



Midterm Evaluation of the 2022-2025 Light-Duty Vehicle Greenhouse Gas Standards

Asilomar Transportation & Energy 2015

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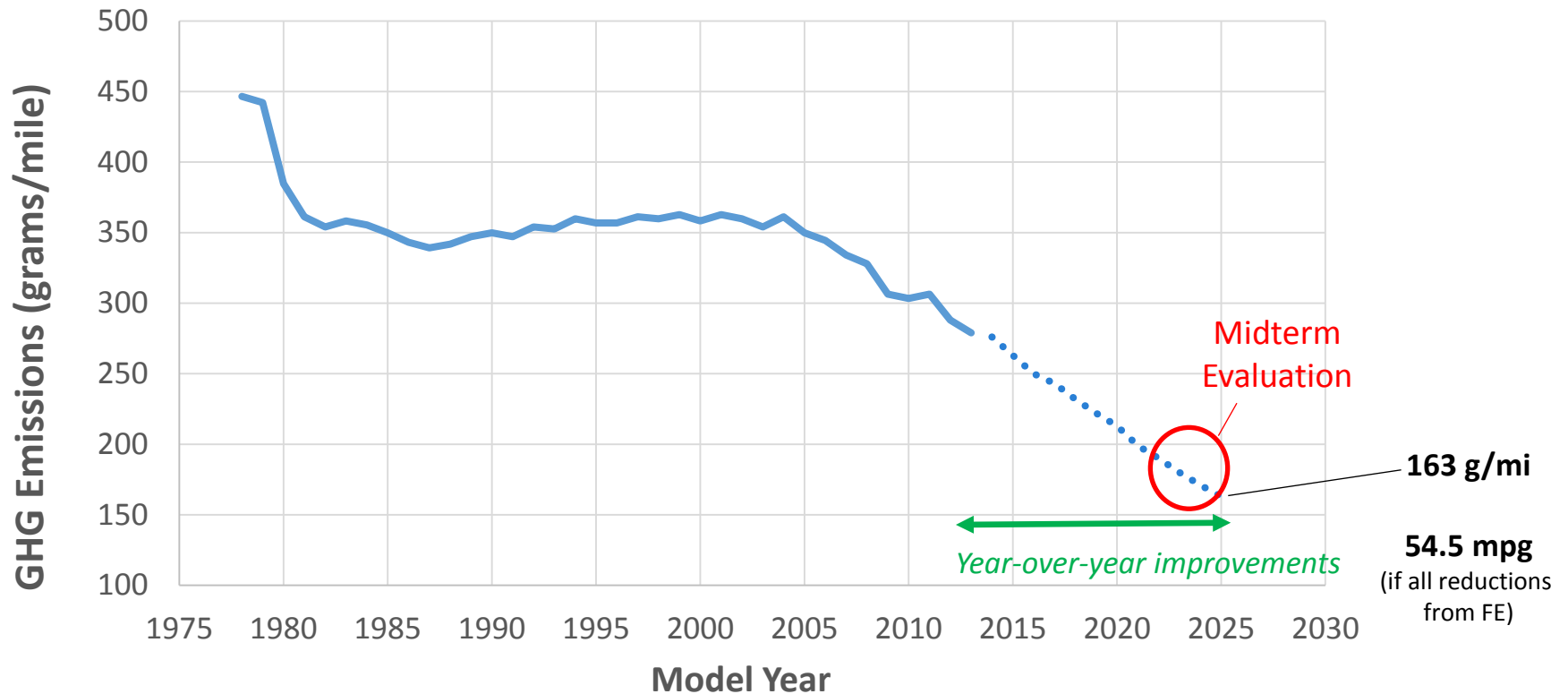
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Office of Transportation and Air Quality

Overview

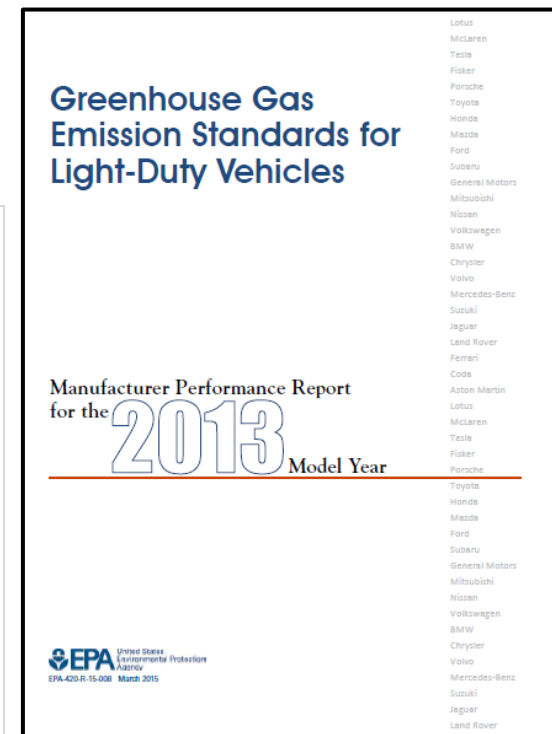
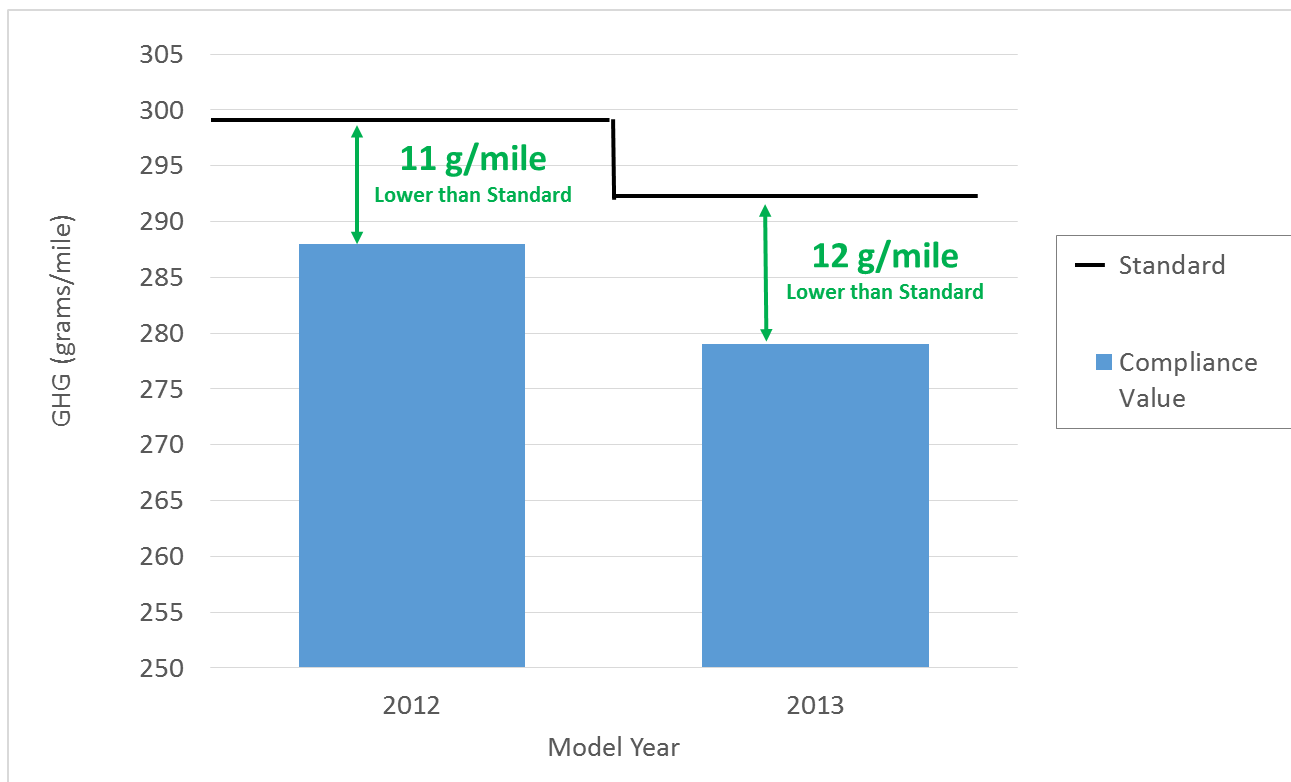
- Light-duty GHG progress thus far
 - Auto manufacturers, technologies, vehicles
- Midterm evaluation
 - Purpose, EPA research areas, process & timing

U.S. GHG/Fuel Economy standards provide significant benefits to climate, oil, consumers

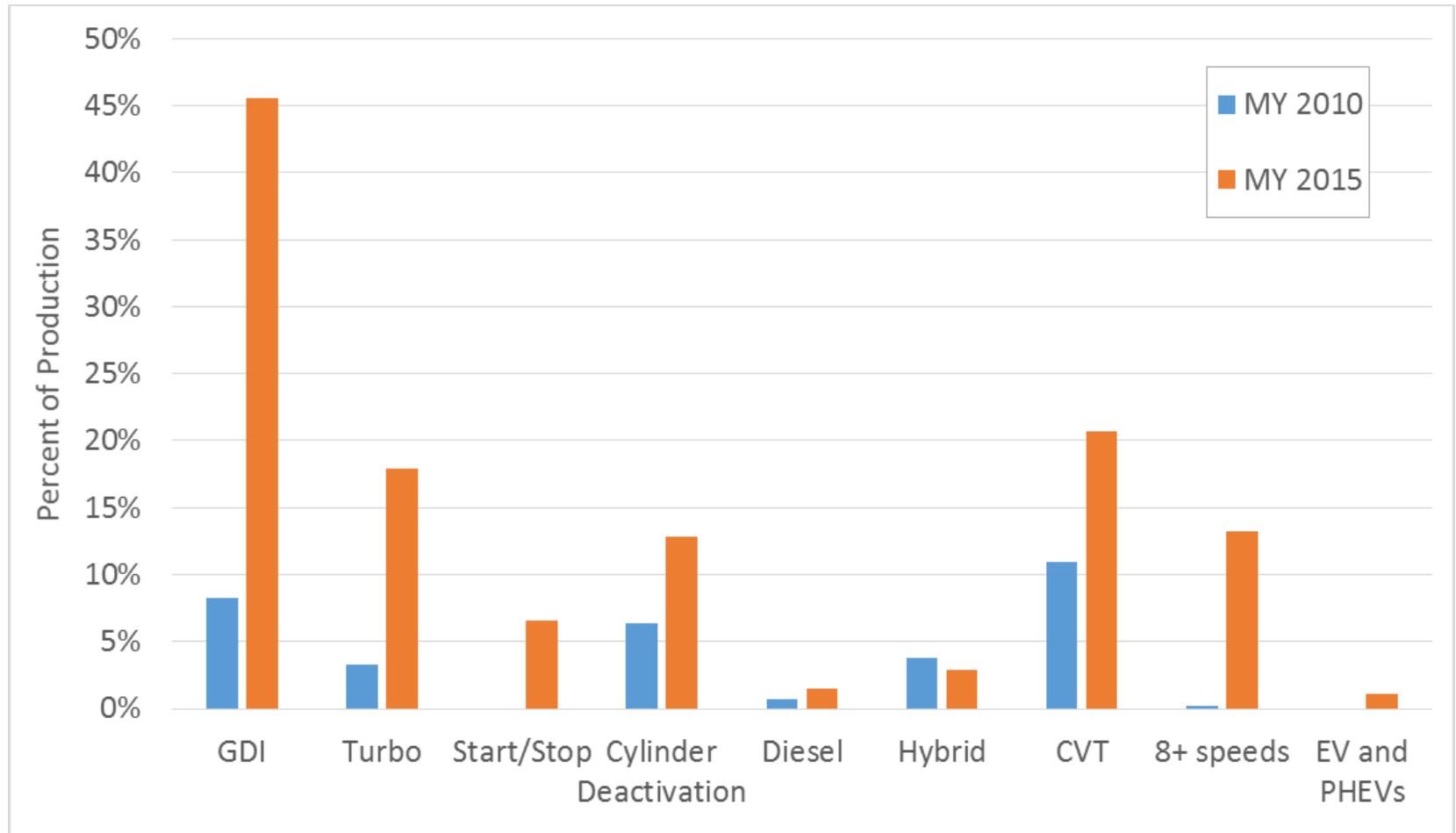


GHG Compliance ... Good News So Far

- Automakers beat standards first two years
- Widespread use of credit flexibilities

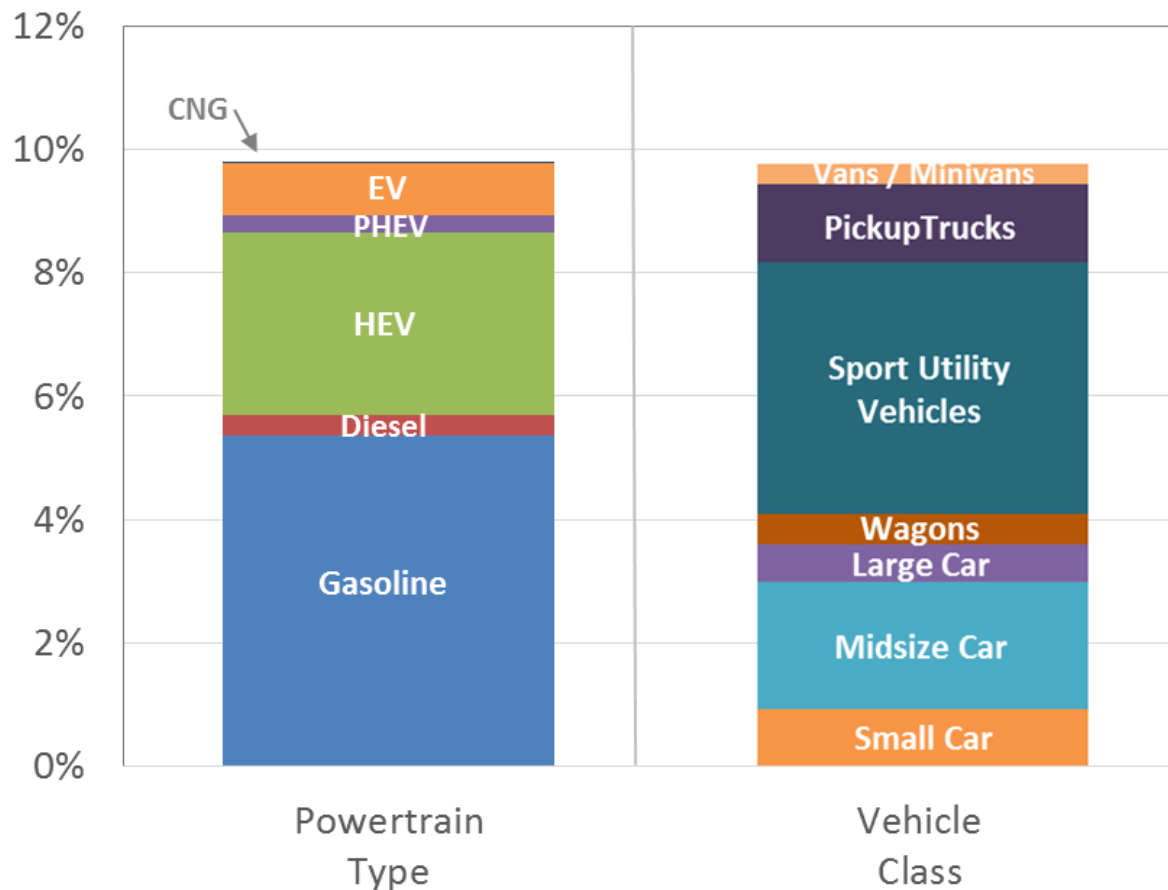


Manufacturers are aggressively adopting technology

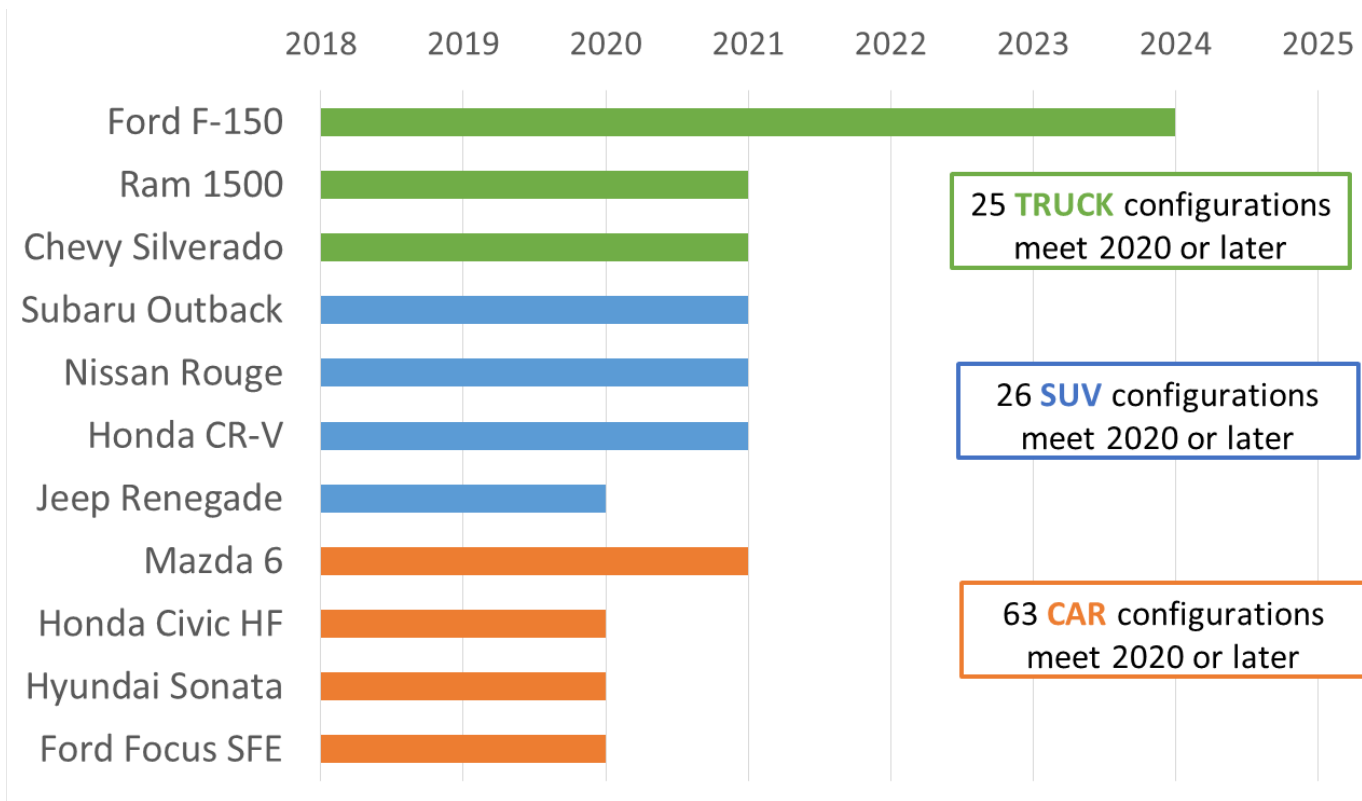


Vehicles are meeting future standards -- with mostly gasoline powertrains, across segments

MY2015 Fleet Volume That Meets MY2020 Standards



Many of today's top-selling vehicles* already meet** future GHG standards



*At least one variant of MY 2015 vehicle model (see Appendix)

** Assumes air conditioning credits

Vehicles are meeting future standards with a variety of technologies

		Trucks			SUVs				Cars			
		Ford F-150	Ram 1500	Chevy Silverado	Subaru Outback	Nissan Rouge	Honda CR-V	Jeep Renegade	Mazda 6	Honda Civic HF	Hyundai Sonata	Ford Focus SFE
Engine	Diesel		X									
	Turbocharging	X						X			X	X
	High Compression Atkinson								X			
	GDI	X		X			X		X		X	X
	Cylinder Deactivation			X								
	Stop-start	X										
Transmission	8+ Speed Transmissions		X									
	CVT				X	X	X			X		
Road Loads	Mass Reduction*	X					X		X			
	Tires**		X			X	X		X	X	X	
	Aero**	X	X	X							X	X

*Compared to MY2008 model's sales-weighted curb weight

** Top 25% of class + other active/passive aero features

NAS Report on Fuel Economy Technologies

- Comprehensive study – good early input to midterm evaluation process
- Consistent with Agencies' analysis, affirmed that 2025 standards can be met through advanced gasoline vehicle technologies
- Many recommendations in line with our research plan already underway, others help prioritize

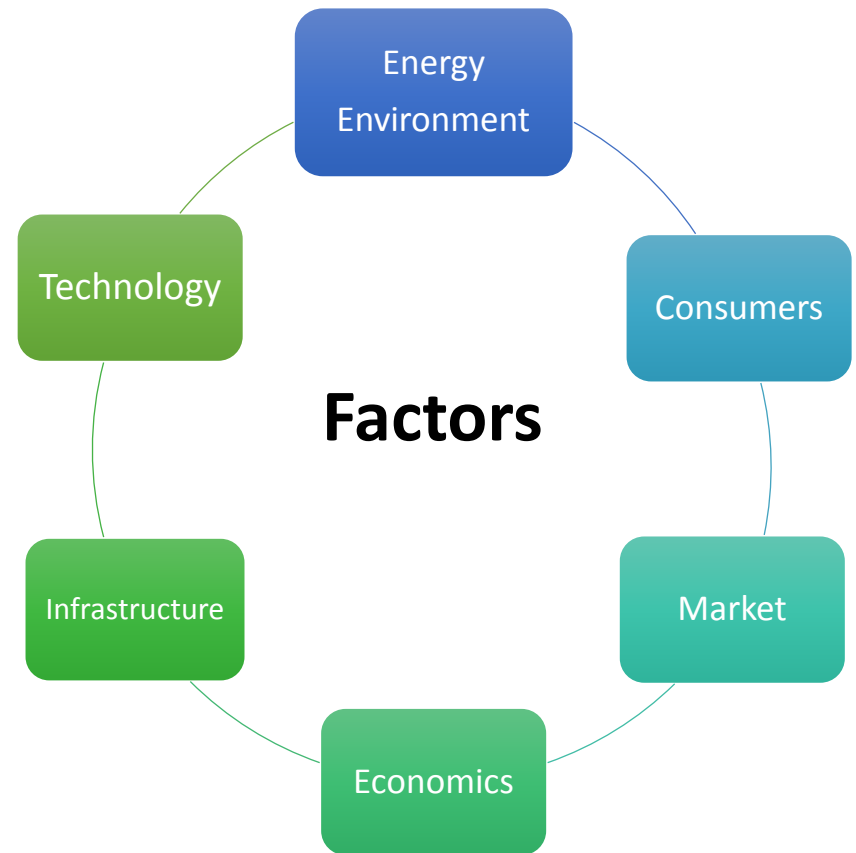
MYTHS



- Standards force small cars
 - Footprint-based standards designed to preserve consumer choice
 - Separate footprint curves for cars/trucks
- Low gasoline prices threaten compliance
 - Industry is complying as sales are booming
 - If fleet mix changes, standards adjust
- Low hybrid/electric vehicle sales mean 2025 standards can't be met
 - EPA standards are performance-based – no technology mandate
 - EPA projected—and NAS reaffirmed—2025 compliance largely from gasoline vehicles

Midterm Evaluation – Overview

- Technical review of longer term standards for 2022-2025
- In coordination with NHTSA and CARB
- EPA decision on whether standards are appropriate. Could go one of 3 ways:
 - Standards remain same
 - More stringent
 - Less stringent



Midterm Evaluation – EPA Research Areas

- Researching advanced engine and transmission technologies
- Mass reduction feasibility/cost study for a full-size pickup
- Cost teardowns on mild hybrid, diesel, turbo-downsized engine, others
- Manufacturer “learning by doing” costs assessment
- Research on consumers, market, economic issues
- Modeling tools: vehicle simulation, feasibility/cost, technology packages
- Collaboration: NHTSA, CARB, DOE, Canada



EPA's Powertrain Assessment

- Testing 20+ vehicles/engines across a wide range of powertrains & segments
 - Cars, SUVs, pickups
 - Naturally aspirated and boosted engines
 - Gasoline and diesel
 - I4 and V6 engines
 - 6 and 8+ speed AT/DCT and CVT transmissions

		N/A Gasoline	Turbo Gasoline	Diesel
Cars	I3/I4	SkyActiv 2.0L 14:1 [demo engine]	Mahle DI3 [demo engine]	
		2013 Malibu 2.5L 6AT [eng mapped by FEV]	2013 Escape 1.6L EcoBoost*	
		2013 Mazda 6 SkyActiv 2.5L* 8MT	2013 Focus 1.6L EcoBoost* [Euro]	
		2013 Mazda 3 SkyActiv 2.0L* 13:1 8MT	2015 Volvo S60 2.0L Drive-E*** 8AT	
		2013 Mazda 3 SkyActiv 2.0L* 14:1 [Euro]	2013 Sonata 2.0L 6AT [tested by TC]	
		2013 Mazda 3 SkyActiv 2.0L 13:1 6AT	2015 Forester 2.0L* [tested by TC]	
		2013 Altima SV 2.5L*** Jatco CVT8	PSA 1.6L ** [tested by SwRI]	
	V6	Chrysler 300 3.6L Pentastar 8AT		2013 Mercedes E350 3.0L 7AT
		Dodge Charger 3.6L Pentastar 5AT		
		Dodge Charger 3.6L Pentastar 8AT		
SUVs Trucks	V6	2014 RAM HFE 3.6L Pentastar*** 8AT	2015 Alum F150 2.7L EcoBoost*	2014 RAM 1500 3.0L EcoDiesel VM 8AT
		2014 Silverado 4.3L Deac* EcoTec3		BMW X5 35d 3.0L* (I6) [tested by FEV]

Midterm Evaluation – Market Research

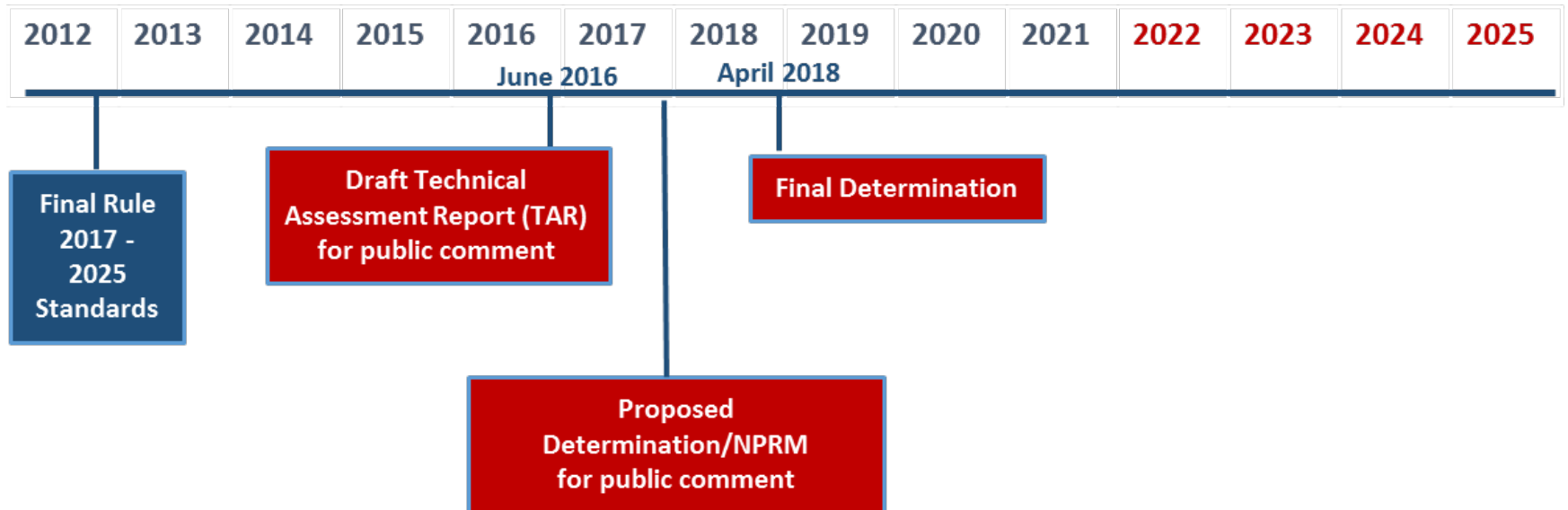
- Vehicle sales
- Fleet mix changes (cars v. trucks)
- Technology penetration in fleet
- Consumer satisfaction surveys
- Automotive reviews

Automotive Reviewers Like Fuel Economy Technologies

- EPA study finds 4 out of 5 mentions of MY 2014 FE technologies in auto reviews have positive or neutral ratings
 - For all technologies, positives outweigh negatives
- Most positives (80-100%)
 - Active aero, mass reduction, cylinder deactivation, LEDs, GDI, turbocharging
- Least positives (but still >50%)
 - CVTs and stop-start
- But no universal issues with technologies -- some manufacturers implementing better than others



Midterm Evaluation Process -- Timeline



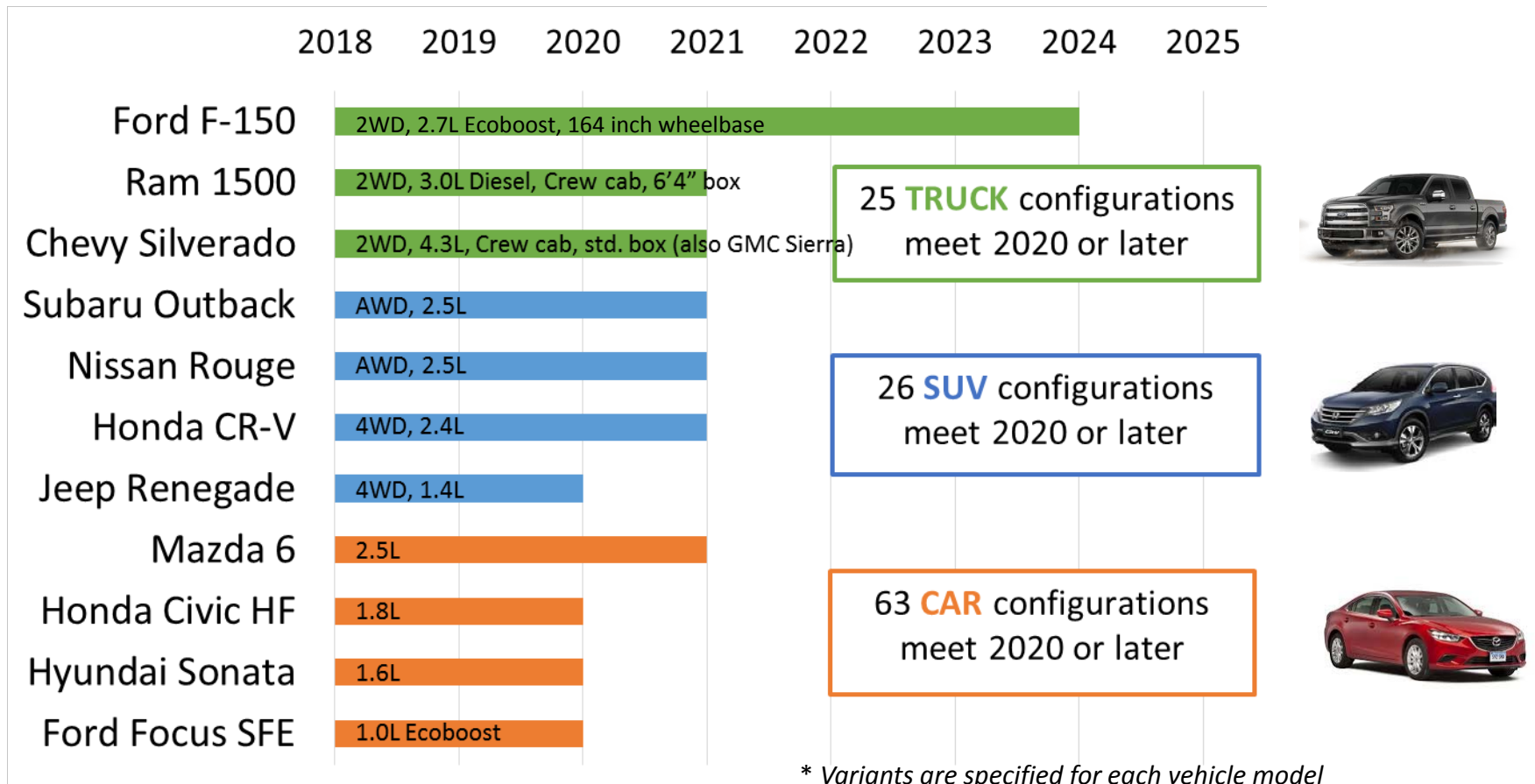
Going forward

- Extensive stakeholder outreach
- Data-driven
- Transparent: we'll share results of technical work along the way

www.epa.gov/otaq/climate/mte.htm

Appendix

Many of today's top-selling vehicles* already meet** future standards (with variant details)



* Variants are specified for each vehicle model

**Assumes addition of air conditioning credits phasing in per EPA rule projections, up to 18.8 g/mi for cars and 24.4 g/mi for trucks in 2021-2025

Automotive Reviews -- Technology results (review level)

Efficiency Technology Categories		Coding level	Negative		Neutral		Positive		Total
Active Air Dam		Active air dam	-	-	-	-	6	100%	6
Active Grill Shutters		Active grill shutters	-	-	-	-	1	100%	1
Active Ride Height		Active ride height	-	-	1	33%	2	67%	3
Electric Assist or Low Drag Brakes		Electric assist or low drag brakes	1	17%	2	33%	3	50%	6
Lighting - LED		Lighting-LED	1	8%	2	15%	10	77%	13
Low Rolling Resistance Tires		Low rolling resistance tires	4	25%	4	25%	8	50%	16
Mass Reduction		Mass reduction	-	-	8	12%	59	88%	67
Passive Aerodynamics		Passive aerodynamics	3	8%	7	19%	27	73%	37
Powertrain	Engine	Cylinder deactivation	1	3%	4	14%	24	83%	29
		Diesel	7	12%	10	17%	41	71%	58
		Electronic power steering	44	24%	35	19%	107	58%	186
		Full electric	2	9%	6	27%	14	64%	22
		GDI	5	8%	6	10%	48	81%	59
		General Engine	85	16%	79	15%	376	70%	540
		Hybrid	16	24%	9	13%	43	63%	68
		Plug-in hybrid electric	4	14%	6	21%	18	64%	28
		Stop-start	15	31%	8	16%	26	53%	49
		Turbocharged	16	8%	19	10%	154	81%	189
	General Powertrain	General Powertrain	9	9%	19	20%	69	71%	97
	Transmission	CVT	34	34%	16	16%	49	49%	99
		DCT	15	25%	9	15%	36	60%	60
		General Transmission	26	19%	24	18%	87	64%	137
High speed automatic		49	14%	70	20%	237	67%	356	
		Total	337	16%	344	16%	1,445	68%	2,126

Note: These data are slightly updated since a preliminary presentation given at the Assn. of Environmental and Resource Economists conference, June 4, 2015, which includes more details on the EPA automotive review content analysis study and can be found at: <http://www.epa.gov/otaq/climate/documents/mte/epa-aere-content-analysis-auto-reviews.pdf>