



DOD Electric Vehicle Working Group



*Motor Vehicle Roundtable
Fleet Electrification
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Overview



- ▶ Objectives
- ▶ Key Barriers
- ▶ Strategy to Address Key Barriers
- ▶ RDT&E Opportunities
- ▶ Projected Outcomes
- ▶ Action Plan
- ▶ Conclusion & Discussion



Project Objectives...



- ▶ Reduce Petroleum Consumption
 - DOD did not meet 2010 goals.
- ▶ Reduce Greenhouse Gas Emissions
- ▶ Increase Use of Alternative Fuel Vehicles



Project Objectives (continued)



- ▶ Develop an optimal strategy to *maximize use* of Electric Vehicles in DOD's non-tactical ground fleet, while *minimizing lifecycle investment*.
- ▶ Achieve lifecycle cost parity (or better) between EV's and comparable ICE vehicles.
- ▶ Begin large-scale integration of EV's within FY2012 to last over a period of 3-5 years.

Barriers for EV Integration



Assuming Comparable Duty Cycles & Reliability

- ▶ Incremental Vehicle Cost
- ▶ Infrastructure Cost
- ▶ Institutional Challenges
- ▶ Staff Training & Education



Current Fleet Statistics



Total # Non-Tactical Vehicles: ~194,710

Vehicle Type	% of Fleet	Ave. Annual Miles
MD Trucks*	22%	6251
LD 4x2 Trucks	15%	7690
LD Pass. Vans	11%	9043
Compact Sedans	9%	~16325
Midsize Sedans	9%	~16325
HD Trucks	9%	3516

*Largest Fuel Consumer in DOD Non-Tactical Fleet: ~43 M gallons of petroleum/year

EV/PHEV Opportunities



Vehicle Class	Est. # OEM's
MD Truck/Van	10
LD 4x2 Truck	2
LD Pass. Van	4
Compact Sedan	10
Mid-Size Sedan	13
HD Truck	0

- ▶ MD Trucks/Vans present the greatest opportunity for impact in DOD's non-tactical fleet, by volume, petroleum consumption, and variety of manufacturers.
- ▶ MD Trucks/Vans typically have well-defined duty cycles, which makes it easier to "right-size" batteries.

Establishing Cost Parity



- ▶ High Volume Acquisition
 - Early estimates of ~20%–25% reduction in base price.
- ▶ “Right-Sizing” Batteries
 - Can cut battery size (and cost) in half for average duty cycles.
- ▶ Ancillary Services
 - Immediate cost savings can be realized by enabling vehicle batteries to communicate w/ grid.
- ▶ Alternate Financing Models
 - Can significantly reduce/eliminate capital investment.



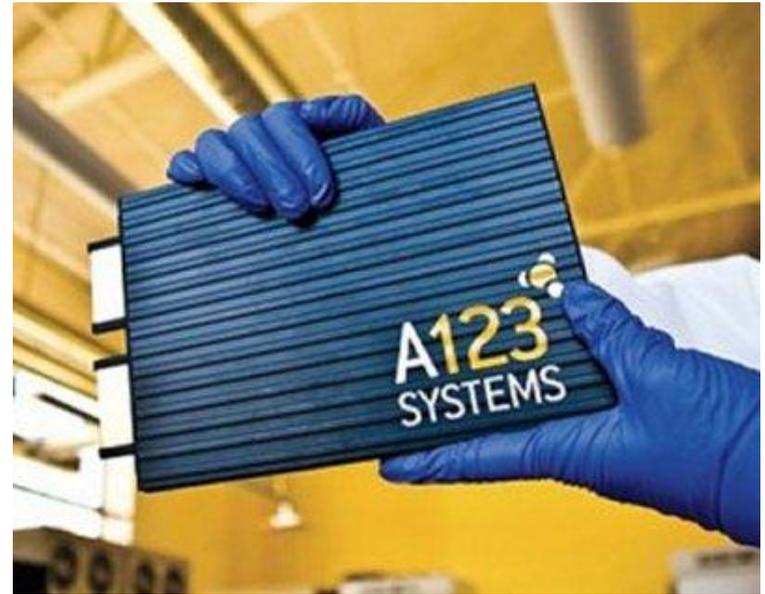
“High Volume”

- ▶ For our purposes, “high volume” means in the low thousands (~3,000–5,000 over a 3–5 year period).
- ▶ Why do these volumes help so much?
 - Most EV OEM’s are manufacturing in the single– and (occasionally) double–digits. Their supply chain costs scale significantly with volume.
 - Most EV OEM’s are currently operating below capacity.
- ▶ Some battery manufacturers will also respond favorably to these volumes.



Battery Size

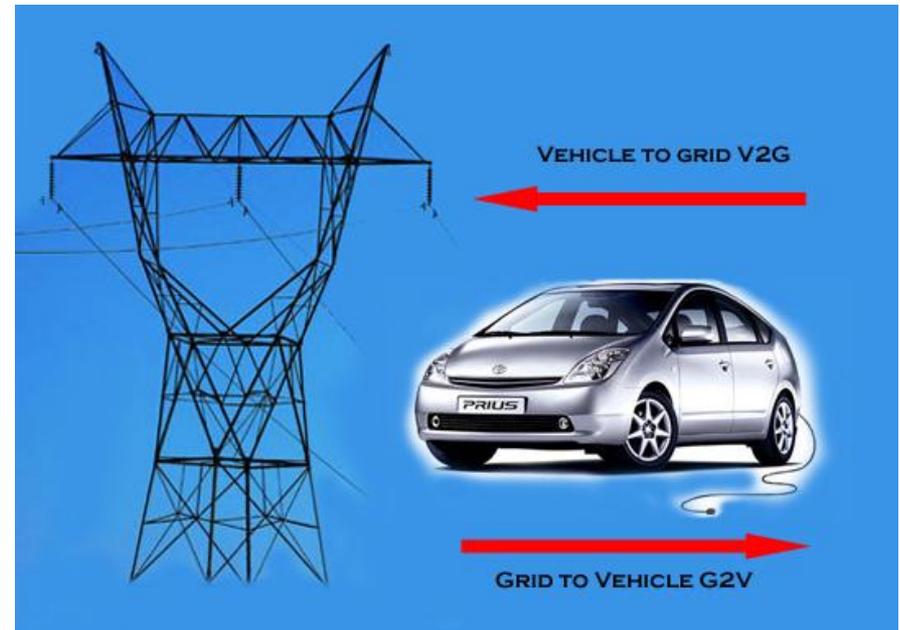
- ▶ DOD's MD Truck fleet drives an average of ~20 miles per day.
- ▶ Current vehicles are typically afforded ~100 miles of range per charge.
- ▶ Cutting the battery size in half (or more) will still provide ample daily range and significantly reduce the overall costs.





Ancillary Services

- ▶ There are technologies currently available that, with modest investment, could provide a significant cost savings and/or revenues.
 - “Peak Shaving”
 - Load Balancing
 - Frequency Regulation
 - Second Life Battery Use
- ▶ Second life battery use represents a substantial financial/operational opportunity.



Alternate Financing Models



- ▶ Conventional leasing options will likely exist but may not be optimal.
- ▶ Consideration of relative useful life of electric vehicles (relative to ICE's) may enable lower price points on leasing.
- ▶ Separate financing of the battery allows it to be replaced at minimal additional expense.
- ▶ There are leasing constructs that could allow negotiation of price relative to projected value.
- ▶ Potentially enables use of Energy Savings Performance Contracts and Utility Energy Savings Contracts, in concert with ancillary services.

Charging Infrastructure



- ▶ Level 2 commercial charging station costs are minimal: ~ \$2,000–\$5,000 for single unit.
 - Many allow real-time, remote monitoring of electrical loads, station use, and other key metrics.
 - Grid-integrated charging stations may cost more.
- ▶ Major costs may/may not occur related to installation of charging stations. This requires site-by-site analysis.
- ▶ In general, I have not heard significant concerns from the civil engineering community regarding impacts on the grid.
 - Low charging rates during off-peak hours helps.
 - More significant concerns seem related to base-level energy use metrics.

Staff Training & Education



- ▶ Typical for any new fleet technology to include training on usage.
 - Training will likely include maintenance, repair, and fleet oversight.
- ▶ Maintenance and service agreements will likely include training and education requirements for DOD staff, service members, and contractors.
 - Multiple training programs already exist.
- ▶ Trainees will gain a highly marketable skill.

RDT&E



- ▶ Hundreds of vehicles in controlled environment creates significant RDT&E opportunity.
- ▶ Most opportunities revolve around technology development and demonstrations, as well as generating economic data.
- ▶ Depending on acquisition model, there may be significant opportunity for testing of second life batteries for grid applications.
 - Substantial financial opportunity.

Projected Outcomes



- ▶ Assuming an Acquisition of 5,000 MD Trucks
 - ~5.1 Million gallon reduction in petroleum consumption
 - ~ 6% of total consumption in 2005
 - ~ 6% increase in alternative fuel vehicles
 - Includes thousands of E85 vehicles that don't have access to E85
 - ~ 113 Million lbs of CO2 saved
 - Net effect depends on regional power generation.
- ▶ Substantial ripple effect through EV market.

Action Plan...



Strategy: Operate on a timeframe that matches industry's ability to respond to DOD's financial and operational needs.

- ▶ Continue gathering internal & external data to finalize recommendations for business model(s).
- ▶ Broaden internal communications with key stakeholders and identify solutions for key policy barriers.
- ▶ Determine RDT&E needs and opportunities.



Action Plan (continued)

- ▶ Host Industry Day for OEM's, battery manufacturers, financial capital firms, and academia.
- ▶ Identify many other issues that are likely to arise.

Target: Begin large-scale integration of EV's into non-tactical fleet within FY2012.

Conclusion



- ▶ A strong “market demand signal” from DOD would likely have a profound impact on the EV industry.
- ▶ While there are significant financial barriers, a path is emerging to overcome most (if not all) of these challenges.
- ▶ Institutional barriers are likely much more significant to the overall success of this initiative.
- ▶ Proactive communication and collaboration are essential to bring this project to fruition.

Questions?

