U.S. DEPARTMENT OF ENERGY

EV Everywhere Battery Workshop:
Preliminary Target-Setting Framework

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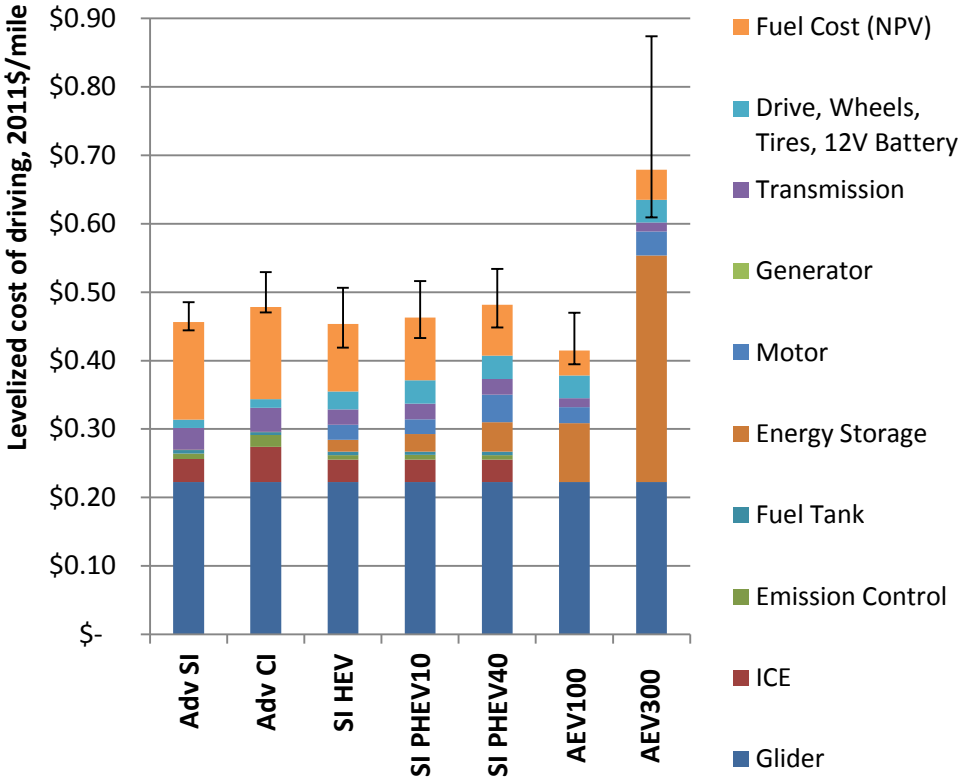
For this Analysis, Three "EV " Scenarios

1. **PHEV40** – reduces battery size while removing range issues, but involves the higher cost of two powertrains
2. **AEV100** – minimizes vehicle purchase cost, but introduces range/vehicle use/infrastructure tradeoffs
3. **AEV300** – helps to address range issues, but large battery leads to high vehicle cost

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

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%*

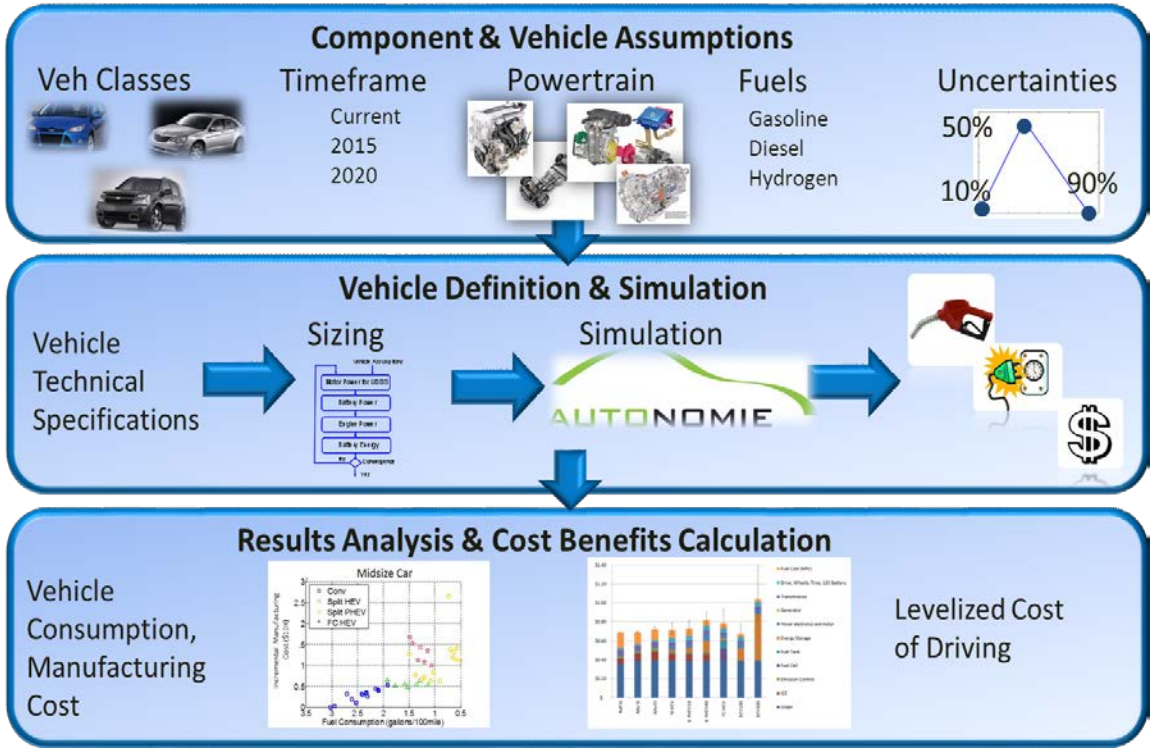
EV Everywhere Analysis Process Flow

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

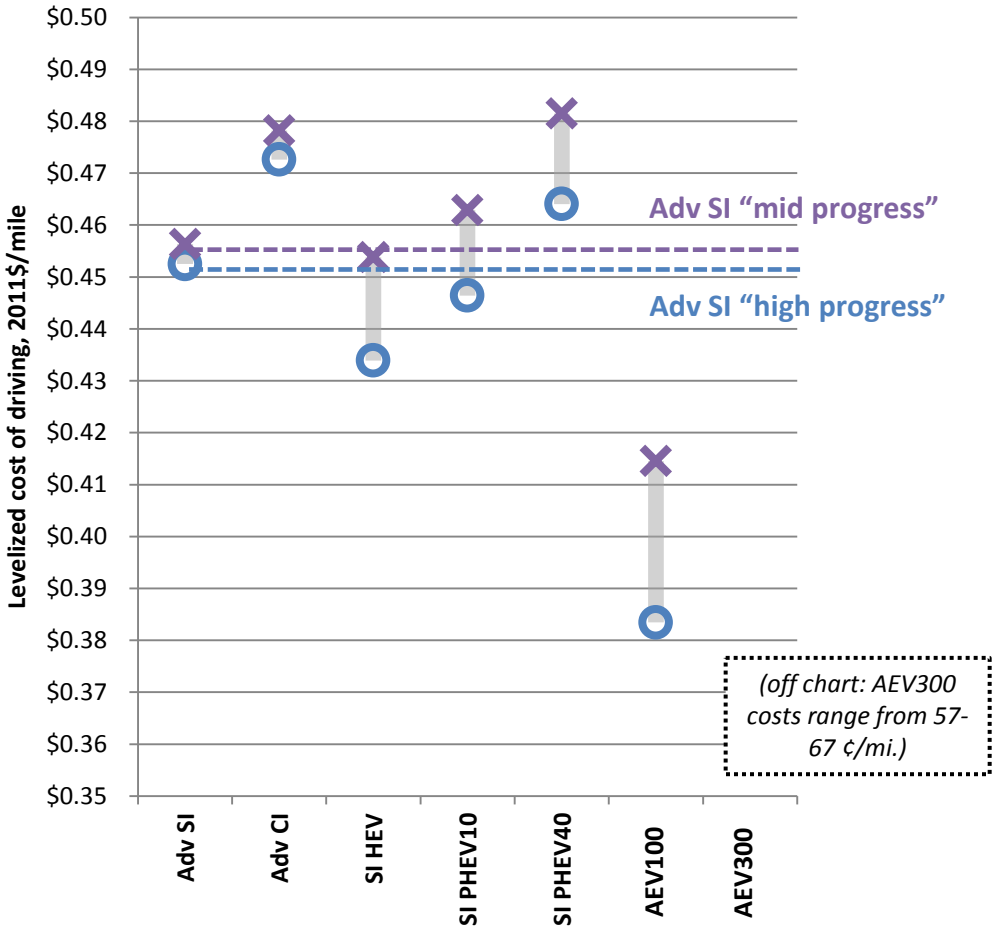
3. **Compare vehicles in a 5-year simple payback framework** within bounds defined by experts



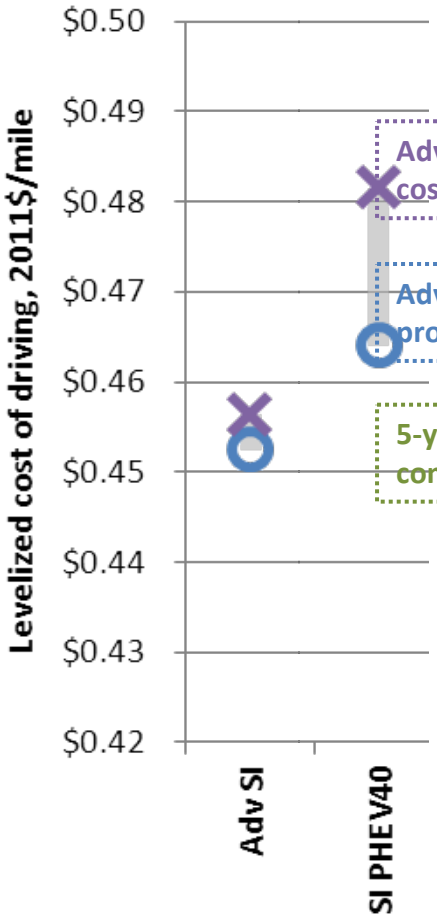
Comparing LCDs

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



Adv SI "mid case" cost/mi.

Adv SI "high progress" cost/mi.

5-year cost competitive cost/mi.

How far beyond current stretch targets might we (should we?) push?

For this analysis, ***use the proportion the LCD has to be lowered as a starting point for technical targets.***

This proportion can imply a ***full set of component-level technical targets*** *for vehicles with a 5-year payback*

Mid case $/kWh

High progress $/kWh

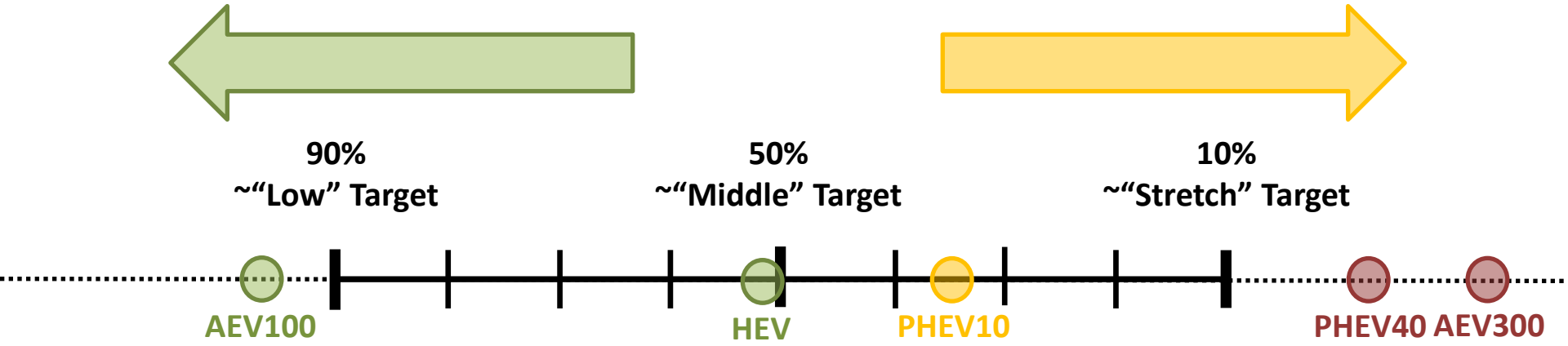
5-year cost competitive $/kWh

Conceptual example: battery cost

Setting Targets – how aggressive?

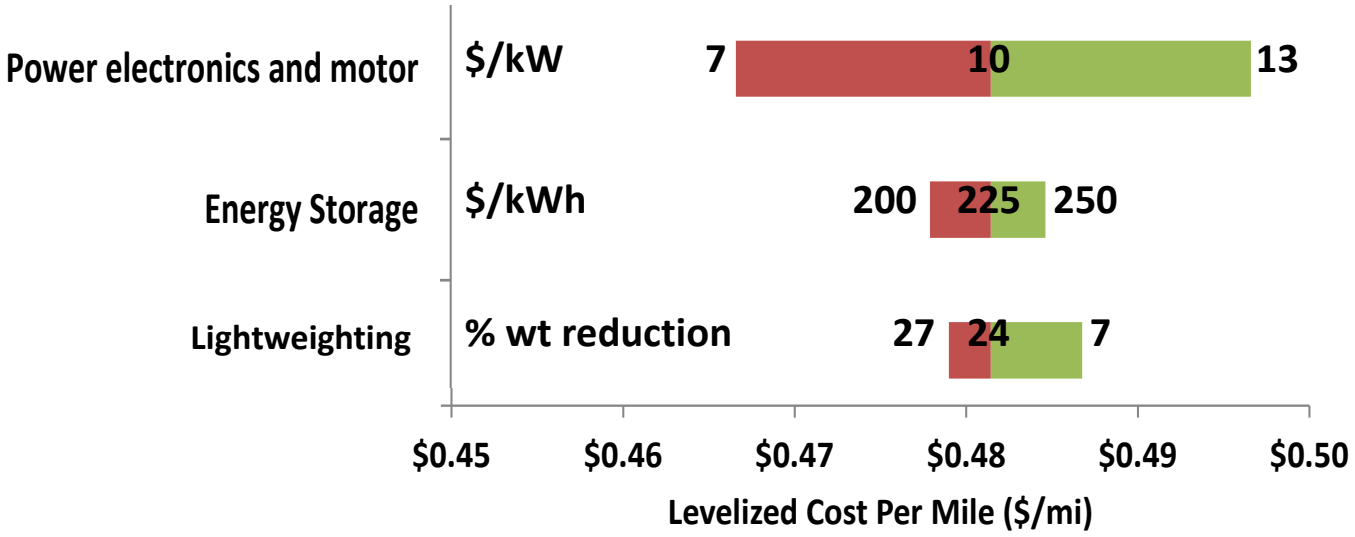
*Vehicle architectures that are already LCD-competitive in the analysis framework at current targets **(green dots)** can still be cost competitive with a less aggressive push to the target:*

*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:

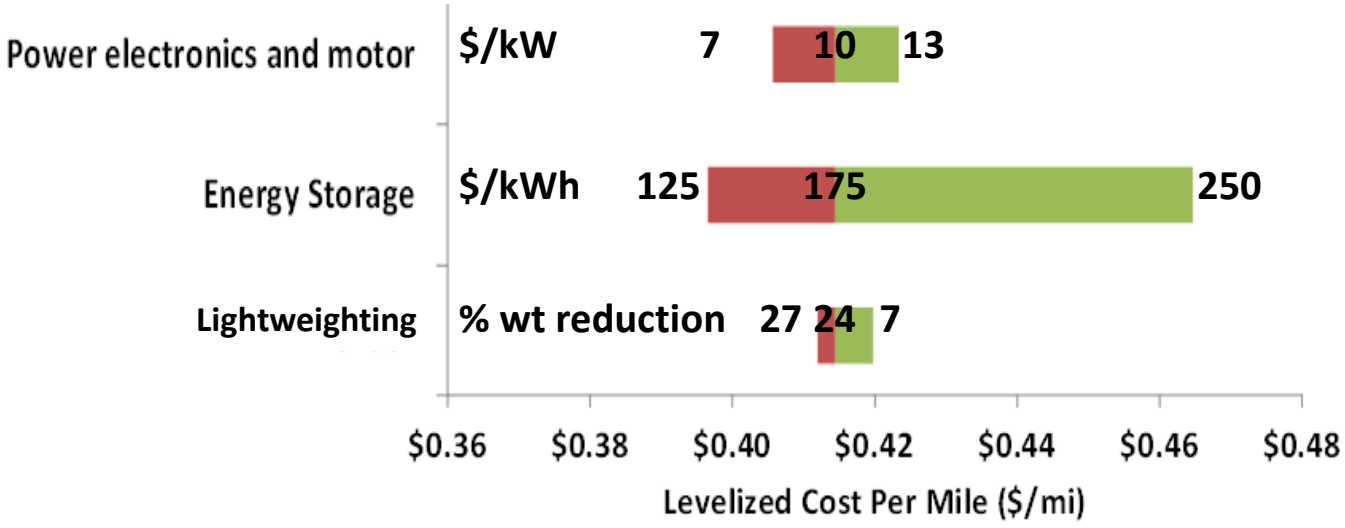
Analysis: 2022 Midsize SI PHEV40



$/kW	5
$/kWh	190
% wt	29

LCD-implied targets

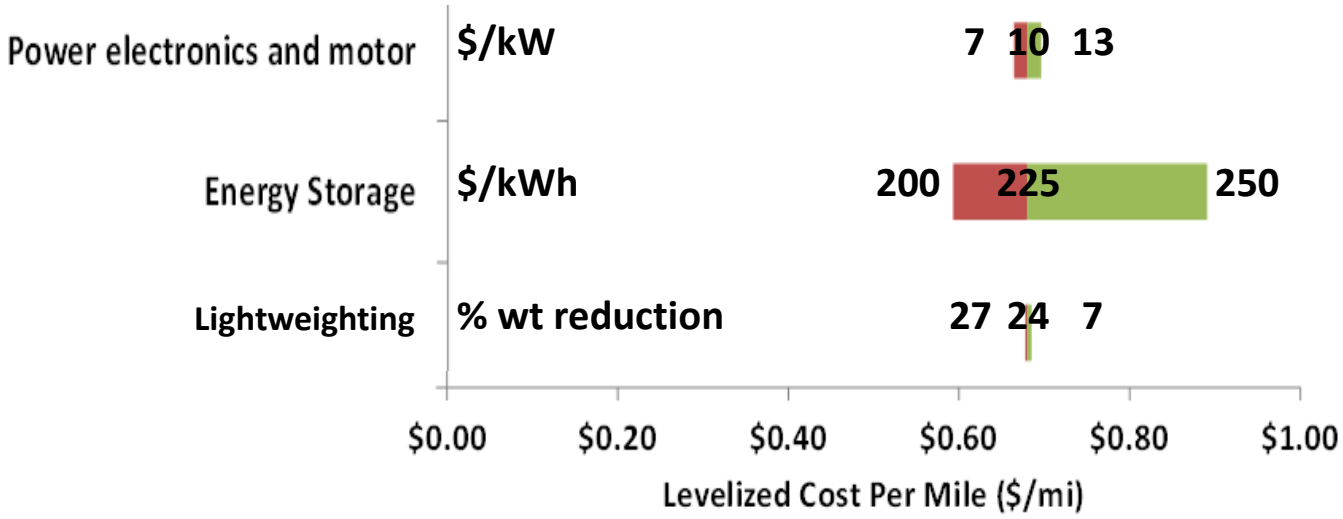
Analysis: 2022 Midsize AEV100



$/kW	14
$/kWh	300
% wt	3

LCD-implied targets

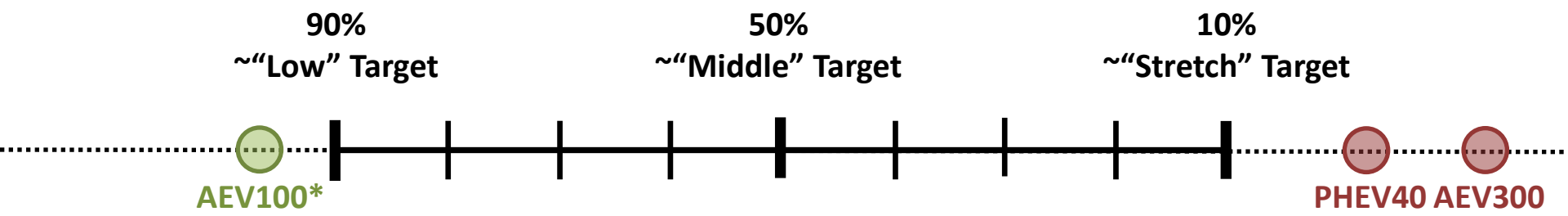
Analysis: 2022 Midsize AEV300



$/kW	4
$/kWh	110
% wt	30

LCD-implied targets

Target Implications Summary –



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