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PHEVs Component Requirements

DOE Merit Review
28 February, 2008

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Sponsored by Lee Slezak



U.S. Department of Energy

Energy Efficiency and Renewable Energy

Bringing you a prosperous future where energy is clean, abundant, reliable, and affordable

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Define PHEVs Component Requirements

Component Data
from R&D Teams

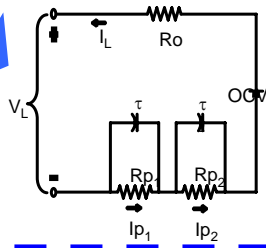
Battery



Testing



Model



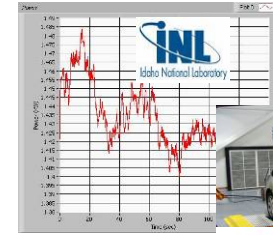
Electric Machine

2004 Prius



Accessories

Camry A/C Power



Prius A/C Power

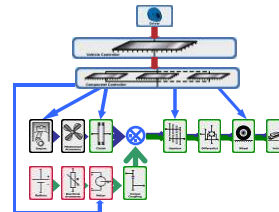


PSAT
Simulations

Vehicle Classes

Sizing & Simulation

Vehicle Requirements



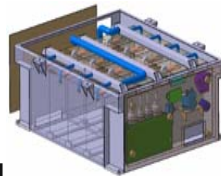
Results Shared with R&D Teams

Validation

Battery RCP



JCS VL41M

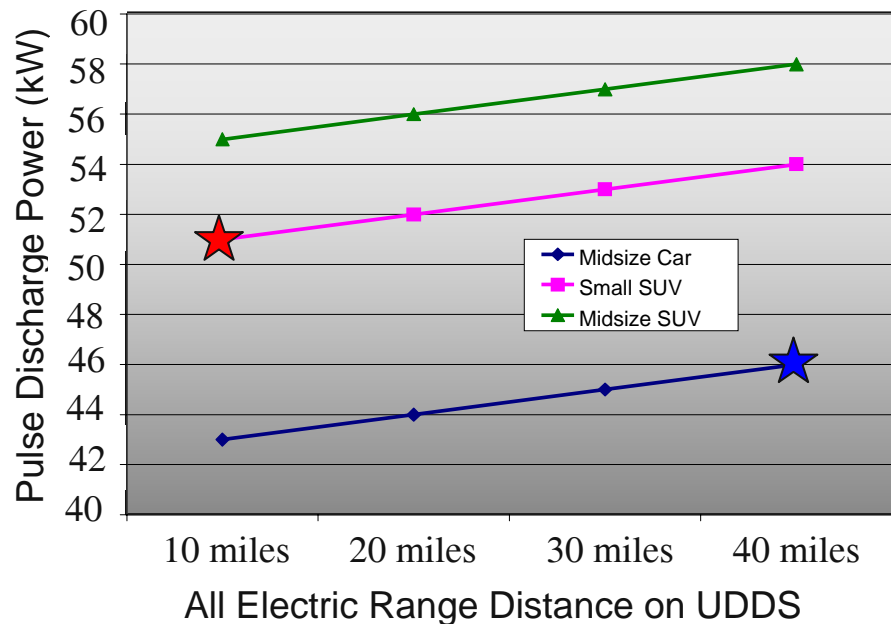


Vehicle Testing

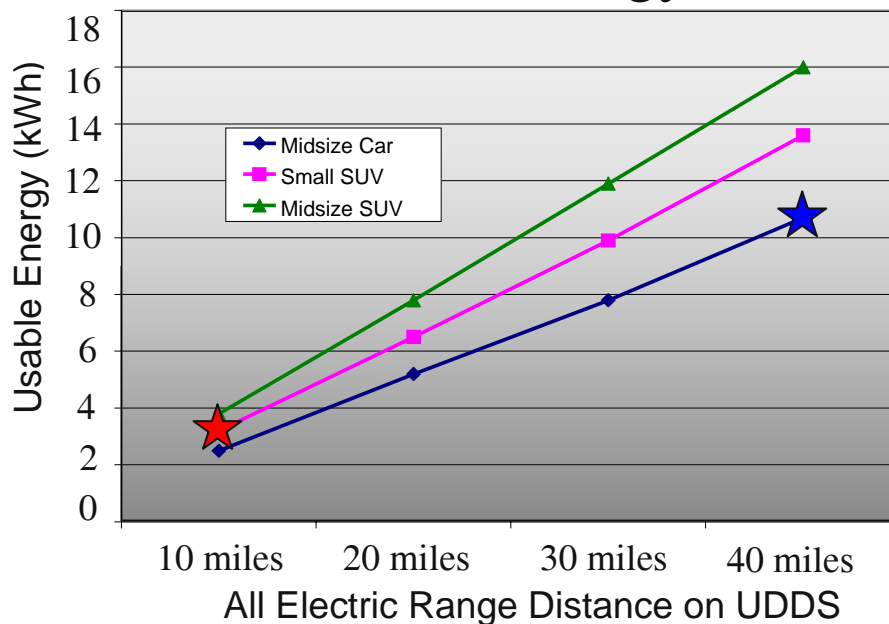


Optimum Battery Power and Energy Defined for Several Vehicle Platforms and AER

Power



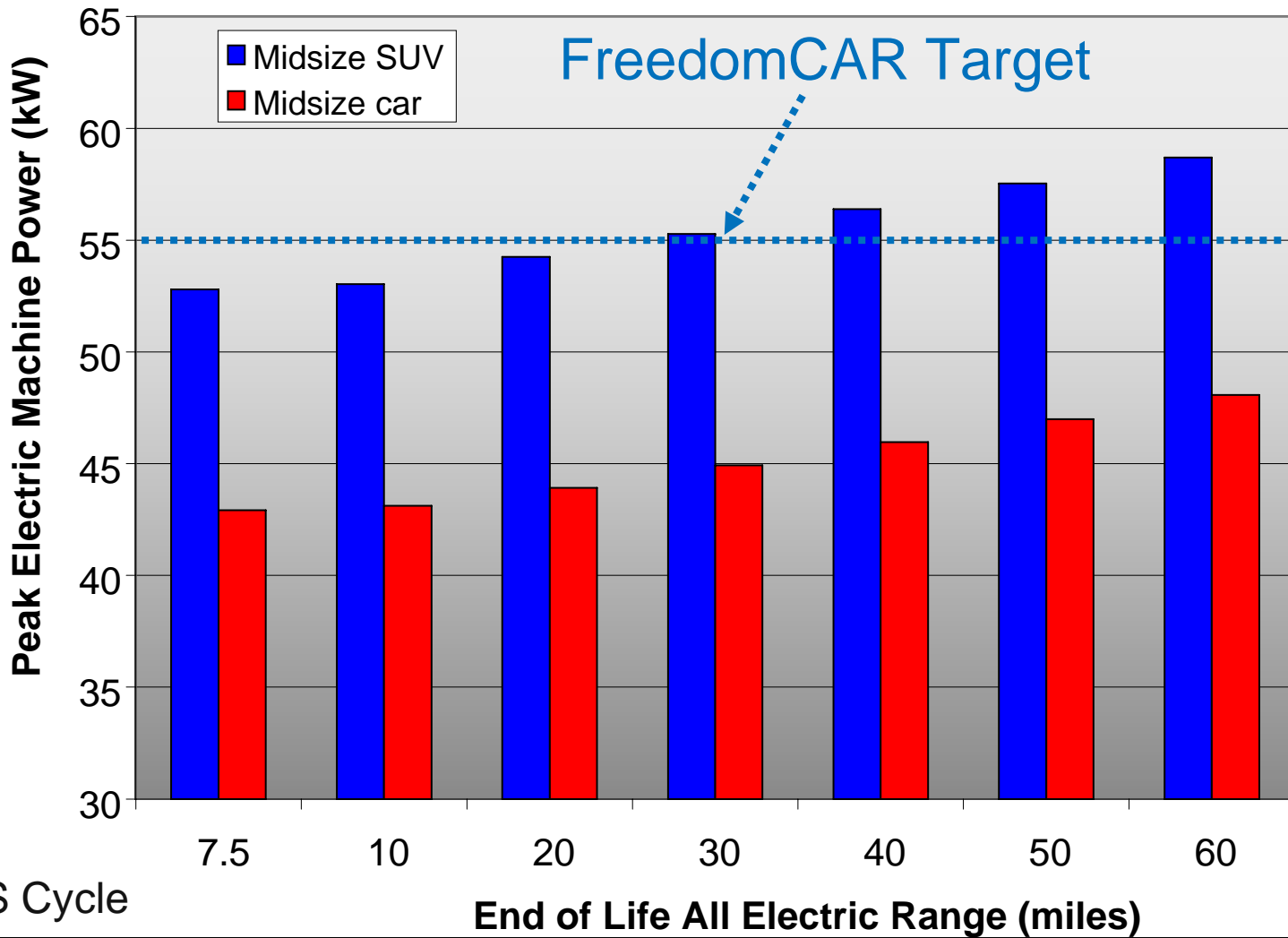
Usable Energy



Final values selected by the ESS Tech Team

- Short term 10 miles AER (3.4 kWh, 50 kW) ★
- Long term 40 miles AER (11.6 kWh, 46 kW) ★

Electric Machine Power Required within FreedomCAR Target



UDDS Cycle

Evaluate PHEV Component Requirements Uncertainties

■ **Objective:**

- How does each assumption influence the requirements?
- Can we lower a requirement without significant fuel economy loss?

■ **Current Status:**

- Gathered additional information on current vehicle characteristics
- Review and updated sizing algorithm logic

Main Assumption Uncertainties Considered in Future Studies

Performance

Acceleration



Gradeability



Towing



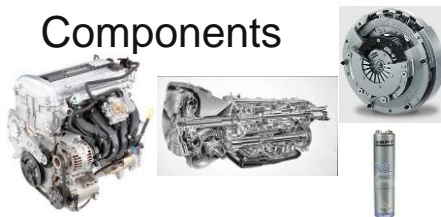
Vehicle Technologies

Glider
Mass

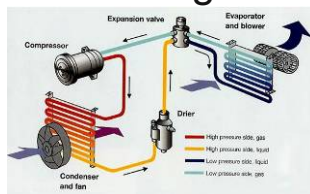


Drag
Coefficient

Components



Air Conditioning

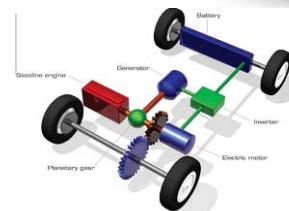


Powertrain Configurations



2Mode

Series



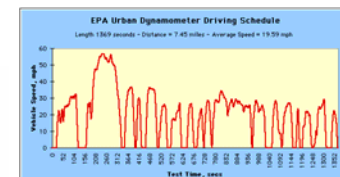
THS II

Parallel

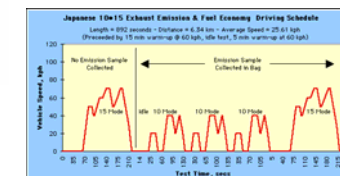


Drive Cycles

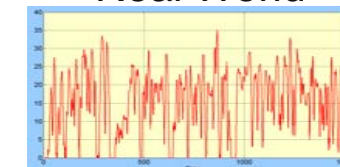
US Standards



Other Standards

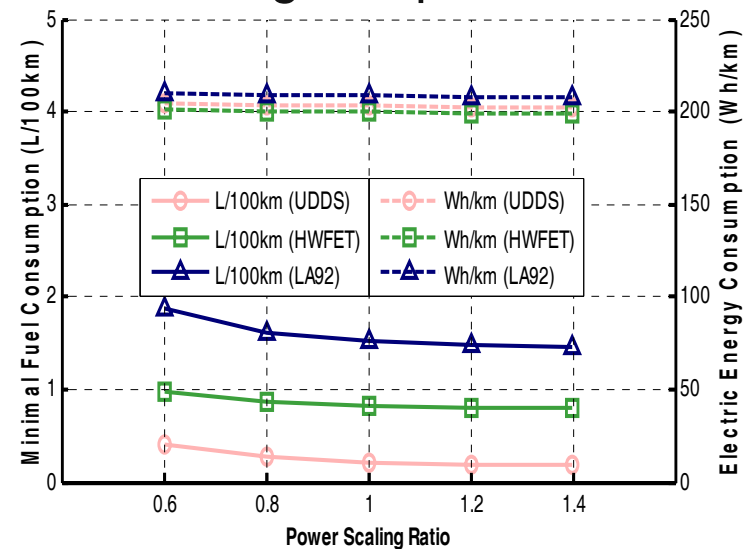


Real World



PSAT Simulation Results Provide Guidance for DOE R&D Component Development

- Collaboration with the different R&D Teams led to
 - Preliminary component requirements
 - Request For Proposals (RFP) for advanced high-performance battery development issued by USABC
- Current and future research focuses on assessing component requirement uncertainties
 - Performance requirements
 - Component technology
 - Powertrain configuration
 - Drive cycles...
- Define trade-offs between cost and performance



Influence of Battery Power Using Global Optimization

References

USABC RFP - http://www.uscar.org/guest/article_view.php?articles_id=97

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■ ***Research on PHEV Battery Requirements and Evaluation of Early Prototypes***

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