DECLARATION OF DR. NICHOLAS LUTSEY

EXHIBIT B

Presentation: EPA Review of CAFE Model with "GHG" Settings
Meeting with Office of Management and Budget/OIRA
Dated: 4/16/2018

Source:
E.O. 12866 Review Materials, File: "Email 5 - Email from William Charmley to Chandana Achanta - June 18, 2018" (June 18, 2018),
https://www.regulations.gov/document?D=EPA-HQ-OAR-2018-0283-0453

EPA review of CAFE model with "GHG" settings (08-Mar ver.)

Meeting with Office of Management and Budget/OIRA

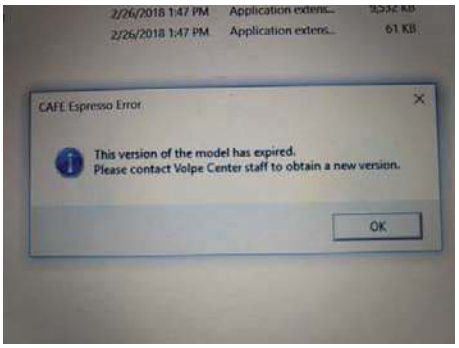
4/16/2018

Agenda

- Overview
- Review of CAFE model Safety Analysis
- Review of CAFE model Realism
- Review of CAFE representation of GHG program
- Summary of CAFE model results 'cost walk'
  - Contributions of the identified issues to large overestimation in program costs
- Other observations
  - Performance
  - Effectiveness
  - Battery costs and sizing
- Appendix: Update on LDV Rebound

Overview (slide 1 of 2)

- EPA began reviewing CAFE model in late January
  - Shared very initial observations with OMB on February 9, raising many significant concerns, and requesting:
    (1) technology descriptions for a handful of key technologies
    (2) description of components included in net benefits summary
    (3) model code
  - EPA has received neither of the requested items



- DOT provided a "GHG" version of the CAFE Model March 8
  - Intent is to properly model the EPA CO_2 program provisions
  - EPA discovered on March 31 model had a built-in "expired" date.
  - EPA requested on April 2 a workable version of the model
  - There has been no response to EPA request from DOT

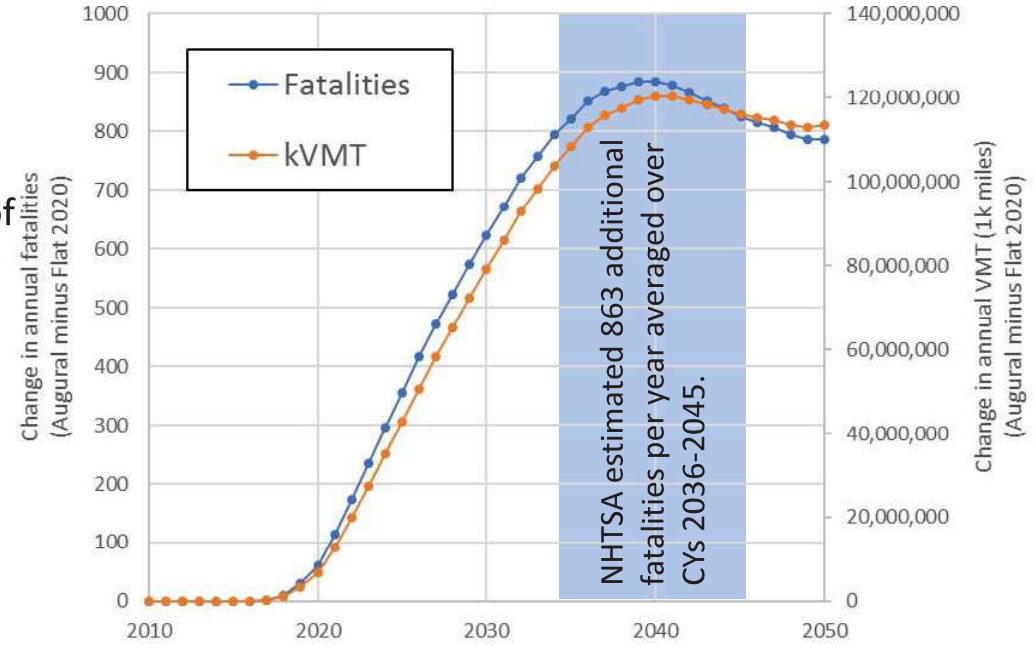
Overview (slide 2 of 2)

- EPA analysis to date shows significant and fundamental flaws in CAFE model (both the CAFE version and the "GHG version")
  - These flaws make the CAFE model unusable in current form for policy analysis and for assessing the appropriate level of the CAFE or GHG standards
- DOT has provided OMB draft preamble and RIA Chapter assessments for the upcoming CAFE and GHG NPRM
  - The underlying technical basis for the policy decisions and the proposed standards is the CAFE model, which has significant and fundamental flaws that must be addressed before being used for informing policy
  - EPA will not be providing comments on the draft material, as the underlying basis (CAFE model) is flawed, and thus comments are of no value until the technical basis is fixed
- DOT has drafted preamble language in which DOT repeatedly speaks for the EPA Administrator
  - DOT speaks for the EPA Administrator's views on the appropriate level of the EPA standard, EPA's interpretation of the Clean Air Act, EPA's views on what factors are relevant in determining EPA's program design and the EPA standards
  - EPA will be drafting the EPA Administrators views for the upcoming rulemaking, and we will not be starting from the DOT draft text

Review: CAFE safety analysis

Relationship between miles traveled and total fatalities

- Total fatalities are highly correlated with total VMT
- CAFE model improperly estimates the VMT impact of the Augural standards (following slides)
- The safety metric of 'fatalities per mile'[1] is unaffected by anomalies in VMT projection, and is therefore a more reliable metric of safety for this review



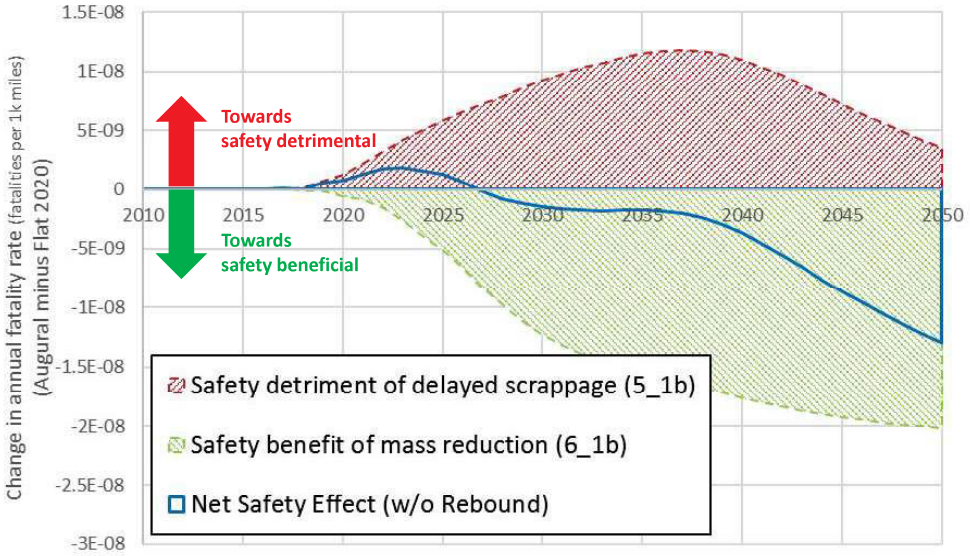
1 NHTSA has previously used a fatality rate metric when estimating the safety impact of changes in vehicle characteristics. Refer to the June 2016 report cited in the Draft TAR, "Relationships between Fatality Risk, Mass, and Footprint in Model Year 2003-2010 Passenger Cars and LTVs."

Review: CAFE safety analysis

Effects of delayed scrappage and mass reduction (excluding rebound)

- The augural standards provide an overall safety benefit, relative to flat standards
- Mass reduction provides a safety benefit due to the greater amount of weight removed from larger vehicles (relative to smaller vehicles) and the resulting improvement in crash compatibility
- Any detriment due to delayed scrappage is more than offset by the benefit of mass reduction
- The benefit of mass reduction extends perpetually into the future, while the detriment of delayed scrappage becomes smaller over time

Contributing factors to safety effect [Δfatalities/mile]
of Augural Standards as projected by the CAFE model (08-Mar ver.)

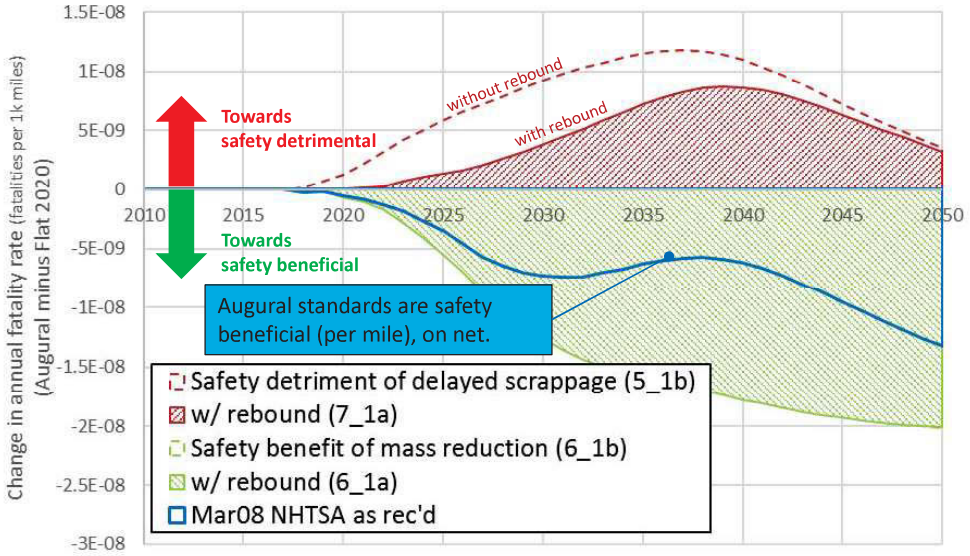


Review: CAFE safety analysis

Effects of delayed scrappage and mass reduction (including rebound)

- The use of a 20% rebound value in the CAFE model reduces the safety detriment of delayed scrappage
- As in the case of excluding rebound, the augural standards provide an overall safety benefit, relative to flat standards when rebound is included

Contributing factors to safety effect [Δfatalities/mile] of Augural Standards as projected by the CAFE model (08-Mar ver.)



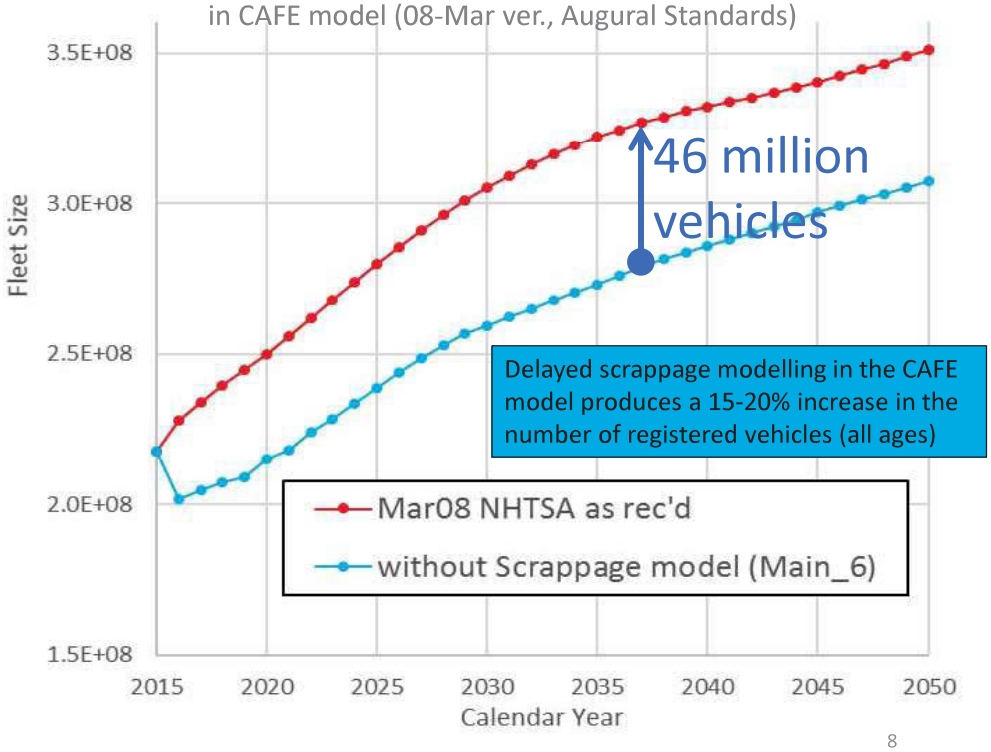
Review: CAFE model realism

Realistic fleet size projections

Real-world : The total number of registered vehicles would not change significantly as a result of consumer decisions to retain used vehicles longer instead of purchasing new vehicles.

CAFE model implementation: The use of the scrappage model produces a 15-20% increase in the total fleet size. The 2016 fleet increases by 26 million vehicles, and the 2030 fleet increases by 46 million

Significant increase in the total fleet size due delayed scrappage in CAFE model (08-Mar ver., Augural Standards)



Review: CAFE model realism

Realistic travel activity (VMT) projections

Real-world : The total number of vehicle miles travelled (VMT) would not change significantly as a result of consumer decisions to retain used vehicles longer instead of purchasing new vehicles.

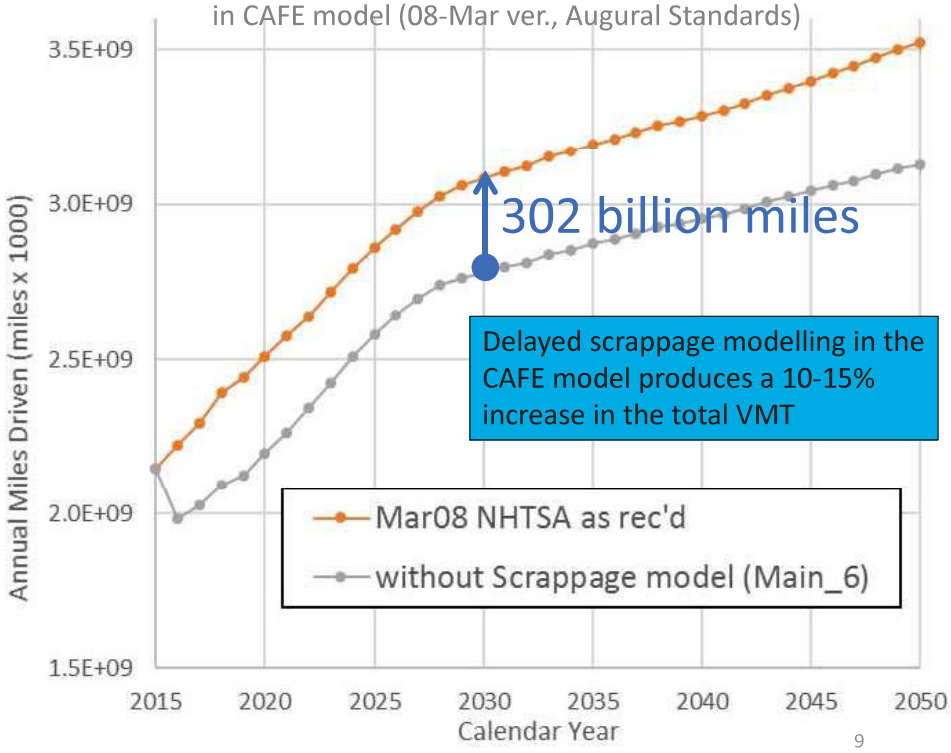
CAFE model implementation: The use of the scrappage model produces a 10-15% increase in total VMT.

The 2016 VMT increases by 239 billion miles, and the 2030 VMT increases by 302 billion miles

Implication of this Error: The unexplained VMT disconnect is clearly wrong, and is driving incorrect fatality estimates[1].

[1]Because of the disconnect with the vehicles sales projections (DFS model), the use of the scrappage model causes an inappropriate increase in the fatalities impact of the Augural standards, and an inappropriate underestimation of the fuel savings and emissions benefits.

Significant increase in the total VMT due delayed scrappage in CAFE model (08-Mar ver., Augural Standards)



Review: CAFE model realism

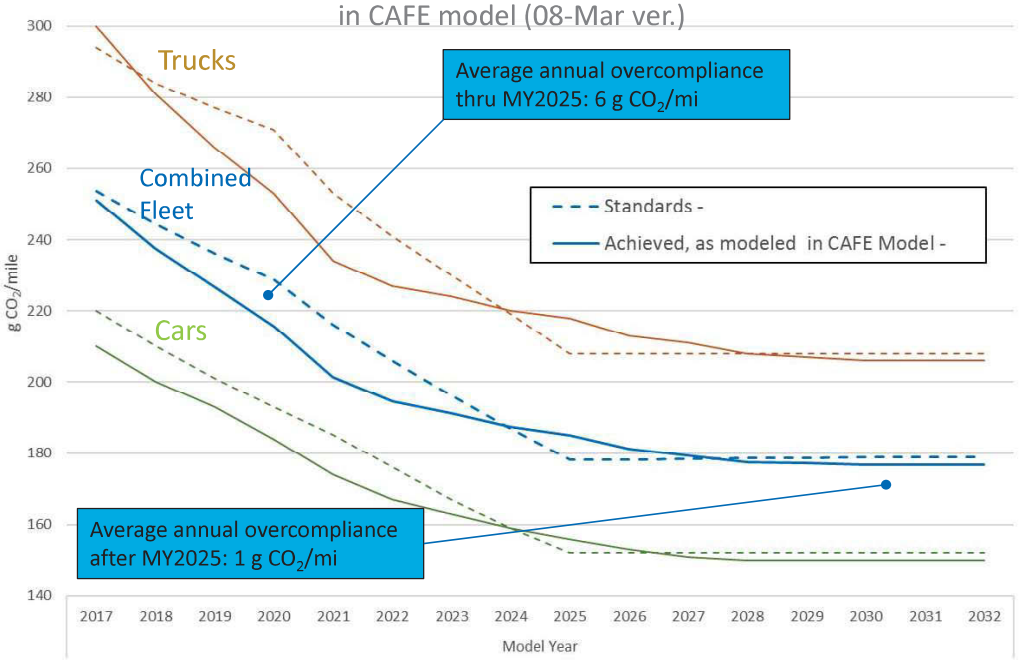
Manufacturer year-by-year compliance strategy projects

Real-world : Manufacturers will consider future vehicle model plans and compliance strategy when introducing technology, transferring credits from year-to-year as needed and avoiding significant over-compliance, on average.

CAFE model implementation: Technology in excess of what is necessary for compliance is applied in nearly every year, particularly prior to MY2024 when lead time is more limited. This sustained and significant overcompliance projected by the CAFE model implies that the industry will not make use of the large quantity of banked credits, or year-to-year credit transfer provisions.

Implication of this overcompliance: Significant overestimation in industry costs. CAFE model is not properly accounting for banked credits in GHG program, which firms clearly do today.

Significant and sustained overcompliance of Augural Standards in CAFE model (08-Mar ver.)



Note: The 'Achieved' emissions represented in the CAFE model include tailpipe CO2, AC efficiency and leakage credits, and off-cycle credits. Banked credits are not included in the 'Achieved' value.

Review: CAFE model realism

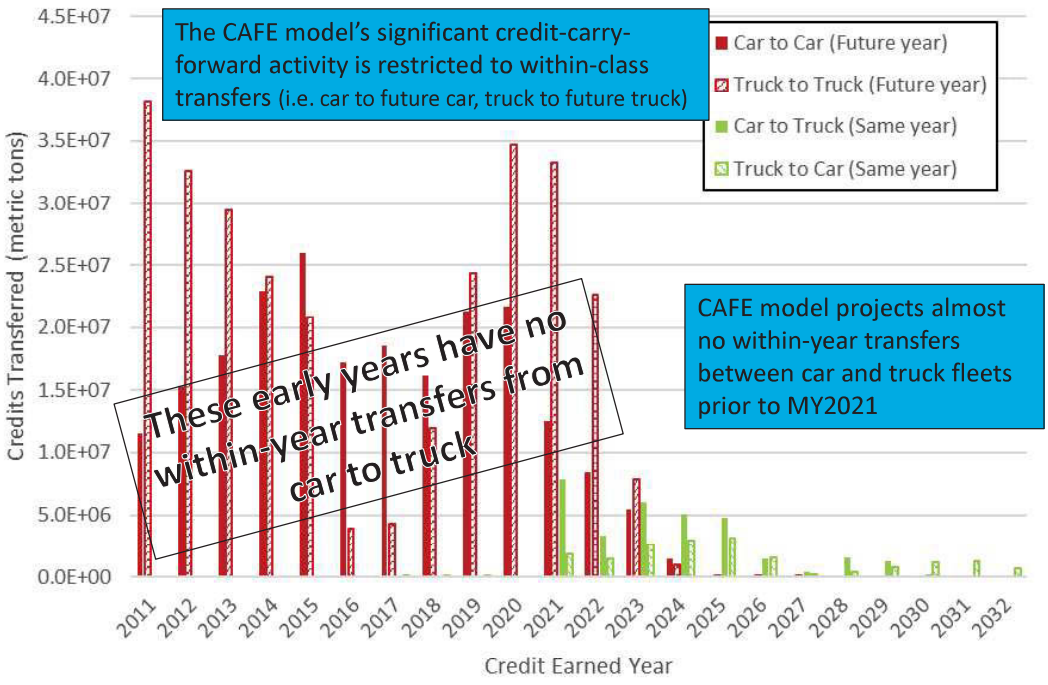
Realistic management of credits by manufacturers

Real-world : Manufacturers will manage their credit banks to even out compliance status given staggered introduction of technology. It is unlikely that manufactures will consistently add excess technology in the earlier years in order to maintain a large credit bank into the future.

CAFE model implementation: Manufacturers are projected to strongly prioritize the carry-forward of credits into future years, relative to within-year transfers between car and truck fleets. The CAFE model projects almost no within-year transfers between car and truck fleets prior to MY2021

Implication of unrealistic credit carry-forward: Overestimation of GHG standards cost. CAFE model not taking advantage of car-truck credit transfer, which firms are clearly doing today

Within-manufacturer transfer of earned credits, Augural Standards in CAFE model (08-Mar ver.)

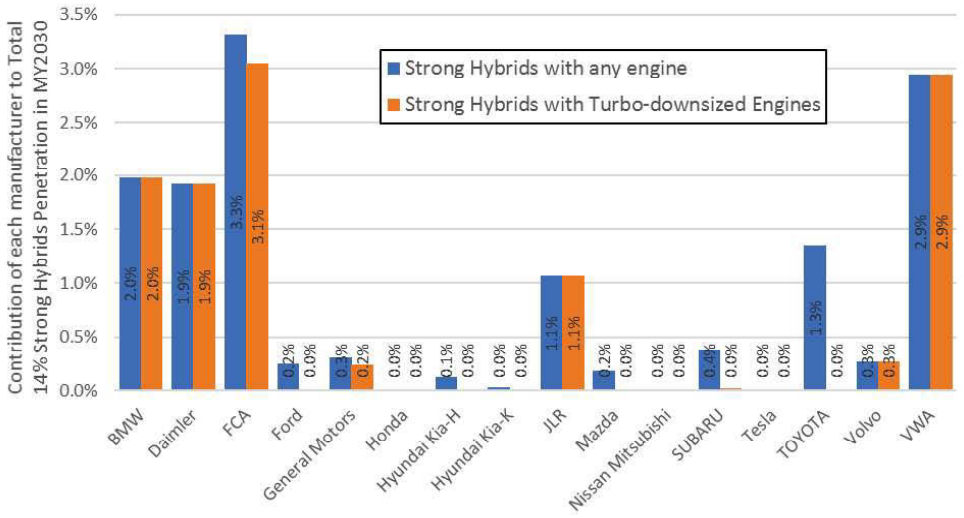


Review: CAFE model realism

CAFE Model Does Not Choose Cost-effective Pairing of Engines and Strong Hybridization (1 of 2)

Strong Hybrid Technology Pathway Comparison: Turbo vs. non-Turbo: Augural Standards in CAFE model (08-Mar ver.)

CAFE model implementation: Over 80% of the strong hybrid packages applied in the Augural case include turbo-downsized engines (11.5% of 14% fleet-wide strong-hybrid penetration)



Review: CAFE model realism

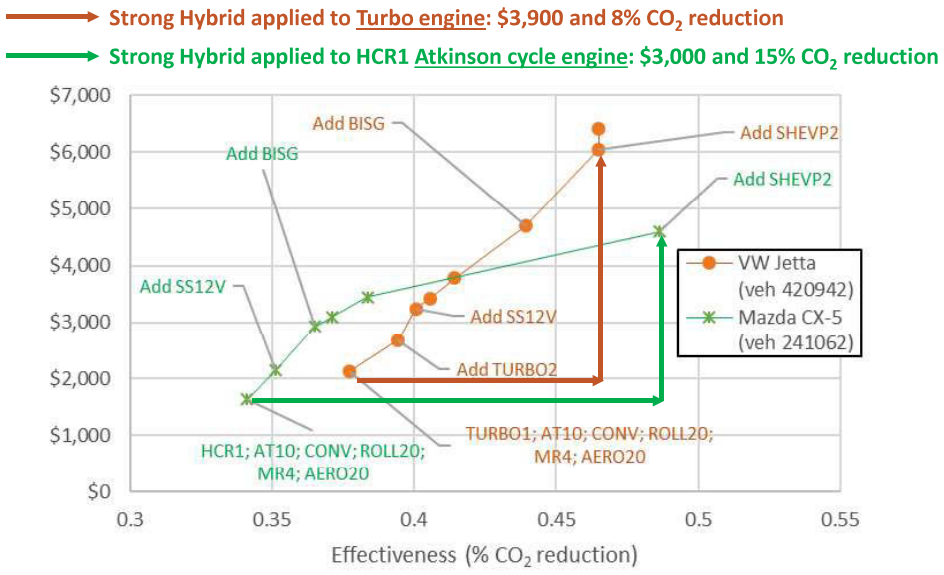
CAFE Model Does Not Choose Cost-effective Pairing of Engines and Strong Hybridization (2 of 2)

Real-world : The effectiveness benefits of strong hybridization (P2HEV and PSHEV) is dependent on the base engine technology to which the technology is applied. In typical applications, manufacturers will pair strong hybridization with efficient, but low cost Atkinson cycle engines.

CAFE model implementation: Due to the CAFE model's pre-defined technology pathways, strong hybridization is applied almost exclusively to turbocharged downsized engines, resulting in strong hybrid packages that are significantly higher costs and less effective than the vast majority of real-world implementations.

Implication of strict technology pathways: Overestimation of GHG standards cost. CAFE model is forcing combinations of technologies that are highly cost-ineffective.

Strong Hybrid Technology Pathway Comparison: Turbo vs. non-Turbo: Augural Standards in CAFE model (08-Mar ver.)



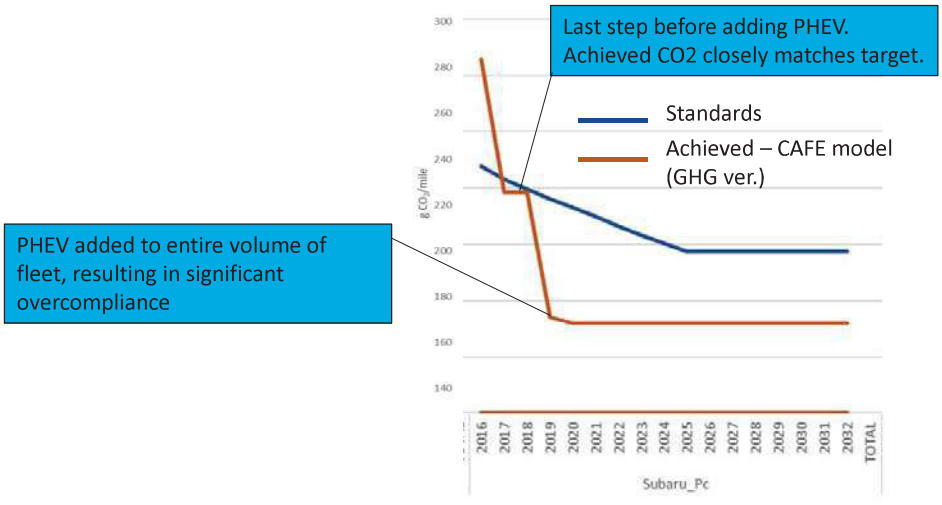
Review: CAFE model realism

Addition of plug-in electrification in reasonable volumes

Real-world : Plug-in vehicles (PEV's) provide significant compliance benefits due to low or zero emissions and multiplier incentives. Mainstream manufacturers will likely continue adopt PEV's in a strategic fashion, without drastically exceeding the volumes needed for compliance

CAFE model implementation: PEV technology is applied to platforms in 'all-or-nothing' manner, resulting in an inability to track the standards closely, and producing overcompliance levels ranging from moderate to very high.

CASE Study: Single vehicle manufacturer

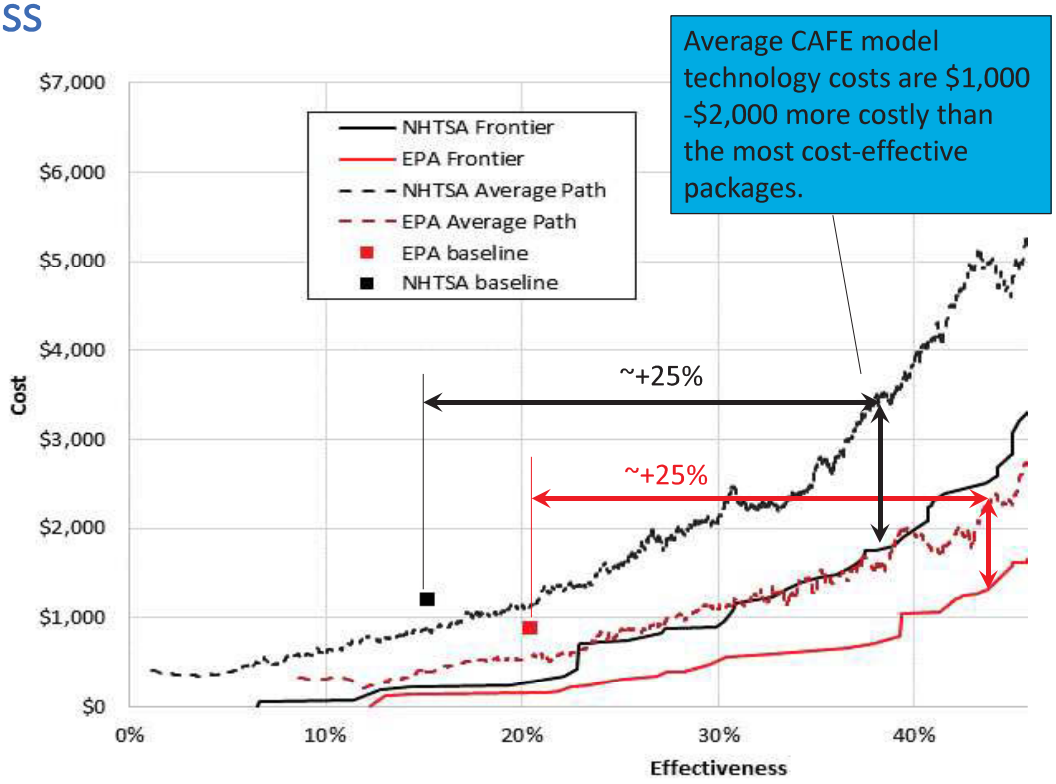


Review: CAFE model realism

Manufacturer consideration of technology package cost-effectiveness

Real-world : Manufactures will apply technology packages that are within a reasonable cost range of the most cost-effective technologies (e.g. well within $2,000)

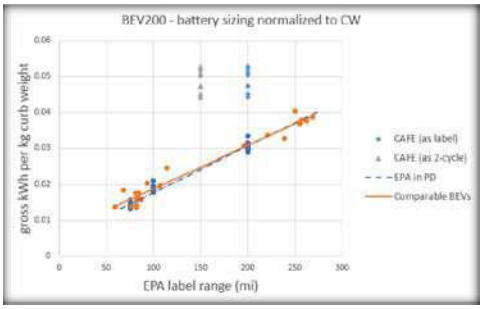
CAFE model implementation: Using the NHTSA inputs, as provided, manufacturers are projected to apply, on average, technology packages that are $1,000-$2,000 more costly than the most cost-effective packages.

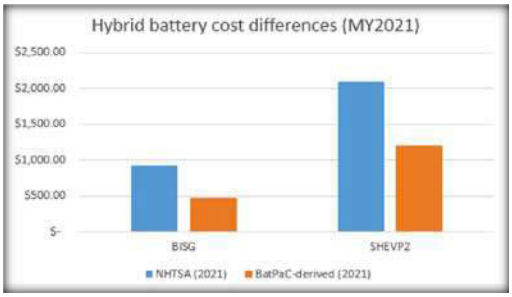


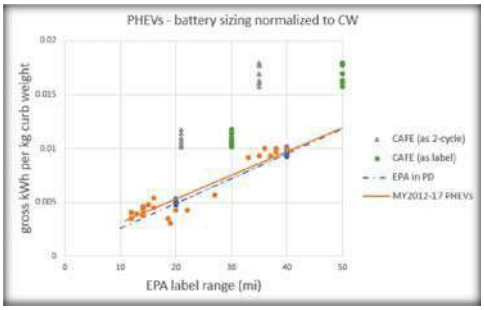
Review: CAFE model realism

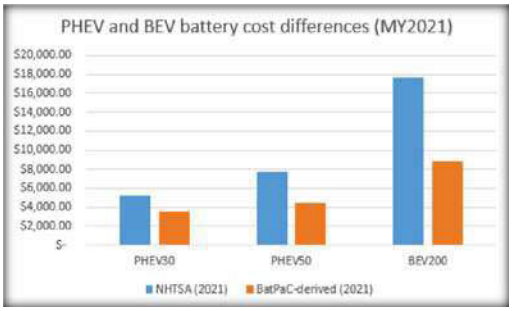
Battery Costs

- *The cost of batteries for hybrid and plug-in vehicles is in most cases significantly higher than expected based on the most recent projections derived from DOE's BatPaC model and battery sizes are substantially larger than observed in the current LD fleet.*









Review: CAFE model realism

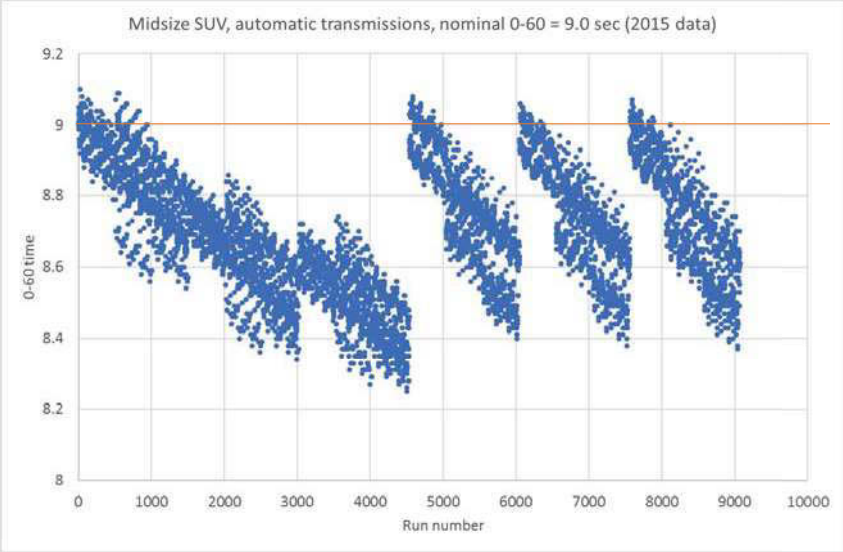
CAFE Model Projects Unquantified and Unmonetized Increase in Vehicle Performance

In the modeling for CAFE, engines are re-sized in two circumstances:

- When constructing an initial conventional or hybrid package.
- When applying over 7.5% mass reduction.

However, applying lower levels of mass reduction, advanced transmissions, or other load reduction will <u>increase acceleration performance</u>.

This additional benefit is <u>not accounted</u> for in the CAFE model.



Target 0-60 time for this class is 9.0 seconds. Actual DOT Autonomie simulations show 0-60 accelerations much better than the target for many technology packages.

Review: CAFE model Representation of GHG Program

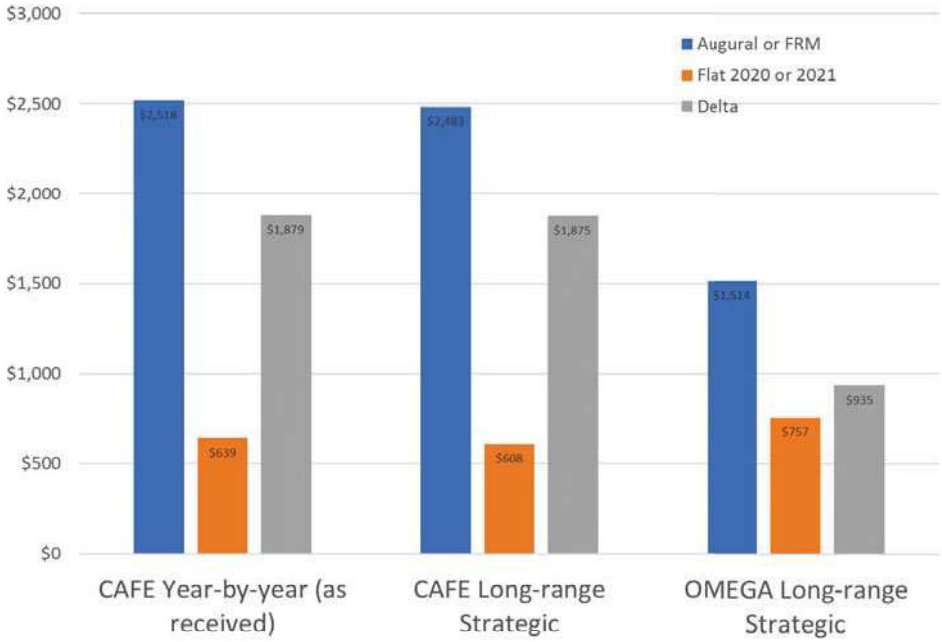
Summary of the representation of GHG Program elements in the CAFE model

Program element	CAFE model implementation issues
BEV and PHEV Advanced Vehicle Technology Multipliers	CAFE model only adjusts the fleet average emissions to account for the multiplier values. For proper accounting of credits, the multipliers must also be incorporated into the GHG target.
Accounting for plug-in vehicle (PEV) upstream emissions	CAFE model does not have any inputs or apparent mechanism for accounting for the upstream emissions of PEVs, as required by the EPA regulations
A/C credits (efficiency and leakage)	The input files, as received from NHTSA, assume that all manufacturers earn a constant credit from AC efficiency and leakage in all years. However, the inputs for the standard footprint curves are adjusted for AC efficiency and leakage that increases over time. As a result, the standards defined in the CAFE model, as received, are less stringent than the actual standards.
Unlimited transfer is allowed within a manufacturer between car and truck fleets	CAFE model does not realistically account for car-truck credit transfers within a manufacturer (as described in earlier slide.) This likely contributes to the model's overall overcompliance, and the associated increase in costs.
Off-cycle Emission Credit caps	CAFE model inappropriately applies the credit cap (10g/mi) separately to each manufacturer's car and truck fleets. The GHG regulations specify that the cap is applied to a manufacturer's combined fleet.

CAFE model results 'walk'

Year-by-year vs. Long-range Strategic Modelling

- Specification of redesign cycles and year-by-year compliance considerations have a minimal effect on the projected 2025 compliance costs in the CAFE model.
- Differences between NHTSA and EPA cost projections are the result of modeling inputs, constraints and anomalies within the CAFE model (see other EPA slides).



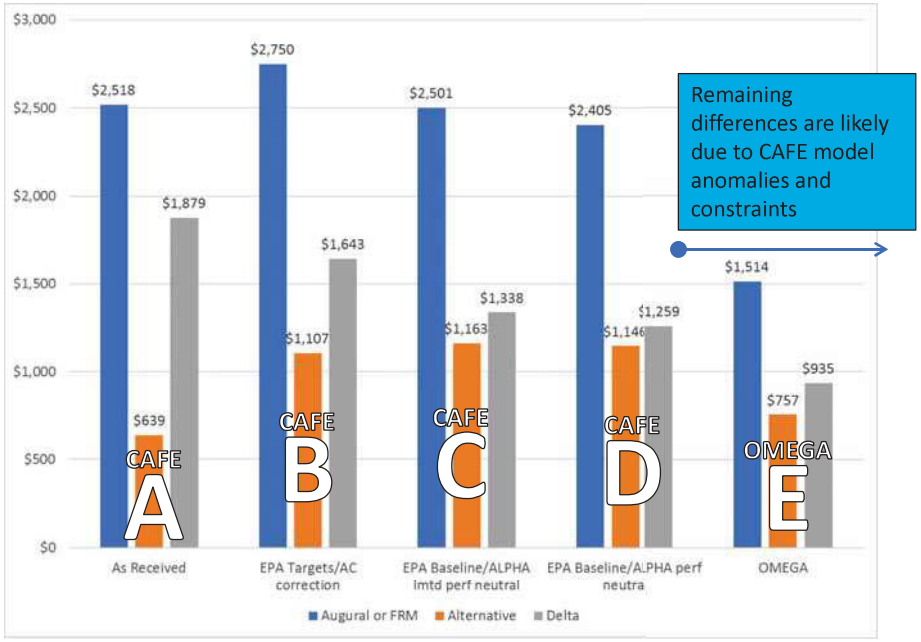
CAFE model results 'walk'

CAFE model runs with EPA settings and inputs

Run A: CAFE (GHG ver.)

"As received" from NTHSA which uses:

- Augural standards as the reference case
- Flat 2020 forward as the alternative case
- NHTSA/Volpe effort at characterizing the A/C provisions of the GHG standards
- Engine effectiveness estimates are compared against targets incorporating A/C efficiency expectations
- A/C leakage values not properly reflected

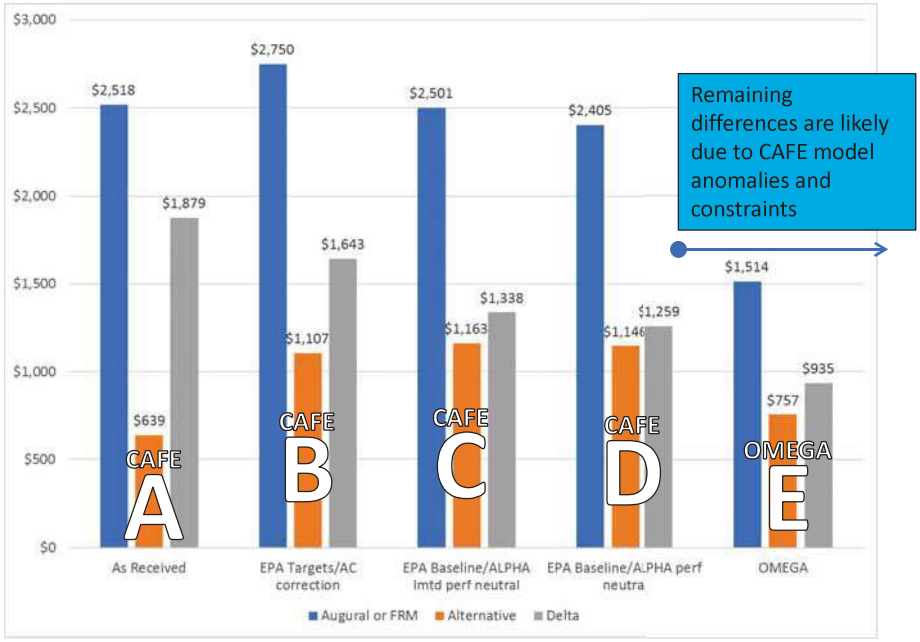


CAFE model results 'walk'

CAFE model runs with EPA settings and inputs

Run B: CAFE (GHG ver.)

- EPA's 2022-2025 FRM targets as the reference case
- EPA's 2021 and later FRM targets as the alternative case
- EPA characterization of the A/C provisions of the GHG standards
- Engine effectiveness estimates are appropriately applied to 2-cycle targets that ignore influence of A/C efficiency expectations
- A/C leakage values corrected

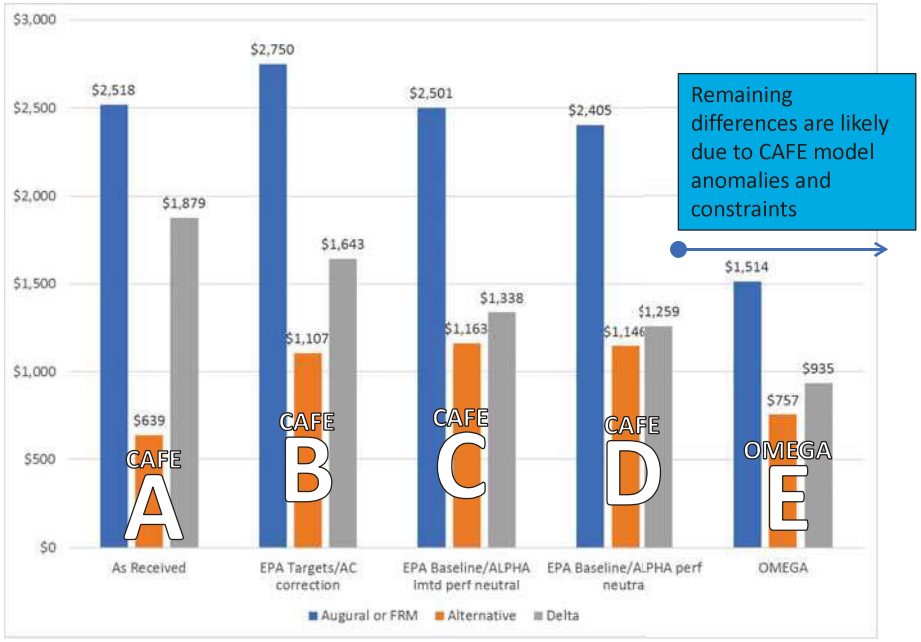


CAFE model results 'walk'

CAFE model runs with EPA settings and inputs

Run C: CAFE (GHG ver.)

- Use of EPA's baseline fleet which incorporates a higher level of technology
- Use of EPA's cost input estimates including more recent BatPaC results
- Use of EPA's ALPHA modeling of effectiveness, but with NHTSA's engine resizing approach which does not maintain performance neutrality

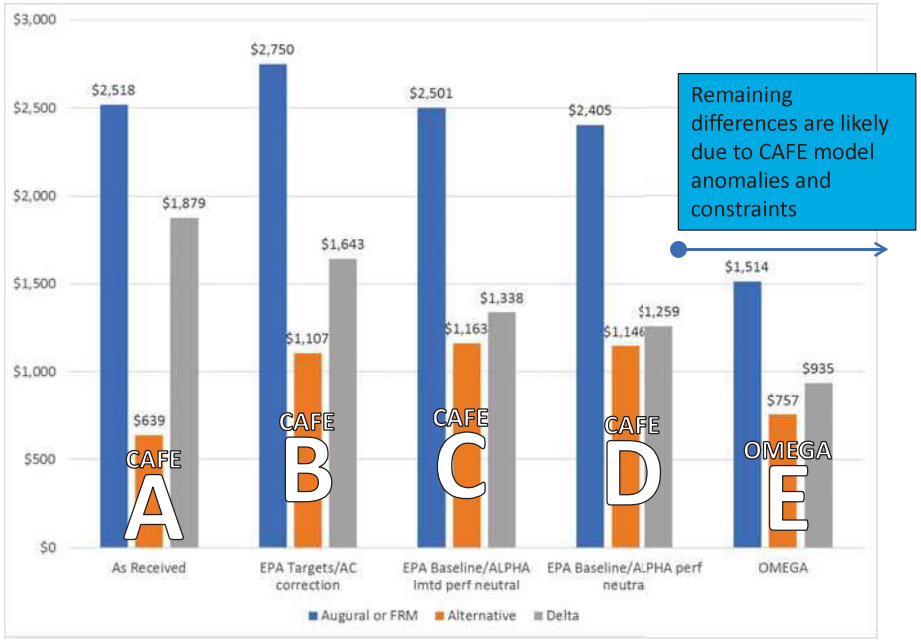


CAFE model results 'walk'

CAFE model runs with EPA settings and inputs

Run D: CAFE (GHG ver.)

- Use of EPA's baseline fleet as in the "C" set
- Use of EPA's cost inputs as in the "C" set
- Use of EPA's ALPHA modeling of effectiveness, maintaining performance neutrality

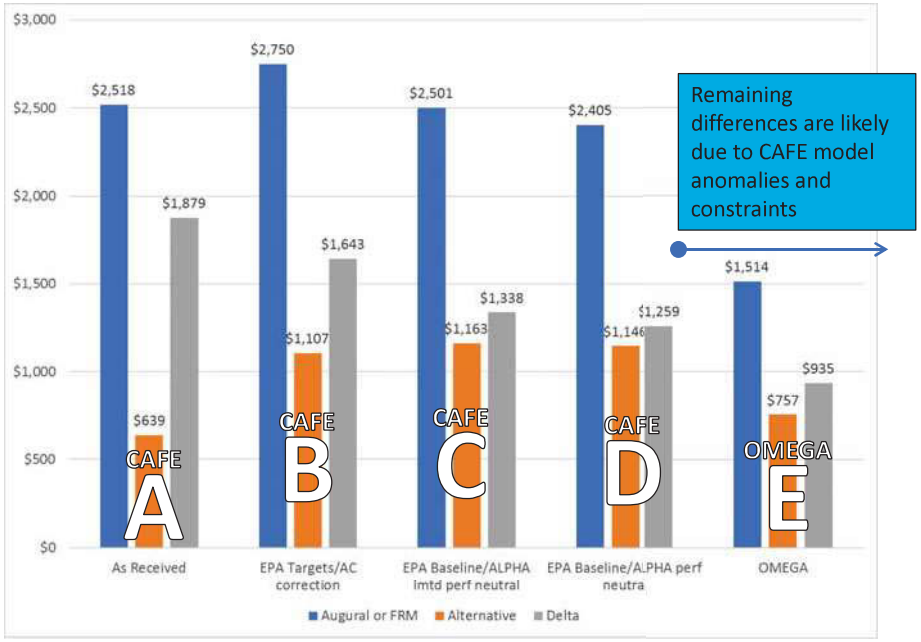


CAFE model results 'walk'

CAFE model runs with EPA settings and inputs

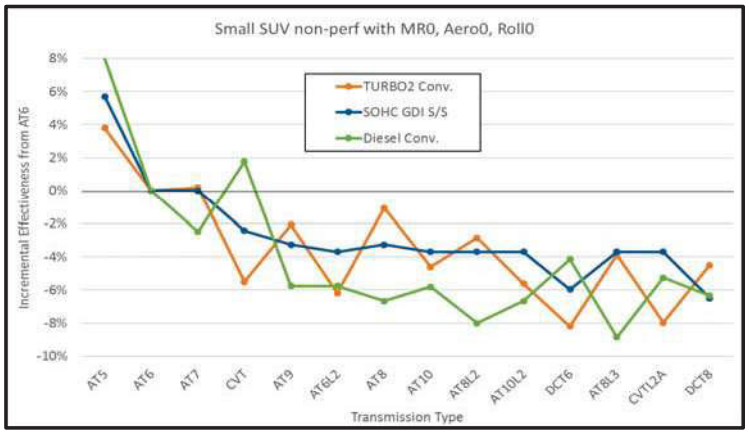
Run E: CAFE (GHG ver.)

- Full use of ALPHA and OMEGA



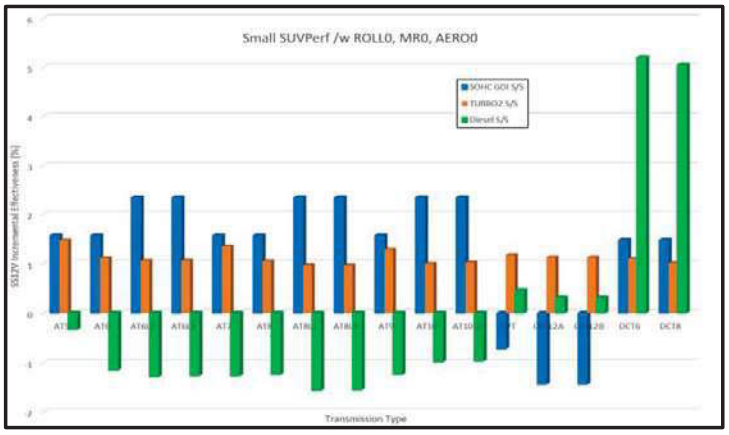
Technology Effectiveness

- *EPA has also identified specific technology effectiveness observations that are inconsistent with expected performance.(examples provided below)*



Observations of Transmission Effectiveness

- Consistent values could indicate lack of resolution in modeling (single values being applied broadly).
- Additional technology does not follow a logical progression of improvement.



Observations of Stop/Start Effectiveness

- Effectiveness of stop/start should be consistent independent of the transmission (for a given engine).
- Stop/start can never produce a negative effectiveness.

CAFE Model Observations

From EPA's March 1st summary status report of CAFE model review:

The use of EPA input values in the CAFE model which update and/or correct the anomalous inputs used in the NTHSA-reported runs from January 22 has a significant impact on several key output results:

Relative to the Augural Standards, technology cost savings of Alternative standards are reduced and fatalities increase.

Source	As summarized by NHTSA		As run by EPA (as received)		EPA-updated inputs w/ DFS and Scrappage models (44)		EPA-updated inputs w/o DFS and Scrappage models (44)	
Model Years	2017-2025 (current standards)	2021-2026	2017-2025 (current standards)	2021-2026	2022-2025	2022-2025	2022-2025	2022-2025
Annual Rate of Increase in Stringency	No Action	0.0%/Year PC 0.0%/Year LT	No Action	0.0%/Year PC 0.0%/Year LT	No Action	0.0%/Year PC 0.0%/Year LT	No Action	0.0%/Year PC 0.0%/Year LT
Price Increase due to New CAFE Standards ($/veh) MY2030	baseline	-$1,879	baseline	-$1,879	baseline	-$1,236	baseline	-$1,259
Weight reduction	19% (not including powertrain)	12% (not including powertrain)	19% (not including powertrain)	12% (not including powertrain)	14% (including powertrain)	11% (including powertrain)	14% (including powertrain)	11% (including powertrain)
HCR	26%	12%	26%	12%	36%	26%	32%	26%
Turbo-downsized	62%	46%	62%	46%	33%	33%	36%	36%
Dynamic Deac (DeacFC)	7%	0%	7%	0%	0%	0%	0%	0%
Diesel	1%	1%	1%	1%	1%	1%	1%	1%
Advanced transmissions	82%	93%	82%	88%	59%	76%	64%	79%
Stop-Start (12V)	10%	13%	10%	13%	23%	11%	14%	11%
MHEV48V	41%	2%	41%	2%	23%	9%	33%	13%
Strong HEV	14%	2%	14%	2%	17%	7%	14%	7%
Sum of mild and strong HEV	55%	5%	55%	5%	40%	16%	47%	19%
Sum of PEVs	1%	1%	1%	1%	13%	5%	14%	6%
Average Annual Fatalities CY 2036-2045 without rebound	baseline	-150	baseline	-150	baseline	-156	baseline	+60
Average Annual Fatalities per Billion Miles CY 2036-2045 without rebound		not reported	baseline	+0.004	baseline	+0.016	baseline	+0.021
Average Annual Fatalities CY 2036-2045 with rebound		-863	baseline	-863	baseline	-911	baseline	-649
Average Annual Fatalities per Billion Miles CY 2036-2045 with rebound		not reported	baseline	+0.007	baseline	+0.017	baseline	+0.023