Summary

What is the recent data showing on overall fuel economy including light trucks?

- Analysis of various data sources shows that the auto industry continues to make improvements, but two factors are contributing to a temporary slowdown in new vehicle fuel economy improvements.
- First, automakers are selling more pickup trucks and SUVs, which while more efficient than in years past, require more fuel as compared to cars. The standards automatically account for these changing trends by having lower requirements for larger vehicles and adjusting the overall requirement downward since trucks must meet a lower standard than cars.
- Second, the number of new models being redesigned (or “replaced”) – when automakers typically add on significant new fuel-efficient technologies – has recently declined. Fewer model replacements in the last two years mean less technology being applied. This trend is cyclical, though, and the rate will increase over the next two to three years.
- Manufacturers have also introduced more vehicles with larger footprints that are also contributing to lower overall fleet fuel economy than originally expected. As noted, the regulations account for this by having a lower standard for larger vehicles.

Will these trends continue?

- No, an increase in the fuel economy of the fleet is expected by analysts as automakers increase the number of new model introductions and redesigns over the MY 2018-2020 timeframe, meaning a larger share of the new fleet will also see major fuel economy gains. Together with other flexibility provisions built into the standards, the industry will be well positioned to meet or exceed standards going forward.
- The way the industry is increasing new model introductions and redesigns should lead to an increase in the rate of fuel economy improvements.
  - Many major models in the LT category will see a redesign between now and 2020. That includes the Chevy Blazer (a planned reintroduction) and Silverado, the Ford Expedition/Navigator, the Jeep Compass, Wrangler, and RAM Pickup, Honda CR-V, and Toyota RAV4 and Highlander.
  - Automakers are also finding ways to incorporate improvements during periodic product refreshes. Take the F-150 for example, which is moving to a 10-speed transmission as well as offering a more fuel-efficient diesel version within the normal product cycle, despite a full redesign not planned until Model Year 2020.
  - The movement toward global platforms as well as part sharing across vehicle platforms is reducing the cost of fuel economy improvements because costs are spread across higher volumes of vehicles.
  - The pace of new product introductions and redesigns is strong.
Detailed Analysis

*Fuel economy improvements have slowed down recently due to a lower share of new products being introduced. As the auto industry’s product cycle picks up, overall fuel economy of the fleet will increase more rapidly.*

The auto industry is cyclical and reached a low point in terms of passenger vehicle sales during the Great Recession starting in 2009, followed by a strong recovery period with sales peaking at record levels in 2016. New product developments and launches were generally delayed during the recession until the finances of the automakers improved.

As a result, our analysis shows that by model years (MYs) 2012-2013, 11 to 12% of all U.S. passenger vehicles sold were either new models or product redesigns that saw a major improvement in fuel economy (“FE”) versus the prior model year product (red line).¹ By MYs 2016-2017, this share fell to only about 4 to 6%, or about half the rate of earlier years, meaning the share of production and sales that underwent a major fuel economy improvement had fallen.

By contrast, the magnitude of the fuel economy improvement for redesigned products has increased strongly more recently. In MYs 2012-2013, those redesigned products saw a sales-weighted, average improvement in fuel economy of 9 to 11%. The magnitude steadily increased so that in MY 2016-2017

¹ These included models that improved by over 5% in fuel economy from one model year to the next. In most cases improvements were 10% or more.
(YTD), the improvement ranged from 16 to 22%. These results are reflective of the increased efficacy of fuel efficiency technology and additional approaches being used. However, in the most recent years these larger improvements have not been enough to counteract the more significant decline in model redesigns. In 2017, the percent of sales with significant redesigns was only a third of its 2013 peak.

Manufacturers have also introduced more vehicles with larger footprints, including Crossover Utility Vehicles (CUVs) that qualify as light trucks, resulting in lower overall fleet fuel economy than originally expected.

Another critical factor affecting the overall fuel economy level is the shift in market share from passenger cars to light trucks. The change has been particularly swift in the last couple of years as automakers have focused on crossover utility vehicles (“CUVs”) for their new product introductions, a trend that blurs the distinction between passenger cars and light trucks.

The National Program has separate standards for cars and trucks, and since the standards take account of the increasing truck share as part of the fleet averaging approach, the overall requirements for the automakers automatically adjust, in this case, downward. In fact, the better fuel economy of crossovers (as compared to sport utilities and pickups) facilitates the efforts of the automakers to improve the fuel economy of their truck fleets.

For example, under the fuel economy and GHG emission standards implemented by the National Highway Traffic Safety Administration and U.S. Environmental Protection Agency, the best-selling CUV (Honda CR-V) qualifies as a passenger car for the two-wheel drive version and as a light truck for the all-wheel drive version, with the latter providing higher fuel economy than framed trucks such as SUVs of the same footprint.² While the crossover products are generally based on car platforms and get relatively high fuel economy, the increasing share of the market satisfied by light trucks (including CUVs designated as light trucks) and vehicles with larger footprints reduces the overall fuel economy requirements. According to Automotive News, 21 out of 25 redesigned models they reviewed since 2012 have gotten bigger.³

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² https://www.eia.gov/todayinenergy/detail.php?id=31352
Will a slowdown in fuel economy for cars and light trucks continue?

No, an increase in the fuel economy of the fleet is expected as the number of new model introductions and redesigns increase over the MY2018-2020 timeframe, meaning a larger share of the new fleet will also see major fuel economy gains. Together with other flexibility provisions built into the standards, the industry will be well positioned to meet or exceed standards going forward.

Based on new product plans included in our North American sales and production forecast, Baum & Associates shows that for MY 2018, 2019, and 2020 the industry will see an exceptionally strong share of new models in the range of 17 to 26% annually, reflecting the cyclical nature of product introductions and plans. Given the reduced cost (higher volume leads to these lower costs) and increased efficacy of fuel-saving technology, complying with the existing standards over these model years is becoming easier and will reverse the potential slowdown in the current rate of fuel economy improvements. These credits can also serve as income for automakers that over-comply and sell these credits to other automakers that may be under-complying with the required levels. Some other flexibility provisions that will likely be taken advantage of by automakers include:

- Other benefits of credit banking: The banking of credits also allows automakers to smooth out the cyclical nature of product introductions and associated fuel economy improvements across their fleet. Over-compliance in some years, such as when new products are introduced or when an automaker decides to for competitive reasons focus upon fuel economy as a marketing strategy, can be saved to use during years when products are not redesigned. In addition, the system enables automakers to utilize credits earned from the car fleet to be applied to under-compliance in its truck fleet (or vice versa).
• Off-cycle credits: Additional credits are available to encourage specific technologies not captured by the methodologies used to measure fuel economy. These include credit multipliers for full-sized pickup trucks using hybrid technologies, air conditioning efficiency and leakage credits, stop/start system credits, multipliers and zero-upstream credits for certain electrified vehicles, and numerous other off-cycle credits. These program flexibilities are enormously significant in making the standards even more feasible than the technology and cost assessments, by themselves, may suggest.

*Industry trends with respect to product cadence are enabling an increase in the rate of fuel economy improvements.*

Specifically, automakers are now making more frequent improvements to their products in the form of 1) shorter times between major redesigns and/or platform replacements, 2) minor redesigns in between these major product improvements that are more substantive, and 3) and continuous updates in the powertrains themselves, some of which are in concert with other product updates and some of which are not.

Typically, powertrains have not been subject to frequent improvement and in many cases were carried over between major changes in the underlying vehicles on which they were used. However, new technologies (and their reduced cost), competitive pressures, and regulatory requirements have led automakers to increase both the pace and content of product improvement within their powertrains. Thus, we are seeing both major improvements (as shown in the chart above) and smaller incremental improvements in fuel economy and emissions.

For example, the Ford F-150 (on the T1 Platform) was launched in Fall 2014 (Model Year 2015) with major changes including vehicle design changes, an aluminum body, and several powertrain changes including the launch of a 2.7 liter V6 EcoBoost engine (which has been strongly embraced by consumers). This Fall (Model Year 2018), Ford will add an additional engine which will result in improved fuel economy as well as a ten-speed transmission that will be applied in most vehicle applications. A diesel engine will launch in Spring 2018, which when combined with the ten-speed transmission will result in the highest fuel economy for any F-150 product to date. While a major product update will not occur until Model Year 2020, Ford’s highest volume product will enjoy a significant gain in fuel economy mid-cycle beginning in the current model year.

While cylinder deactivation has been used for some time by GM and FCA, Delphi Technologies has recently commercialized Dynamic Skip Fire (DSF) which unlike previous cylinder deactivation systems, is electronically controlled and can shut off portions of the engine on a continuously changing basis. Dynamic cylinder deactivation technologies like DSF will be incorporated in new vehicles in 2018, and is expected to reduce carbon dioxide and fuel emissions by 8-15%. According to Delphi Technologies, when dynamic cylinder deactivation is coupled with a 48-volt hybrid system (see below for more details on this system), up to a 20% decline in emissions can be achieved.

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4 These methods have the virtue of being predictable and standard across the industry and are well understood. However, the impact of some new fuel saving technologies would not be included and thus the National Program includes these “special” or off-cycle credits.
The movement toward global platforms as well as part sharing across platforms is spreading out the costs of fuel economy improvements across higher volumes of vehicles.

One might wonder how the cost of these improvements is being borne by the automakers and their customers. Automakers are moving to global platforms that are achieving much higher volumes than in the past. This approach spreads the cost of research, design, and part procurement over higher volumes. This strategy works well for consumers who can enjoy improvements in product and cost while spending less on operating costs (including fuel). In addition, an increasing number of parts are being used across platforms, thus further reducing development and procurement costs.

Examples of these global platforms include:

1. Toyota—Toyota New Generation Architecture (TNGA)
2. Renault Alliance—Common Module Family (CMF)
3. GM—C1XX, D2XX, G2XX, K2XX, P2XX and VSS-F, VSS-R, VSS-S, VSS-T
4. Ford—C1, C2, CD3, CD6, T6
5. Honda—CCA platform that combines Accord, Civic, and its variants
6. VW—MQB, MLB, MSB

What is the availability of technology and new vehicles going forward to improve fuel economy?

The pace of new product introductions and redesigns is strong. This year and next, the following new products will be introduced, most of which are high-volume and will result in significant fuel economy improvement from their prior versions:

- FCA
  - Jeep Compass
  - Jeep Wrangler
  - RAM Pickup
- Ford
  - Ford Hybrid Car
  - Lincoln Aviator
  - Ford Expedition/Lincoln Navigator
- GM
  - Buick Enclave
  - Cadillac XT4
  - Chevrolet Blazer (to be reintroduced in Model Year 2019 as a crossover)
  - Chevrolet Traverse
  - Chevrolet Equinox
  - Chevrolet Silverado
  - GMC Sierra
- Honda
  - Honda Accord (complete updating of vehicle and powertrain with no V6 offered)
  - Honda CR-V
- Hyundai
  - Hyundai Santa Fe
  - Hyundai Sonata
- Nissan
  - Nissan Altima
  - Nissan Leaf (increased range at lower cost)
- Toyota
  - Toyota Camry (fuel economy improvement expected at over 20%)
  - Toyota Avalon
  - Toyota RAV4
- VW
  - VW Atlas
  - VW Jetta
  - VW Tiguan

Other technologies that will enable higher fuel economy include 48 volt battery systems offered by key suppliers including Bosch, Continental, Delphi Technologies, Denso, and Valeo. This battery supplements the existing electrical system and can be thought of as a mild hybrid that allows for downsizing of the engine, increases the ease of incorporating a variety of popular convenience and safety technologies, while enabling dramatic increases in fuel economy at lower costs. The technology is “bolt-on” meaning it can be added to vehicles without major vehicle or powertrain upgrades or redesigns. Among the Detroit Three, Ford is the leader in this technology which is currently debuting in Europe and should be available in North America by 2020.

Stop/start systems are becoming ubiquitous and offer excellent fuel economy improvement (around 5% in newer systems that shut the engine off during coasting) at relatively low cost (around $300).

Mazda has been a leader in its SkyActiv technology which uses improvements in chassis, material selection, braking, and powertrain to improve fuel economy. By 2019, the system will proceed to the next generation with the launch of SkyActiv-X engine that will use compression ignition and will improve engine efficiency by 20-30%.

These examples illustrate the many ways in which auto companies will be able to meet the current National Program standards.