

# EPA'S LIGHT-DUTY VEHICLE EMISSIONS CONTROL PROGRAMS

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# Topics

- Tier 3 Vehicle and Fuels Program
- Light-duty Greenhouse Gas National Program
- Midterm Evaluation of 2022-2025 Light-duty GHG Standards

# TIER 3 VEHICLE AND FUELS PROGRAM

# Tier 3 Vehicle and Fuel Program - Overview

- **Systems approach to reducing motor vehicle pollution: more stringent vehicle standards enabled by gasoline sulfur control**
- **Creates a harmonized vehicle program**
  - Coordinated with California Low Emission Vehicle (LEV) III standards
  - Enables auto industry to produce and sell one vehicle nationwide
- **Part of comprehensive approach to create cleaner, more efficient vehicles**
  - Phase in begins model year (MY) 2017
  - Coordinated compliance with both LEV III and light-duty GHG/fuel economy standards for MY 2017-2025

- **Tier 3 standards will have immediate health and air quality benefits when they take effect in 2017**
  - Reduce ozone, particulate matter (PM), and toxics
- **Help States and Local areas attain and maintain ozone and PM NAAQS**
  - Tier 3 provides cost-effective national reductions that avoid more expensive local controls
- **Reduce pollution near roads**
  - More than 50 million people live, work, or go to school near major roads

***“There is not another air pollution control strategy that we know of that will produce as substantial, cost-effective and expeditious emissions reductions.”***

*--Bill Becker, Executive Director of National Association of Clean Air Agencies*

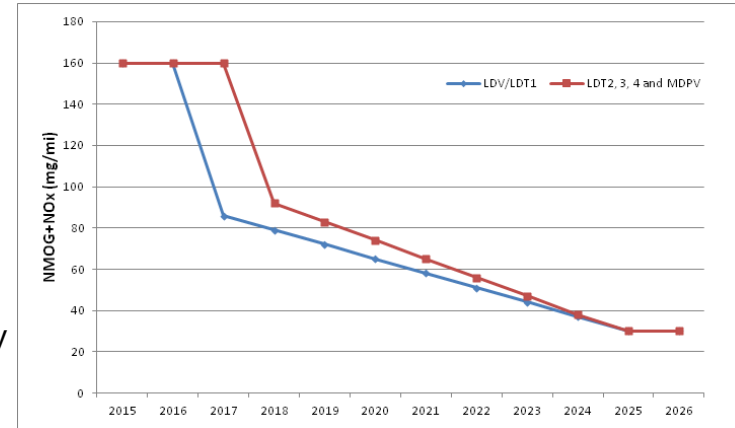
# Tier 3 – Vehicle and Fuel Standards

- **Vehicles**

- Phase in 2017 - 2025
- Tighter VOC and NO<sub>x</sub> tailpipe standards
  - 80% reduction from today's fleet average
- Tighter PM tailpipe standard
  - 70% reduction in per-vehicle standard
- Evaporative emissions standards
  - Reduced fuel vapor emissions and improved system durability
- Revised certification test fuel from E0 to E10 to better reflect in-use gasoline

- **Fuels**

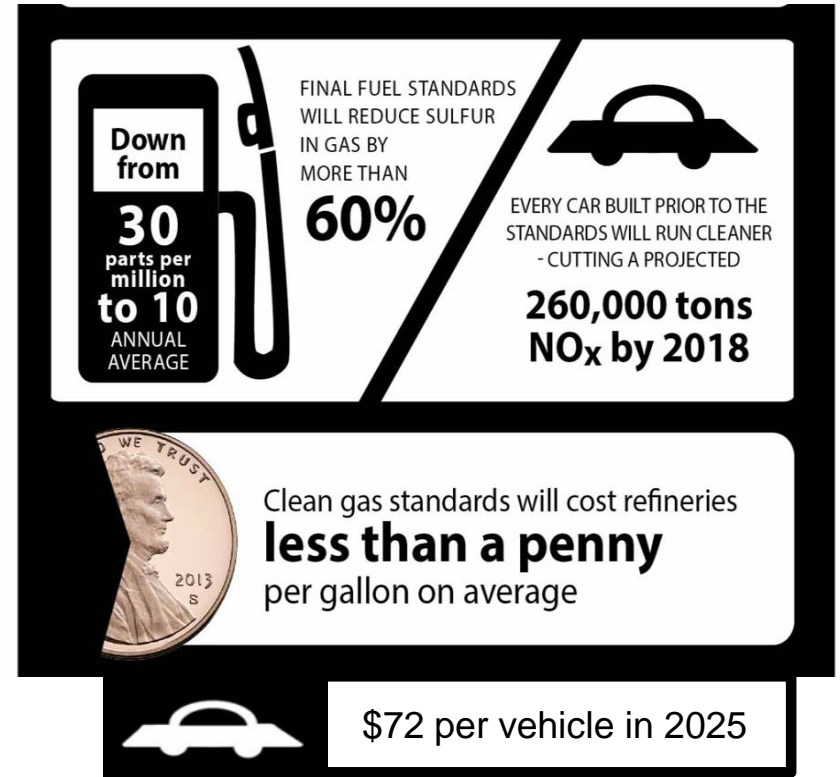
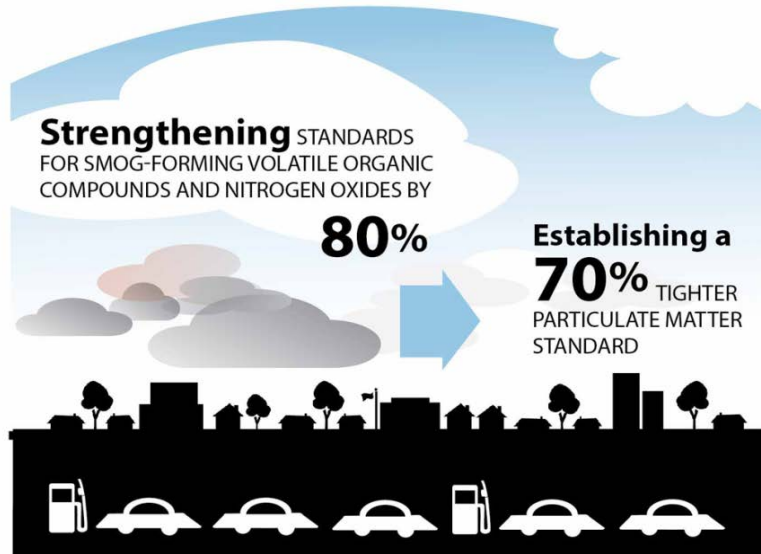
- Lower annual average sulfur standard from 30 to 10 ppm, starting January 1, 2017
- Maintain the current per-gallon sulfur caps (80 ppm at refinery gate, 95 ppm at retail)



# EPA's Tier 3 Cleaner Car and Gasoline Standards

## REDUCING AIR POLLUTION FROM PASSENGER CARS & TRUCKS

TIER 3 VEHICLE & FUEL STANDARDS  
WILL PROVIDE SUBSTANTIAL  
POLLUTION REDUCTION AT LOW COST



### BY 2030, EPA PROJECTS ANNUAL PREVENTION OF:

UP TO **2,000** PREMATURE DEATHS

**50,000**  
RESPIRATORY ILLNESSES  
IN CHILDREN

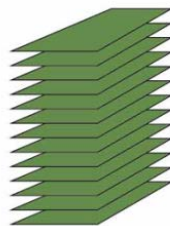
**2,200** ASTHMA ATTACKS



**1.4M** LOST WORK/SCHOOL DAYS & DAYS WHEN ACTIVITY WOULD BE RESTRICTED

THE FINAL STANDARDS ARE EXPECTED TO PROVIDE

**Up to \$13 in health  
benefits for every  
\$1 spent**



TO MEET THE STANDARDS

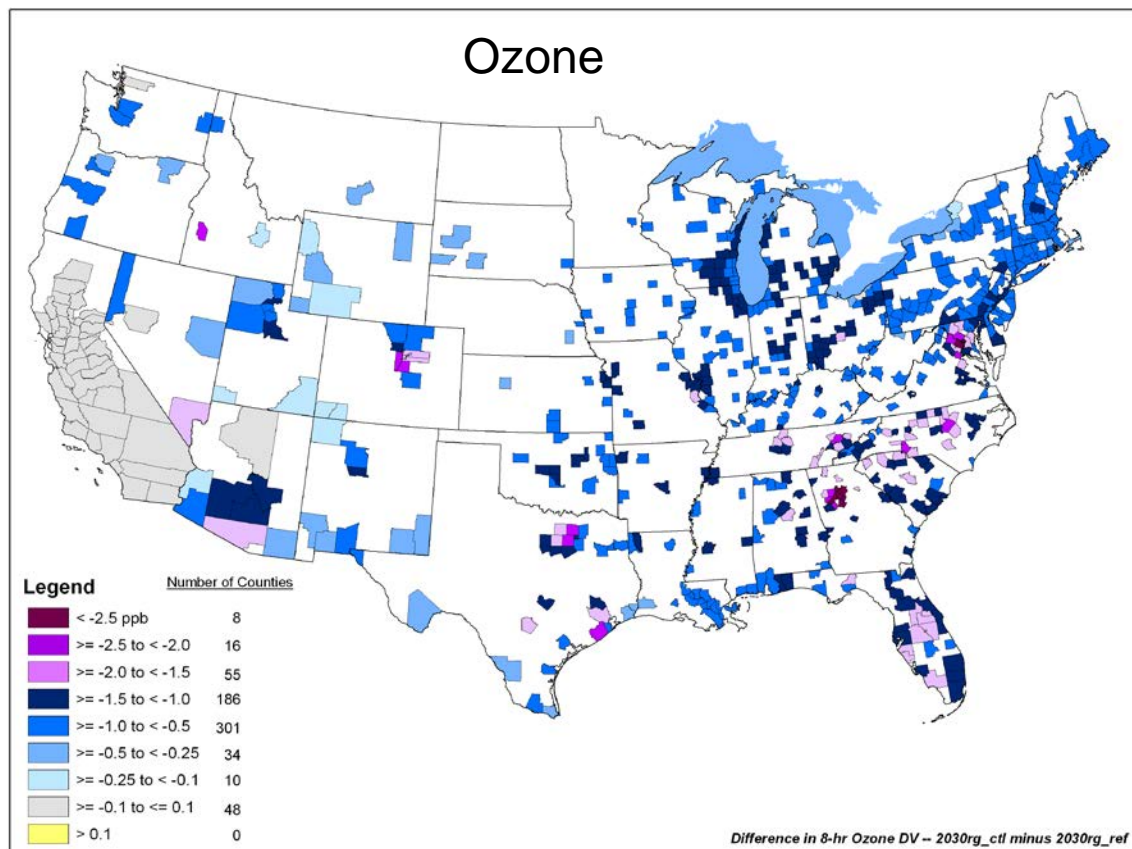
TOTAL HEALTH  
RELATED BENEFITS IN  
2030 WILL BE BETWEEN



**\$6.7-19 billion annually**



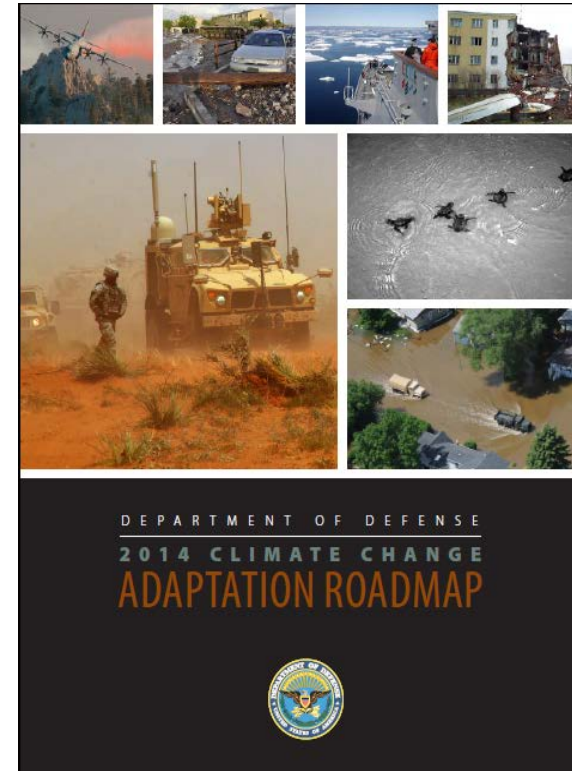
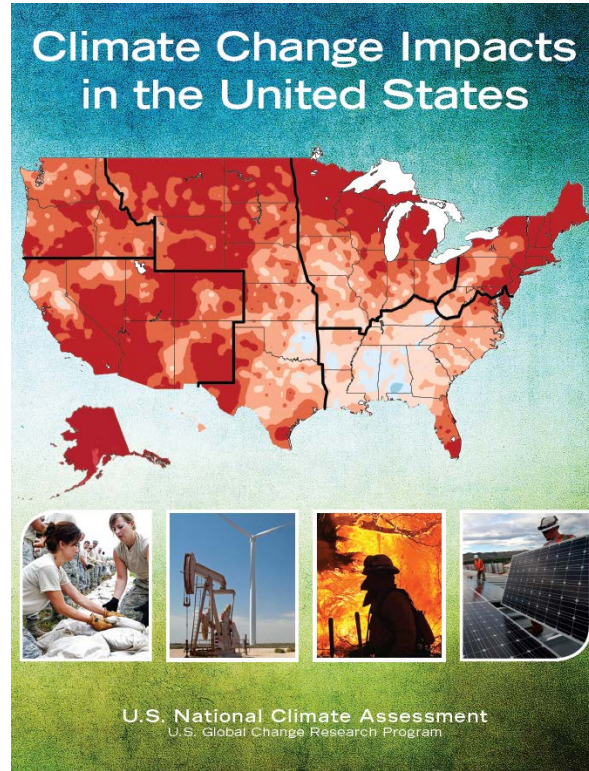
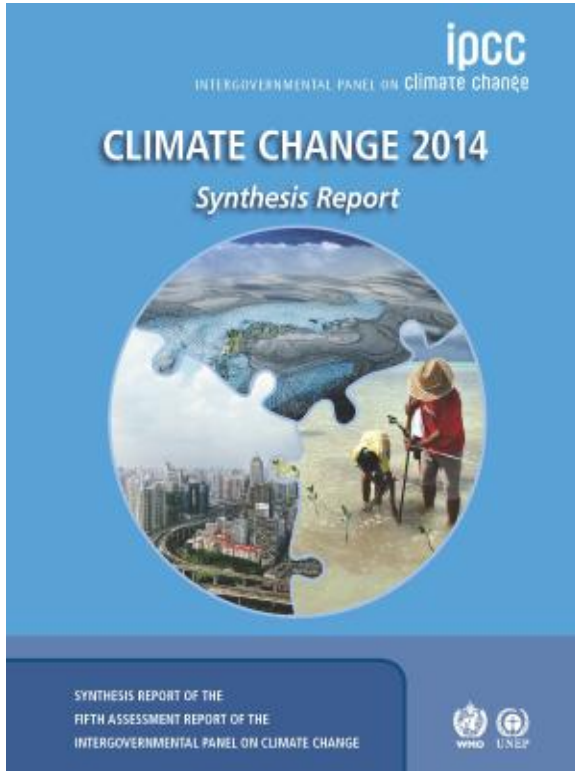
# Tier 3 - Air Quality Impacts in 2030



- **Large decreases in ozone design values across the country**
  - Many counties with decreases over 1 ppb
- **Also meaningful reductions in ambient PM and air toxics**

# LIGHT-DUTY VEHICLE GREENHOUSE GAS NATIONAL PROGRAM

# In 2014 the climate science has become even more certain – and the U.S. prepares for domestic mitigation and global challenges



# Why GHG Emissions Matter

## Global Temperature and CO<sub>2</sub> Emissions

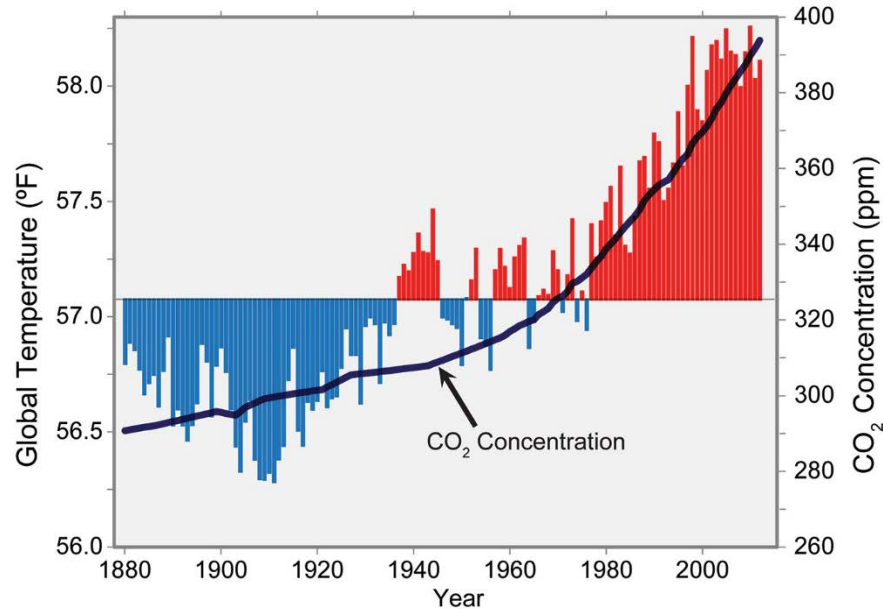


Figure source: updated from Karl et al. 2009

## Global Temperature by Decade

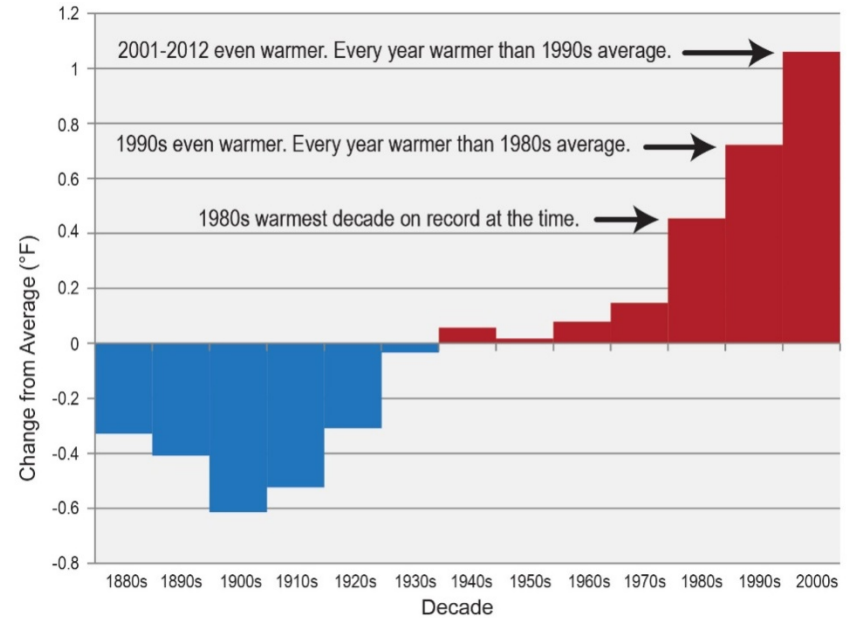
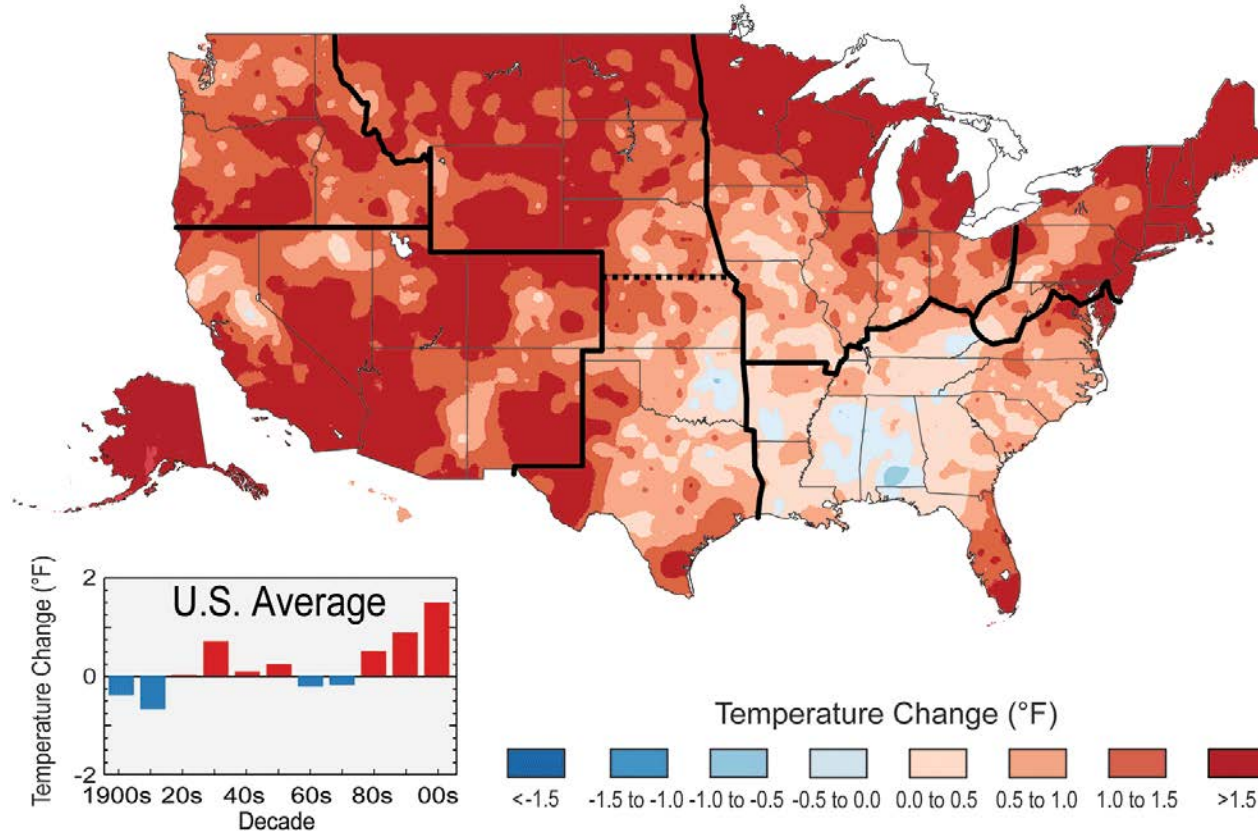


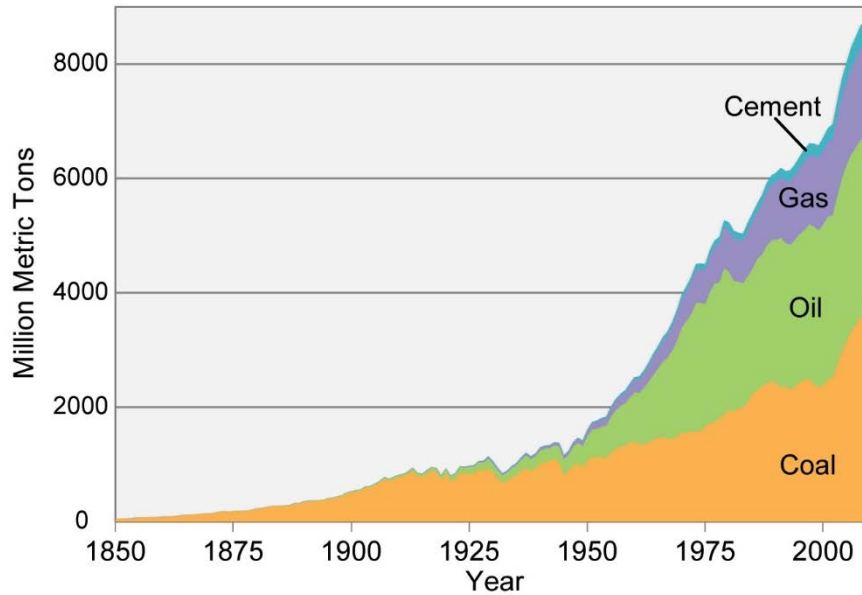
Figure source: NOAA NCDC

# Why GHG Emissions Matter



# Where does the carbon come from?

## Carbon Emissions and Sources



Data from Boden et al. 2012

## Major North American CO<sub>2</sub> Sources & Sinks

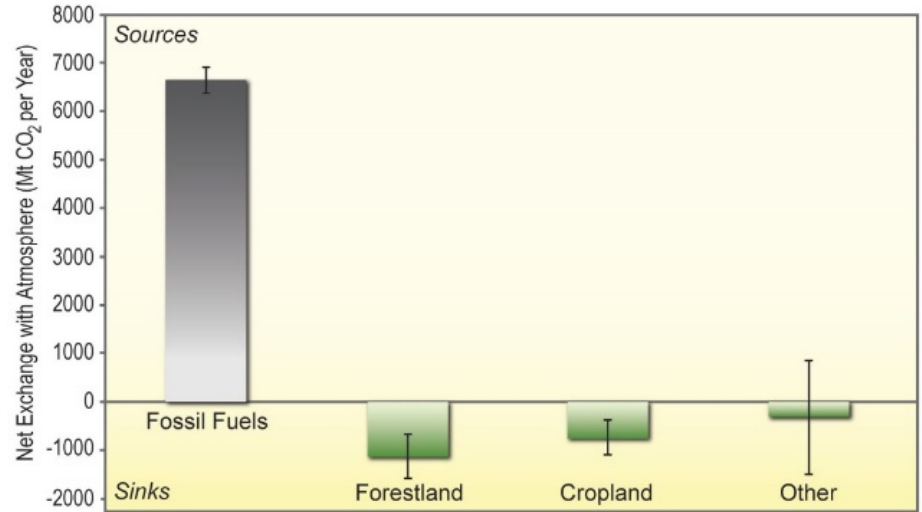
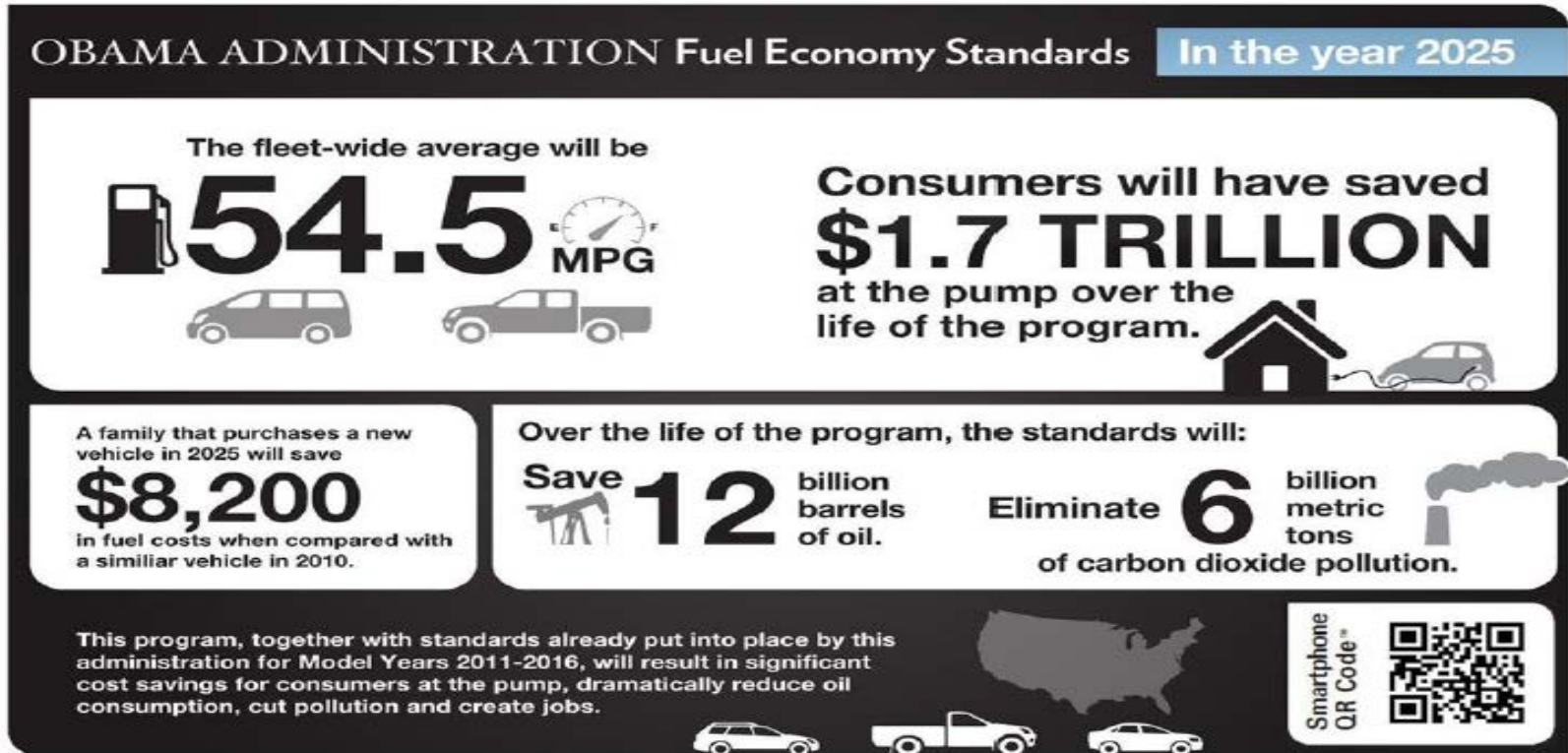


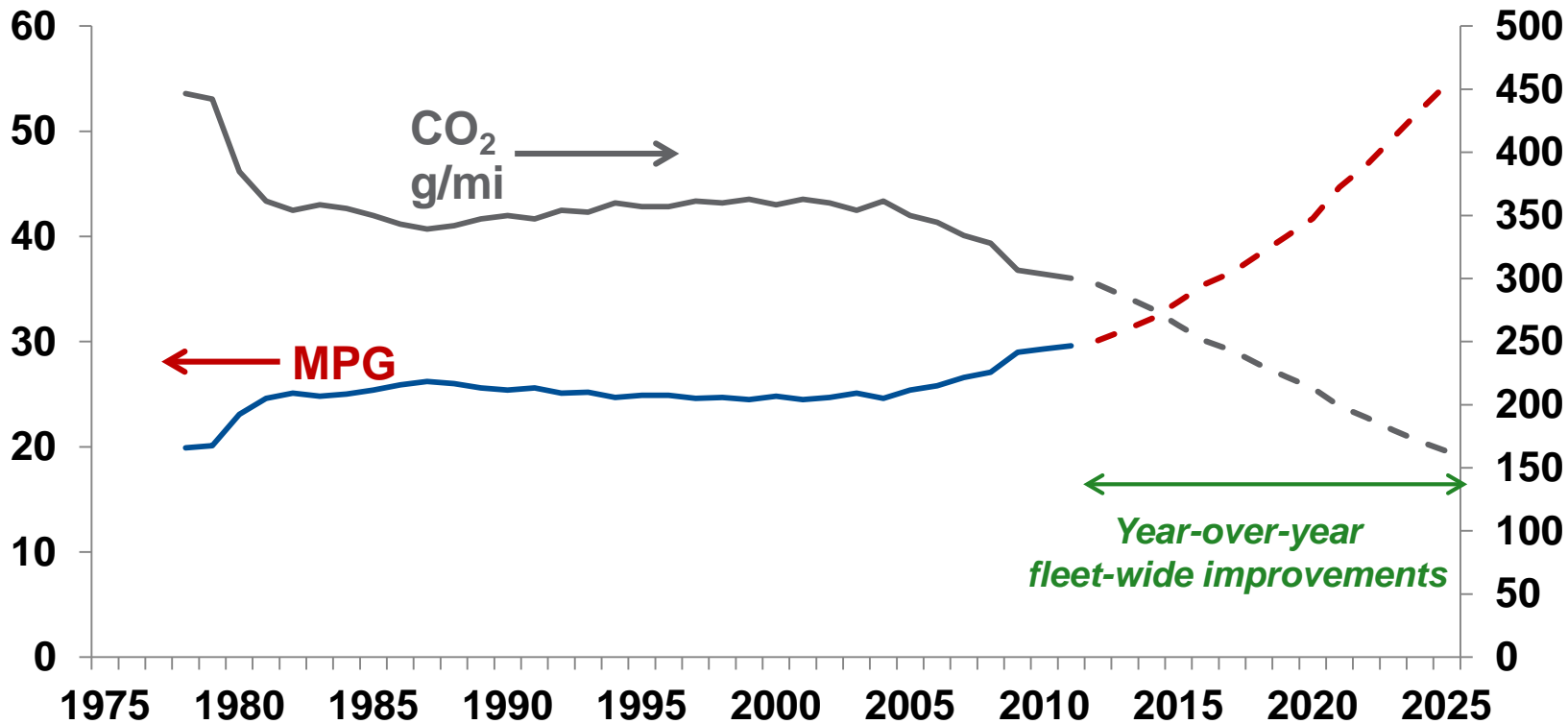
Figure source: King et al. 2012

# National Program has huge GHG, oil, and consumer benefits



WHITEHOUSE.GOV

# GHG/FE Standards Lay Out a 14-Year Transformation for the Auto Industry - 2012-2025

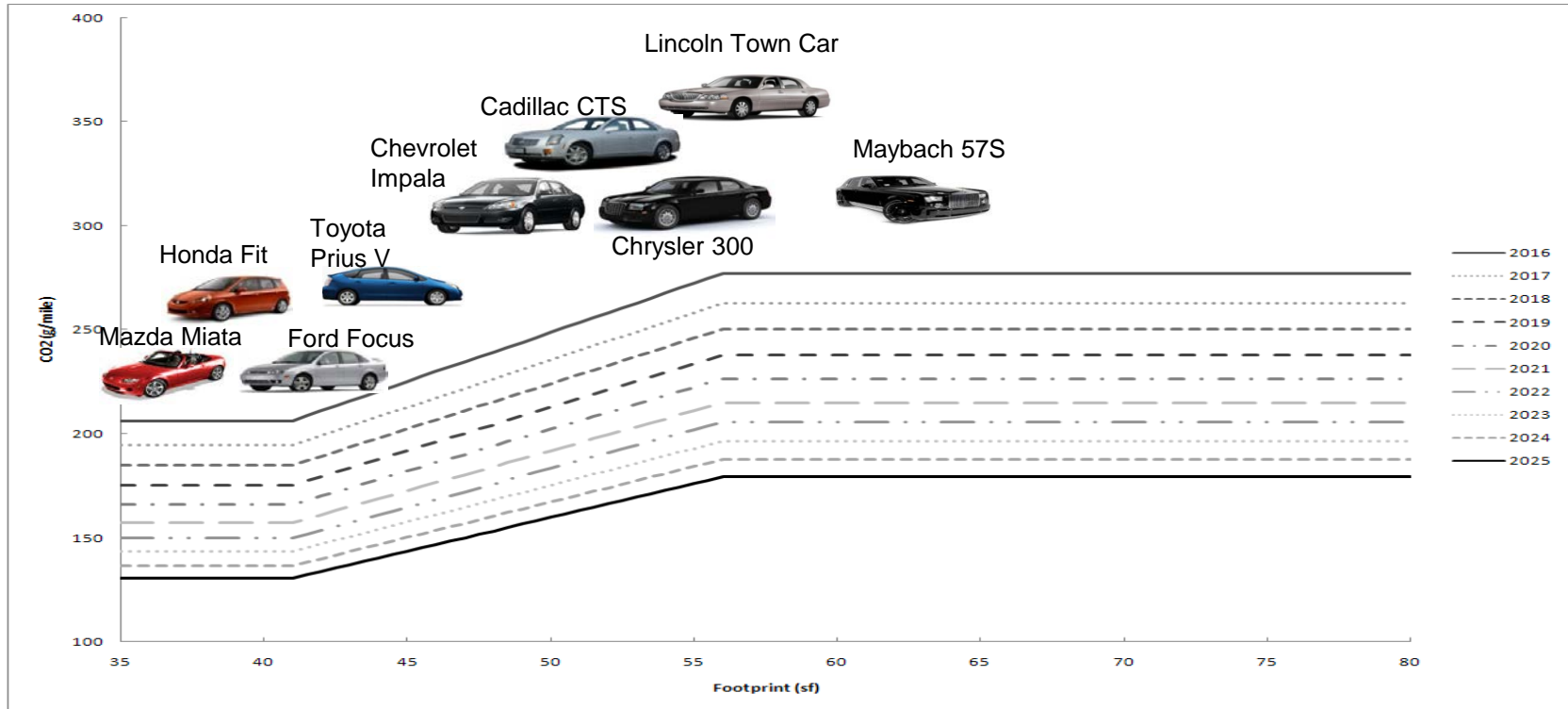


(2 cycle compliance: CAFE 1978-2011, GHG 2012-2025)



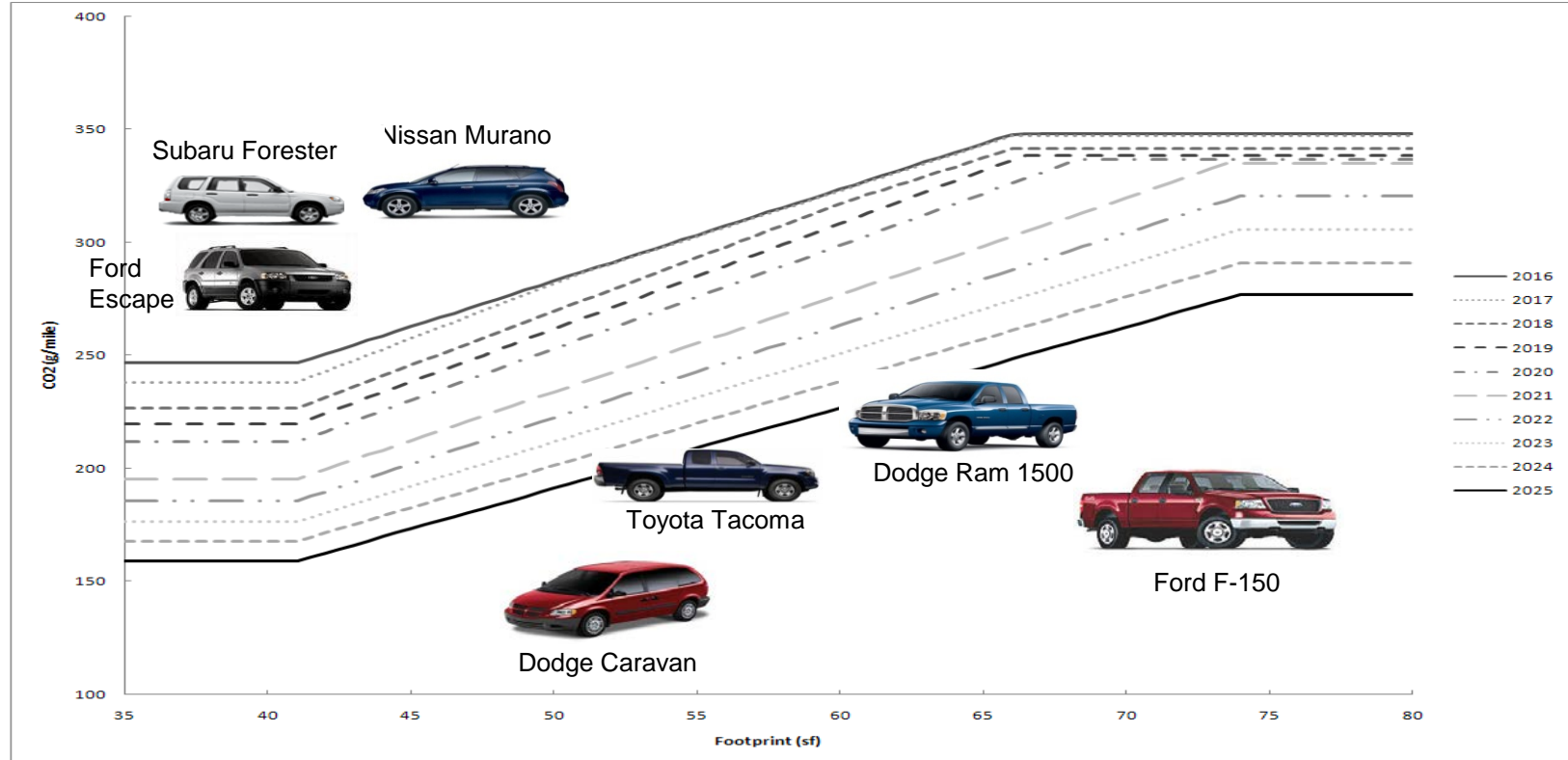
# CO<sub>2</sub> standards based on sales-weighted size (footprint) of each manufacturer's fleet

## Cars - CO<sub>2</sub> Target Curves (with sample vehicle footprints)



# Separate standard curves for Cars and Trucks

## Trucks - CO2 Target Curves (with sample vehicle footprints)



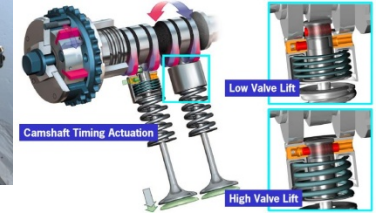
# 2025 CO<sub>2</sub>/Fuel Economy Targets and Labels – example vehicles

Vehicle Type	Example Model	Footprint (sq. ft.)	2025 CO <sub>2</sub> Target (g/mi)	2025 CAFE Target (mpg)	2025 Projected Label (mpg)
<b>Cars</b>					
Compact car	Honda Fit	40	131	61	49
Midsize car	Ford Fusion	46	147	55	44
Fullsize car	Chrysler 300	53	170	48	38
<b>Trucks</b>					
Small SUV	Ford Escape 4WD	43	170	48	38
Midsize crossover	Nissan Murano	49	188	43	34
Minivan	Toyota Sienna	56	209	39	31
Large pickup	Chevy Silverado	67	252	33	26

**2025 Fleet-wide projection of 54.5 mpg translates to ~ 40 mpg avg. label value**

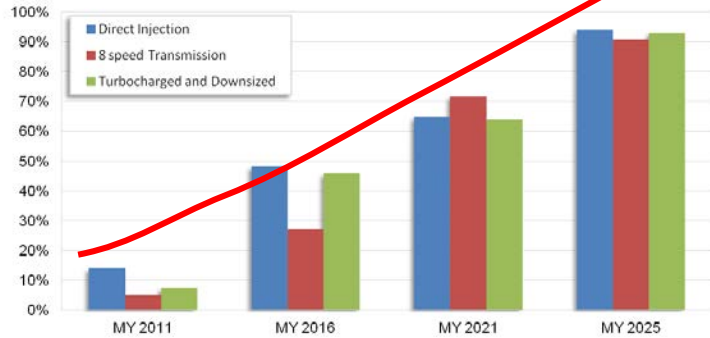
# Technology improvements needed for every aspect of vehicle that contributes energy losses...

- Engine, transmission, drive line
- Aerodynamics, tires, brakes
- Accessories (e.g., A/C, EPS, alternators)
- Mass reduction
- Electrification (start/stop, mild HEV, strong HEV, PHEV, EV)

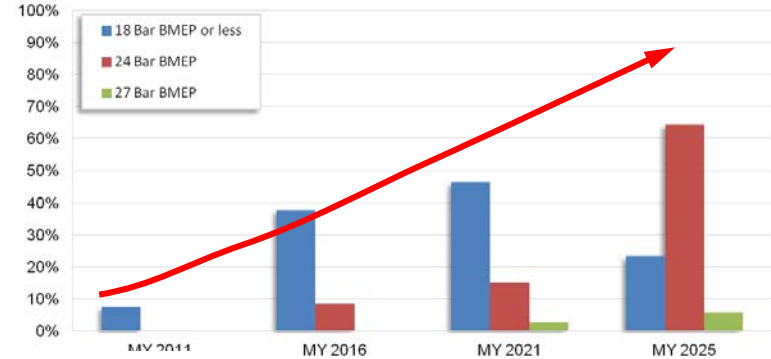


# EPA's Technology Penetrations Project Increasing Use of Advanced Technologies

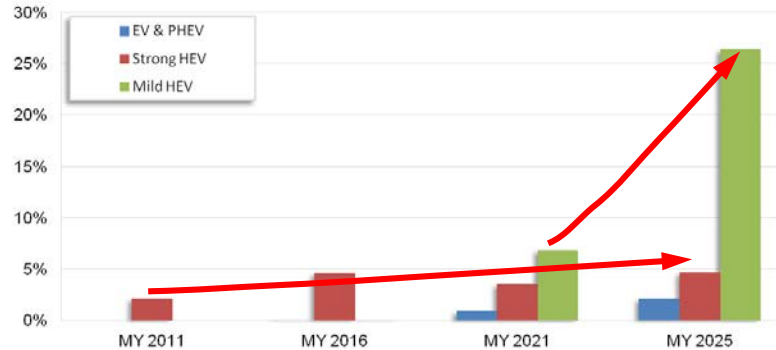
## Engines and Transmissions



## Turbocharging



## Battery Electric Technologies



# The Economist ranks U.S. GHG/FE Standards as 6<sup>th</sup> most important action worldwide to cut climate emissions

The Economist



## Curbing climate change: The deepest cuts

Our guide to the actions that have done the most to slow global warming

Sep 20th 2014

#6

### To slash or to trim

1

Emission reductions by policies/actions, bn tonnes CO<sub>2</sub> equivalent

Policy/Action	Cumulative emissions	Period	Annual emissions*
Montreal protocol <sup>1</sup>	135.0bn	1989-2013	5.6bn
Hydropower worldwide <sup>2</sup>	2.8bn	2010	2.8bn
Nuclear power worldwide <sup>2</sup>	2.2bn	2010	2.2bn
China one-child policy <sup>3</sup>	1.3bn	2005	1.3bn
Other renewables worldwide <sup>2</sup>	600m	2010	600m
<b>US vehicle emissions &amp; fuel economy standards<sup>14</sup></b>	6.0bn	2012-25	460m
Brazil forest preservation <sup>5</sup>	3.2bn	2005-13	400m
India land-use change <sup>6</sup>	177m	2007	177m
Clean Development Mechanism <sup>7</sup>	1.5bn	2004-14	150m
US building & appliances codes <sup>4</sup>	3.0bn	2008-30	136m
China SOE efficiency targets <sup>8</sup>	1.9bn	2005-20	126m
Collapse of USSR <sup>9</sup>	709m	1992-98	118m
Global Environment Facility <sup>10</sup>	2.3bn	1991-2014	100m
EU energy efficiency <sup>11</sup>	230m	2008-12	58m
US vehicle emissions & fuel economy standards <sup>4</sup>	270m	2014-18	54m
EU renewables <sup>11</sup>	117m	2008-12	29m
US building codes (2013) <sup>12</sup>	230m	2014-30	10m
US appliances (2013) <sup>12</sup>	158m	2014-30	10m
Clean technology fund <sup>13</sup>	1.7bn	project lifetime	na
EU vehicle emission standards <sup>14</sup>	140m	2020	na

#### CATEGORIES:

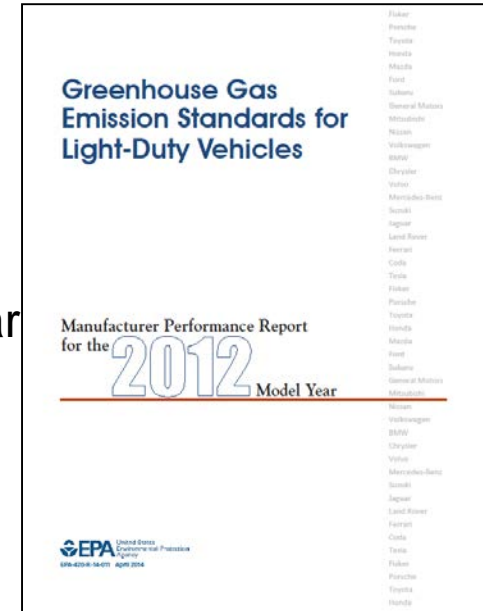
- Energy production
- Transport
- Other regulations
- Global treaties
- Land & forests
- Other

See following panel for sources and explanations

\*Annual emissions are cumulative emissions divided by the relevant period. The estimate for the current emissions avoided under the Montreal protocol is eight billion tonnes of CO<sub>2</sub>e. The annual figure for the collapse of the USSR refers to the years 1992-98. <sup>†</sup>Cars and light trucks <sup>‡</sup>Heavy trucks

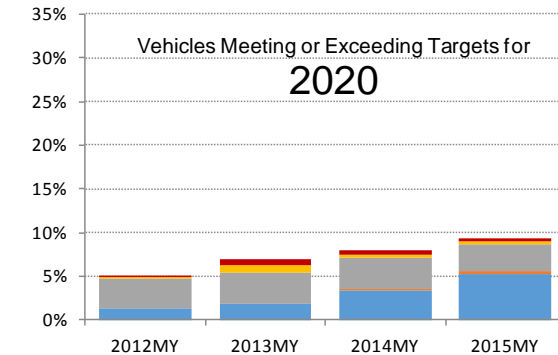
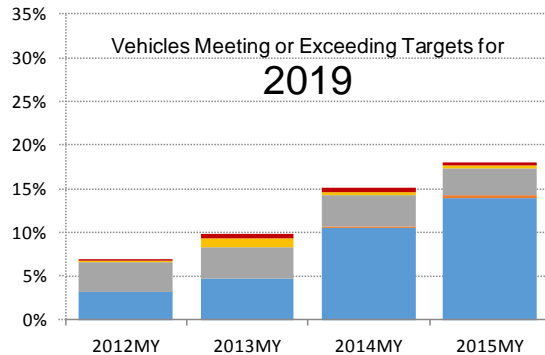
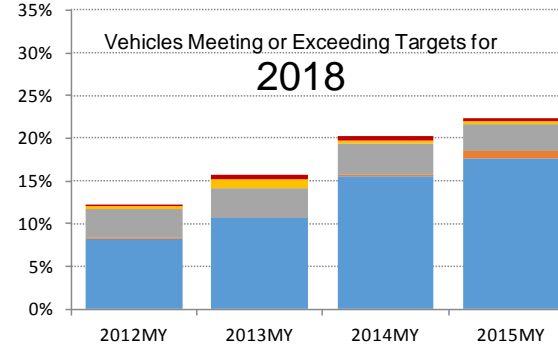
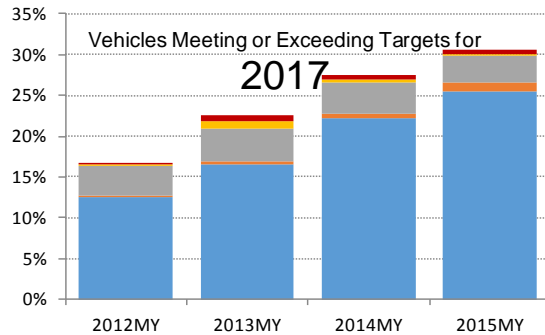
# The first few years – good news so far

- **Manufacturers are ahead of the game**
  - Fleet-wide industry beat standards by about 10 g/mi (1mpg) for MY 2012, first year of program
  - Huge bank of credits
  - Credit trading between firms for first time in the 40-year history of EPA's LD vehicle program
- **Consumers appear to love their choices**
  - Sales are booming, even as price tags rise slightly
  - Fuel economy clearly a key marketing tool
    - NADA's 2014 New Car Shopper Preference Survey ranks fuel economy the #1 most important factor considered in purchasing for both cars and trucks



# Fleet-wide progress is steady

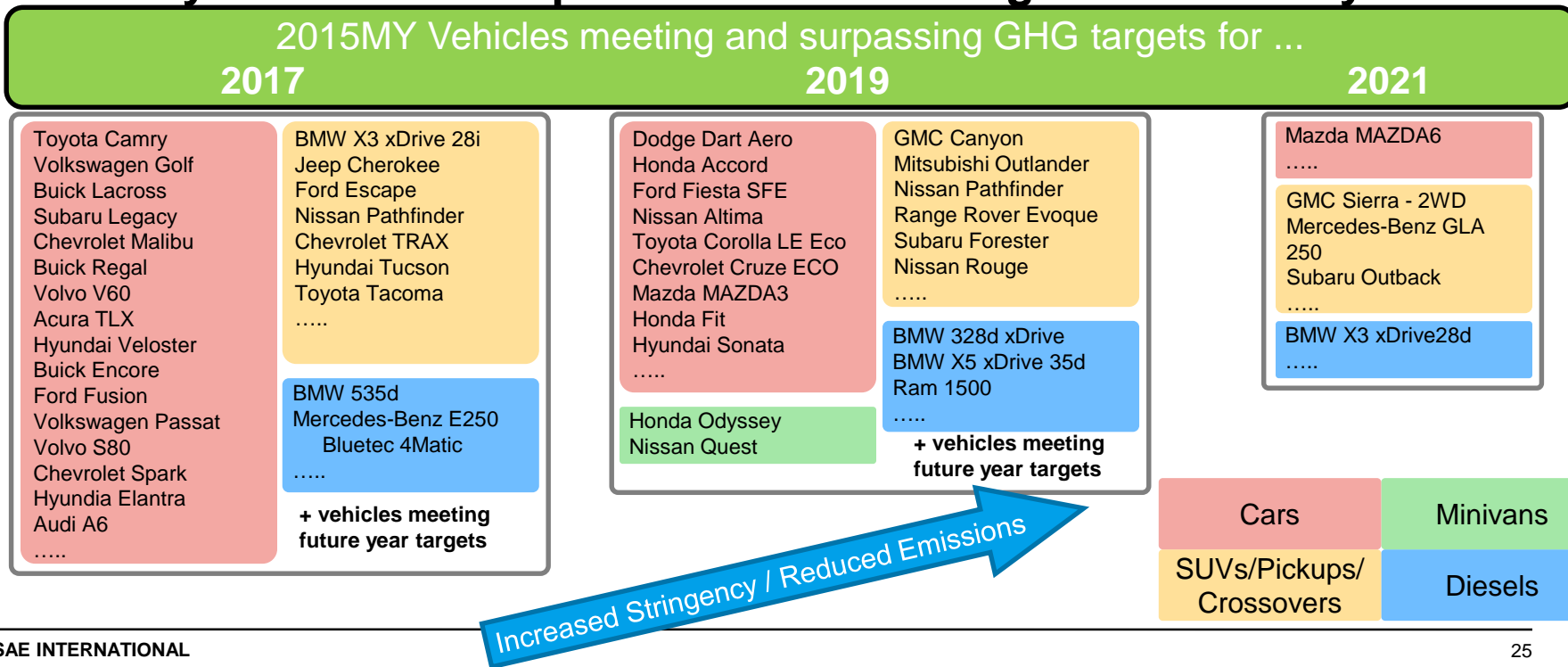
- Reduced-emissions vehicles are being produced in significant volumes





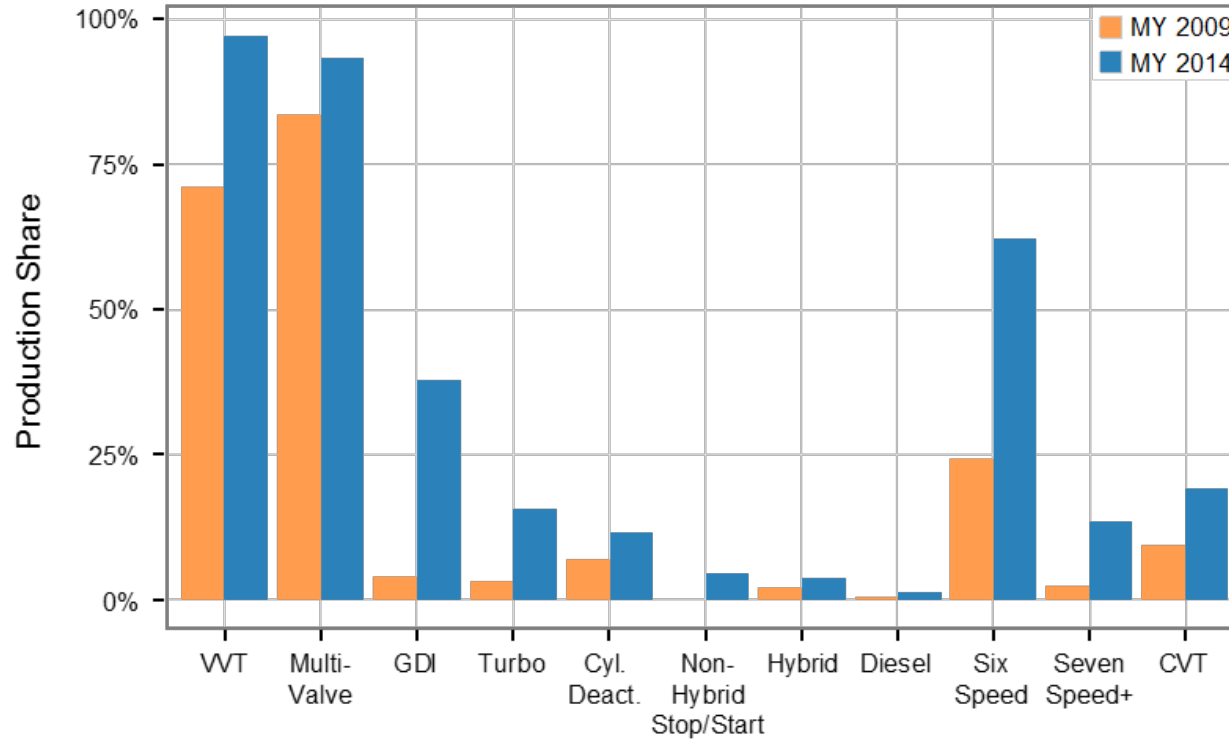
# GHG high performers: It's not just hybrids

- A number of non-hybrid gasoline and diesel vehicles in 2015MY already meet their footprint-based GHG targets for future years



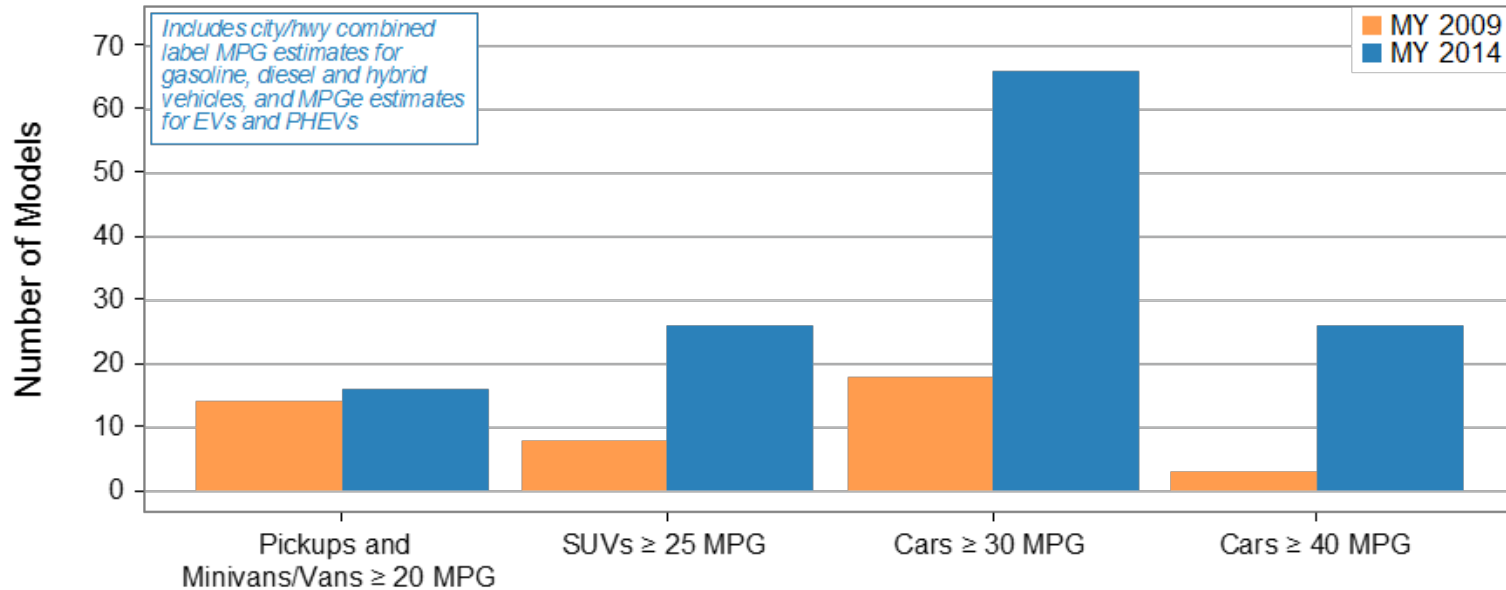
# Many new technologies are rapidly gaining market share

## Technology Penetration Share for MY 2009 and MY 2014



# Consumers have an increasing number of high FE/low CO<sub>2</sub> vehicle choices

## Vehicle Models Meeting Fuel Economy Thresholds in MY 2009 and MY 2014



# MIDTERM EVALUATION OF THE 2022-2025 LIGHT-DUTY GHG STANDARDS

- Technical review of longer-term standards (2022-2025)
- In coordination with NHTSA and California Air Resources Board
- EPA's decision on the 2022-2025 standards could go one of 3 ways:
  - standards remain appropriate; more stringent; less stringent
- Data driven, transparent
- Extensive stakeholder dialogue to gather data/information

# What factors will we consider for the Midterm Evaluation?

- ✓ Powertrain improvements
- ✓ Light-weighting and impacts on vehicle safety
- ✓ Market penetration of fuel efficient technologies
- ✓ Consumer acceptance
- ✓ Payback periods for consumers
- ✓ Fuel prices
- ✓ Fleet mix
- ✓ Infrastructure
- ✓ Employment impacts
- ✓ Many others ...

# Midterm Evaluation Major Milestones

- Joint Draft Technical Support Document published in June 2016
  - Agencies will request public comment on the Draft report
- EPA Proposed Determination (on whether 2022-2025 standards are appropriate)
  - EPA will request public comment on the Proposed Determination
- EPA Final Determination (on whether 2022-2025 standards are appropriate) no later than April 2018

# EPA's National Vehicle and Fuel Emissions Laboratory has many technical projects underway to support the Midterm Evaluation

- Through our National Center for Advanced Technology (NCAT) group, researching future advanced engine and transmission technologies to support modeling, advanced technology testing, and demonstrations
- Continued development of modeling tools:
  - Vehicle simulation modeling (ALPHA - Advanced Light-Duty Powertrain and Hybrid Analysis)
  - Technology feasibility and cost model (OMEGA - Optimization Model for reducing Emissions of Greenhouse gases from Automobiles)
  - Technology packages efficiencies (Lumped Parameter Model)
  - Exploring potential use of consumer choice modeling
- Mass reduction study with FEV for a full-size pickup
- Continued cost teardown work with FEV on mild hybrid, diesel, others
- Research on consumer issues – content analysis of auto reviews, consumer satisfaction surveys, affordability
- Continued work on economic issues (VMT rebound, energy security)
- In addition to working with CARB and NHTSA, EPA is collaborating with Environment Canada and Transport Canada on aerodynamics, light-weighting, vehicle modeling, and other areas





# Wrap-up

- **EPA's standards for criteria emissions and GHGs provide important air quality, public health, and climate benefits**
- **Already seeing exciting auto industry innovations as year-over-year improvements needed to meet the 2025 targets**
- **So far auto industry is off to a good start, even beating the standards**
- **We look forward to dialog with all stakeholders to inform the Midterm Evaluation of 2022-2025 standards**

# APPENDIX

# Non-hybrids are closing the gap

- **Today, non-hybrids have many technologies emphasized in early hybrids**
  - Improved aerodynamics
  - Low rolling resistance tires
  - Increased use of lightweight materials
- **Since 2004, the difference between average hybrid and non-hybrid midsize cars has narrowed from 24 to 15mpg.**

