Sustainable TRANSPORTATION

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

U.S. Transportation GHG Emissions: A look back and a look forward

Jacob Ward
U.S. Department of Energy
vehicles.energy.gov

UC-Davis STEPS Symposium
May 12, 2015

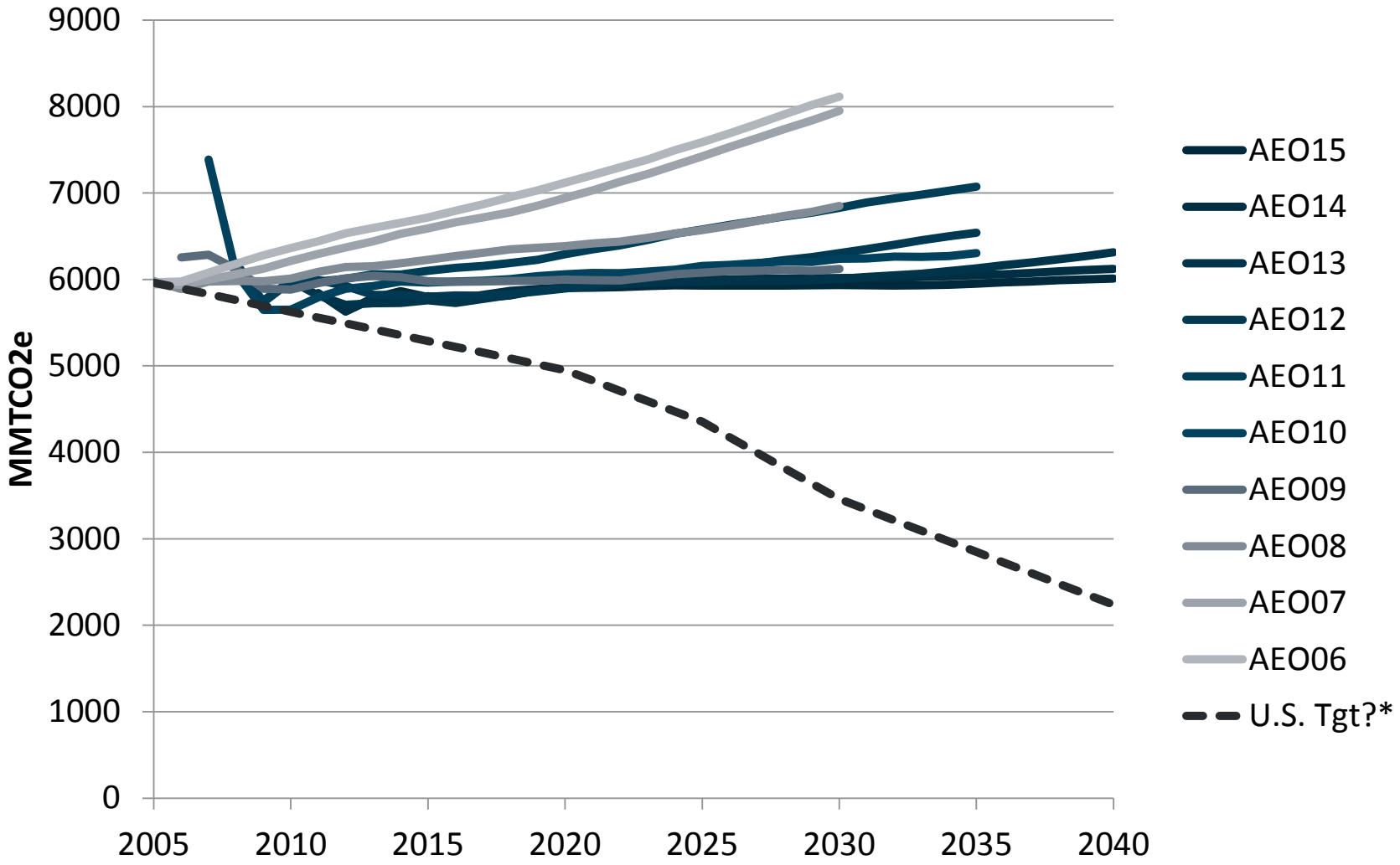
GHG Emissions Targets at the U.S. National Level

What's being "announced/discussed" at the national level?

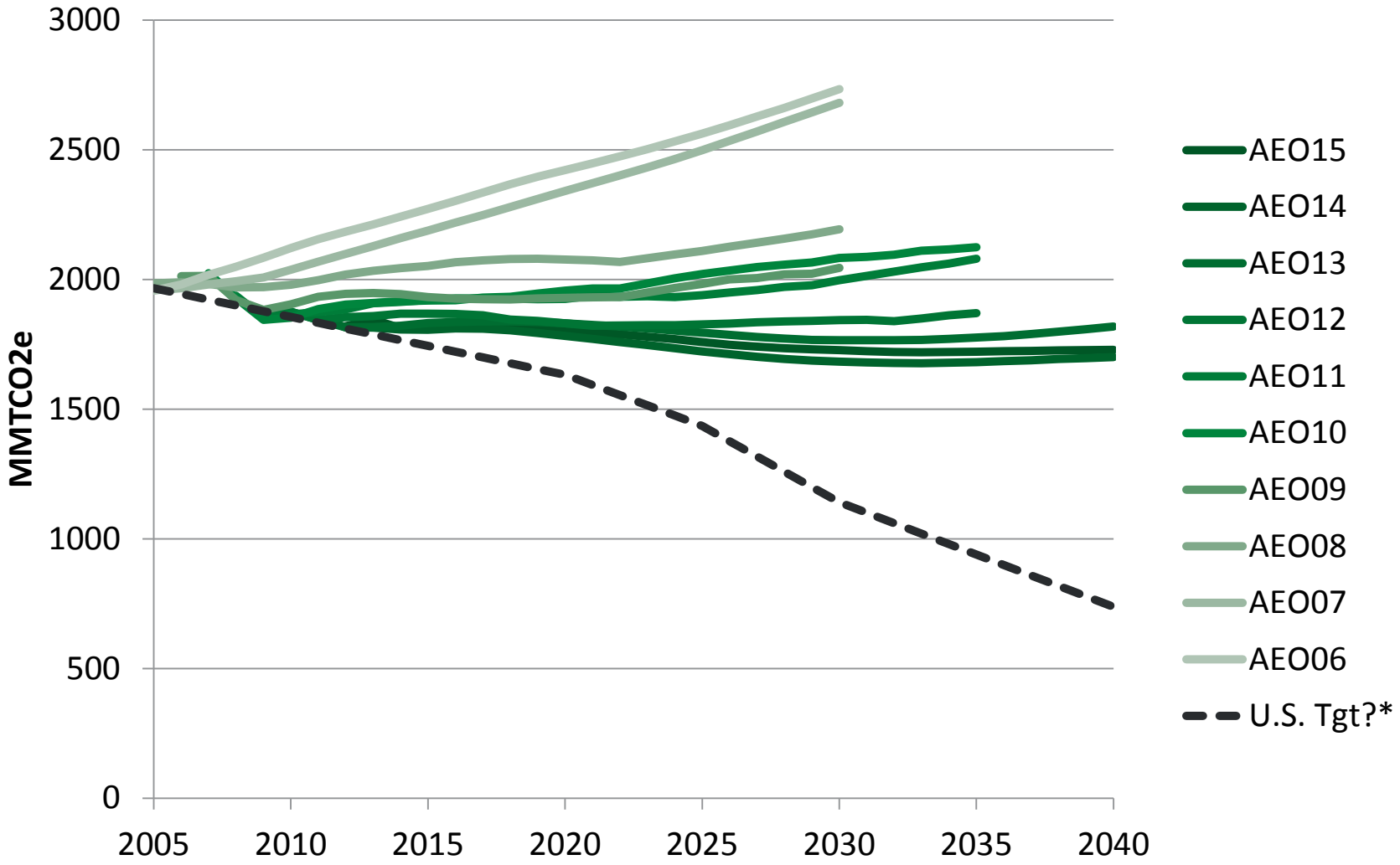
Target Year	Reductions from 2005 Levels*
2020	17%
2025	26-28%
2030	42%
2050	83%

** announced/discussed*

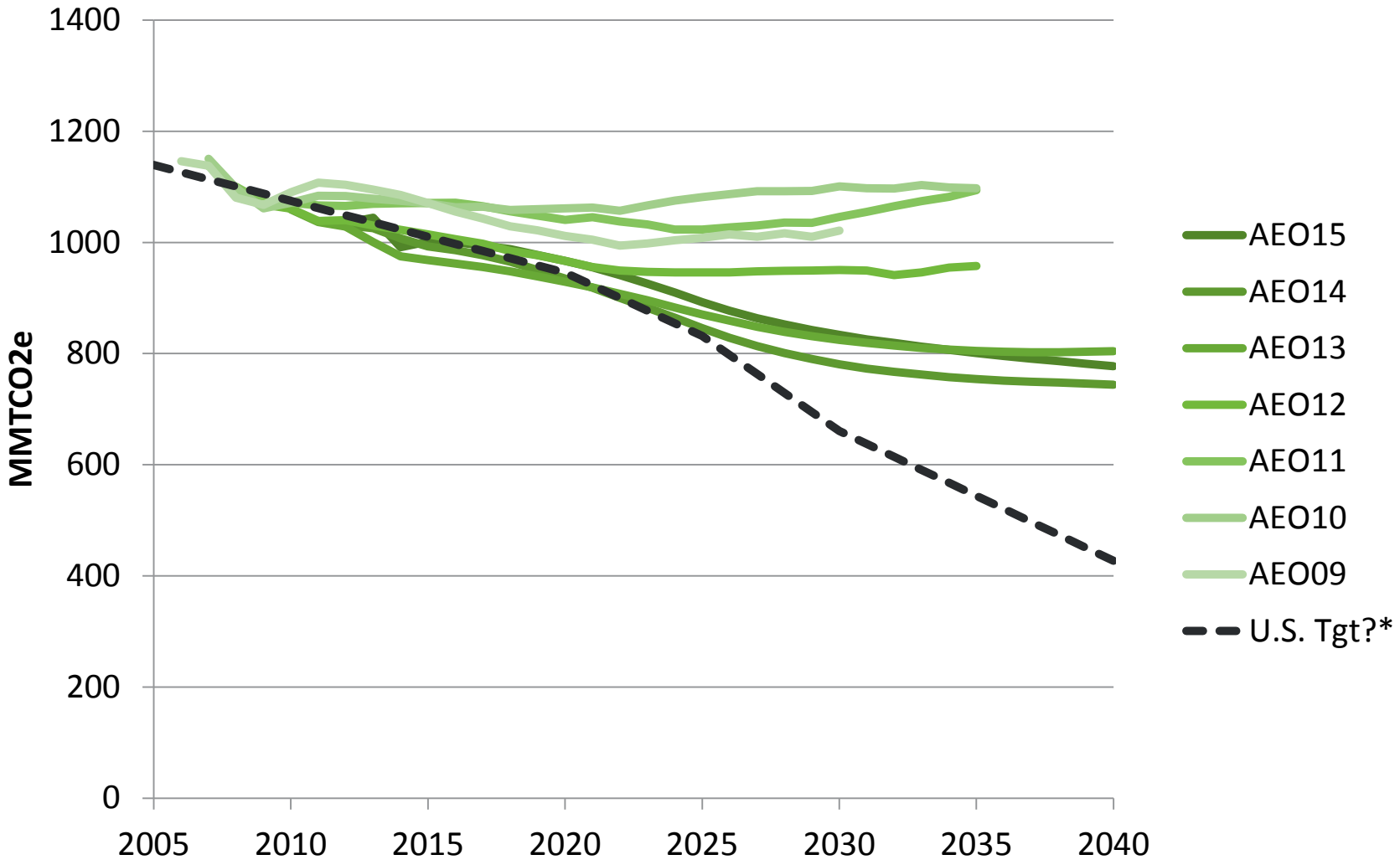
U.S. GHG Emissions



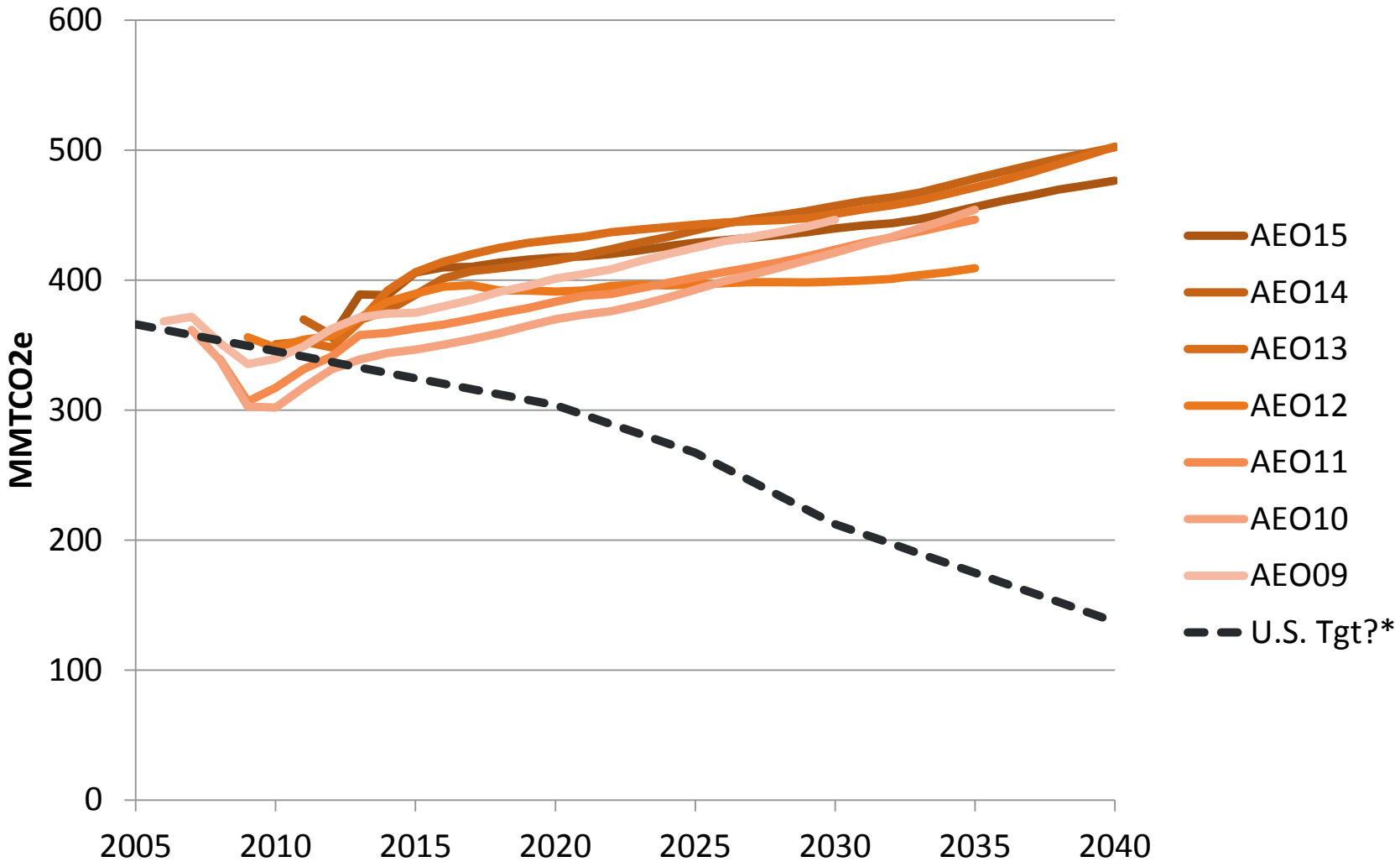
U.S. Transportation GHG Emissions



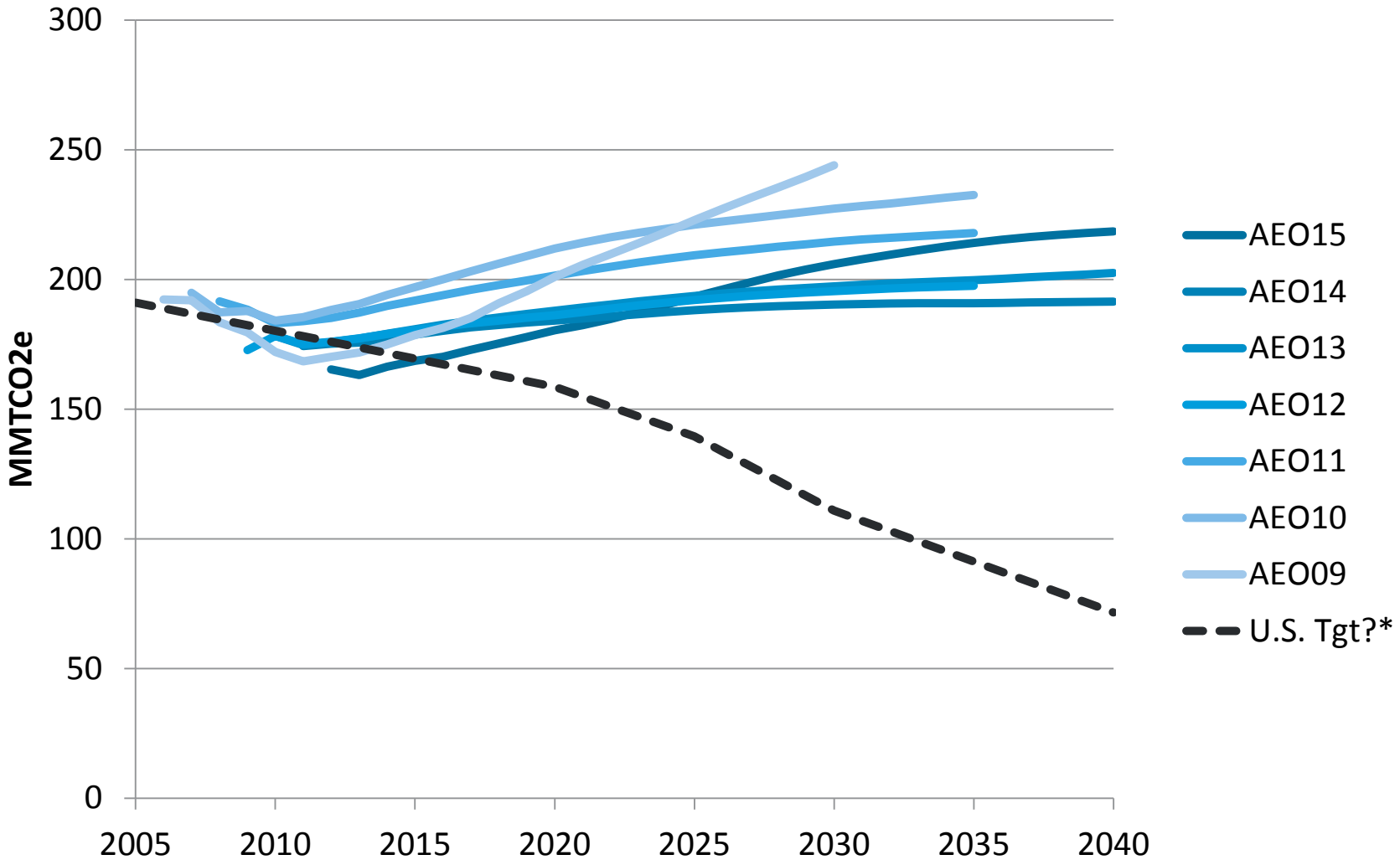
U.S. Transportation GHG Emissions: LDVs



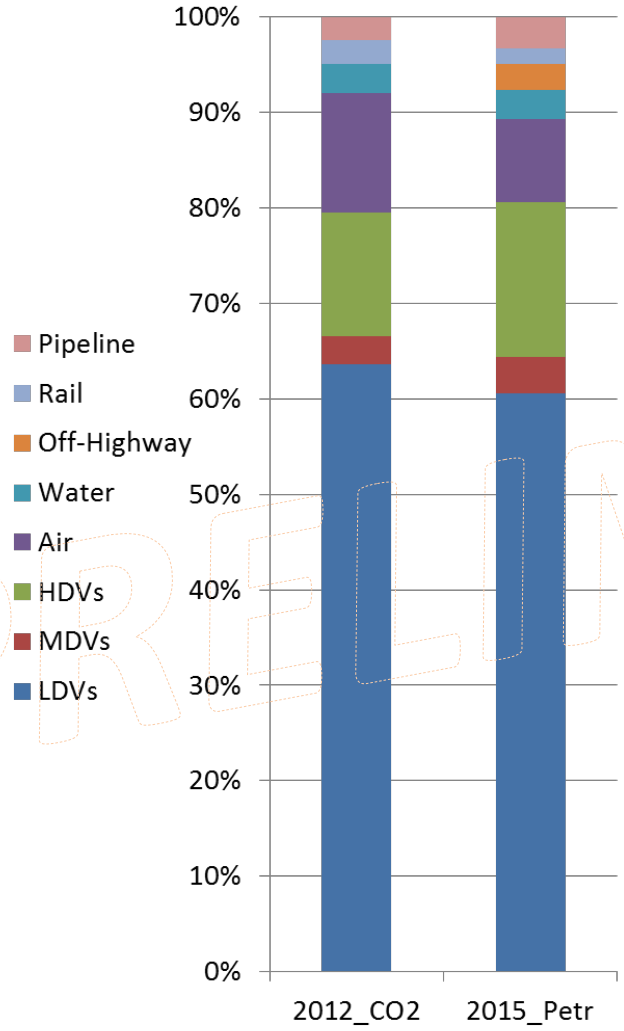
U.S. Transportation GHG Emissions: Class 3-8 Trucks



U.S. Transportation GHG Emissions: Air



Abatement "opportunity" and potential "size of the prize"



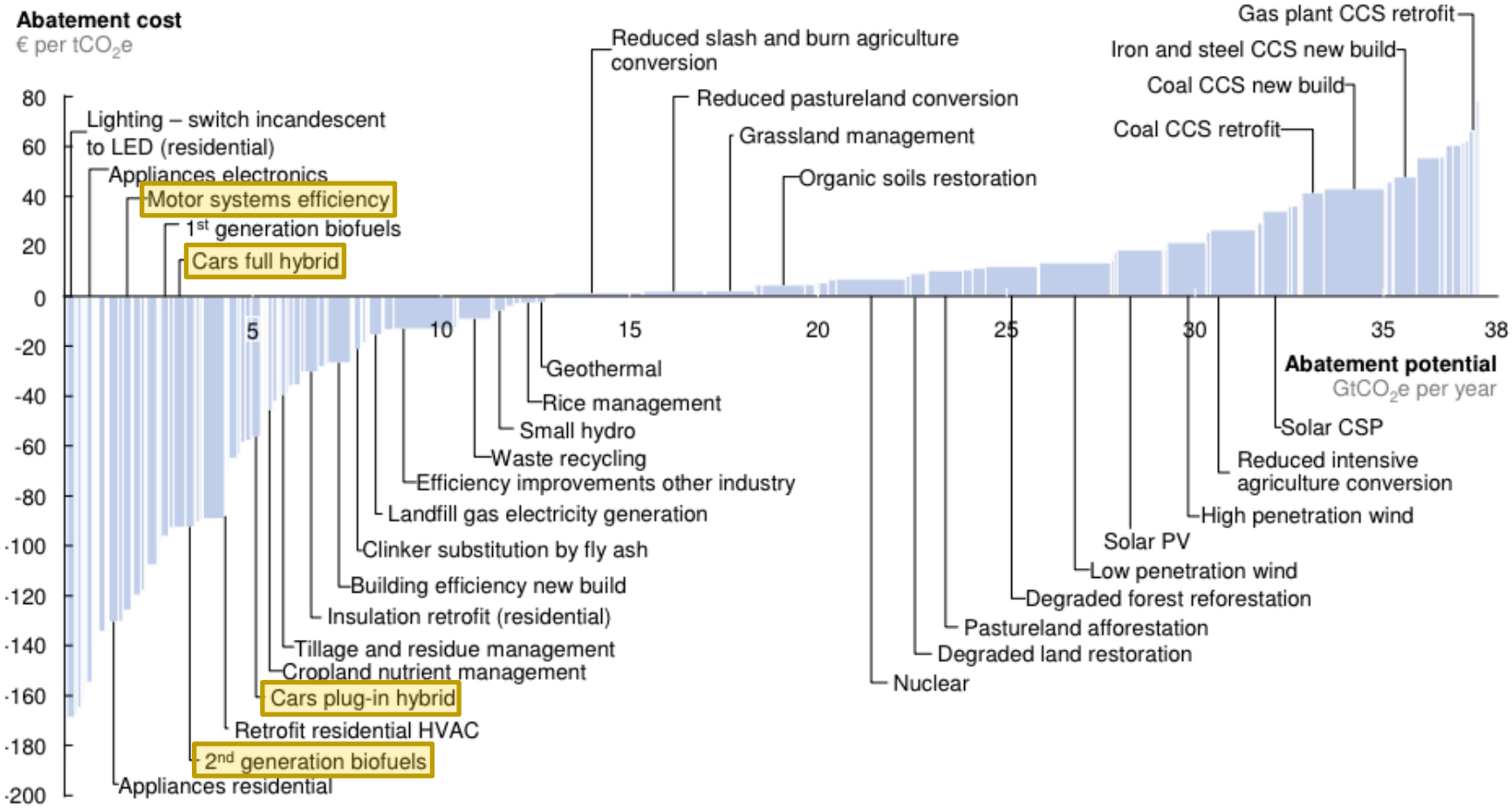
HDV	GHG Benefit	Petrol'm Benefit	Timing
Combustion	→ 25%	→ 25%	Near
Systems	→ 20%	→ 20%	Near

LDV	GHG Benefit	Petrol'm Benefit	Timing
Combustion	→ 25%	→ 25%	Near
LDV Systems	→ 20%	→ 20%	Near
Adv. Matls.	→ 20%	→ 20%	Mid
Electrification	→ 99%	→ 99%	Mid
Fuel Cell	→ 99%	→ 99%	Long

Note: "→" indicates up to.

Source: PRELIMINARY from forthcoming Quadrennial Technology Review (DOE, 2015).

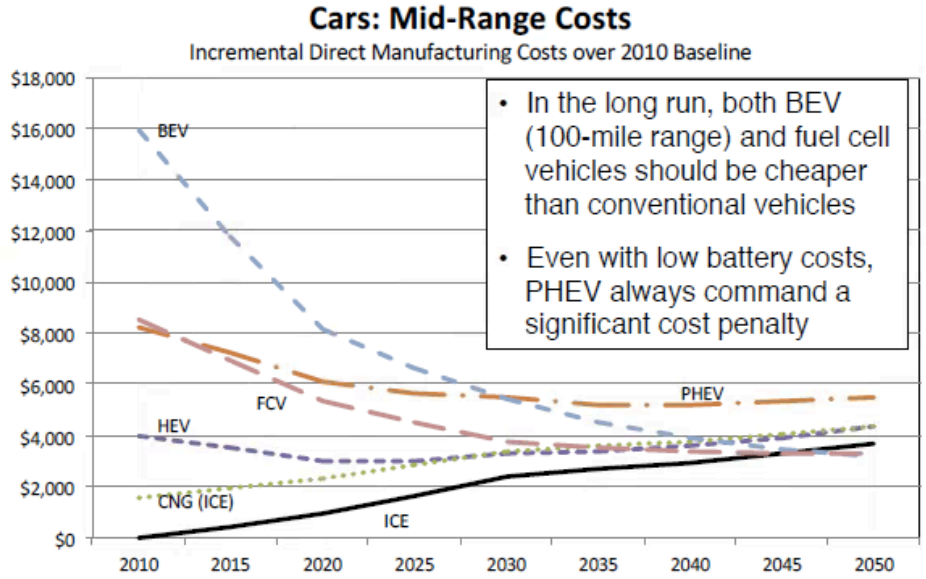
But [importantly] "size of the prize" isn't all that matters…

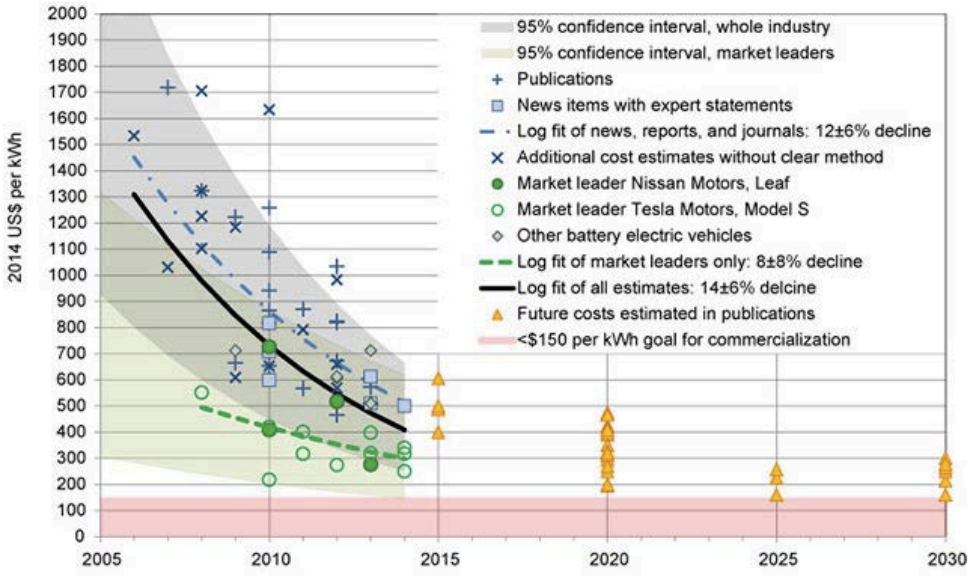


Note: The curve presents an estimate of the maximum potential of all technical GHG abatement measures below €80 per tCO_2e if each lever was pursued aggressively. It is not a forecast of what role different abatement measures and technologies will play.

Source: McKinsey, 2010. "Impact of the Financial Crisis on Carbon Economics"
http://www.mckinsey.com/client_service/sustainability/latest_thinking/greenhouse_gas_abatement_cost_curves

Vehicle costs *are* decreasing





Studies have projected (and project) low-cost advanced technology vehicles...

Source: NRC, 2013. Transitions to Alternative Vehicles and Fuels. http://www.nap.edu/catalog/18264/transitions-to-alternative-vehicles-and-fuels

...and market prices are falling.

Source: Nykvist & Nihllson 2015. "Rapidly falling costs of battery packs for electric vehicles," Nature Climate Change. http://www.nature.com/nclimate/journal/v5/n4/full/nclimate2564.html

80% GHG reductions for LDVs are possible (DOE, 2014)

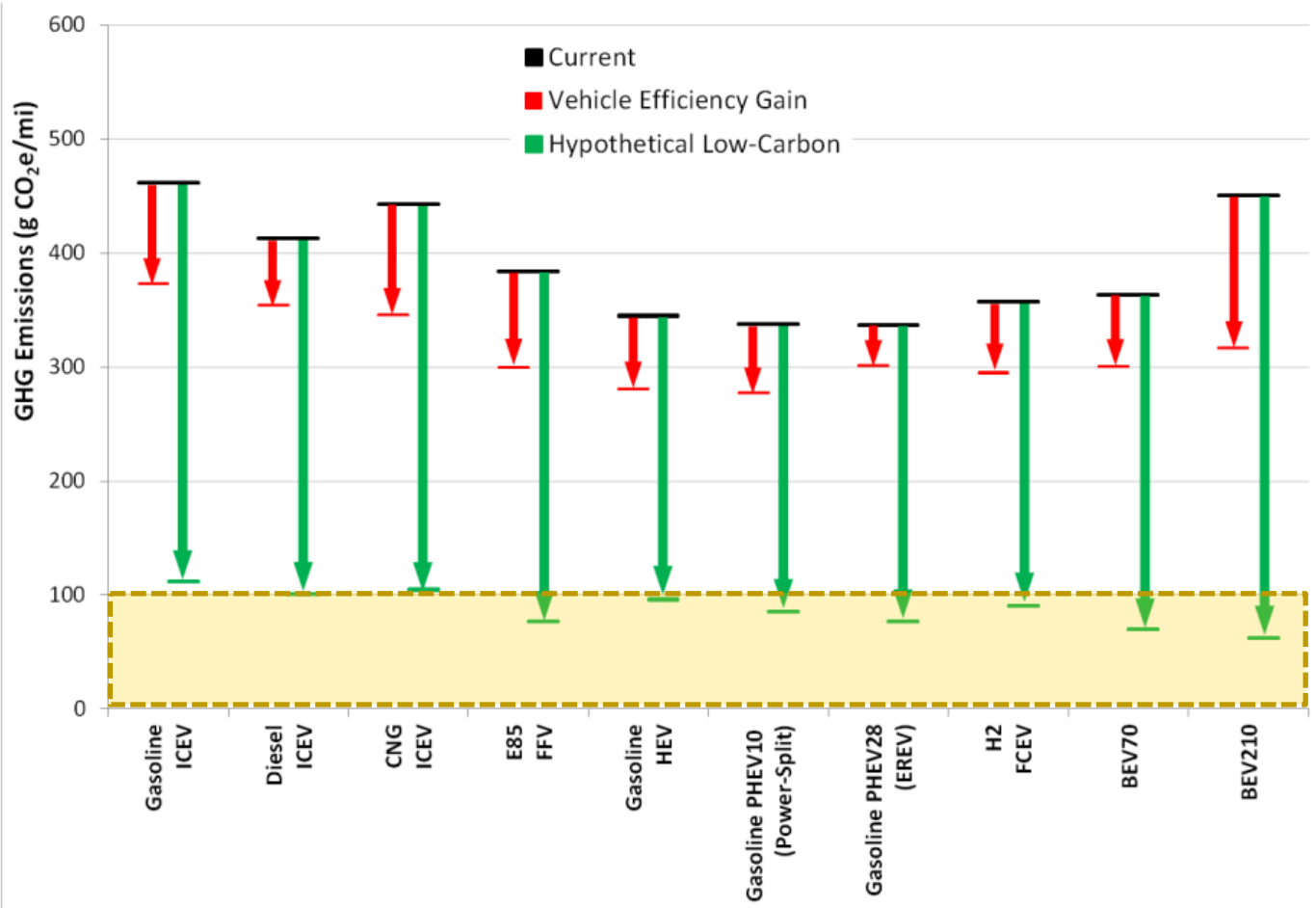
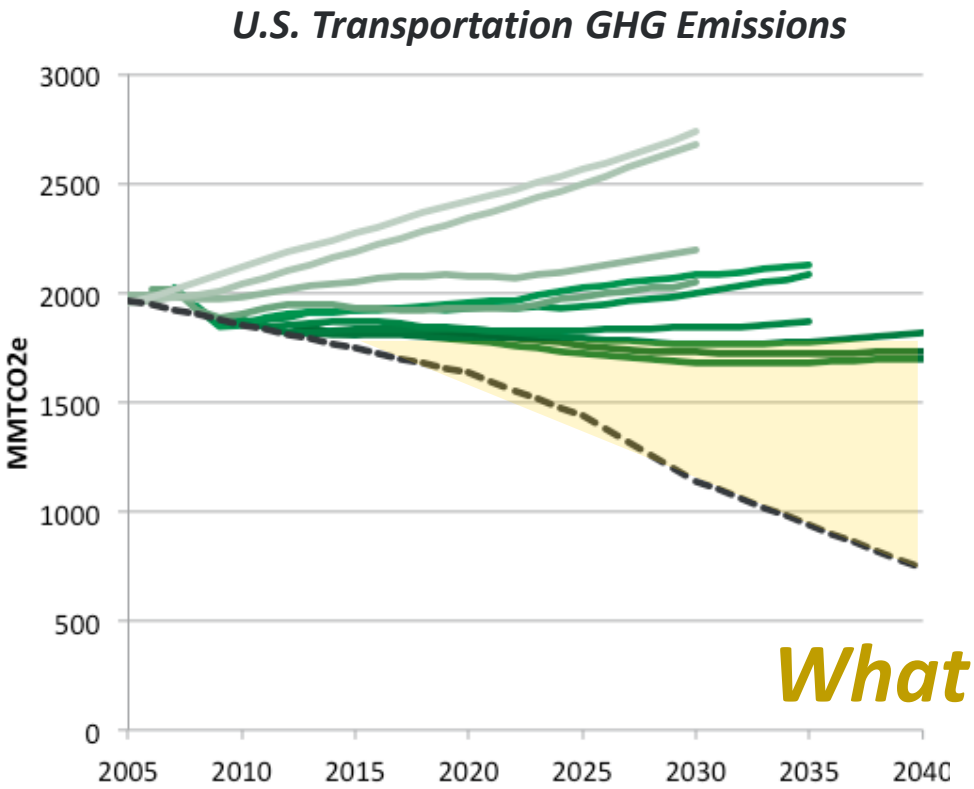


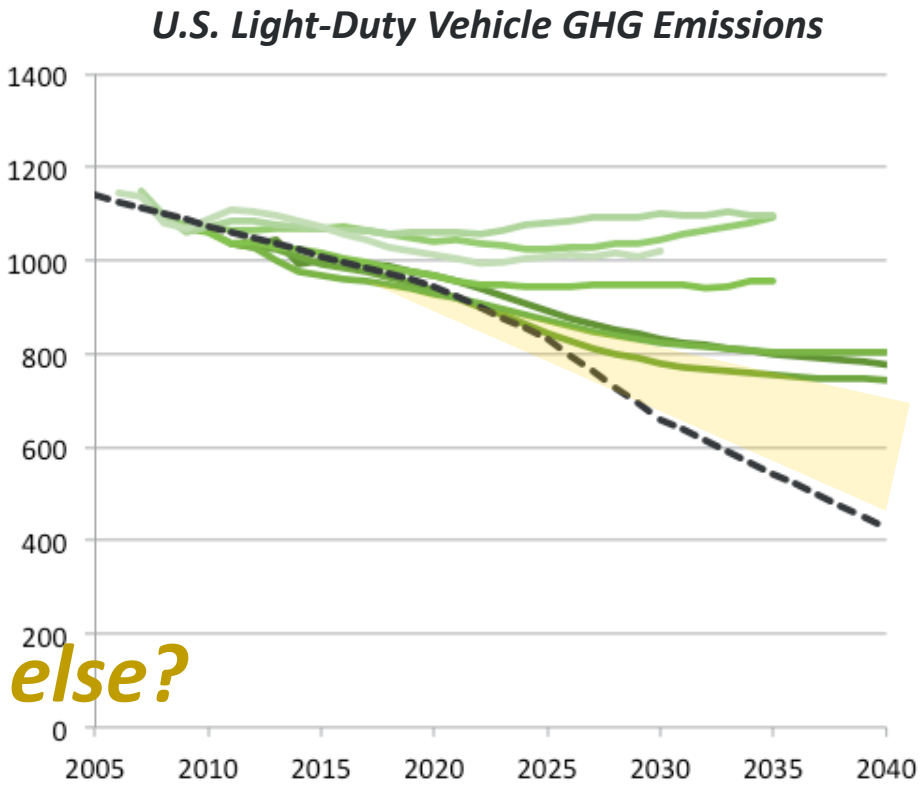
Figure 5. C2G GHG emissions for two bookends ("Current" and "Hypothetical low carbon"*) and the intermediate case ("Vehicle Efficiency Gains"). Contributions of vehicle cycle, fuel production and vehicle operations are shown in the appendix.

*100% biomass derived gasoline, diesel, natural gas, cellulosic ethanol and zero carbon based electricity for hydrogen and plug-in vehicles

Source: http://www.hydrogen.energy.gov/pdfs/14006_cradle_to_grave_analysis.pdf

U.S. Transportation GHG Emissions





What else?

Important Questions for Discussion

To get to 17%, ~28%, 42%, and/or 83% GHG reductions…

- **What role can/should/will transportation play?**

- EIA/AEO-projected "current policy" transportation emissions reductions are attributable almost entirely to light-duty vehicle efficiency.
  - What role can/should/will **non-LDV modes** play?
  - What role can/should/will **non-cost barriers** for alternative fuel vehicles play?
  - What role can/should/will **lower-carbon fuels** play?

Sustainable TRANSPORTATION

U.S. DEPARTMENT OF ENERGY | Energy Efficiency & Renewable Energy

Discussion.

Jacob Ward
U.S. DOE/EERE
Vehicle Technologies Office
jacob.ward@ee.doe.gov
vehicles.energy.gov