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ENERGY

EV Everywhere Challenge Kick-Off

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Hyatt Regency, Dearborn, Michigan



EV Everywhere Workshops

- Recruit the best and brightest American scientists, engineers, and businesses to tackle this electric vehicle challenge
- Re-evaluate and refine the existing technical goals for increasing performance and cutting costs

Topic	Date	Location
Electric Drive Components	July 24-25	Chicago, IL
Advanced Batteries	July 26	Chicago, IL
Consumer Behavior and Charging Infrastructure	July 31 – Aug 1	Los Angeles, CA
Lightweight Vehicles and Structures	TBD	TBD



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The EV Everywhere Challenge Involves All of DOE



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The EV Everywhere Challenge

Key Parameters

- 5-passenger vehicle suitable for an average American family
- Majority of vehicle-miles-traveled powered by electricity under standard drivecycles
- 5-year simple payback vs. equivalent gasoline powered vehicle
- Any “vehicle range-charging infrastructure” scenario to be considered must credibly allow for the majority of American consumers to be willing to purchase the PEV as a primary vehicle
- No reduction in grid reliability



Three Primary Analysis Scenarios

1. **PHEV40** – minimizes battery cost and public infrastructure requirements, removes range issues
2. **AEV100** – minimizes battery for an AEV, introduces range/vehicle use/infrastructure tradeoffs
3. **AEV300** – helps to address range issues, but at high cost

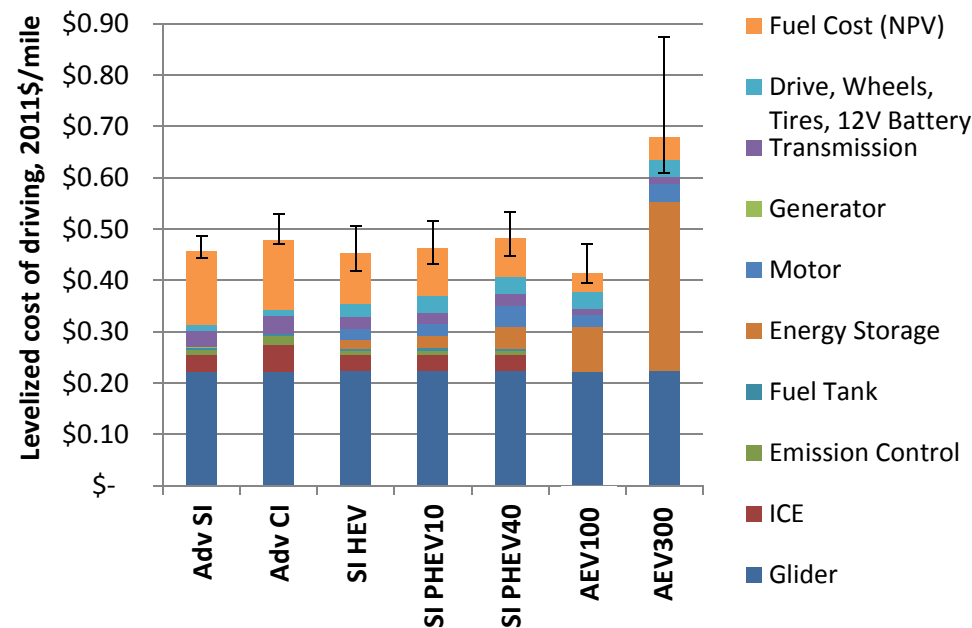
Vehicle-level analysis provides a starting point for setting EV Everywhere technical targets for these vehicles.



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Levelized Cost of Driving (LCD)

vehicle purchase price + fuel expenditure over 5 years, expressed per mile traveled



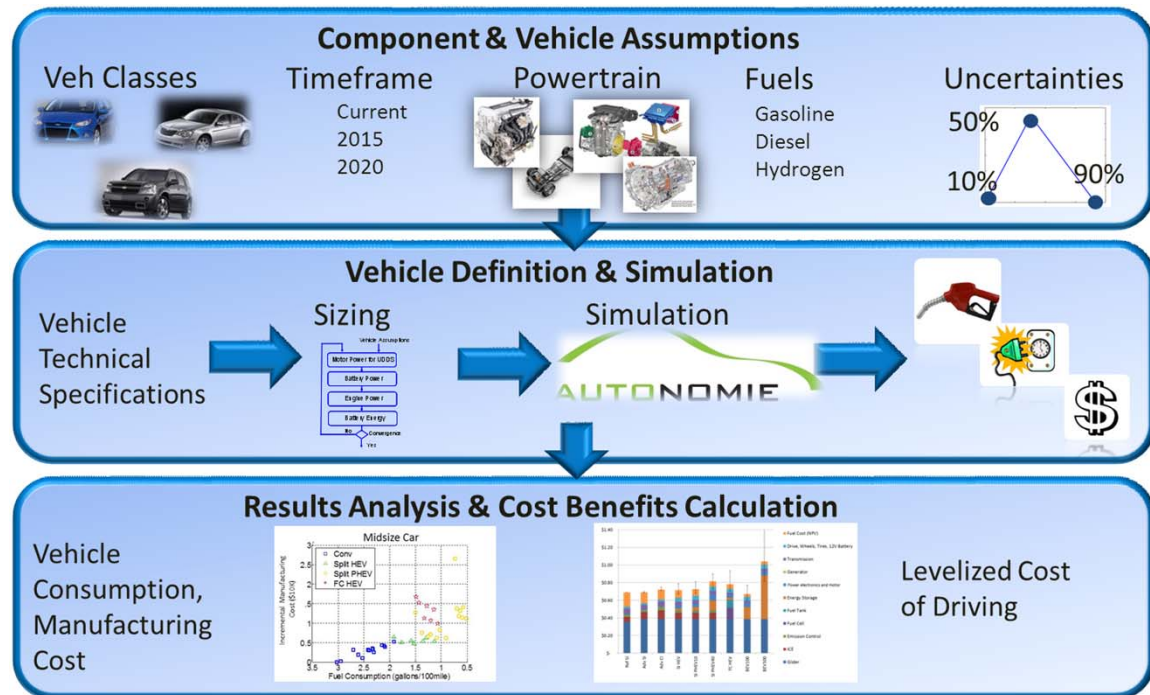
Analysis Assumptions: 2022 midsize vehicle, mid-case technology projection (with high and low technology sensitivities), EIA's AEO11 "High Oil" fuel prices projections for 2022 = {Gasoline \$5.12/gal, diesel \$4.76/gal, Electricity \$4.12/gge), 14.5k miles/year, 5-year analysis period, no discounting, retail markup over manufactured cost = +50%



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EV Everywhere Analysis Process Flow, *in three steps...*

1. DOE experts **define the bounds of technical possibility** for technology key metrics
 - 90% “low progress” scenario
 - 50% “mid case” scenario
 - 10% “high progress” scenario
2. **Define virtual vehicles** in Argonne National Lab’s *Autonomie* modeling and simulation software
3. **Compare vehicles in a 5-year simple payback framework** within bounds defined by experts

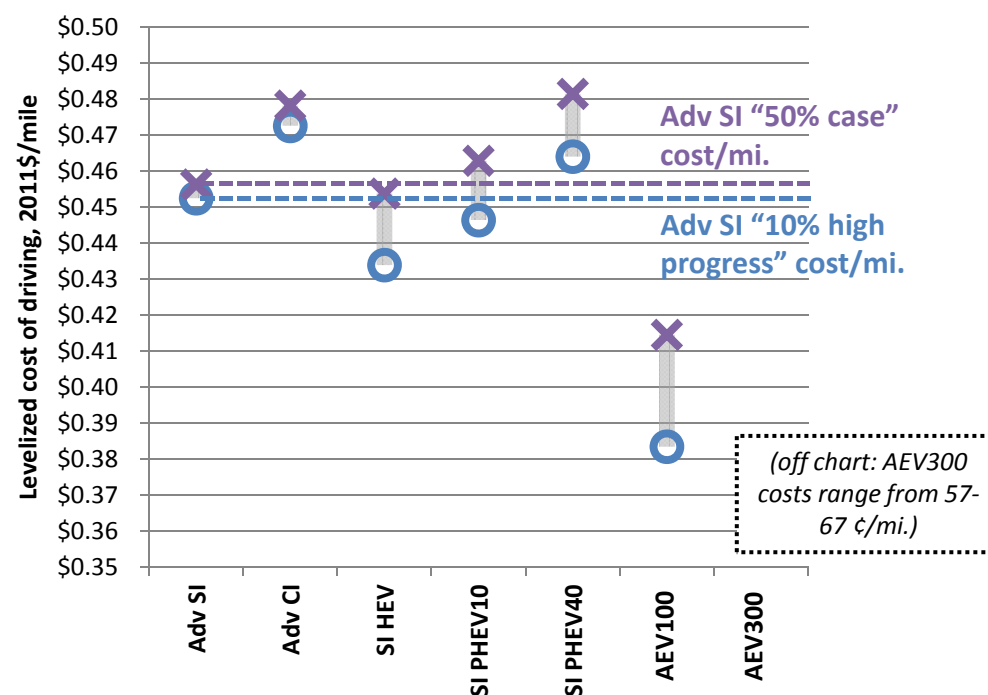




Comparing LCDs

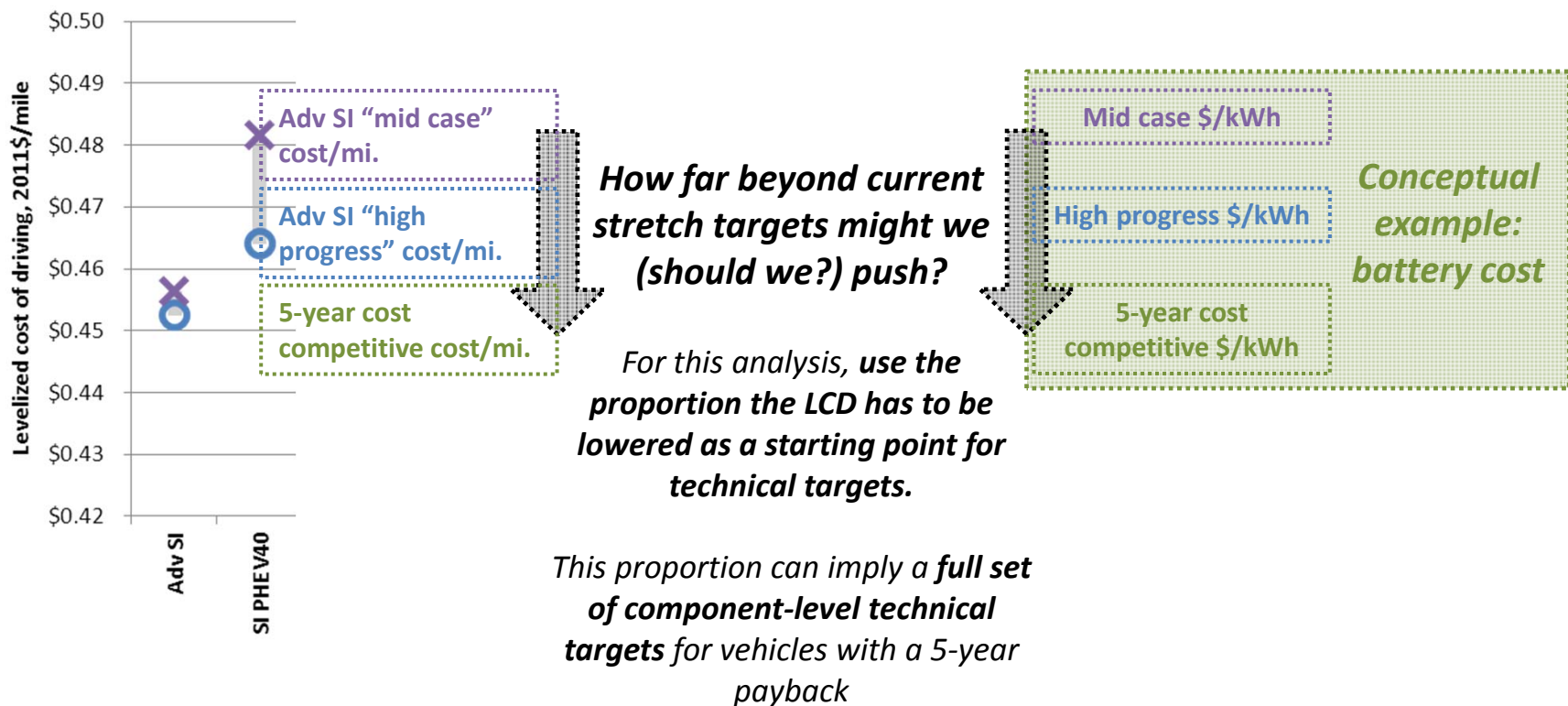
Implications for 5-year payback—

Vehicle	Payback (?)
SI HEV	Yes, at mid technology case
SI PHEV10	Yes, between mid and high technology case
SI PHEV40	No, requires push just beyond high technology case
AEV100*	Yes, even at “low” technology case
AEV300	No, requires aggressive push beyond high technology case





Estimating 5-year LCD equivalents



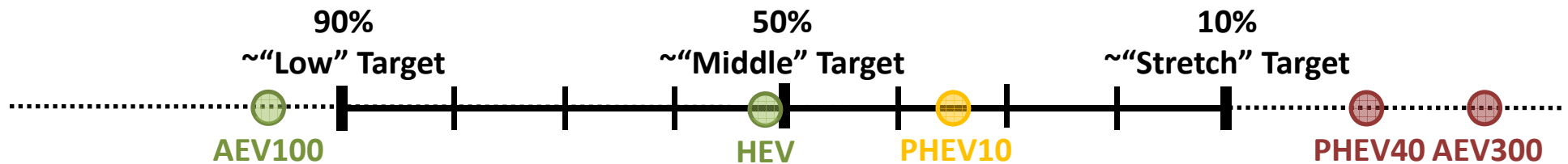


Setting Targets – how aggressive?

Vehicle architectures that are already LCD-competitive in the analysis framework at current targets (**green dots**) can still be cost competitive with a less aggressive push to the target:



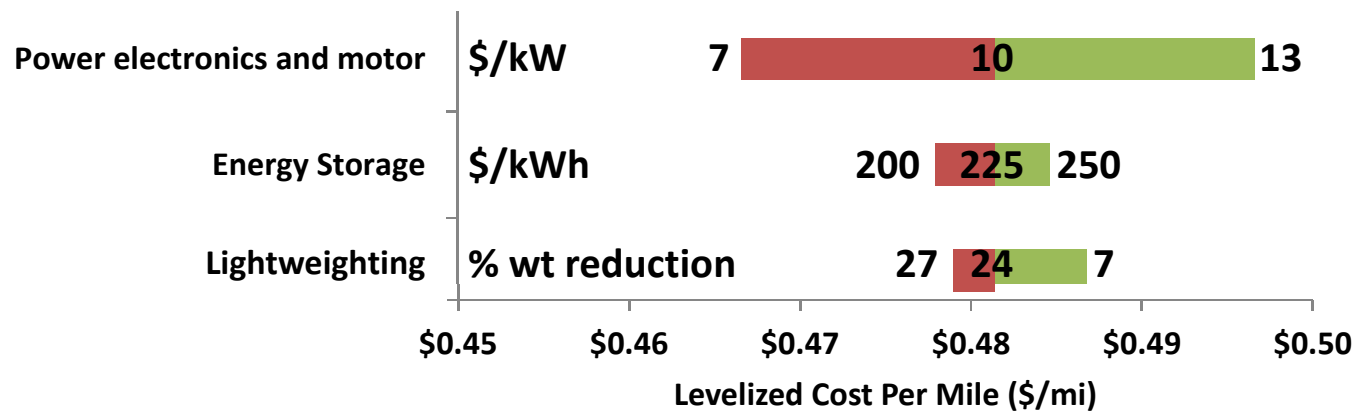
Vehicle architectures that are not LCD-competitive in the analysis framework at current targets (**yellow dots**) can still be cost competitive with more aggressive push to the target:



Vehicle architectures that are not LCD-competitive even at the stretch target level (**red dots**) require an even more aggressive push beyond stretch targets:



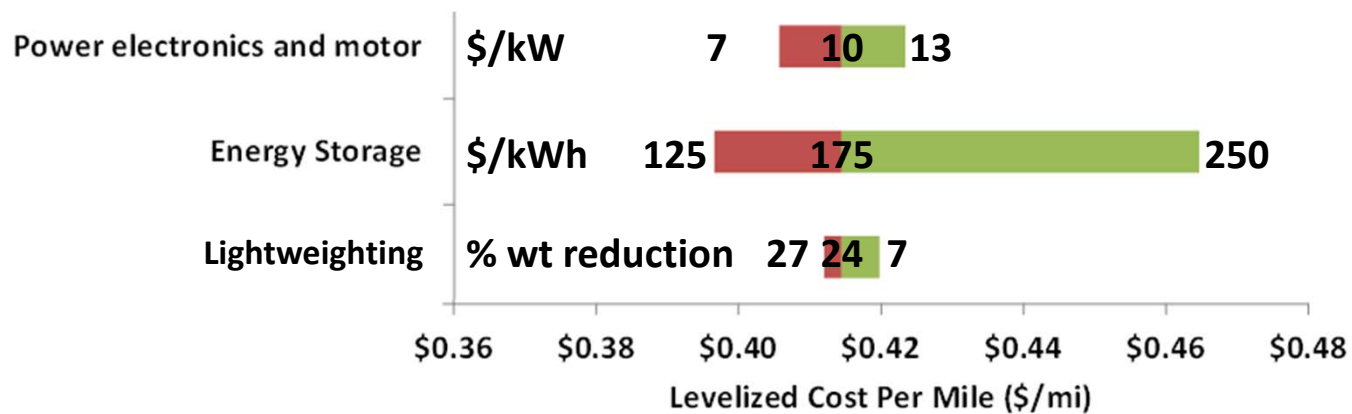
Analysis: 2022 Midsize SI PHEV40



\$/kW	5
\$/kWh	190
% wt	29
LCD-implied targets	



Analysis: 2022 Midsize AEV100

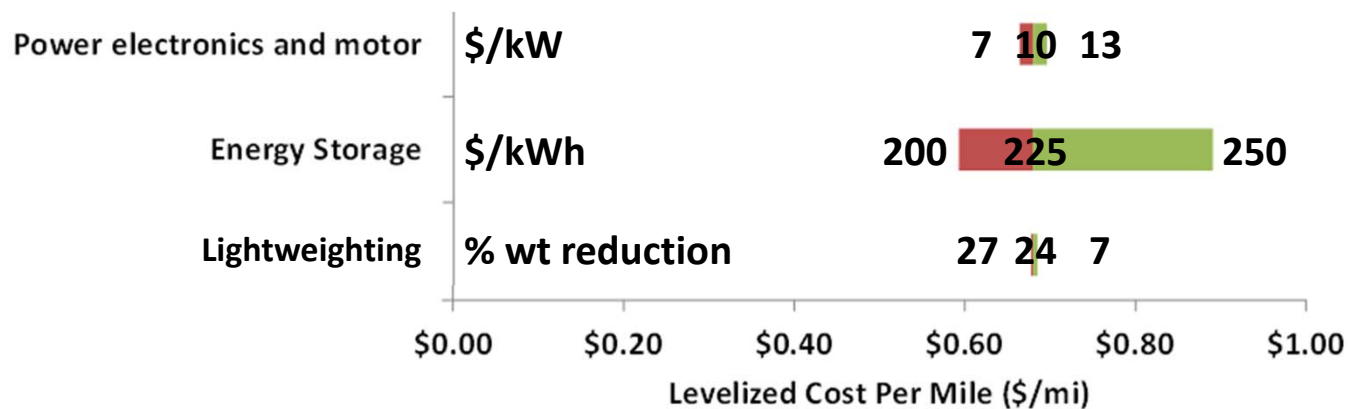


\$/kW 14
\$/kWh 300
% wt 3

*LCD-implied
targets*



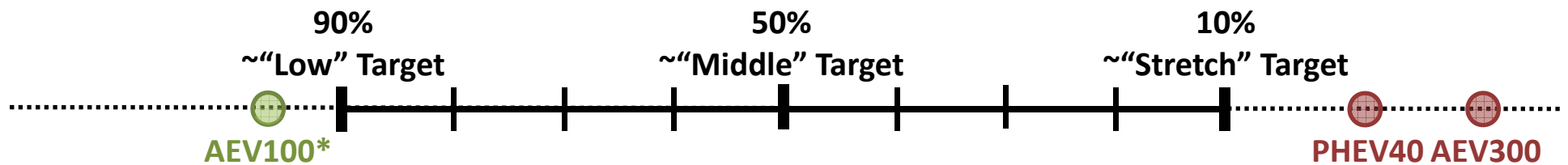
Analysis: 2022 Midsize AEV300



\$/kW 4
\$/kWh 110
% wt 30
LCD-implied targets



Target Implications Summary –



		Current Status	PHEV40	AEV100*	AEV300
Battery Cost	\$/kWh	650	190	300	110
System Cost	\$/kW	20	5	14	4
% Weight Removed	%	n/a	29	3	30
Charger Cost	\$	150	35	140	25