

UCDAVIS

SUSTAINABLE TRANSPORTATION ENERGY PATHWAYS

An Institute of Transportation Studies Program

State-of-the-World Fuel Economy

Paris, 11 June 2015

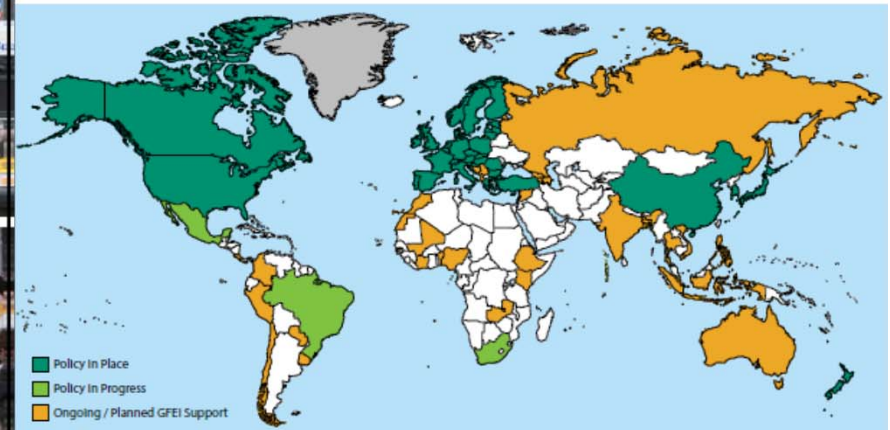
Dr. Lewis Fulton, STEPS3 Program,
Institute of Transportation Studies
University of California, Davis



www.steps.ucdavis.edu



FIGURE 1 UNEP Policy Progress Map



Fuel Economy State of the World 2014

The World is Shifting into Gear on Fuel Economy



	2020	2030	2050
New Cars	30% reduction* in L/100km compared to 2005 Engines, drive-trains, weight, aerodynamics.	50% average improvement globally Hybridisation of most models.	50% + globally Significant contributions from Plug-in vehicles
Total fleet	20% reduction With lag time for stock turnover; includes eco-driving, maintenance	35% reduction	50by50

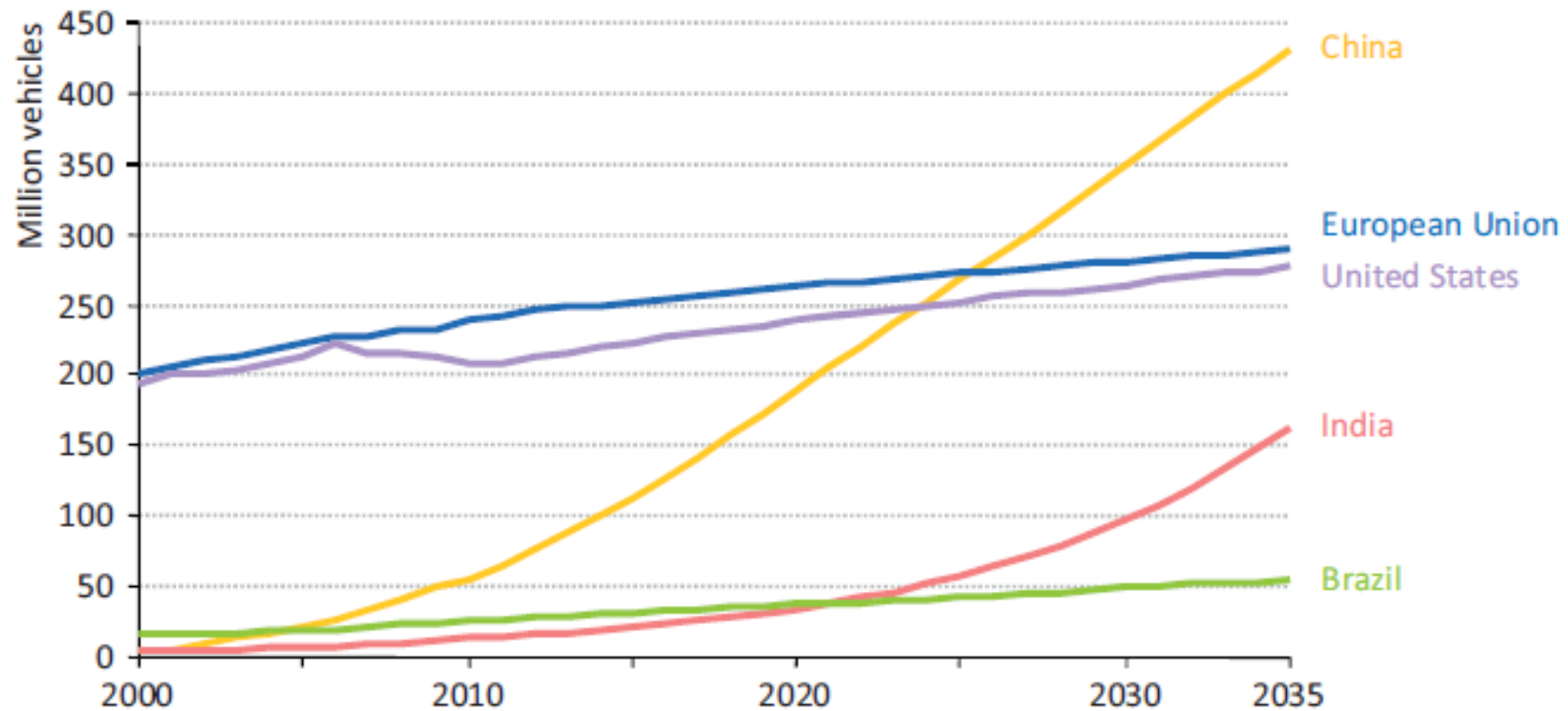
Typical national objectives related to transportation/fuels policies

- Reduce oil dependence (diversify fuels)
- Improve balance of payments
- Reduce pollutant emissions
- Reduce greenhouse gases
- Promote domestic economies/jobs

IEA WEO 2012: heading toward 2 billion cars

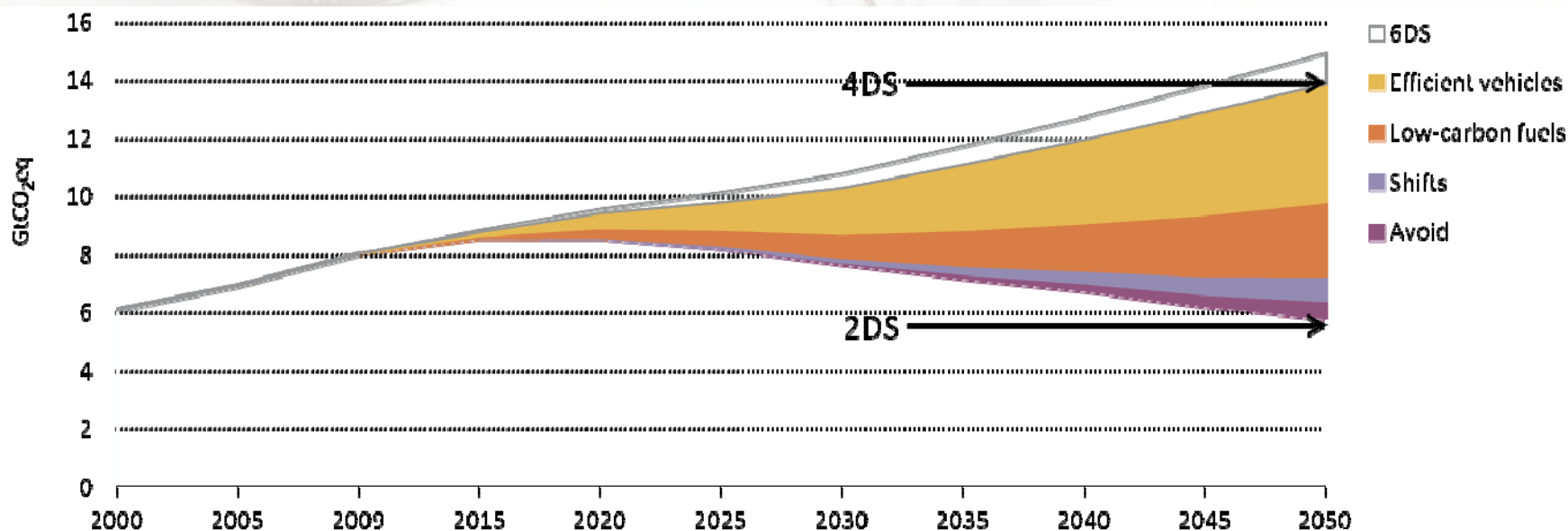
OECD is fairly saturated, but rest of the world is not.:

Figure 3.6 ▶ PLDV fleet in selected regions in the New Policies Scenario



Deep Transport CO₂ Reductions in ETP-2012 2 Degree Scenario (2DS)

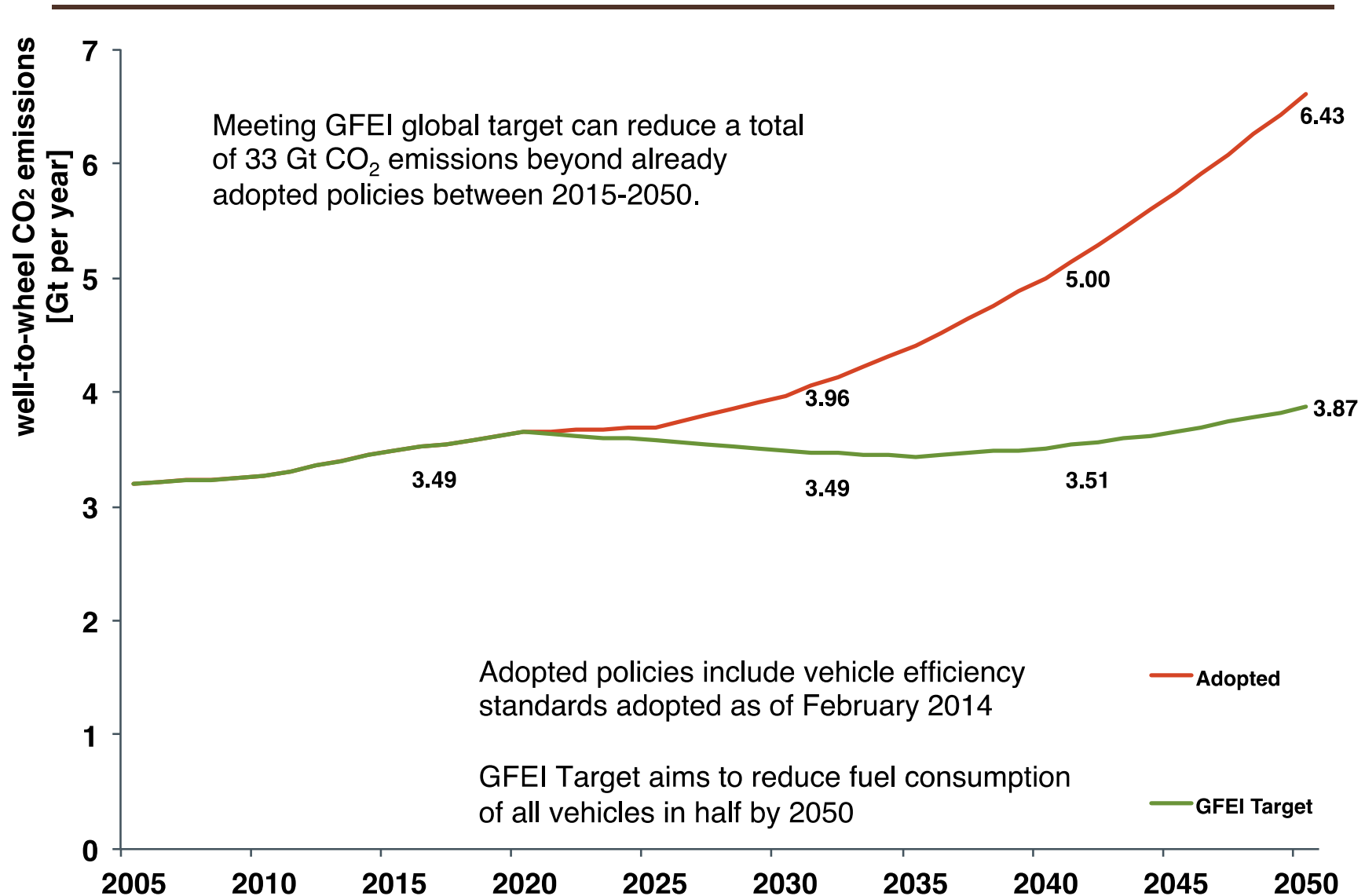
- Fuel economy improvement plays largest role, particularly through 2030



Fuel economy context

- **Fuel economy improvement can be achieved through**
 - Technical changes to vehicles
 - Changing the types of vehicles bought
 - Improving vehicle maintenance
 - Changing the way vehicles are driven (ecodriving)
 - Reducing traffic congestion
- **Fuel economy improvement to vehicles should be part of a broader strategy:**
 - Traffic management
 - City and regional planning
 - Promotion of public transit
 - Etc.

Meeting GFEI targets can stabilize global light-vehicle CO₂ emissions, despite more than a doubling of vehicle fleet.



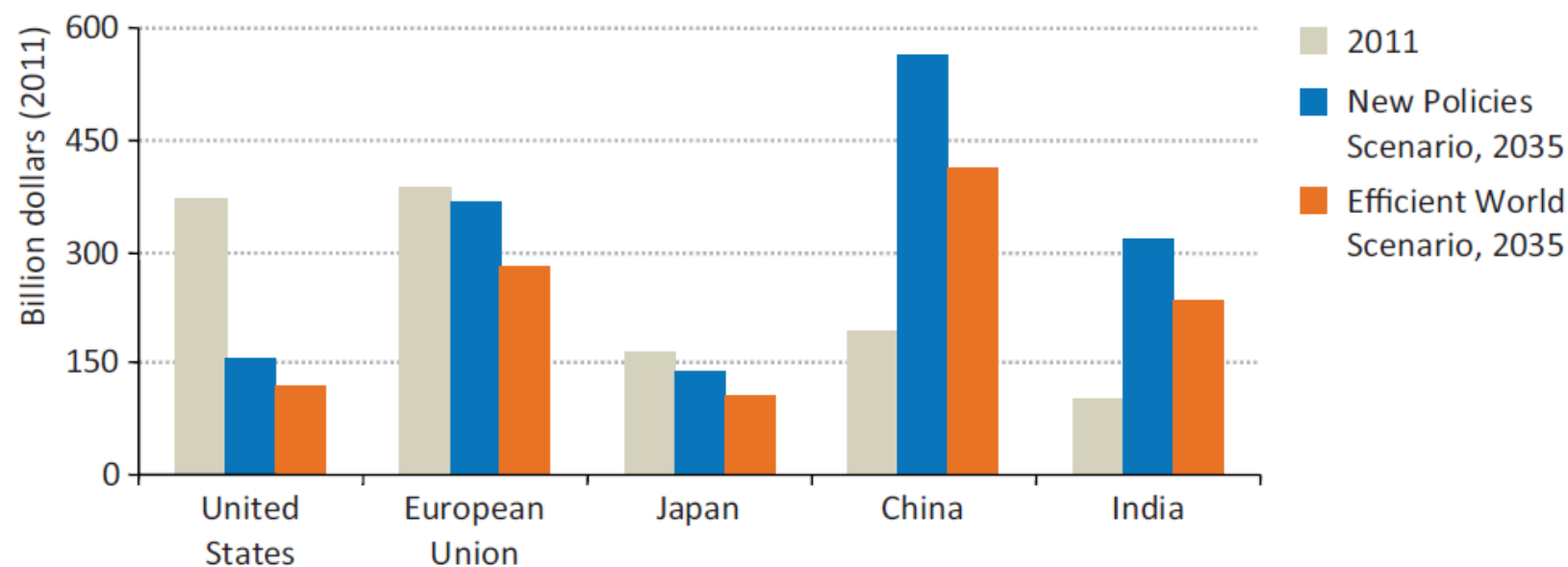
Source: ICCT Roadmap Model

Improving efficiency can save \$billions

Countries could dramatically cut their fuel import bills in the future...

Figure 10.9 ▷ Fuel import bills in selected countries by fuel and scenario

a) Oil import bills



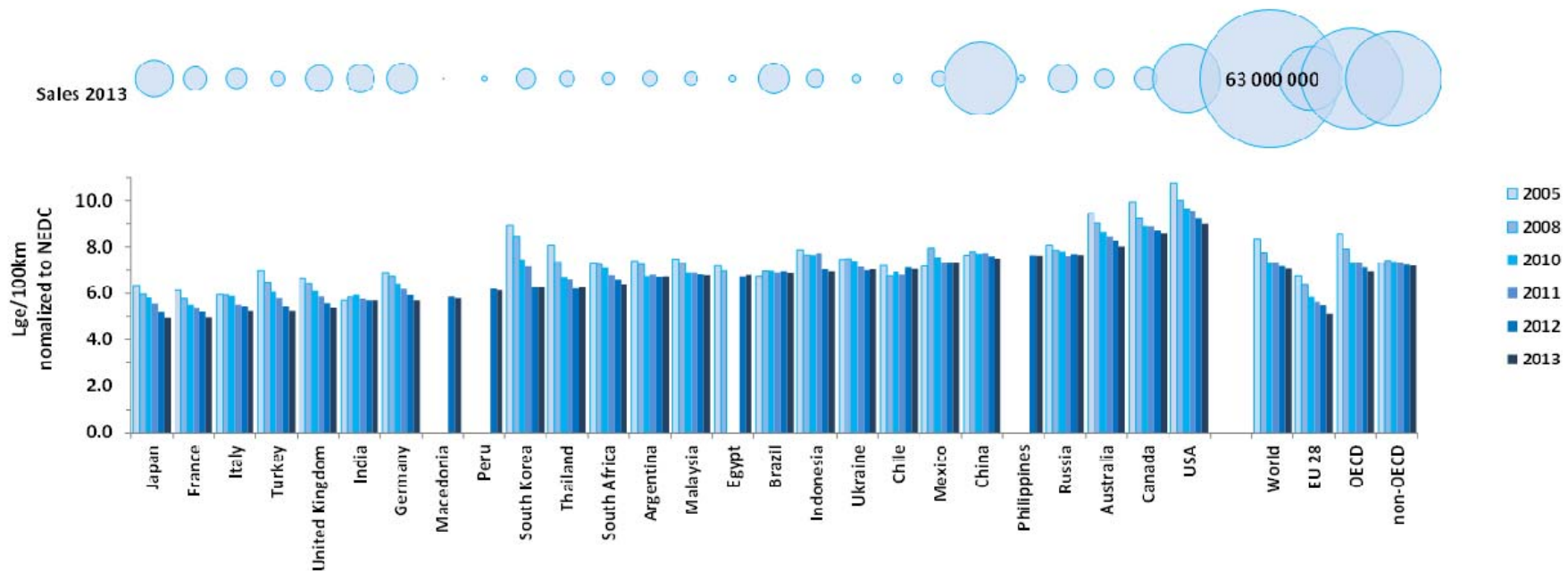
Source: IEA World Energy Outlook 2012

GFEI fuel economy report 2015

- 3rd edition since 2010
- Unique compilation of OECD and non-OECD new light duty vehicle fuel economy data
- Dataset currently comprises 26 countries covering more than 80% of the global LDV market
- Dataset covering eight years time series from 2008 to 2013
- Next update will come in 2016 and will include data of GFEI pilot countries



Regional fuel economy trends



- Countries with FE policies in place show encouraging improvement rates
- Size shift vs. technology evolution moderates non-OECD improvement
- Normalization to NEDC affects FTP based markets most – 15% increase of FE due to conversion compared to last edition

FE improvement - Targets and reality

		2005	2008	2011	2013	2030	
OECD average	average fuel economy (Lge/100km)	8.6	7.9	7.3	6.9		
	annual improvement rate (% per year)	-2.7%	-2.6%	-2.6%			
		-2.6%					
Non-OECD average	average fuel economy (Lge/100km)	7.3	7.4	7.3	7.2		
	annual improvement rate (% per year)	0.5%	-0.4%	-0.9%			
		-0.2%					
Global average	average fuel economy (Lge/100km)	8.3	7.7	7.3	7.1		
	annual improvement rate (% per year)	-2.3%	-1.9%	-1.8%			
		-2.0%					
GFEI target	average fuel economy (Lge/100km)	8.3				4.2	
	required annual improvement rate (% per year)	2005 base year	-2.7%				
		2014 base year	-3.1%				

← OECD: rates close to target

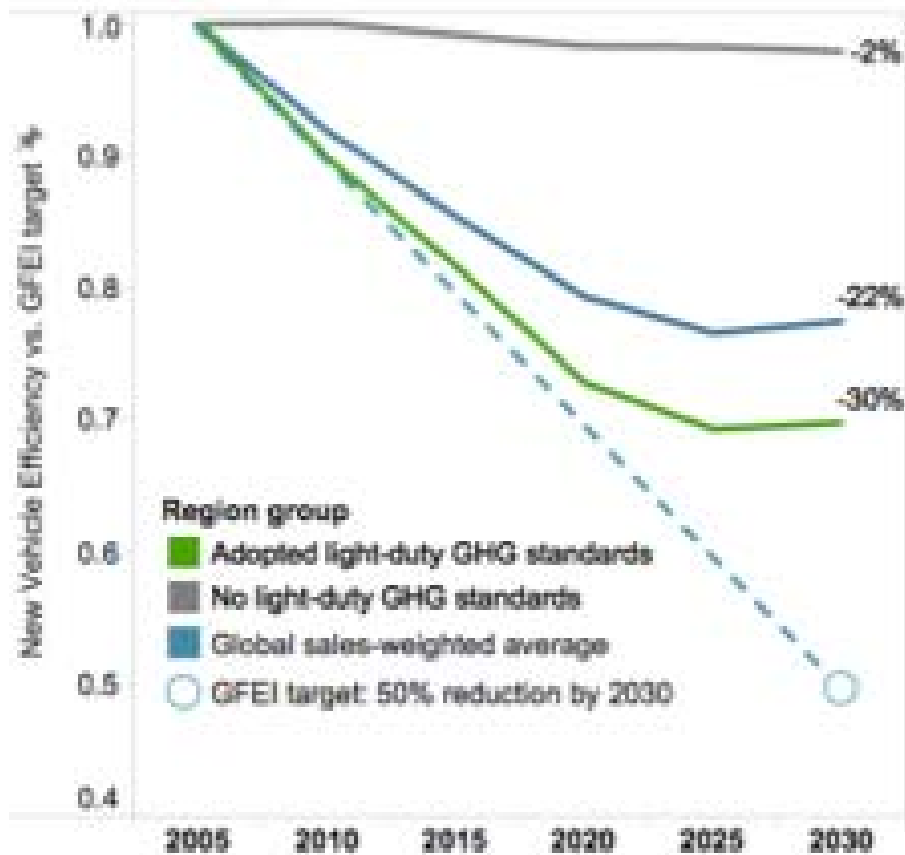
← Non-OECD: little improvement

← Global: Right trend at slow pace

← 2030: Improve global FE by 50%

Progress towards 2030 GFEI target

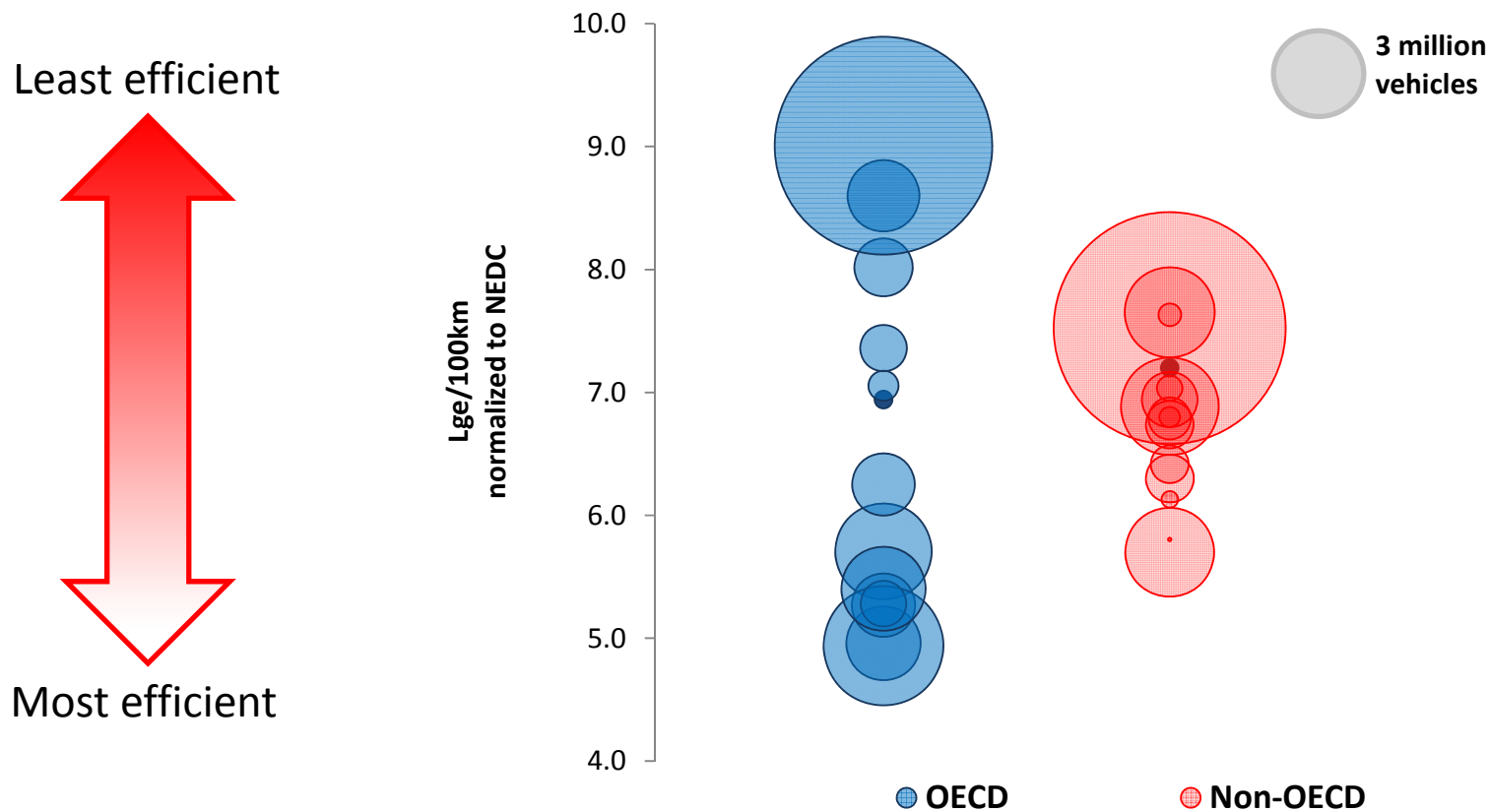
(We're about half way there; next several years are critical)



		2030	
		% of total sales	% reduction in new vehicle fuel consumption (2005 baseline)
Adopted light-duty GHG standards	China	26%	-15%
	EU-28	15%	-40%
	U.S.	15%	-50%
	India	8%	-20%
	Japan	5%	-30%
	Brazil	3%	-12%
	Canada	2%	-24%
	Mexico	2%	-10%
	South Korea	1%	-24%
	Average	78%	-30%
No light-duty GHG standards	Russia	4%	0%
	Australia	1%	-8%
	Other countries	19%	-1%
	Average	24%	-2%
Global Average	100%	-22%	

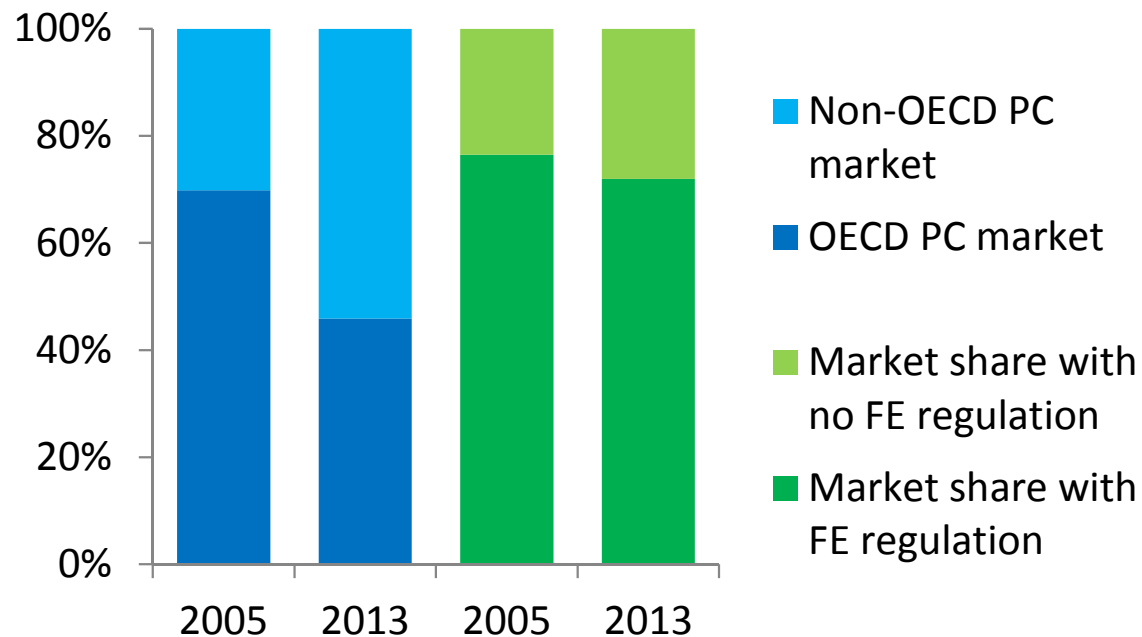
Sales-weighted averages include projected sales of passenger cars and light commercial vehicles through 2030.

FE in OECD is very heterogeneous



- Both, least and most efficient markets are in OECD

Vehicle market dynamics



- The non-OECD market accounts for almost 60% of global PLDV sales, leading to a decreasing share of markets with fuel economy regulation
- Shifts towards least efficient markets lead to moderate average OECD FE improvement rates although more than half of the OECD markets have improvement rates >3%

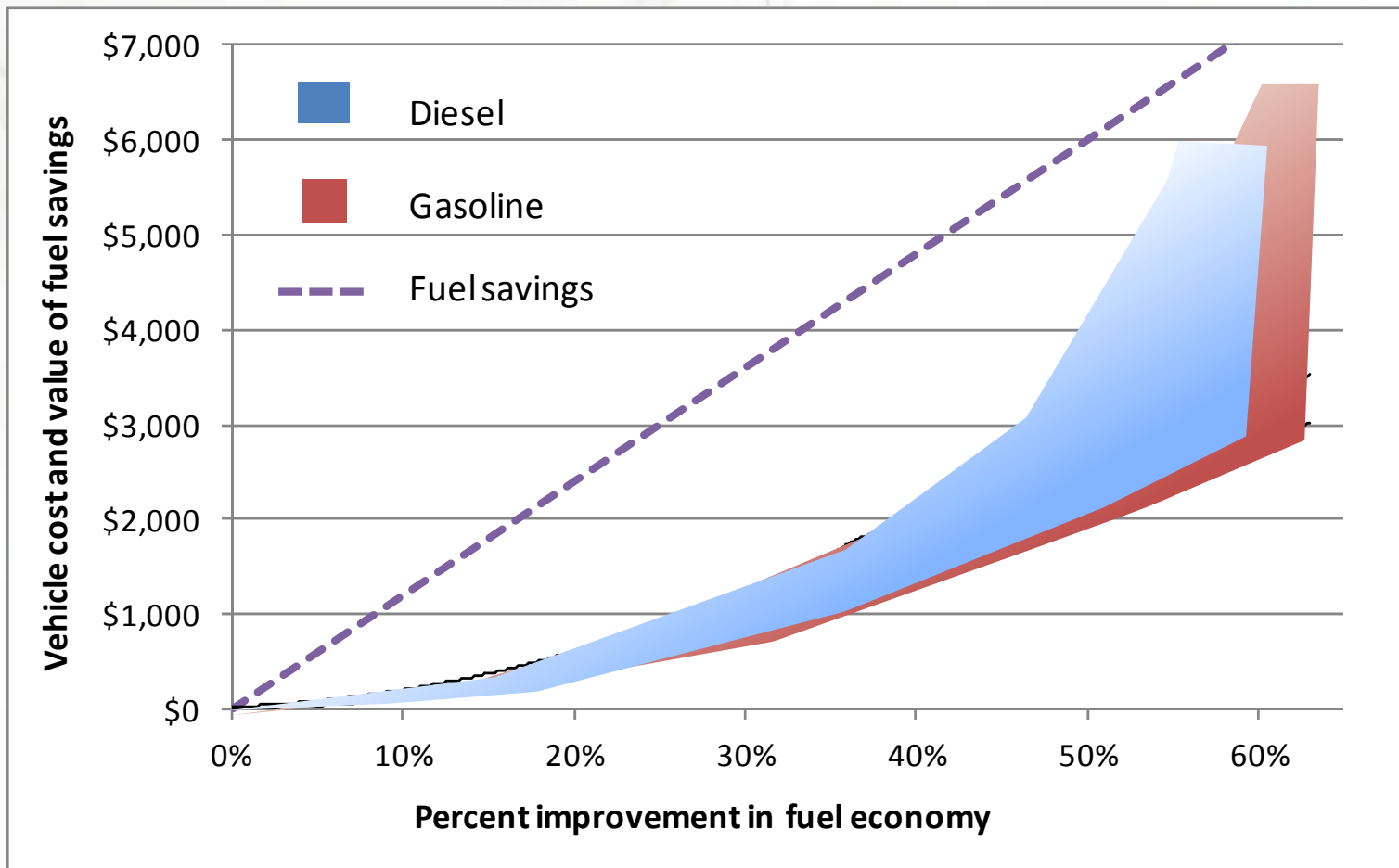
Potential Fuel Economy Improvements to 2030

From the U.S. NRC 2013 report:

- Light-weighting of up to 25% in 2030, 50% in 2050 relative to 2010
- High efficiency accessories (e.g. air conditioning, lighting, tires)
- High efficiency engines (including but not limited to hybridization)
 - E.g. 25% improvement from turbocharged, downsized direct injection gasoline engines
- **Overall Impacts:**
 - By 2030, potential for 50% reduction in fuel consumption/CO2 per km at \$2000-3500 per vehicle (through hybridization)
 - 66% reduction by 2050 at somewhat higher cost

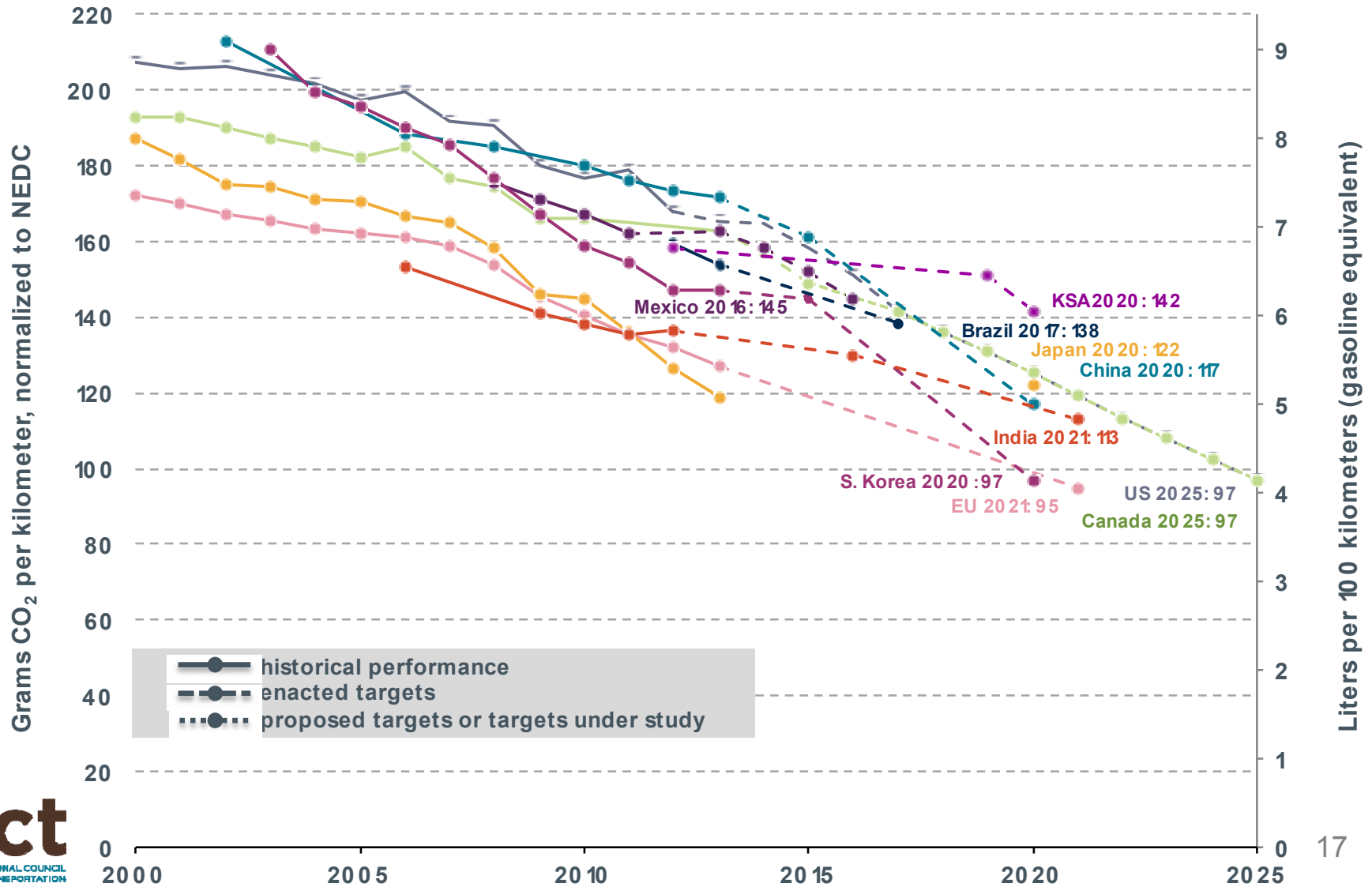
Fuel Economy Improvements are Cost-effective

Fuel savings more than pays for fuel economy improvements in light-duty vehicles

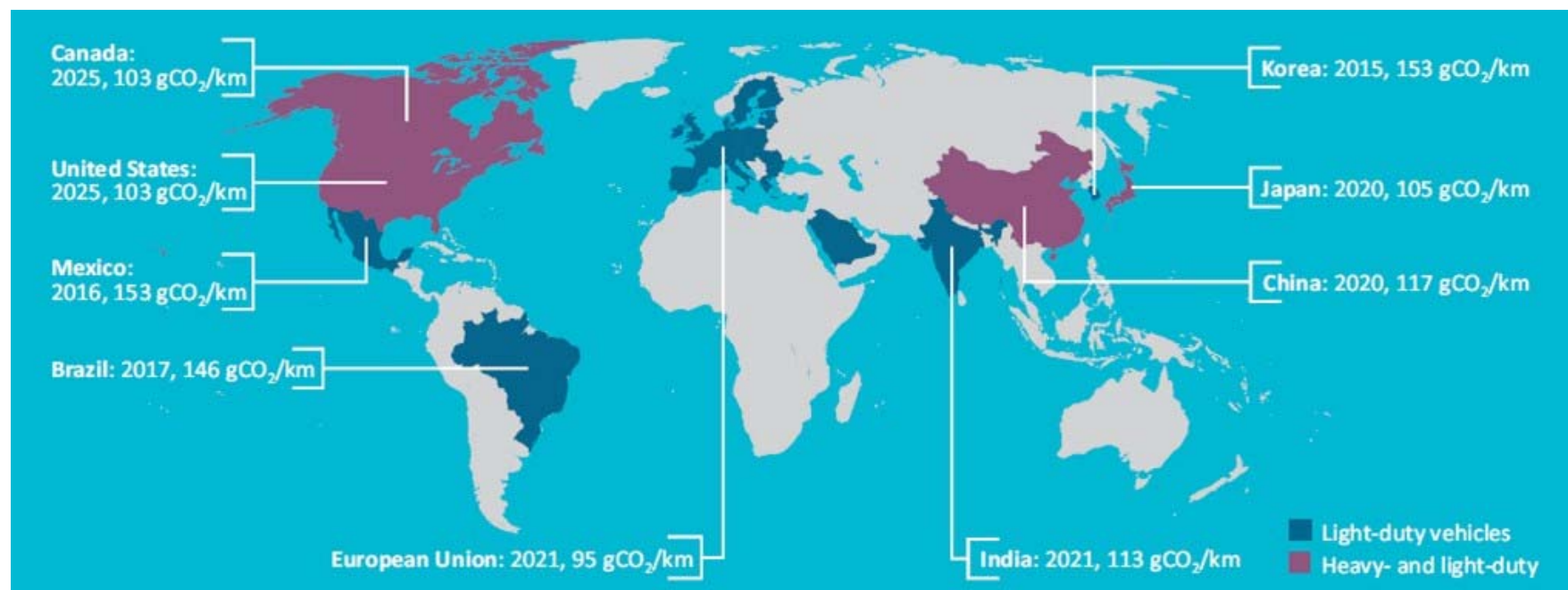


Source: IEA Fuel Economy Roadmap, July 2012

Passenger Car Fuel Economy Standards Globally



Countries are at various points in developing fuel economy policies



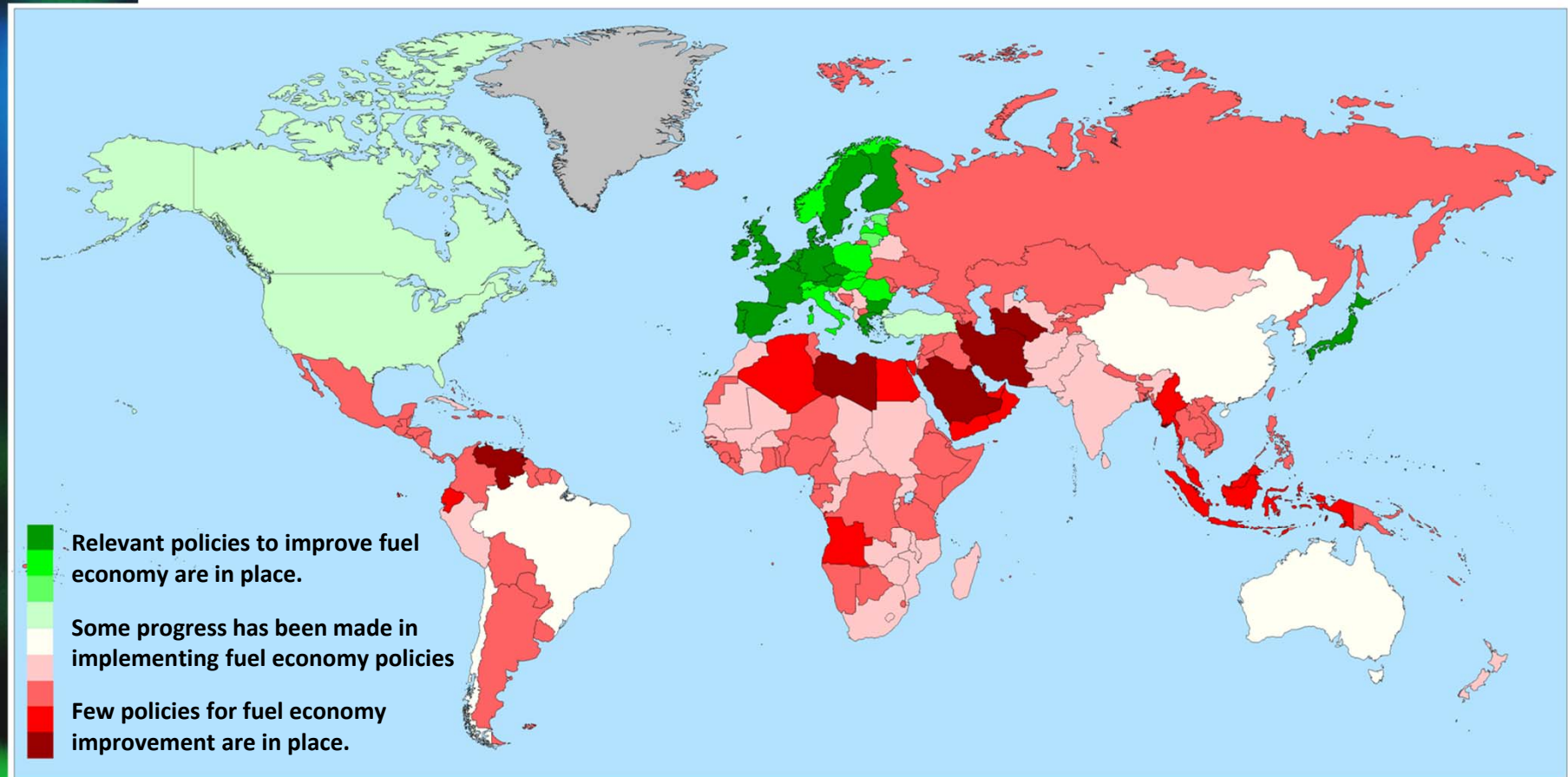
Note: light vehicle fuel economy values normalized or NEDC test cycle

Source: IEA ETP 2015 and ICCT



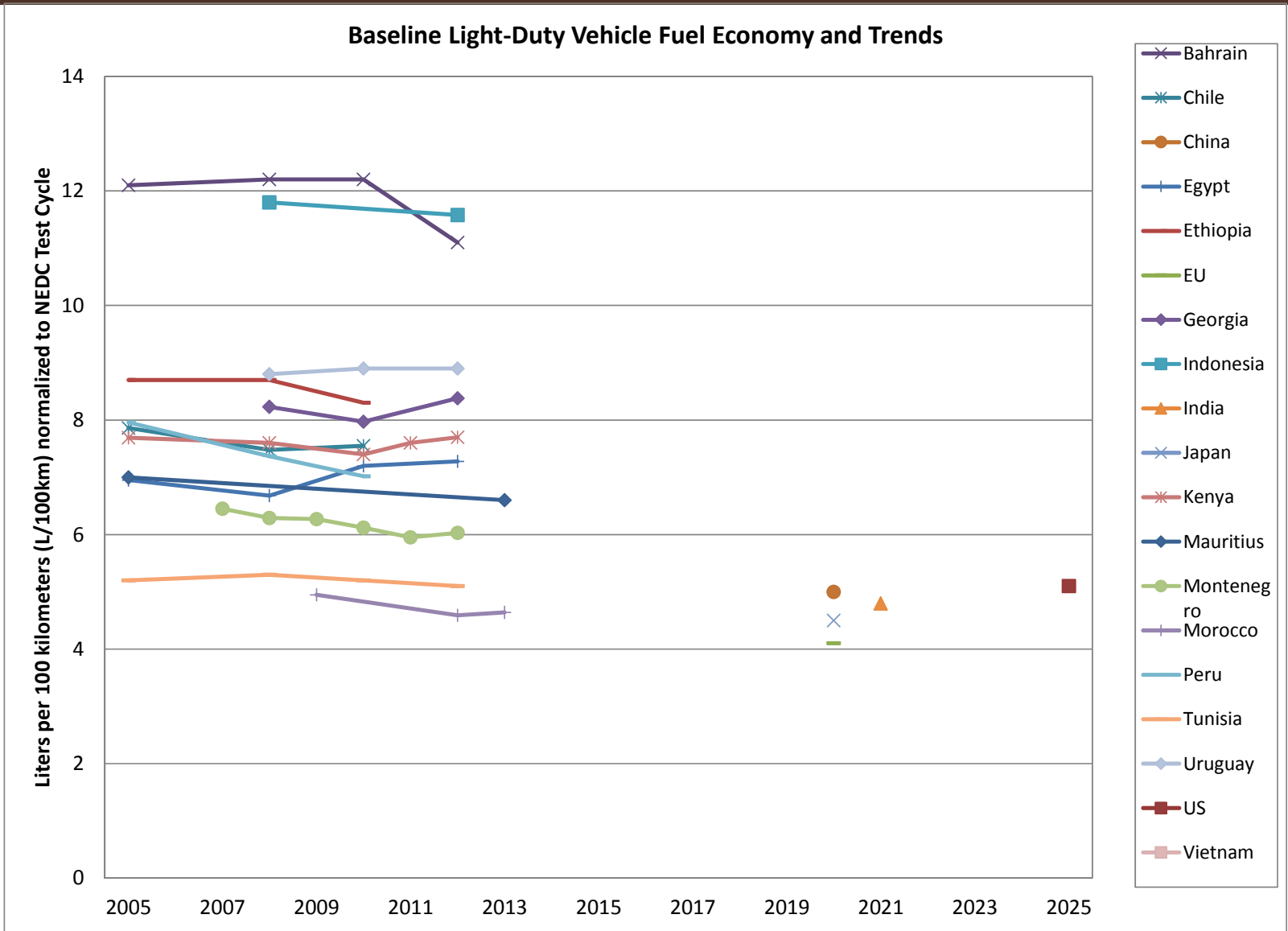
The IEA's fuel economy readiness index

Countries are at various points in developing fuel economy policies



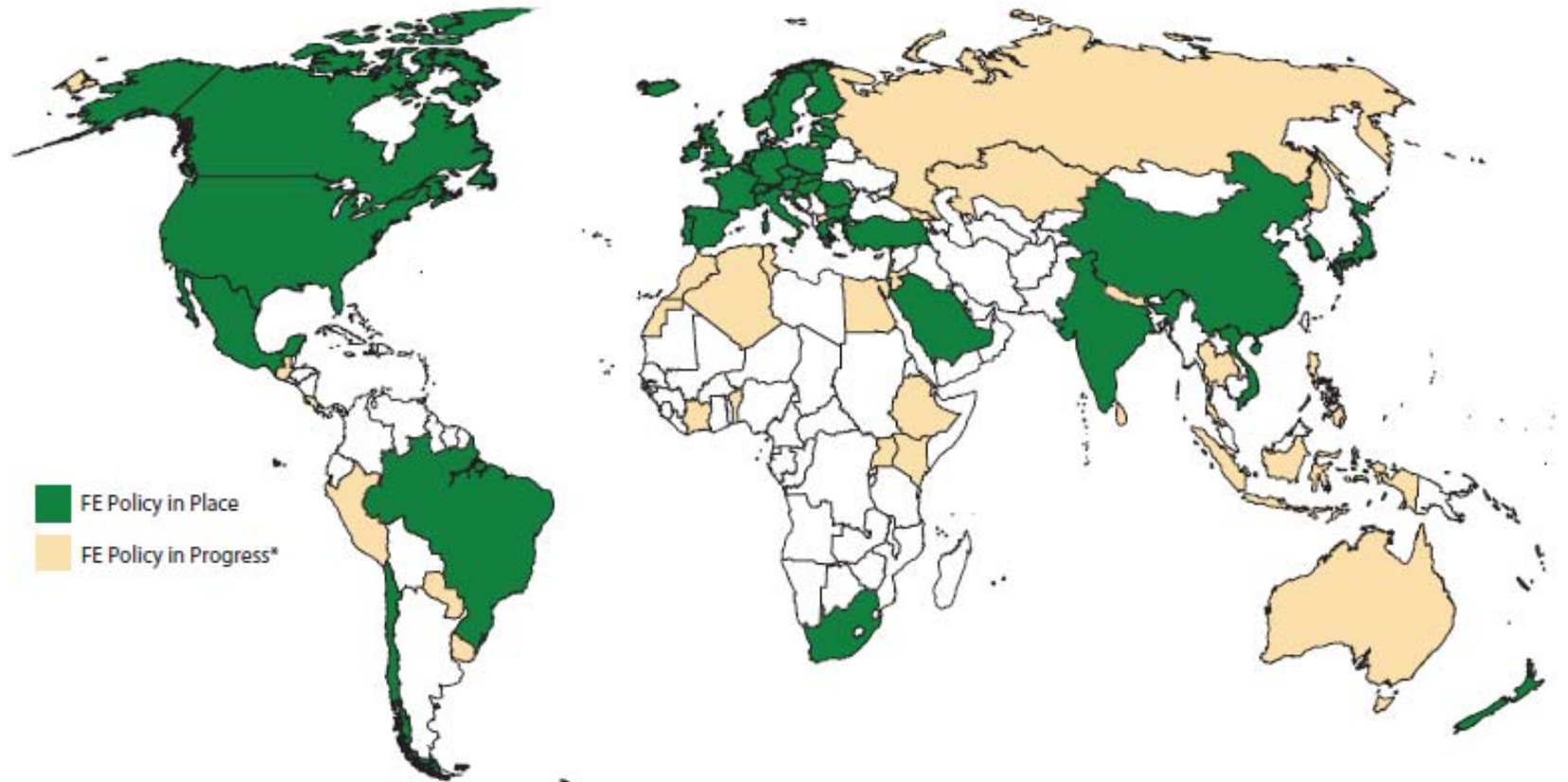
Source: IEA Fuel Economy Roadmap, July 2012

UNEPs Country engagement picture



UNEPs Mapping of Fuel Economy Policy Progress

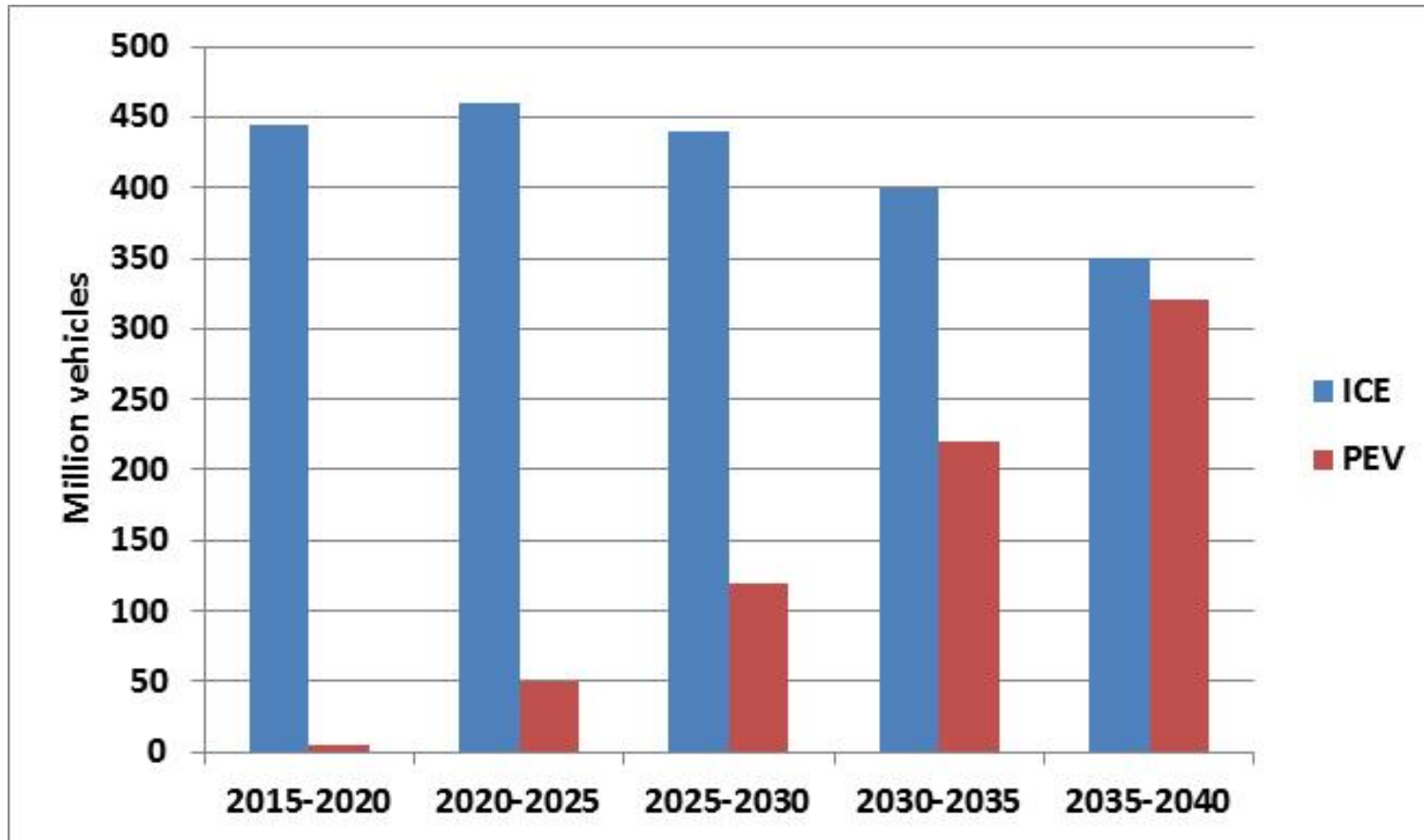
Global Progress on Fuel Economy Policy
(2015)



* GFEI partners are involved in supporting all these countries except in Brasil
June 2015 - For more information visit www.globalfueleconomy.org

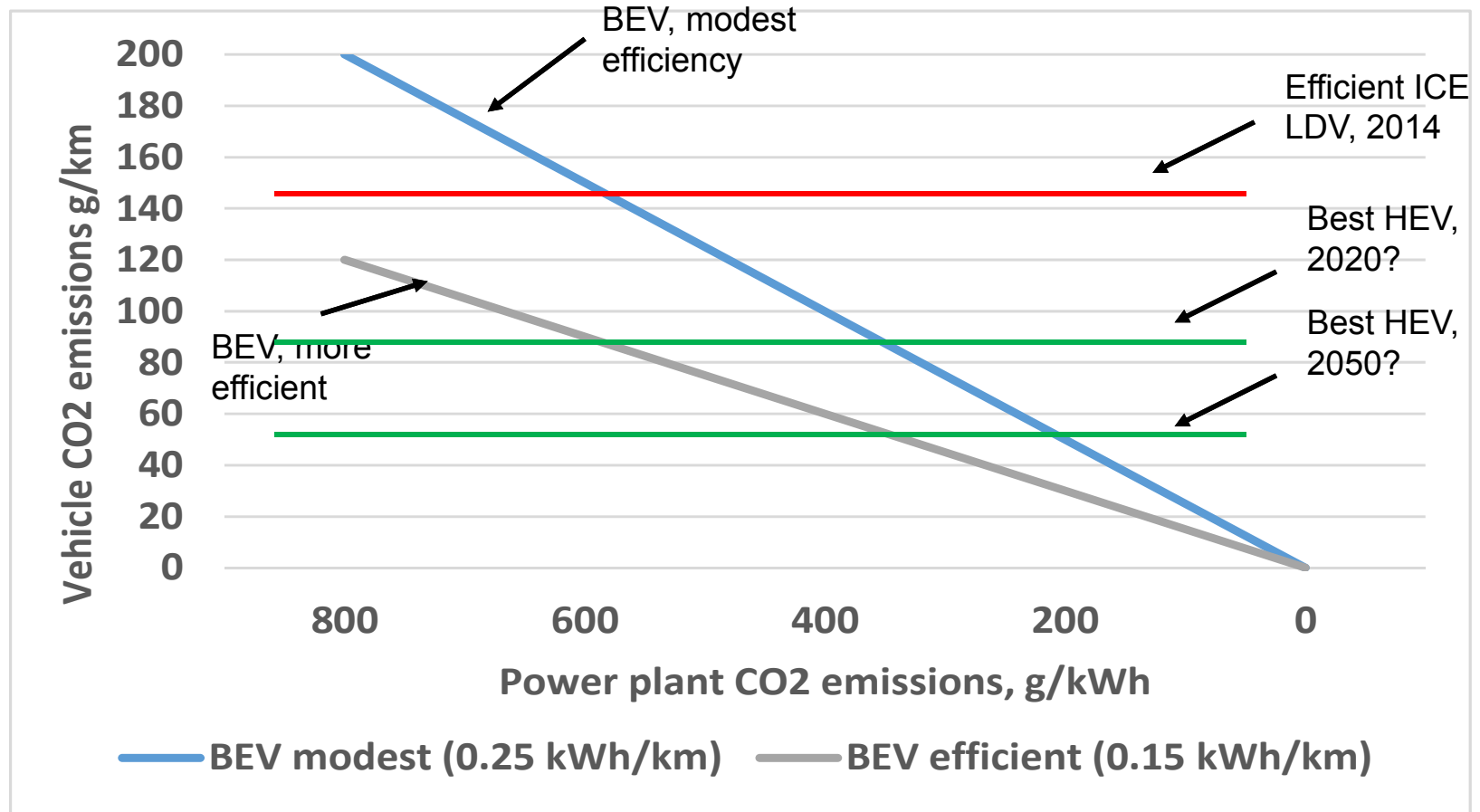
Global Fuel Economy Initiative (GFEI)

The next 2-decades will likely be ICE-driven, even with rapid Plug-in Vehicle (PEV) growth



Note: this aligns with the IEA ETP 2012 2DS Scenario except with only 5 million PEV sales by 2020 instead of 20 million.

Electric vehicles v. gasoline/diesel, with declining power plant CO2 emissions



Battery electric vehicles will probably be needed to get below 50 g/km, but we will also need deeply decarbonized electricity generation
 (Based on NRC, 2013 assumptions for fuel economy)

Conclusions

Reaching the GFEI target to cut by half specific light-duty vehicle fuel consumption by 2030 requires:

- **to keep scaling up the market coverage of fuel economy regulations;**
- **to set strengthened fuel economy improvement targets for the 2015-2030 period (especially in the non-OECD);**
- **to monitor the stringency of fuel economy improvement targets already in place;**
- **to keep monitoring the developments of fuel economy worldwide.**



Thank You!

Lew Fulton
Imfulton@ucdavis.edu