) <sup>4</sup>		226
Number of trips		1,700
Percent of trips city   highway	96%   4%	
Distance traveled (mi)		7,700
Percent of total distance traveled		20%
Trips in both Charge Depleting & Charge Sustaining (CD/CS) modes <sup>5</sup>		
Gasoline fuel economy (mpg)		21
DC electrical energy consumption (DC Wh/mi) <sup>6</sup>		79
Number of trips		302
Percent of trips city   highway	79%   21%	
Distance traveled CD   CS (mi)	2,327   3,759	
Percent of total distance traveled CD   CS	6%   10%	
Trips in Charge Sustaining (CS) mode <sup>7</sup>		
Gasoline fuel economy (mpg)		18
Number of trips		2,544
Percent of trips city   highway	91%   9%	
Distance traveled (mi)		24,549
Percent of total distance traveled		64%



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**VEHICLE TECHNOLOGIES PROGRAM**

Trips in Charge Depleting (CD) mode		
	City	Highway
Gasoline fuel economy (mpg)	23	26
Percent of miles with internal combustion engine off	20%	3%
Percent of miles with air conditioning selected	74%	83%

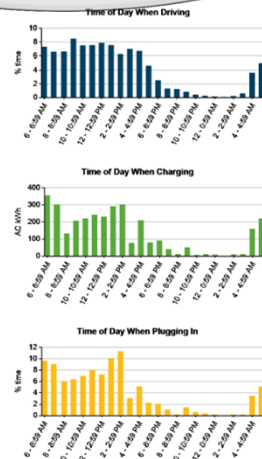
Trips in Charge Depleting and Charge Sustaining (CD/CS) mode		
	City	Highway
Gasoline fuel economy (mpg)	20	21
Percent of miles with internal combustion engine off	15%	2%
Percent of miles with air conditioning selected	83%	84%

Trips in Charge Sustaining (CS) mode		
	City	Highway
Gasoline fuel economy (mpg)	17	20
Average trip Aggressiveness	4.1	2.1
Average trip distance (mi)	7	34

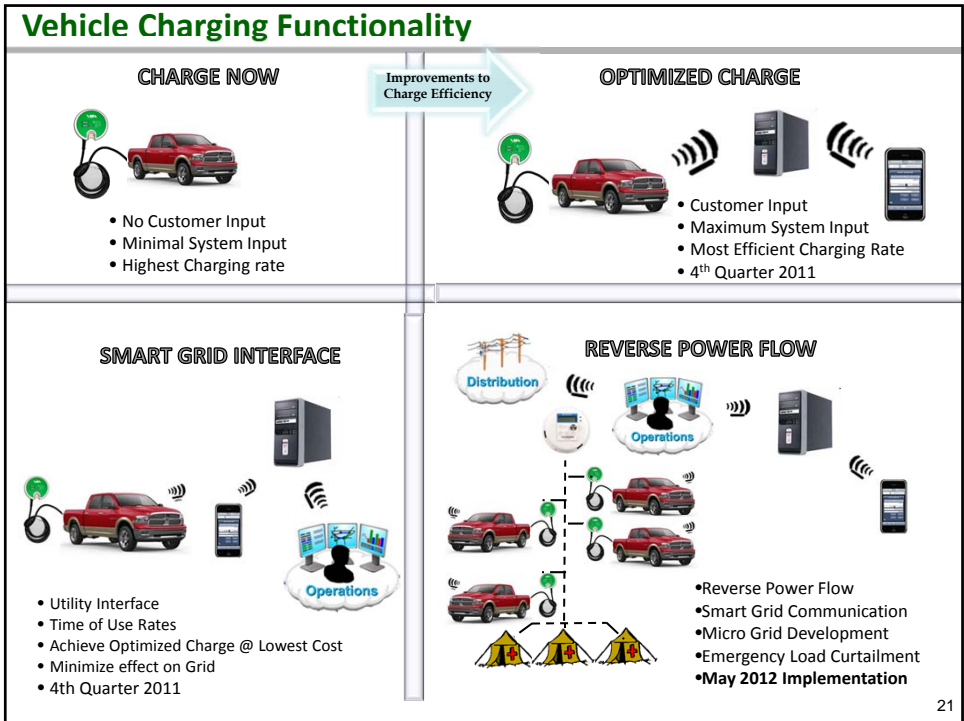
### Plug-in charging

Average number of charging events per vehicle per month when driven	7.06
Average number of charging events per vehicle per day when driven	0.58
Average distance driven between charging events (mi)	78.72
Average number of trips between charging events	9.33
Average time charging per charging event (hr)	2.13
Average energy per charging event (AC kWh)	6.71
Average charging energy per vehicle per month (AC kWh)	47.34
Total number of charging events	487
Number of charging events at Level 1   Level 2	82   399
Total charging energy consumed (AC kWh)	3,266
Charging energy consumed at Level 1   Level 2 (AC kWh)	502   2,764
Percent of total charging energy from Level 1   Level 2	15%   85%
Average time to charge from 20% to 100% SOC (hrs) Level 1   Level 2 <sup>9</sup>	23.65   2.27



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UCDavis University of California



## UC DAVIS

**PLUG-IN HYBRID & ELECTRIC VEHICLE RESEARCH CENTER**





Thank you

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# Data Reporting – Technical Accomplishments

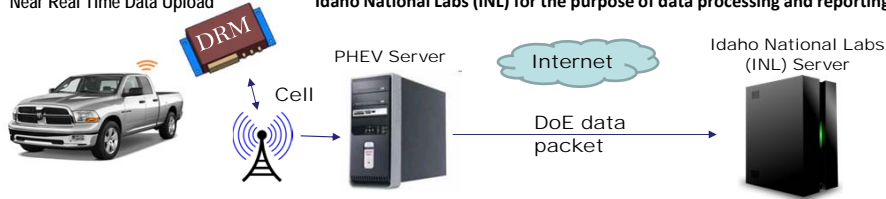


## Initial Fleet Deployment Implementation – May 2011

- Remote Software Flash
- Remote Diagnostics
- Near Real Time Data Upload

### STATUS:

- Chrysler's PHEV server sends the DoE required Unlimited Rights data to Idaho National Labs (INL) for the purpose of data processing and reporting.



## 4<sup>th</sup> Quarter 2011 Implementation



User Interface  
\*Scheduled Charging  
\*Smart Grid Charging

## User Interface

Copy of DoE Data

## 2nd Quarter 2012 Implementation



Demo Partners  
Access only DOE  
Data for their fleet

Engineering  
Full Access to  
Fleet Data

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