primer on PEVs for practitioners:

taxonomy, potential benefits, metrics of interest, challenges of electrification

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presented to trb workshop 137: transitioning to plug-in electric vehicles

12 jan 2013

topics

taxonomy

benefits

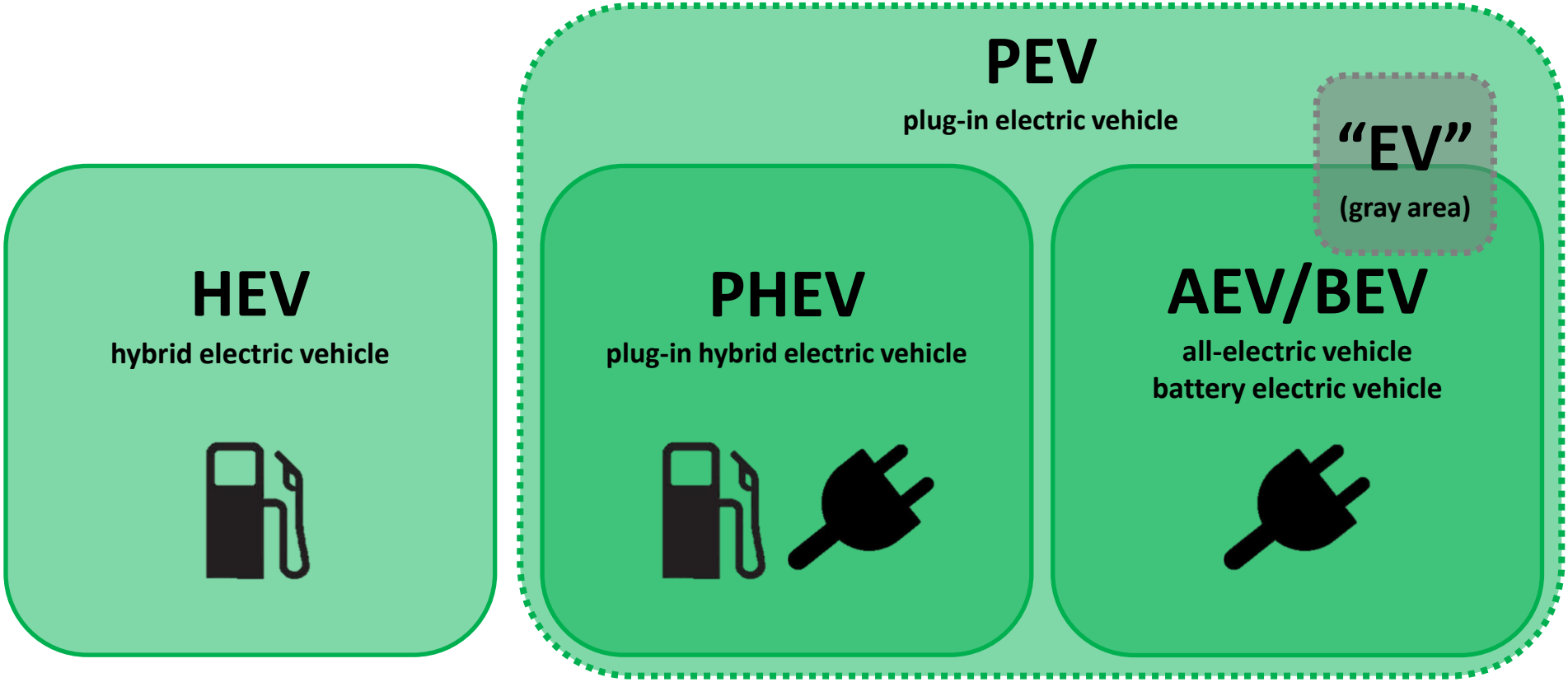
metrics

challenges

outline

pev primer

taxonomy


PEV
plug-in electric vehicle
"EV"
(gray area)
HEV
hybrid electric vehicle
PHEV
plug-in hybrid electric vehicle
AEV/BEV
all-electric vehicle
battery electric vehicle

taxonomy

What's in a name? DOE's official* nomenclature:

PEV/EV
plug-in electric vehicle

HEV
hybrid electric vehicle

PHEV
plug-in hybrid electric vehicle

AEV
all-electric vehicle

*per *EV Everywhere* Grand Challenge literature, effective July, 2012

taxonomy

Numerical suffixes (in miles) denote electric range

PEV/EV
plug-in electric vehicle

PHEV
plug-in hybrid electric vehicle

PHEV10
10-mile range
~1/4 electric

PHEV40
40-mile range
~2/3 electric

AEV
all-electric vehicle

AEV100
100-mile range

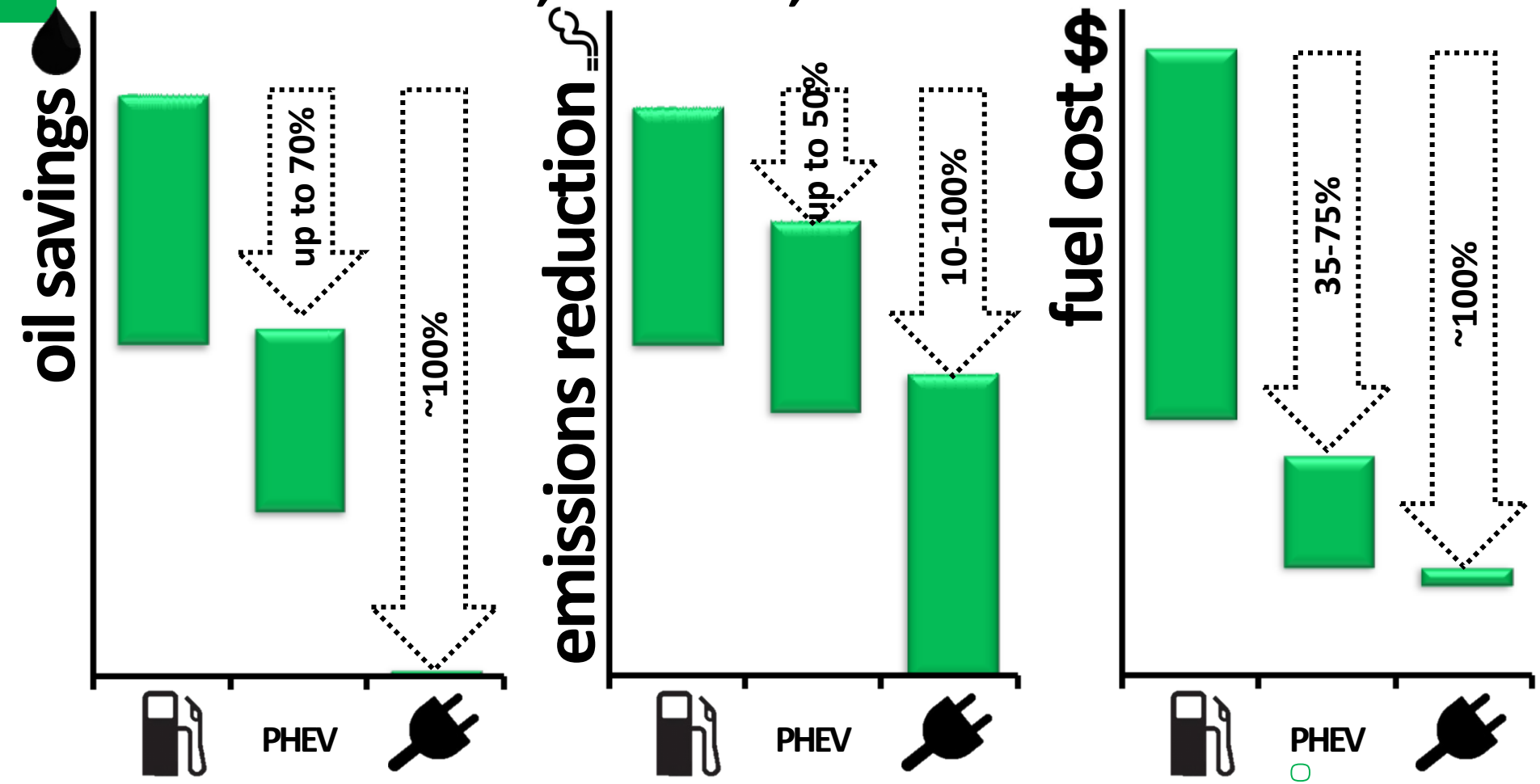
AEV300
300-mile range

benefits

- oil savings
- emissions reduction
- $ economic security

benefits

Future potential (lifecycle basis): per-mile traveled, PEVs use less oil, emit less, and cost less.



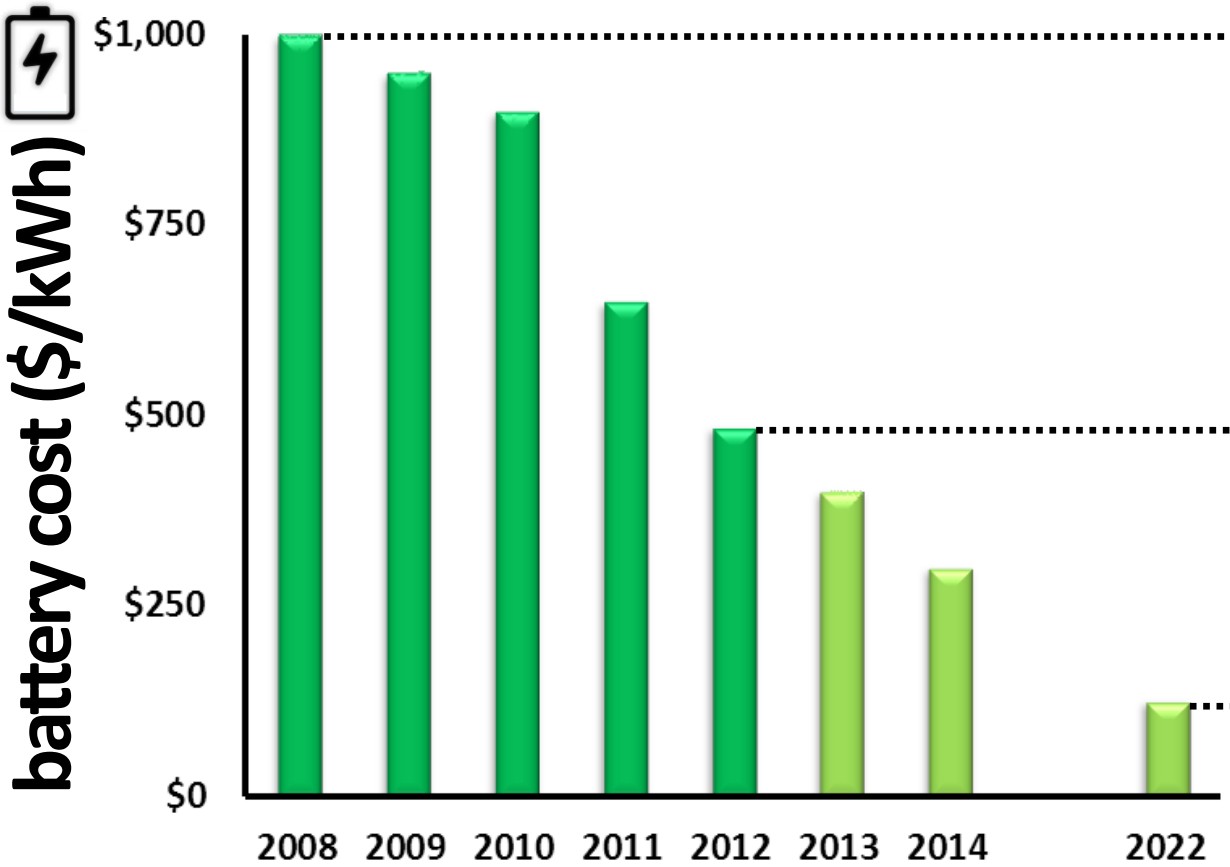
Source(s): U.S. DOE Program Records ("Well-to-Wheels GHGs and Oil", "LDV Lifecycle Costs"

metrics&challenges

- technical
- economical
- environmental
- human

metrics&challenges

technical: batteries are EXPENSIVE. R&D can bring costs down, but very low costs require a breakthrough.



At 1,000 $/kWh a PHEV40 costs <$50,000

progress to-date

At 500 $/kWh a PHEV40 costs <$40,000

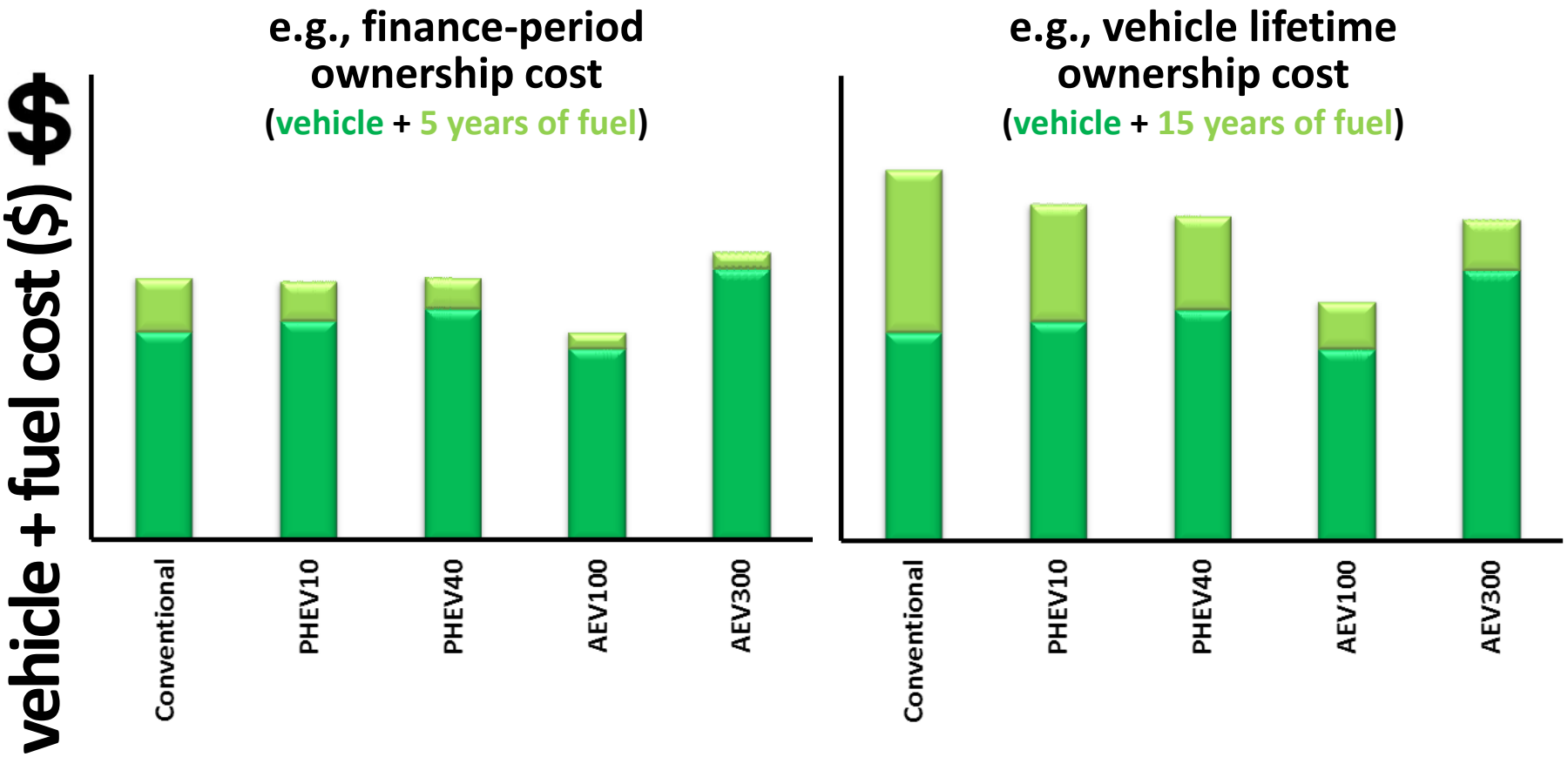
breakthrough to 2022

At 125 $/kWh a PHEV40 costs <30,000

Source(s): U.S. DOE published progress and future targets

metrics&challenges

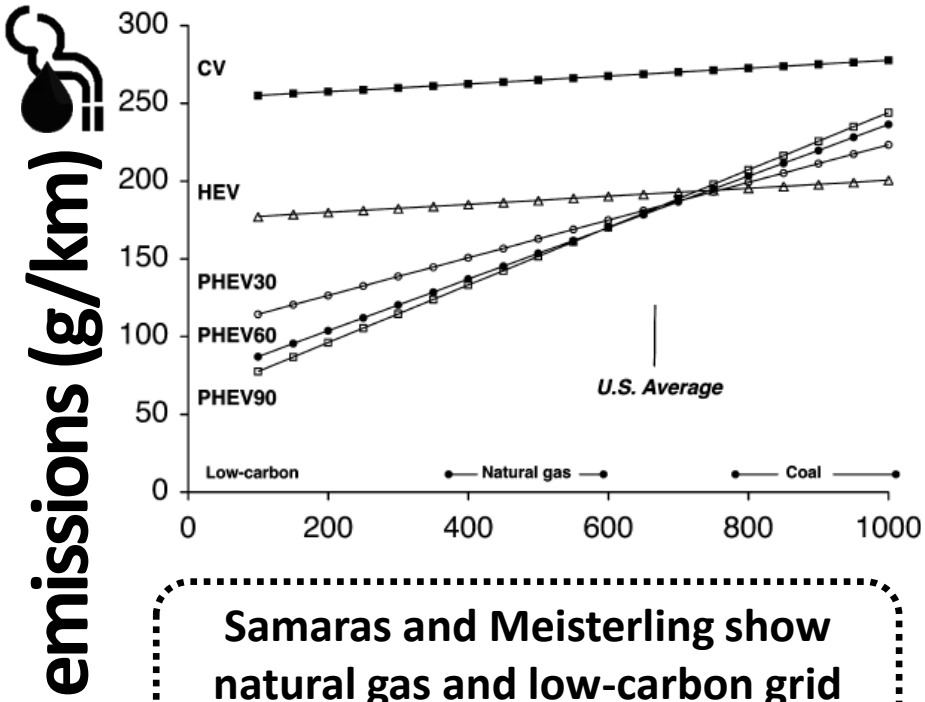
economical: PEVs look EXPENSIVE, but fuel savings can make up for the incremental cost of future vehicles.



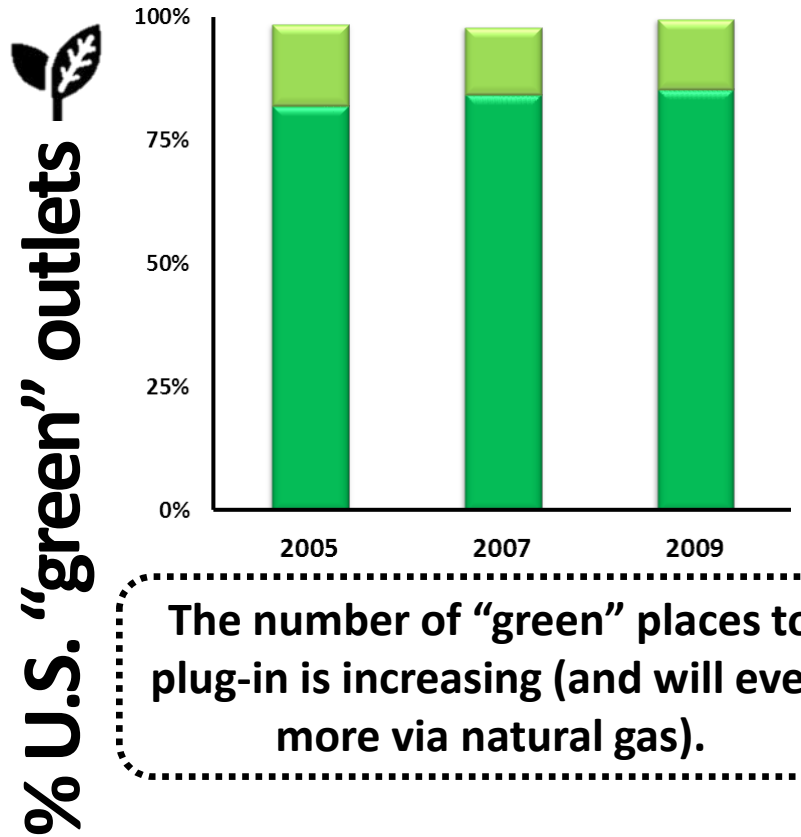
Source(s): U.S. DOE, Vehicle Technologies Program. Government Performance and Results Act Benefits internal analysis.

metrics&challenges

environmental: PEV lifecycle emissions are tied to the grid; coal is dirty, but the grid is, by law, getting greener.



Samaras and Meisterling show natural gas and low-carbon grid regimes fuel "green" PEVs



The number of "green" places to plug-in is increasing (and will even more via natural gas).

Source(s): Samaras and Meisterling (2008), EPA's eGRID data (www.epa.gov/egrid/)

metrics&challenges

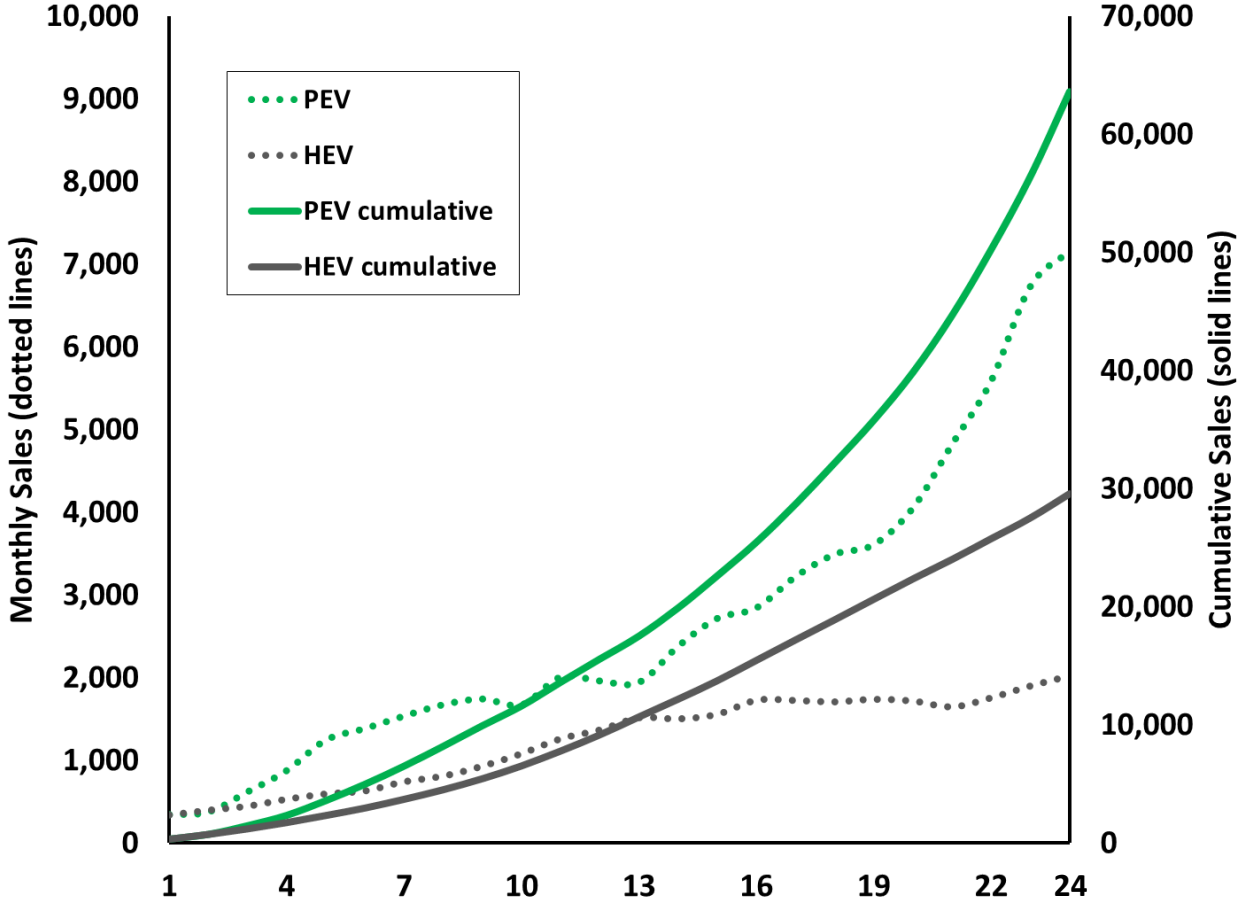
human: PEVs offer a huge potential change in the human-vehicle interface paradigm.

human factors

• Technology unfamiliarity (aversion?)	• Technology added value (generator functionality)
• Range anxiety (limited functionality?)	• Range opportunity (convenience charging)
• New infrastructure?	• Existing infrastructure!
• Refueling familiarity (etiquette?)	• Domestic fuel, relatively stable pricing
• Limited model availability (for now…?)	• Drive and send a message (green, tech-savvy, etc.)
• Not “Class 2b-friendly”	• Consistent with future driver wants (?)

metrics&challenges

final note: PEVs have taken off faster than HEVs; are we on track for more than 3% market share in 10 years…?



pev primer

summary

taxonomy

> nomenclature can be (is?) confusing

benefits

> PEVs offer huge oil savings and ghg reduction potential, with technology and policy success

metrics& challenges

> PEV technology is on-track to reduce cost; potential battery breakthroughs could lower cost even more

> the value proposition is unclear to many consumers; technology familiarity and education can help

> an ever-greener grid corresponds to shrinking carbon footprints for PEVs

> human/behavior metrics are fuzzy, at best, but potentially powerful determinants of market success

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