A DOD Perspective on EV Ancillary Services

NIST Workshop:
Power Conditioning System Architectures for Plug-In Electric Vehicle Fleets as Grid Storage

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Overview

- EV Project Objectives
- DOD Fleet Overview
- Strategies to Improve EV Financial Picture
- EV Ancillary Services
  - Rationale for Exploration
  - Considerations & Opportunities
- Current/Upcoming Activities
- Conclusion & Discussion

EV Project Objectives…

- Reduce Petroleum Consumption
- Reduce Greenhouse Gas Emissions
- Increase Use of Alternative Fuel Vehicles

EV 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.

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.

Strategies for Improving EV Financial Outlook

Volume Pricing

- DOD's non-tactical ground fleet consists of ~200,000 vehicles.
- Annual volumes in the 10,000's can significantly reduce price of EV sedans.
    - Passenger sedans compose ~20% of fleet.
- Annual volumes of ~1,000 can significantly reduce the price of EV trucks.
    - LD/MD/HD trucks compose ~52% of fleet.

Battery Right-Sizing

- DOD MD/HD trucks average ~6,000/3,000 miles per year, respectively.
- A significantly downsized battery can provide the same functionality as ICE trucks for the vast majority of DOD applications.
- Goal for battery right-sizing is to match the battery size to the average daily range, as close as possible.

Ancillary Services

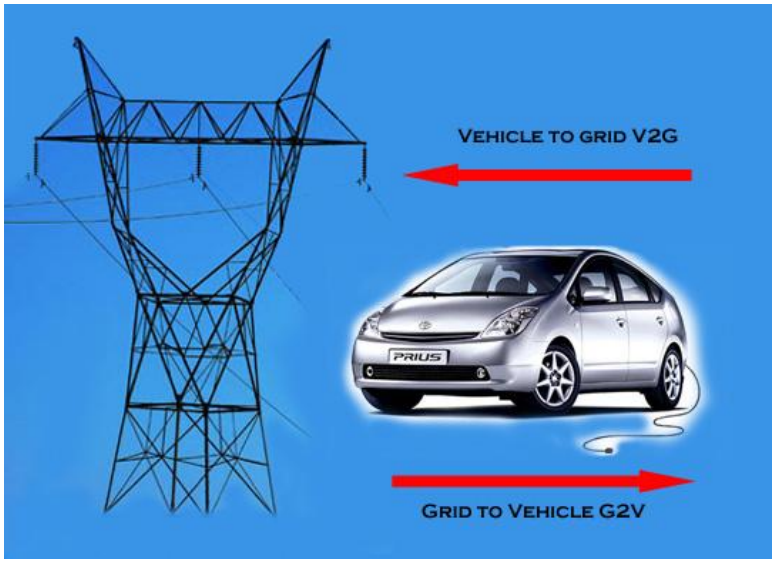
- Hardware and software exist to integrate EV's with micro- and macro-grids.
    - OEM support necessary for implementation.
- Revenue estimates range from ~$2,000-$6,000/vehicle, depending on vehicle type.
- Cost savings estimates from peak shaving are ~$1,200-$1,800/vehicle.
- Dependent on regional/local conditions.
- Supports base-level energy management.

Infrastructure Planning

- Cost of EV charging hardware is minimal, particularly with volume.
- Infrastructure improvements may be significant but vary by location.
- Co-locating multiple EV chargers may significantly reduce installation costs.
- Baseline analyses underway.
- Studying costs associated with various bi-directional charging architectures.

Why EV Ancillary Services?

- Financial Benefits
- Micro-Grids and Grid Security
- Potential GHG Emission Reductions
- Asset Management
- Impact on Broader EV & Utility Industries



Considerations & Opportunities

- Large, under-utilized fleet is ideal for EV ancillary services
- Financial propositions remain unclear.
  - Revenues/Cost-Savings must be more clearly defined.
  - Bi-directional charging infrastructure costs unclear.
- Operational requirements for DOD fleet must be met.
- Controlled environment on DOD bases enables relatively low-risk technology deployment.

Current/Upcoming Activities

- **Objective**: Establish detailed understanding of the costs, benefits, and operational considerations for using EV's as grid energy storage devices.
- Planning base-level analyses for EV ancillary services and corresponding infrastructure.
- Hosting DOD working session on June 17.
- Continuing industry market research.
- Investigating opportunities to conduct relevant technology demonstrations.

Conclusion

- The DOD EV project is expanding rapidly, and we are engaging industry, academia, and government on multiple fronts.
- EV ancillary services may play a critical role in maximizing the scope and scale of DOD's overall EV effort.
- Analyses and activities currently underway to help generate cost/benefit analyses.
- This workshop is an excellent opportunity for DOD to gather ideas toward an actionable short-term plan.

Questions?