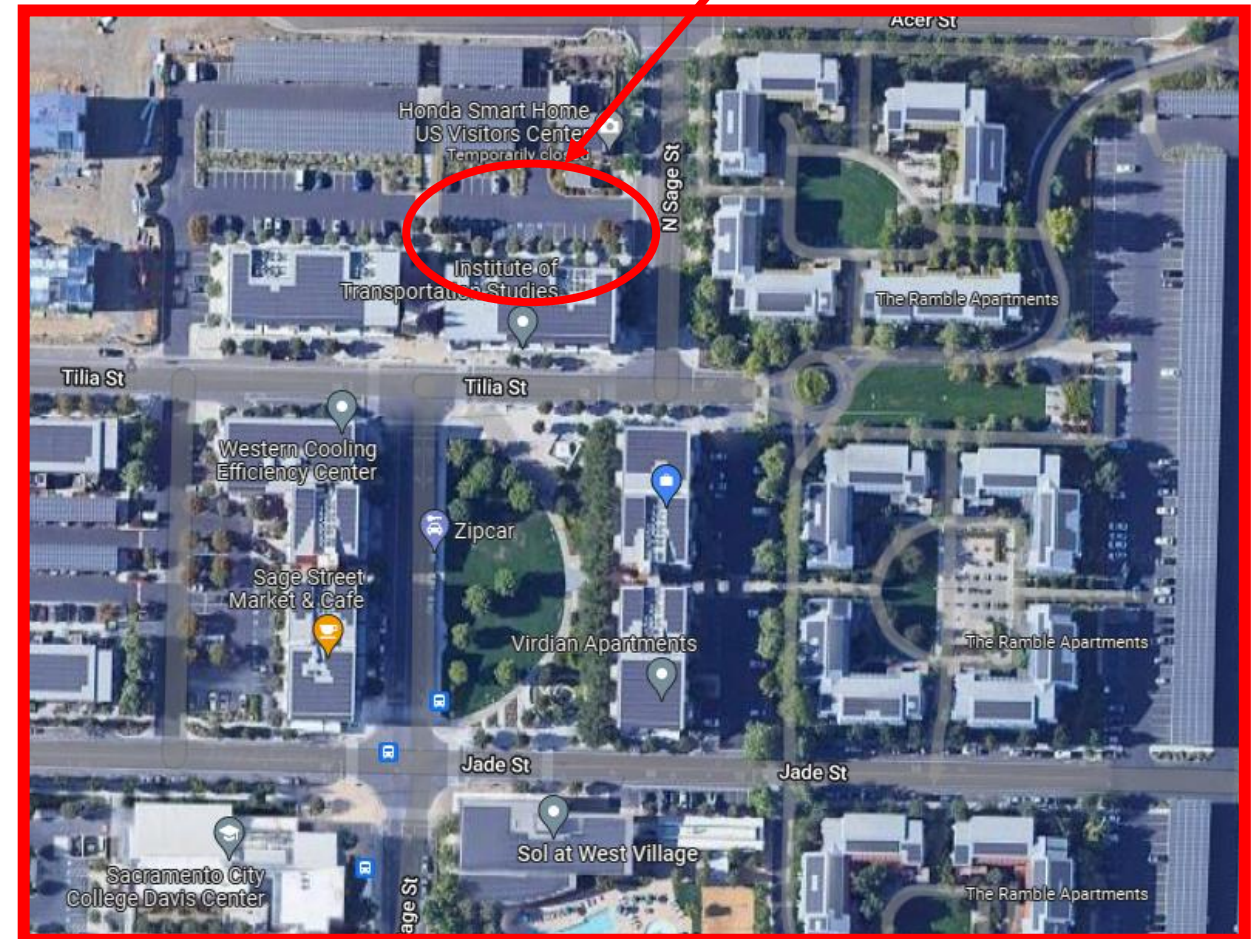


Final day of class (June 1st)

- EV showcase, come see a bunch of EVs in person!
- Free pizza

Parking lot behind 1605 Tilia St
in West Village





CAFE and GHG emission standards

ECI 189G: Lecture 16

Dan Sperling

Alan Jenn

Spring 2022

Legislation vs. Regulation

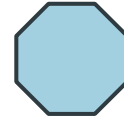
While the process is different, both hold the same force of law



Introduced by...



Altered by...



Can be stopped by...



Finalized when...



Has the effect of...

Legislation

Lawmakers
Any senator or congressperson can introduce legislation

Congress
Committees in either chamber can alter proposed legislation through the amendment process

Stalling/Failing in Congress
Legislation may be stopped in its tracks if it stalls in the committee phase, fails a vote or cloture motion, is vetoed, or is not brought up by the other chamber

Signed by President or Congress Overrides Veto
The president can sign the bill into law, or Congress can override a presidential veto by two-thirds majorities in both chambers

Law
Finalized legislation has the binding force of law

Regulation

Federal Agencies
A federal agency may draft a regulation after reviewing or finding ambiguity in a law and realizing a clarifying regulation is necessary; regulations must be based in laws already passed

The Public
The public and interested parties may attempt to change a proposed regulation by submitting comments, which require consideration and response by the agency

Congress/The Public
A proposed regulation may be stopped in its tracks by strong, nearly unanimous or very influential public comments, or a resolution of disapproval by Congress (which can be vetoed by the president)

Published
A regulation becomes a rule when it is published into the Federal Register after final consideration of comments and adjustments

Law
Exactly the same as legislation; a finalized regulation has the binding force of law

Notable Federal Regulatory Agencies



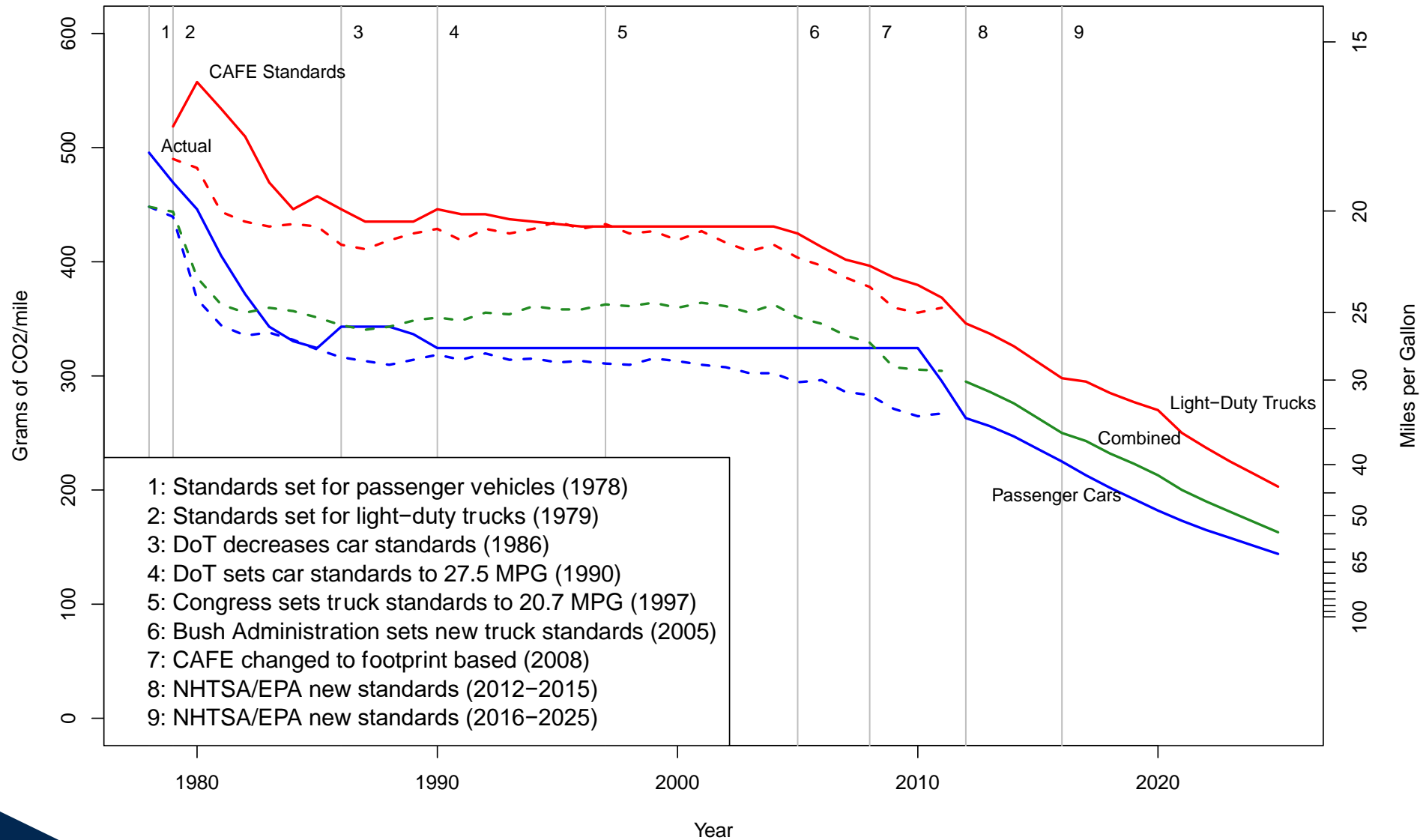


A history of CAFE

Formation of CAFE standards

- Energy Policy and Conservation Act of 1975 responded to the oil crisis in 1973:
 - Increase energy production and supply
 - Reduce energy demand
 - Provide energy efficiency
 - More powers to respond to disruptions in energy supply
- Required the US Department of Transportation, specifically the National Highway Traffic Safety Administration (NHTSA), to enforce compliance with standards

Corporate Average Fuel Economy (CAFE) Standards

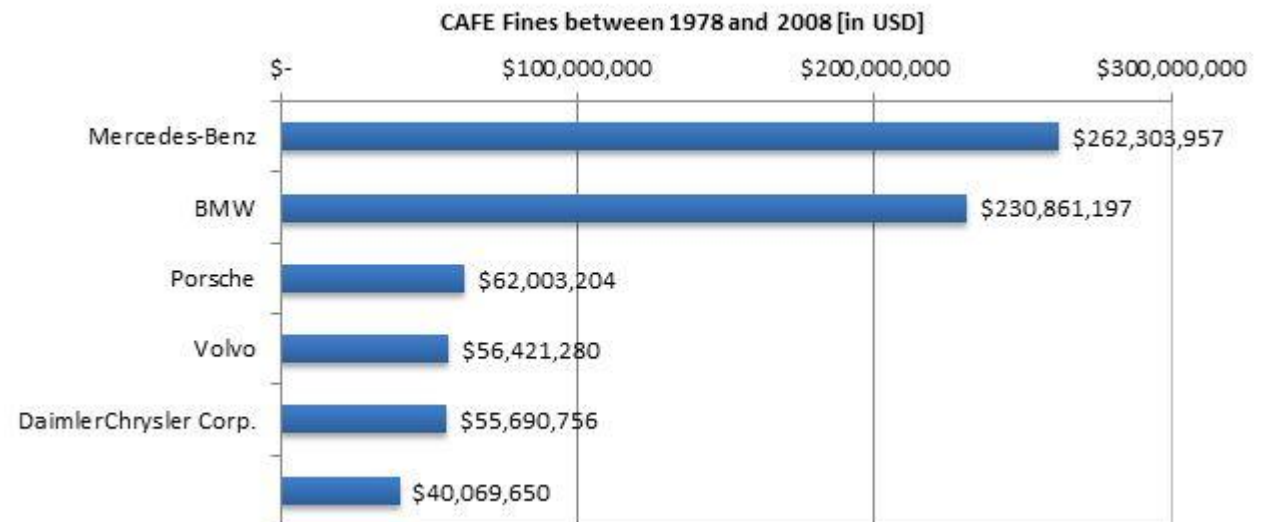


CAFE is a requirement for automakers, not individual cars

- A common misconception is that all cars need to be a certain fuel efficiency, in reality the *average* sales-weighted fuel efficiency for every manufacturer needs to reach a specific target
- What is the average fuel economy for a manufacturer that sells:
 - 10x 20 MPG cars
 - 10x 30 MPG cars

CAFE credit system

- When an automaker complies with the regulation, they generate credits based on their target
- Credits can be traded between different automakers and they can be banked
- NHTSA is able to enforce civil penalties: \$55 per 1 mpg out of compliance (per vehicle)



AB 1493 – “Pavley” regulations

- During the Bush Sr. administration, CAFE standards were frozen (which persisted for nearly 20 years)
- Senator Fran Pavley decided to author AB1493 which required a reduction in GHG emission from vehicle tailpipes
- The first implementation waiver request was made in Dec 2005 and denied by the US EPA in March 2008

Massachusetts v. Environmental Protection Agency

- In 2007, Massachusetts and 11 other states sued the EPA to determine whether EPA has the legal authority to regulate CO₂ under the Clean Air Act
- Supreme Court rules that EPA *must* regulate CO₂ emissions from motor vehicles

Obama's EPA grants waiver to California



One National Program (ONP)

- Automakers protest: following three different standards (NHTSA, EPA, CARB) will be too difficult and costly
- EPA and NHTSA agree to harmonize the standards so they match exactly (sort of...)
 - Greenhouse Gas Emissions standard (EPA) regulates gCO_2/mi
 - CAFE standard (NHTSA) regulates mi/gal
- CARB chooses not to pursue their own rules under the Pavley regulation but are able to influence the rulemaking to be much more stringent

2012-2025 CAFE standards

- The famous 54.5 mpg by 2025 standards (on the 2-cycle test for passenger vehicles)
 - This was modified to 52 mpg after the midterm review
- NHTSA isn't allowed to regulate for 14 years so the regulation is split into two phases: 2012-2016 and 2017-2025



Federal Register

Friday,
May 7, 2010

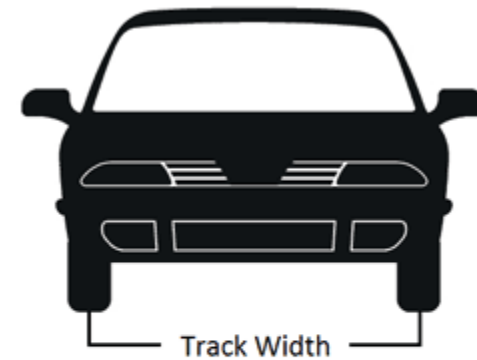
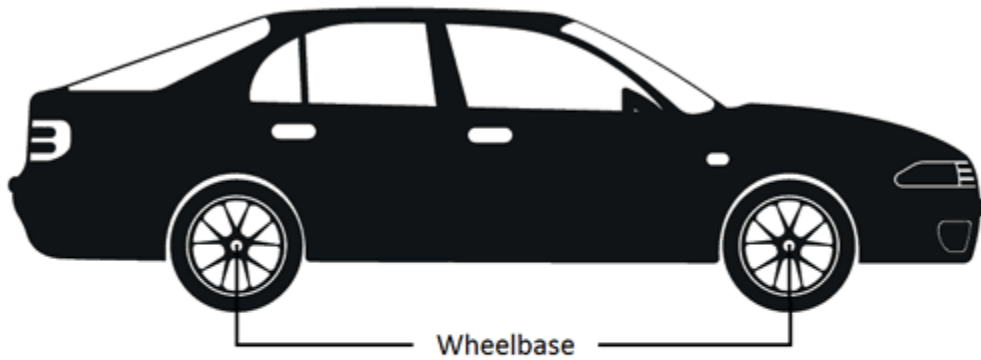
Part II

**Environmental
Protection Agency**

**Department of
Transportation**

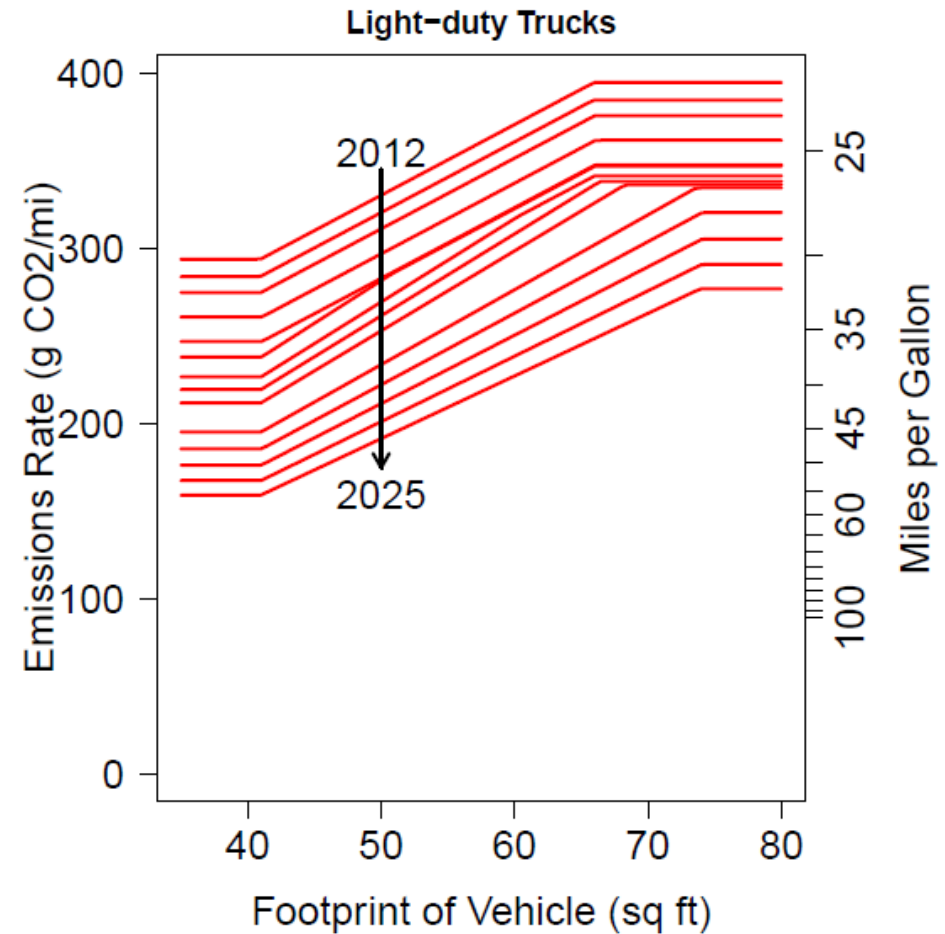
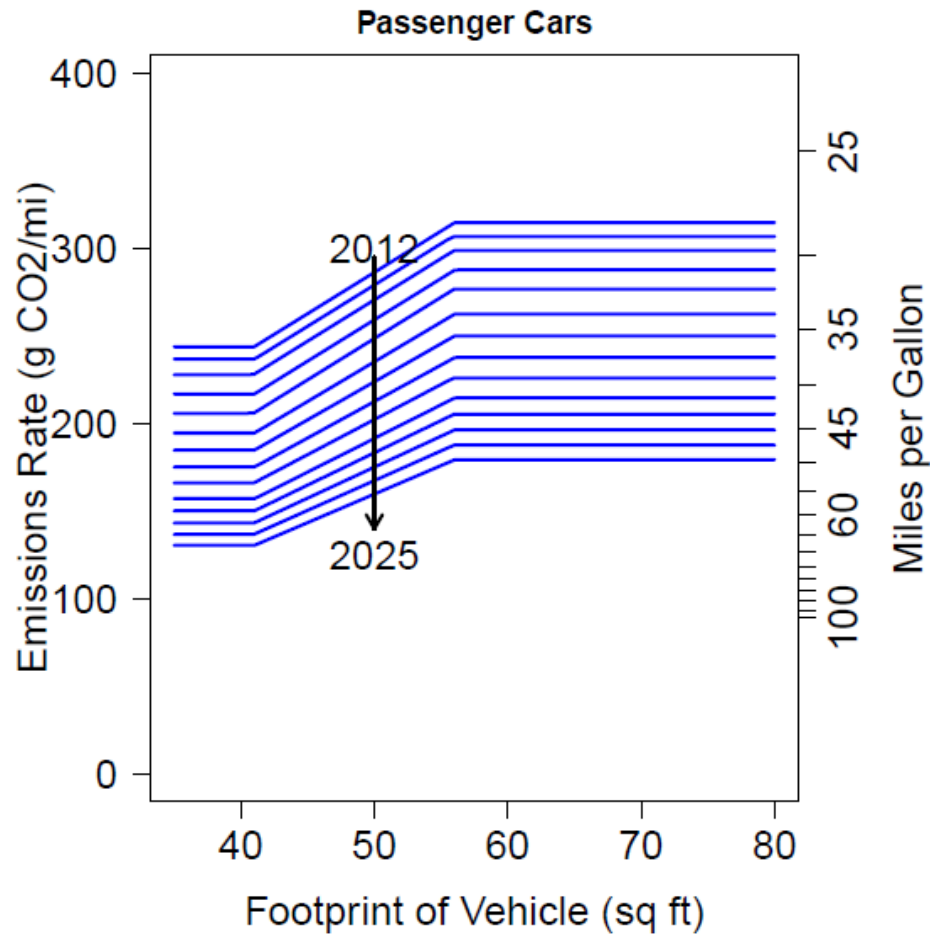
National Highway Traffic Safety
Administration
40 CFR Parts 85, 86, and 600; 49 CFR
Parts 531, 533, 536, et al.
Light-Duty Vehicle Greenhouse Gas
Emission Standards and Corporate
Average Fuel Economy Standards; Final
Rule

Vehicle footprint



$$\text{Footprint} = \frac{\text{front track width} + \text{rear track width}}{2} \times \text{wheelbase}$$

Footprint based standards



Fuel economy and emissions rates are no longer tied together

- Federal regulation on vehicle efficiency are harmonized through NHTSA's CAFE standards and EPA's GHG emission standards
- This pairing is anachronistic for alternative fuel vehicles (particularly electricity and H₂)

Efficiency

Emissions Rates



Toyota
Prius

55 MPG

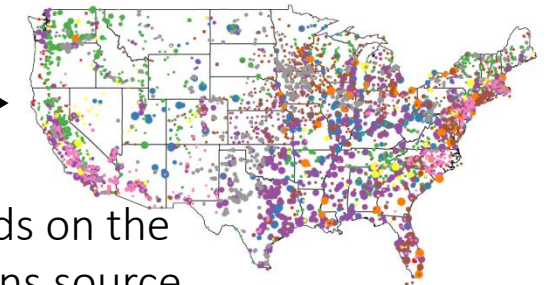


160 g CO₂/mi



Tesla
Model 3

0.29 kWh/mi



Depends on the
emissions source

AFV incentives: weights and multipliers

- Weights: multiplicatively affect emissions rate for alternative fuel vehicles
- Multipliers: Increase the accounting of sales for alternative fuel vehicles

AFV Incentives in 2017-2025

Vehicle Type	Proportion Operating on Alternative Fuel	Multiplier (2017-2019)	Multiplier (2020)	Multiplier (2021)	Multiplier (2022-2025)	Weighting Factor
ICV	0	1	1	1	1	1
FFV	0.15	1	1	1	1	1
CNG	1	1.6	1.45	1.3	1	1
BEV	1	2.0	1.75	1.5	1	0
PHEV	0.29-0.66	1.6	1.45	1.3	1	0
FCV	1	2.0	1.75	1.5	1	0

Current CAFE regulation doesn't differentiate PEVs



Hyundai Ioniq (BEV)
25 kWh/100 mi

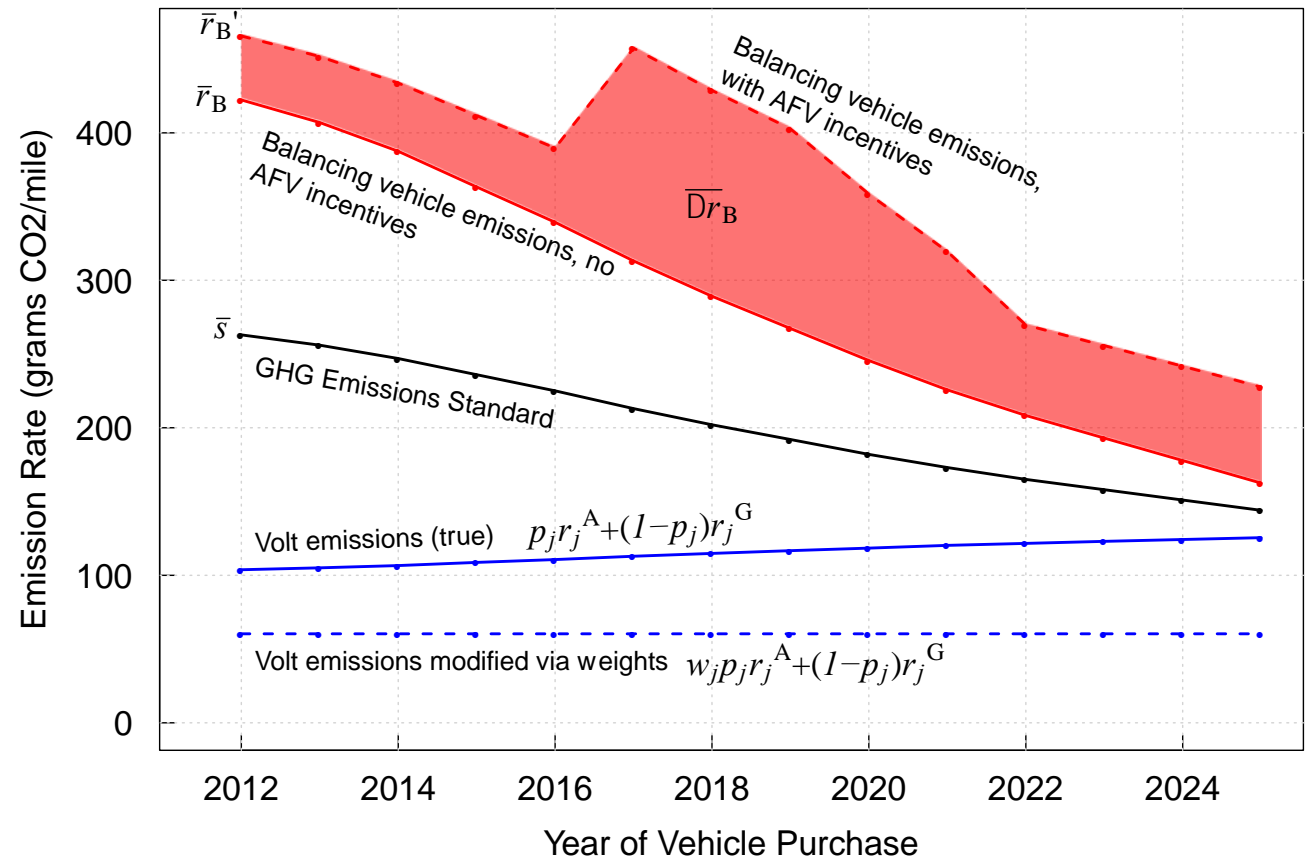


Jaguar i-Pace (BEV)
44 kWh/100 mi

Despite the i-Pace consuming 76% more energy, fuel economy regulations consider these vehicles the “same”. Automakers are not being given policy signals to improve the efficiency of PEVs.

Implications of AFV incentives on fuel economy

- Selling PEVs increases overall emissions when CAFE is a binding constraint
- Through 2025, the effect is relatively small: a 1-2% decrease in stringency of standards (footprint gamification and market trends was more significant at ~6%)



2017 midterm review

- Review of CAFE for 2021-2025 (remember NHTSA isn't allowed to develop rules for more than 4 years at a time) was to happen over the course of 2017
 - Announcement of rulemaking, proposed rule
 - Public comment period (several months)
 - Final rule announced
- End of 2016 rolls around, Trump is elected president
- Obama EPA announces proposed rule in December of 2016, gives one week (!) for public comments, several days after the comment period closes the final rule is released with no changes

CAFE during Trump's tenure

- Trump wanted to get rid of the CAFE regulation and the (ex) director of the EPA Scott Pruitt made moves to get rid of the regulation
- Some institutional barriers:
 - Needs to go through another rule-making process
 - Substantial resistance from environmental community



Safer Affordable Fuel-Efficient (SAFE) rule

- Proposed to freeze standards starting in 2021
- Some changes:
 - Faster turnover (higher costs with old rules meant older cars would be kept longer which are less safe)
 - Reduced carbon price for benefits
 - Increased technology costs

DEPARTMENT OF TRANSPORTATION

National Highway Traffic Safety Administration

49 CFR Parts 523, 531, 533, 536, and 537

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 85 and 86

[NHTSA–2018–0067; EPA–HQ–OAR–2018–0283; FRL–9981–74–OAR]

RIN 2127–AL76; RIN 2060–AU09

The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks

AGENCY: Environmental Protection Agency and National Highway Traffic Safety Administration.

ACTION: Notice of proposed rulemaking.

SUMMARY: The National Highway Traffic Safety Administration (NHTSA) and the Environmental Protection Agency (EPA) are proposing the “Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021–2026 Passenger Cars and Light Trucks” (SAFE Vehicles Rule). The SAFE Vehicles Rule, if finalized, would amend certain existing Corporate Average Fuel Economy (CAFE) and tailpipe carbon dioxide emissions standards for passenger cars and light trucks and establish new standards, all covering model years 2021 through 2026. More specifically, NHTSA is proposing new CAFE standards for model years 2022 through 2026 and amending its 2021 model year CAFE standards because they are no longer maximum feasible standards, and EPA is proposing to amend its carbon dioxide emissions standards for model years 2021 through 2025 because they are no longer appropriate and reasonable in addition to establishing new standards for model year 2026. The preferred alternative is to retain the model year 2020 standards (specifically, the footprint target curves for passenger cars and light trucks) for both programs through model year 2026, but comment is sought on a range of alternatives discussed throughout this document. Compared to maintaining the post-2020 standards set forth in 2012, current estimates indicate that the proposed SAFE Vehicles Rule would save over 500 billion dollars in societal costs and reduce highway fatalities by 12,700 lives (over the lifetimes of vehicles through MY 2029). U.S. fuel consumption would increase by about

half a million barrels per day (2–3 percent of total daily consumption, according to the Energy Information Administration) and would impact the global climate by 3/1000th of one degree Celsius by 2100, also when compared to the standards set forth in 2012.

DATES: *Comments:* Comments are requested on or before October 23, 2018. Under the Paperwork Reduction Act, comments on the information collection provisions must be received by the Office of Management and Budget (OMB) on or before October 23, 2018. See the **SUPPLEMENTARY INFORMATION** section on “Public Participation,” below, for more information about written comments.

Public Hearings: NHTSA and EPA will jointly hold three public hearings in Washington, DC; the Detroit, MI area; and in the Los Angeles, CA area. The agencies will announce the specific dates and addresses for each hearing location in a supplemental **Federal Register** notice. The agencies will accept oral and written comments to the rulemaking documents, and NHTSA will also accept comments to the Draft Environmental Impact Statement (DEIS) at these hearings. The hearings will start at 10 a.m. local time and continue until everyone has had a chance to speak. See the **SUPPLEMENTARY INFORMATION** section on “Public Participation,” below, for more information about the public hearings.

ADDRESSES: You may send comments, identified by Docket No. EPA–HQ–OAR–2018–0283 and/or NHTSA–2018–0067, by any of the following methods:

- **Federal eRulemaking Portal:** <http://www.regulations.gov>. Follow the instructions for sending comments.
- **Fax:** EPA: (202) 566–9744; NHTSA: (202) 493–2251.
- **Mail:**
 - EPA: Environmental Protection Agency, EPA Docket Center (EPA/DC), Air and Radiation Docket, Mail Code 28221T, 1200 Pennsylvania Avenue NW, Washington, DC 20460, Attention Docket ID No. EPA–HQ–OAR–2018–0283. In addition, please mail a copy of your comments on the information collection provisions for the EPA proposal to the Office of Information and Regulatory Affairs, Office of Management and Budget (OMB), Attn: Desk Officer for EPA, 725 17th St. NW, Washington, DC 20503.
 - NHTSA: Docket Management Facility, M–30, U.S. Department of Transportation, West Building, Ground Floor, Rm. W12–140, 1200 New Jersey Avenue SE, Washington, DC 20590.
- **Hand Delivery:**

○ EPA: Docket Center (EPA/DC), EPA West, Room B102, 1301 Constitution Avenue NW, Washington, DC, Attention Docket ID No. EPA–HQ–OAR–2018–0283. Such deliveries are only accepted during the Docket’s normal hours of operation, and special arrangements should be made for deliveries of boxed information.

○ NHTSA: West Building, Ground Floor, Rm. W12–140, 1200 New Jersey Avenue SE, Washington, DC 20590, between 9 a.m. and 4 p.m. Eastern Time, Monday through Friday, except Federal holidays.

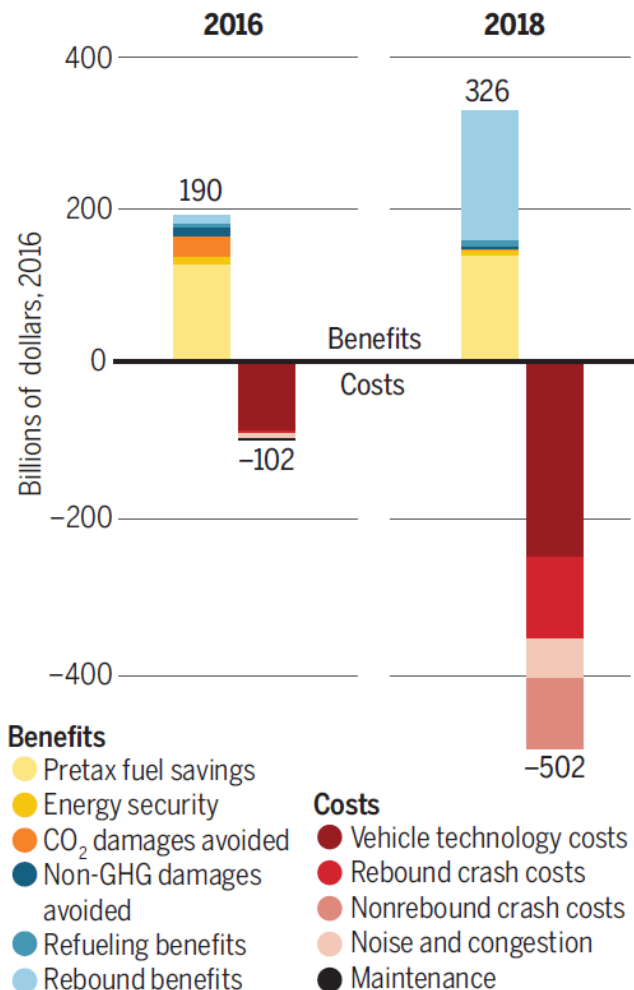
Instructions: All submissions received must include the agency name and docket number or Regulatory Information Number (RIN) for this rulemaking. All comments received will be posted without change to <http://www.regulations.gov>, including any personal information provided. For detailed instructions on sending comments and additional information on the rulemaking process, see the “Public Participation” heading of the **SUPPLEMENTARY INFORMATION** section of this document.

Docket: For access to the dockets to read background documents or comments received, go to <http://www.regulations.gov>, and/or:

- For EPA: EPA Docket Center (EPA/DC), EPA West, Room 3334, 1301 Constitution Avenue NW, Washington, DC 20460. The Public Reading Room is open from 8:30 a.m. to 4:30 p.m., Monday through Friday, excluding legal holidays. The telephone number for the Public Reading Room is (202) 566–1744.
- For NHTSA: Docket Management Facility, M–30, U.S. Department of Transportation, West Building, Ground Floor, Rm. W12–140, 1200 New Jersey Avenue SE, Washington, DC 20590. The Docket Management Facility is open between 9 a.m. and 4 p.m. Eastern Time, Monday through Friday, except Federal holidays.

FOR FURTHER INFORMATION CONTACT: EPA: Christopher Lieske, Office of Transportation and Air Quality, Assessment and Standards Division, Environmental Protection Agency, 2000 Traverwood Drive, Ann Arbor, MI 48105; telephone number: (734) 214–4584; fax number: (734) 214–4816; email address: lieske.christopher@epa.gov, or contact the Assessment and Standards Division, email address: otaqpublicweb@epa.gov. NHTSA: James Tamm, Office of Rulemaking, Fuel Economy Division, National Highway Traffic Safety Administration, 1200 New Jersey Avenue SE, Washington, DC 20590; telephone number: (202) 493–0515.

Economists disagree!



Flawed analyses of U.S. auto fuel economy standards

A 2018 analysis discarded at least \$112 billion in benefits

By Antonio M. Bento^{1,2}, Kenneth Gillingham^{3,4}, Mark R. Jacobsen^{4,5}, Christopher R. Knittel^{6,7}, Benjamin Leard⁸, Joshua Linn⁷, Virginia McConnell⁹, David Rapson⁴, James M. Sallee¹⁰, Arthur A. van Benthem^{11,12}, Kate S. Whitefoot¹³

Corporate Average Fuel Economy (CAFE) and greenhouse gas (GHG) emissions standards for passenger vehicles and light trucks have long been a centerpiece of the U.S. strategy to reduce energy use and GHG emissions and increase energy security. Under the authority of the Energy Independence and Security Act, the Environmental Protection Agency (EPA), and the National Highway Traffic Safety Administration (NHTSA) jointly set GHG and CAFE standards to reach 55 miles per gallon by 2025. A 2016 draft technical assessment report (TAR) affirmed by the EPA in January 2017 concluded that the 2022–2025 standards were technologically feasible and that benefits far exceeded costs. But under the current administration, those agencies are now challenging that conclusion in a 2018 Notice of Proposed Rulemaking (NPRM), which proposes freezing standards at model year (MY) 2020 levels through 2025. Its analysis finds that the costs of the previous standards now exceed benefits. With the agencies currently in the process of determining whether the rule should be finalized, we describe how the 2018 analysis has fundamental flaws and inconsistencies, is at odds with basic economic theory and empirical studies, is misleading, and does not improve estimates of costs and benefits of fuel economy standards beyond those in the 2016 analysis.

A COMPREHENSIVE PROTOCOL

A benefit-cost analysis (see table S1) for fuel economy standards grounded on basic economic principles must consider the behavior of consumers and automakers as well as keep account of several externalities (1). It must consider a range of parameter values and assumptions to account for inherent uncertainty as well as the impact of related policies

that determine the relevant baseline against which the standards are compared.

Modeling consumer behavior should include the purchase of general goods and new or used vehicles. Consumers trade off vehicle prices for various vehicle attributes (for example, performance, safety features, seating capacity, and so on). They also decide how much to drive and whether to keep or scrap their older vehicles.

A comprehensive analysis would allow automakers to comply with standards by adjusting vehicle prices, improving fuel economy, and altering performance and other vehicle attributes (2–5). It would also recognize that technology is determined by automaker investments, while accounting for learning-by-doing and knowledge spillovers that, over time, may lower the compliance costs.

Modeling of the interaction between new and used vehicle markets is critical to determine the resulting size of the total fleet and its composition, as well as the prices of vehicles (relative to the price of other goods). Prices, fuel economy, and other attributes determine the total cost of ownership, which affects total vehicle miles traveled (VMT), as well as willingness to pay for vehicles (1, 6).

A comprehensive protocol should also consider costs and benefits that arise from “external effects,” including GHG emissions, energy security, local air pollution, safety, and traffic congestion (7), which are affected by fleet size and its composition and the total number of miles driven.

In the case of safety, four additional outcomes are relevant: changes in fleet weights and sizes, distribution of weights and sizes in the entire fleet, distribution of vehicle vintage, and sorting of individuals into vehicles on the basis of their risk preferences, risk profiles, and preferences for other vehicle attributes (8–10).



In addition to greenhouse gas emissions and fuel economy, analyses must also consider effects on pollution, safety, and traffic congestion.

Valuation parameters are critical for converting impacts into costs and benefits. The value of a statistical life is used to value fatalities, whereas the social cost of carbon is used for valuing the benefits of reduced gasoline use (11, 12). Other valuation parameters reflect the value of energy security and the health costs of tailpipe emissions. A comprehensive protocol should also account for other factors, including changes in gasoline prices over time.

TWO FLAWED ANALYSES

Both the 2016 and 2018 analyses deviate from the comprehensive protocol outlined above because they do not explicitly model consumer choices and tend to miss important trade-offs between general consumption, vehicle choice, and VMT. On the supply side, the modeling of the new and used car markets does not fully consider important interactions between these markets. As a consequence, multimarket adjustments, and resulting outcomes such as the size of the fleet, fleet composition, and prices of vehicles, are captured imperfectly. Incomplete accounting for such adjustments also affects the magnitudes of the external costs and benefits.

The 2018 analysis did attempt to incorporate several channels of adjustment that were missing from the 2016 TAR (see table S1, fourth column). However, the most impactful channels were added in an ad hoc way that runs afoul of the proposed protocol outlined above, existing research, and basic economic principles. As a result, the changes in the 2018 NPRM are misleading. Although we do not endorse the 2016 TAR, the 2018 analysis failed to advance our understanding of the true costs and benefits of fuel economy standards.

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California pre-empts the SAFE rule

Defying Trump, 5 Automakers Lock In a Deal on Greenhouse Gas Pollution

The five — Ford, Honda, BMW, Volkswagen and Volvo — sealed a binding agreement with California to follow the state's stricter tailpipe emissions rules.

GM, Chrysler and Toyota side with Trump in emissions fight with California

SAFE rule passed

- On March 31, 2020, the Safer Affordable Fuel Efficient (SAFE) rule was passed by the Trump administration
- Fuel efficiency improvements decreased to 1.5% per year (down from 5%, but more than the expectation that they would be frozen)

...and then defeated

- August 10, 2021: New rulemaking proposal for CAFE standards 2024-2026
 - Increase in stringency at an 8% annual rate (compared to 1.5%)
 - 60-day comment period has already passed
- December 21, 2021: SAFE Rule repealed

New standards for 2024-2026

Estimated Average of CAFE Levels (mpg) Required Under Final Rule

Fleet	2024	2025	2026	2027	2028	2029
Passenger Cars	49.2	53.4	59.4	59.4	59.3	59.3
Light Trucks	35.1	38.2	42.4	42.4	42.4	42.4
Overall Fleet	40.6	44.2	49.1	49.1	49.2	49.3

- As of April 2022, the new standards have been announced to increase efficiency 8% annually for 2024-2025 and 10% for 2026
- Estimated to reduce fuel use by 200 billion gallons through 2050—more in line with Obama era standards

What does this mean for EVs?

- Unlike EU's standards, CAFE/GHG standards can theoretically be satisfied with gas cars but EVs make it a lot easier for automakers to meet the requirements
- Currently EVs are considered 0 g CO₂/mi in the GHG standards – no upstream emissions accounted. Will this change in the future?
- Unless efficiencies are accounted for in EVs, there will be no incentive for automakers to improve efficiency