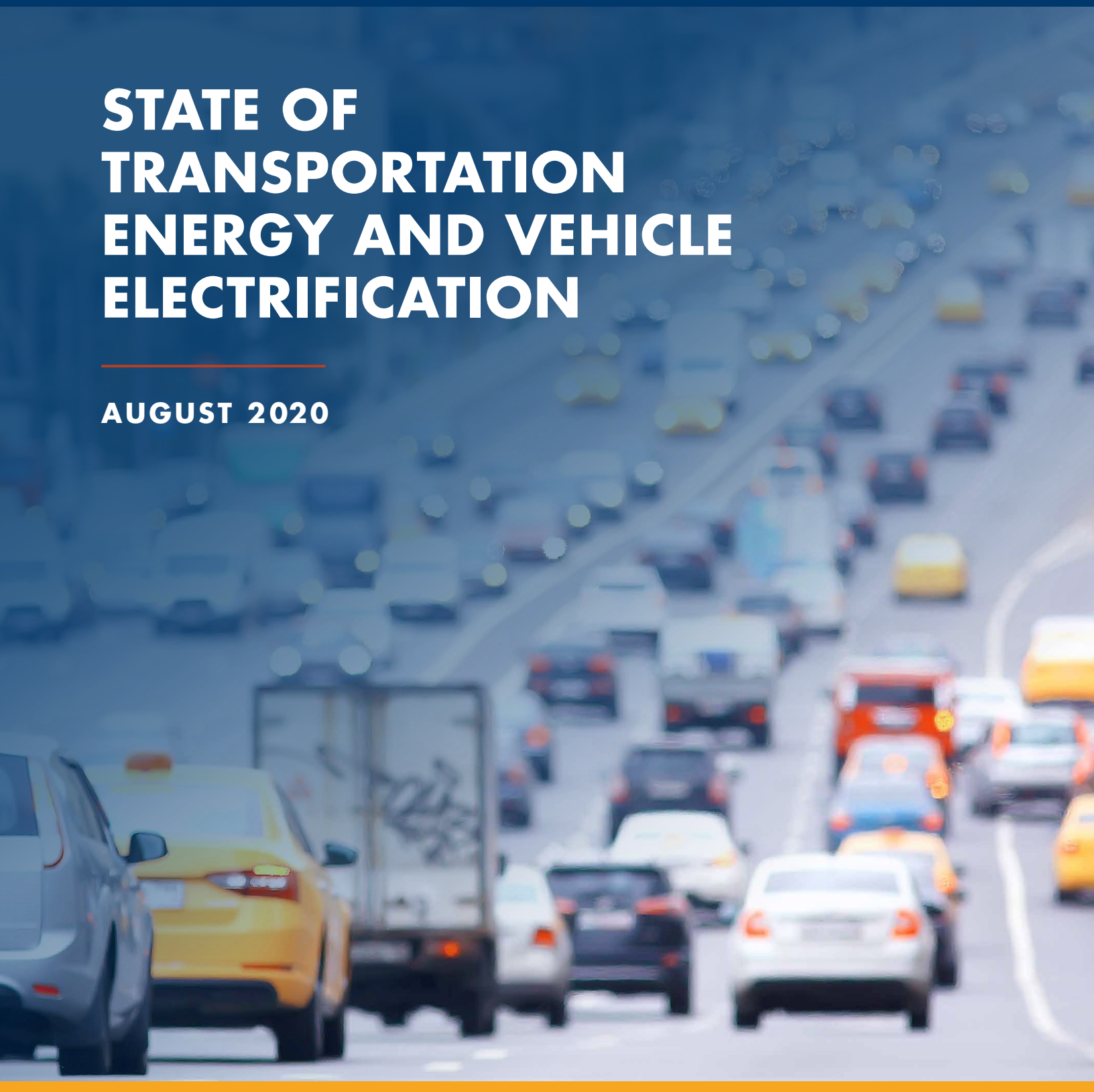
Fuels Institute

WHITE PAPER

STATE OF TRANSPORTATION ENERGY AND VEHICLE ELECTRIFICATION

AUGUST 2020



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ABOUT THIS WHITE PAPER

This report was written by the Fuels Institute, combining public and proprietary data as well as industry insights gained from members and other industry relationships.

Introduction

The transportation market is transitioning to lower-carbon-intense sources of energy and more efficient use of existing energy resources, but the transition is proceeding at an evolutionary pace. While many are advocating a rapid transition to an electrified transportation market, the realities of market fundamentals and the nature of consumer choice stand in the way of radical reform.

Rather, a more measured pace of transition is likely to occur with a broad mix of powertrains moving people from one place to another. This is not to say that disruption cannot occur — it most certainly can, and there are a number of market areas in which a more rapid restructuring of market fundamentals could take place — but as of now, there does not appear to be the impetus for such dramatic change and consumers do not seem poised to force a revolution. An objective look at the numbers as they stood at the end of 2019 provides a solid foundation upon which to evaluate the future of the market's evolution.

The Fleet Is Becoming More Efficient

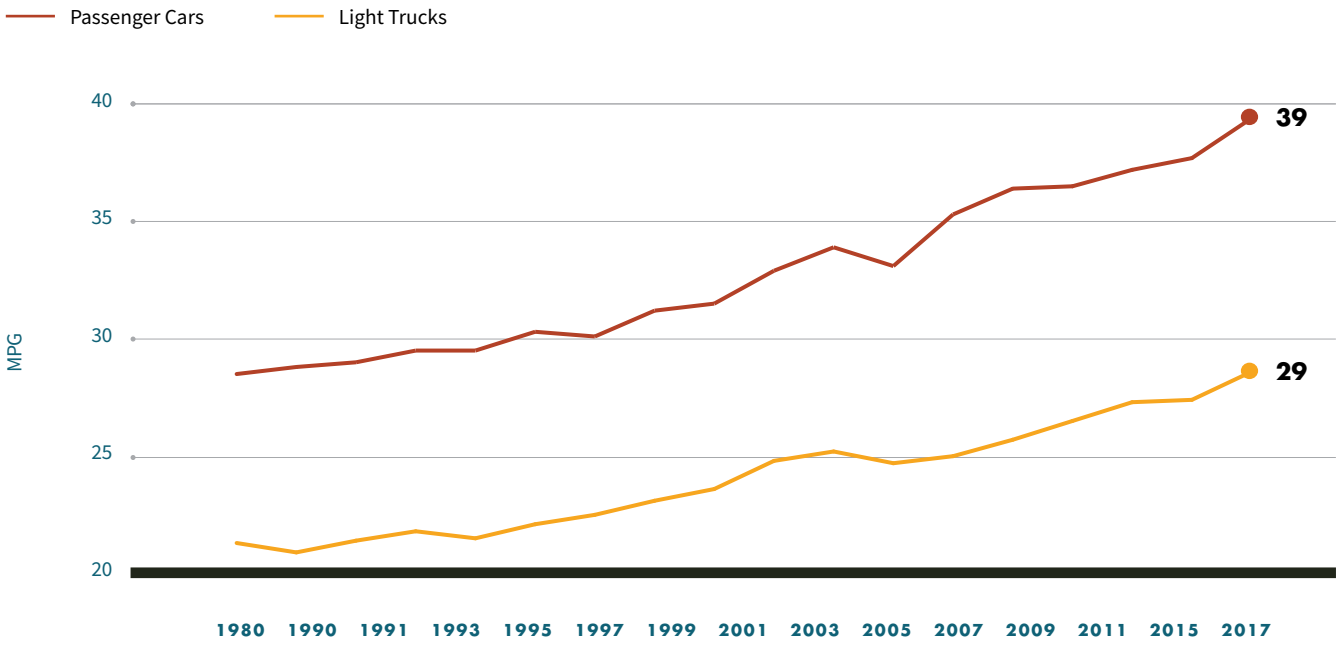
It is no illusion that the vehicle fleet is becoming more efficient and that the impact on overall liquid-fuel demand will be pronounced.

According to the U.S. Bureau of Transportation Statistics, the average miles per gallon (MPG) of the light-duty fleet improved by more than 35% between 2000 and 2017.[1] As a result, the environmental performance of every class of vehicle has improved. According to the U.S. Environmental Protection Agency (EPA), carbon dioxide (CO2) emissions and MPG for pickups, minivans, sport utility vehicles, crossover utility vehicles, and sedans improved significantly between 2004 and 2018.

What is impressive about these achievements is the technologies used by the automotive manufacturing industry to achieve them. Through 2018 the use of

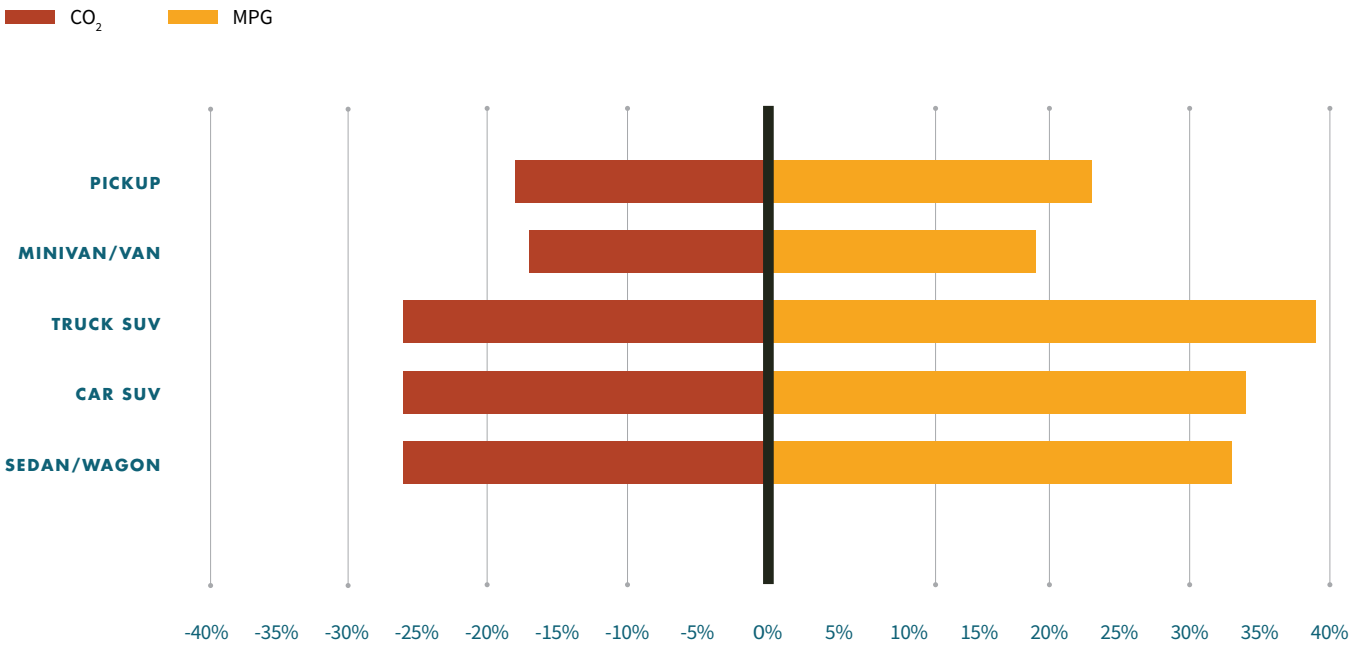
1 "Average Fuel Efficiency of U.S. Light Duty Vehicles," U.S. Department of Transportation, accessed June 3, 2020, https://www.bts.dot.gov/content/average-fuel-efficiency-us-light-duty-vehicles.

FIGURE 1: AVERAGE FUEL ECONOMY OF NEW VEHICLES



Source: U.S. Bureau of Transportation Statistics

FIGURE 1. CHANGE IN CO_2 EMISSIONS AND MILES PER GALLON (2004–2018)



Source: U.S. Environmental Protection Agency

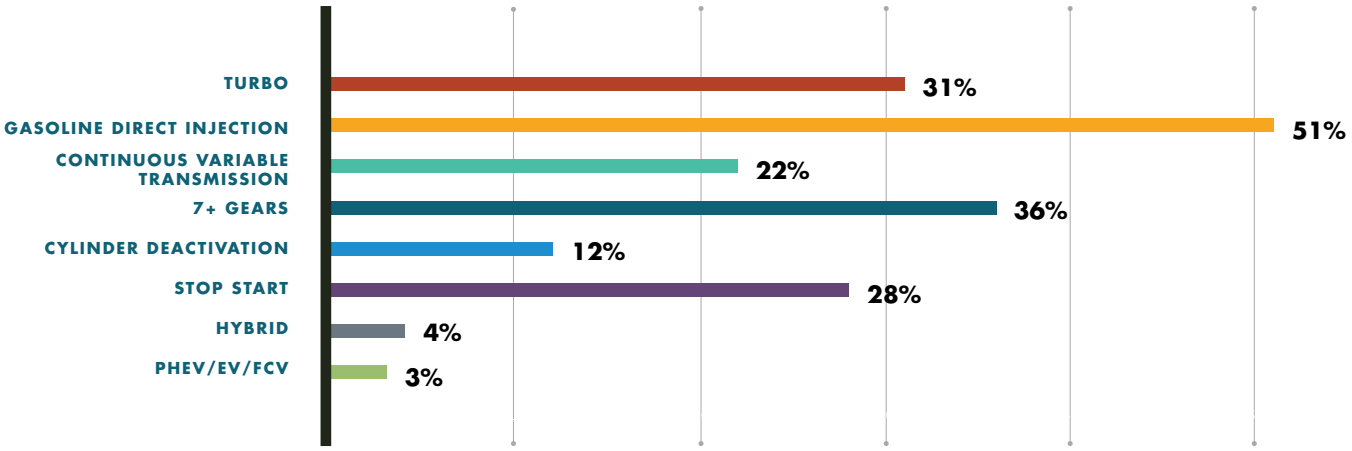
electrified powertrains was very limited. Engineers leveraged a variety of other strategies to achieve improved efficiency, reduced emissions, and enhanced performance (a vehicle characteristic many consumers were most aggressively seeking). According to the EPA, some of the emerging technologies brought to market to deliver these improvements have been adopted at rapid rates:[2]

- **Multi-valve cylinders** debuted in 1986 and in 2018 represented 92% of new engines
- **Turbo boosting** was a relatively niche product until the mid-1990s and are now available in 31% of new vehicles
- **Variable valve timing** debuted in 2000 and within 18 years was installed in 96% of new vehicles
- **Gasoline direct injection** was first introduced in 2008 and by 2018 was found in 51% of new vehicles
- **Stop start**, which shuts off the engine when idling to save fuel and then automatically restarts, first appeared in 2012 and in 2018 was found in 28% of the market

Equally impressive is how engineers leveraged transmission technology. Anyone who has ever ridden a bicycle knows that the more gear selections you have at your disposal, the easier it is to climb hills, go faster, and travel further without exhaustion. By increasing the number of gears available in a vehicle, automotive engineers are able to get the most performance from their engines. By 2018, vehicles equipped with seven or more gears, including continuously variable transmissions, accounted for 58% of new vehicles. The number of vehicles equipped with four- or five-speed transmissions, which were once the dominant transmissions in the market, became virtually non-existent by 2015.

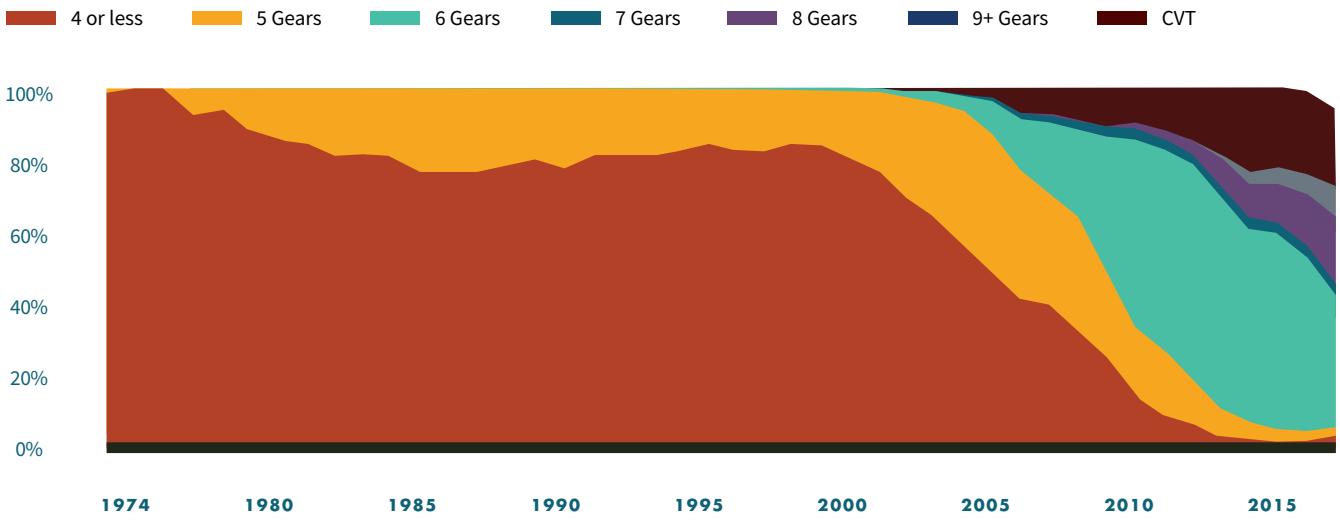
2 U.S. Environmental Protection Agency, *2018 Automotive Trends Report*, March 2019, https://www.epa.gov/automotive-trends/download-2018-automotive-trends-report-previous-year.

FIGURE 3. MANUFACTURERS' USE OF EMERGING TECHNOLOGIES (MODEL YEAR 2018)



Source: U.S. EPA, "The 2018 EPA Automotive Trend Report"

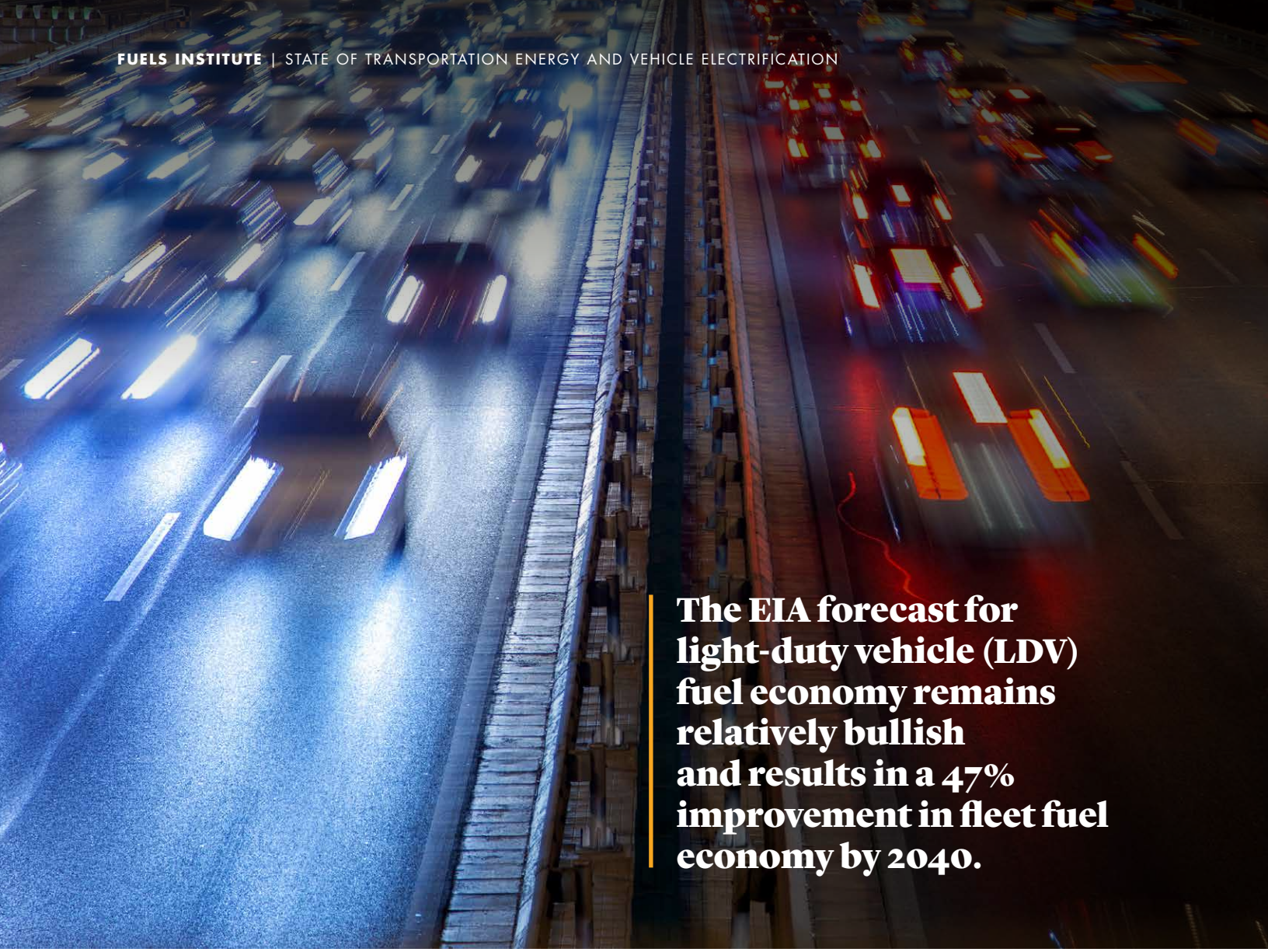
FIGURE 4. SHARE OF TRANSMISSIONS BY NUMBER OF GEARS



Source: U.S. Environmental Protection Agency

The fact is that automotive engineers have boosted fuel economy and reduced emissions by improving upon technologies within the internal combustion engine (ICE). An executive for a major global automaker was quoted in the July/August 2019 issue of *Automotive Engineering* saying, "The way things are being covered right now, you would think we had just stopped everything, and everything is electric, and that certainly is not the way things are going to develop …. In the end you want to provide what the customers want: fuel economy, performance, quality, reliability …. We are doubling the number of resources that we have on [battery electric vehicles], but we still have a tremendous amount of work to do on ICEs."[3]

3 Paul Seredynski, "GM'S Ken Morris Lives the Pace of the Powertrain Revolution," Automotive Engineering, July/August 2019, 26, https://www.nxtbook.com/nxtbooks/sae/19AUTP08/index.php?lre=1%3A353238363545423336393836333243424439303739383333363731464642414 4#/0

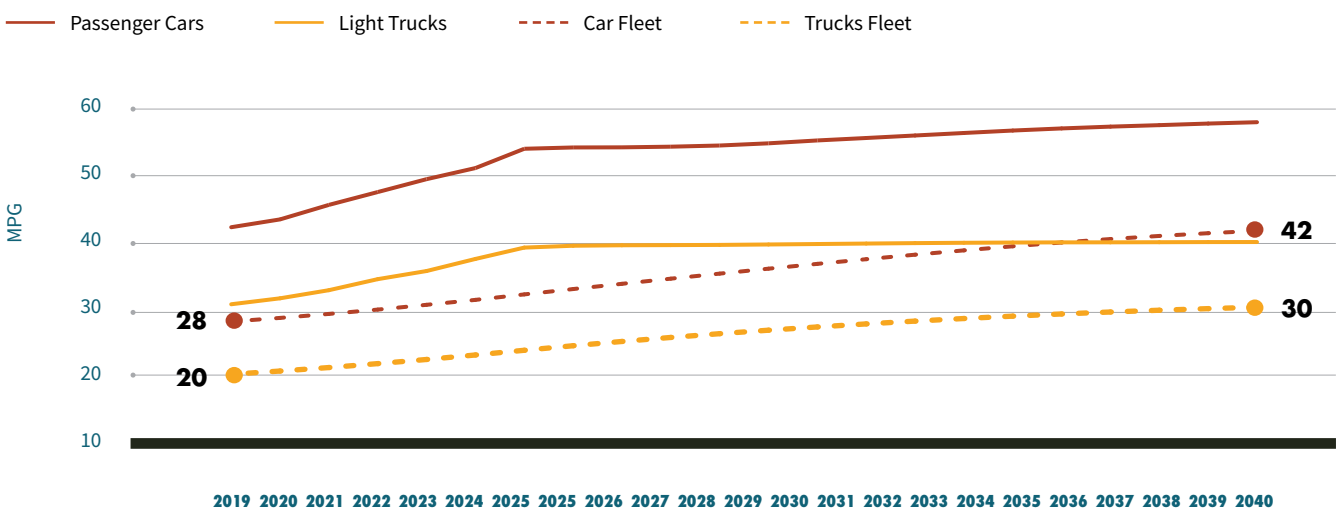


The EIA forecast for light-duty vehicle (LDV) fuel economy remains relatively bullish and results in a 47% improvement in fleet fuel economy by 2040.

Despite recent progress, there remains room to improve, and the federal Corporate Average Fuel Economy (CAFE) standards require such improvements be achieved by 2025. In its Annual Energy Outlook 2020,[4] the U.S. Energy Information Administration (EIA) forecast new vehicle and fleet fuel economy through 2050. In framing its forecast, the agency assumed the CAFE program that existed at the end of 2019 would remain in place and that no further required efficiency improvements will be enacted. Some change in the CAFE program beyond 2025 is likely, but with no policy guidance to inform its model, EIA used what standards exist today. Even so, their forecast for light-duty vehicle (LDV) fuel economy remains relatively bullish and results in a 47% improvement in fleet fuel economy by 2040 with total passenger cars on the road delivering 42 MPG and light trucks delivering 30 MPG New vehicles are projected to deliver greater fuel economy, but the impact on the fleet is determined by new vehicles sales and overall fleet turnover, which takes a significant period of time. The diesel freight fleet is likewise projected to become much more efficient, delivering approximately 30% more MPG across the market by 2040.

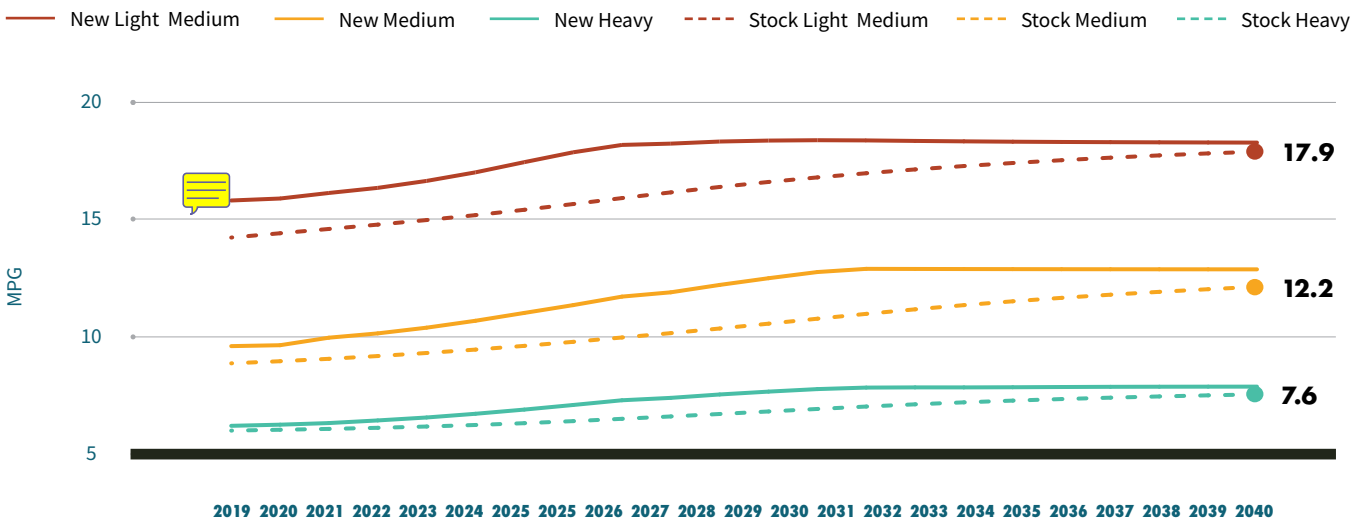
4 U.S. Energy Information Administration, Annual Energy Outlook 2020, January 29, 2020, https://www.eia.gov/outlooks/aeo/.

FIGURE 5: PROJECTED LIGHT-DUTY VEHICLE FUEL ECONOMY



Source: U.S. Energy Information Administration AEO2020

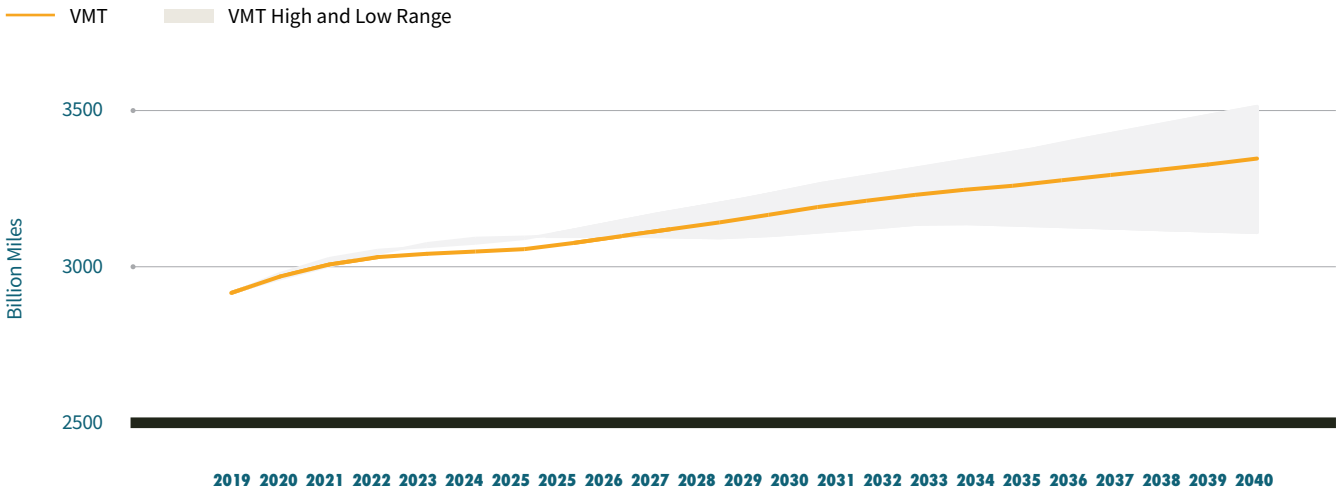
FIGURE 6: PROJECTED AVERAGE DIESEL FUEL ECONOMY OF NEW AND STOCK VEHICLES



Source: U.S. Energy Information Administration AEO2020

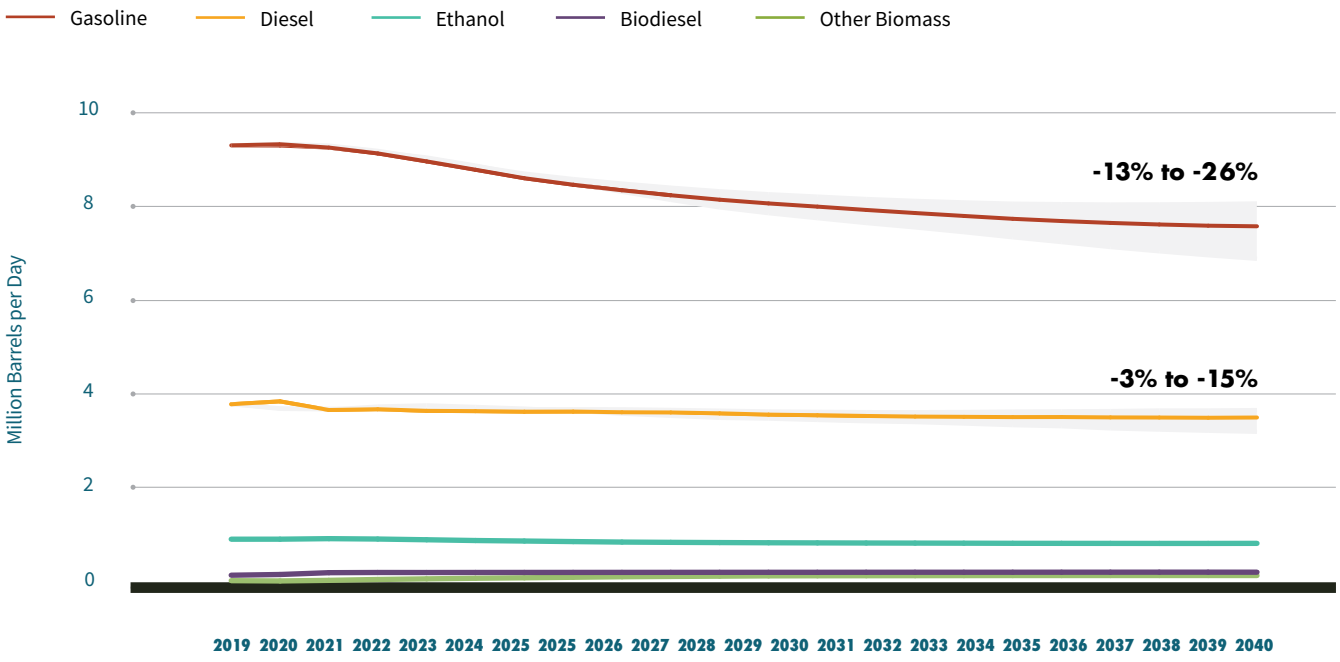
The market effect of these projected gains in efficiency could be significant. Although EIA projects overall vehicle miles traveled to increase between 7% and 20% (depending on the oil price scenario evaluated) and the number of licensed drivers to increase 12%, the efficiency gains are still projected to reduce gasoline consumption between 13% and 26% and diesel fuel consumption between 3% and 15%, with the ranges reflecting the difference between the high oil price and low oil price scenarios.

FIGURE 7: PROJECTED LDV MILES TRAVELED PER YEAR



Source: U.S. Energy Information Administration AEO2020

FIGURE 8: LIQUID FUEL DEMAND



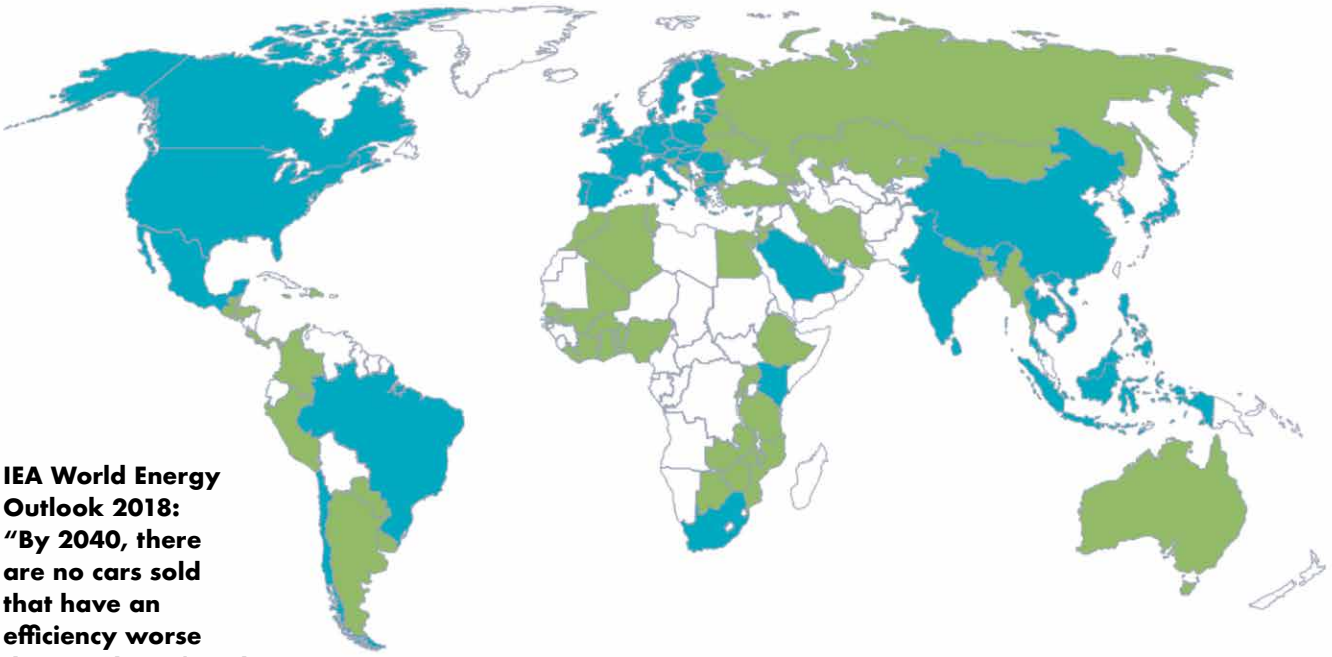
Source: U.S. Energy Information Administration AEO2020

Achievements in fuel efficiency are likely to continue despite domestic policy decisions. In April 2020, the EPA finalized the SAFE Vehicles Rule that reduces annual efficiency improvements from 5.0% to 1.5% per year. The original proposal and the final rule raise questions about the impact it might have on overall vehicle efficiency improvements. It is important to remember that the automobile manufacturing industry is producing vehicles for more than just the U.S., and soon more than 90% of the vehicles sold globally will be sold into markets that are governed by some sort of efficiency/emissions program. Consequently, while U.S. policy has a major influence on the market, the demands of the global market are likely to compel the industry to continue delivering more efficient vehicles, perhaps at a rate greater than mandated by the U.S. In addition, automakers have made it a practice to market their vehicles' fuel efficiency relative to competing models, seeking to capitalize on consumer's interest in purchasing more fuel efficient vehicles.

FIGURE 9: GLOBAL FUEL ECONOMY EFFIENCY STANDARDS

Has Set Standards In the Planning Process to Set Standards

LDV=Passenger Cars, Light Trucks and Sport Utility Vehicles (SUVs)



IEA World Energy Outlook 2018: "By 2040, there are no cars sold that have an efficiency worse than 6.5 liters/100 km (approximately 36 mpg)."

Source: Compiled by Future Fuel Strategies citing numerous sources including "Global Fuel Economy An update for COP23," Global Fuel Economy Initiative; September 2018

ICEs Will Survive for Decades

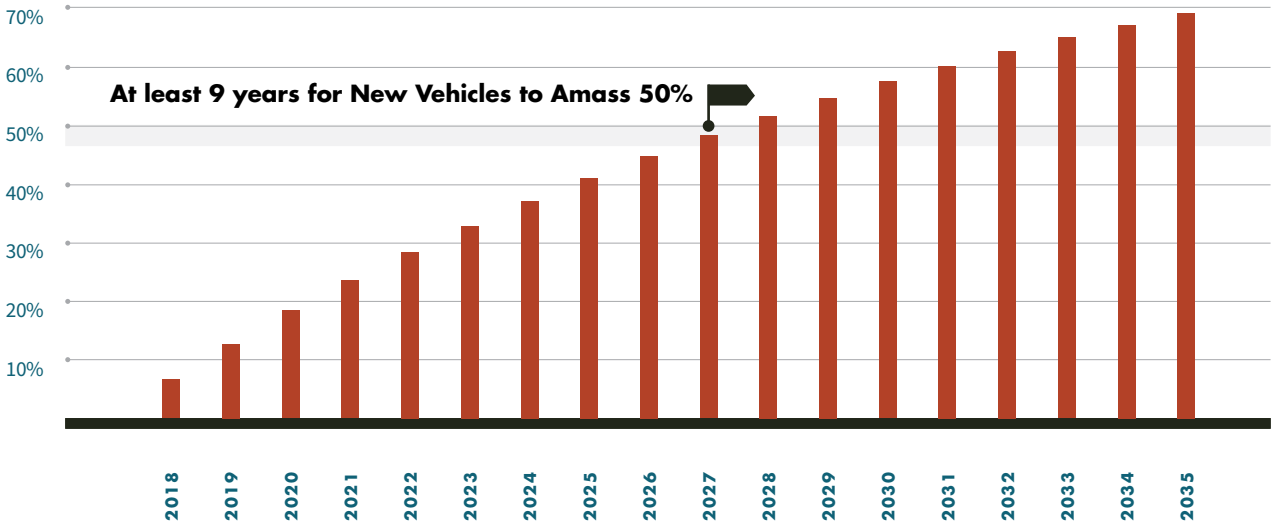
The registered improvements in vehicle efficiency to date have been achieved with improved ICEs. Engineers have successfully delivered more miles from each drop of fuel through better engine design and application of technologies, and that is not slowing down. Such continued improvement is critical because ICEs will be a significant part of the market for the foreseeable future. This is because the LDV market is substantial, and any change will take time to have a tangible impact.

It is clear that electrified powertrains will be entering the market and will play a significant role in the transportation sector, but even if the government were to mandate a 100% transition, the impact would not be immediate.

For example, assume every single vehicle sold beginning January 1, 2018, included some new technology. Given projected sales and scrappage rates at the time, it would take nine years before 50% of the vehicles on the road were equipped with the new technology. This assumes that the new technology did not increase the price of vehicles to such a level that sales would suffer and that the new technology did not dissuade consumers from buying new vehicles at the expected pace.

FIGURE 10: NEW VEHICLES AS SHARE OF FLEET ON THE ROAD

Data and Assumptions:
U.S. EIA LDV Fleet Size - 243.8 million in 2018
U.S. EIA LDV Sales Forcast - 16.1 million/year average



Source: U.S. EIA Annual Energy Outlook 2018

Since ICEs are expected to be around for decades to come, the pursuit of lower carbon emissions may require changes to the fuel being consumed—by both legacy and future engines. Already, the market is witnessing policies, regulations, and incentives encouraging the use of alternative fuels such as E15, B20, and renewable diesel. But other blends have captured the attention of engine manufacturers and some refining interests.

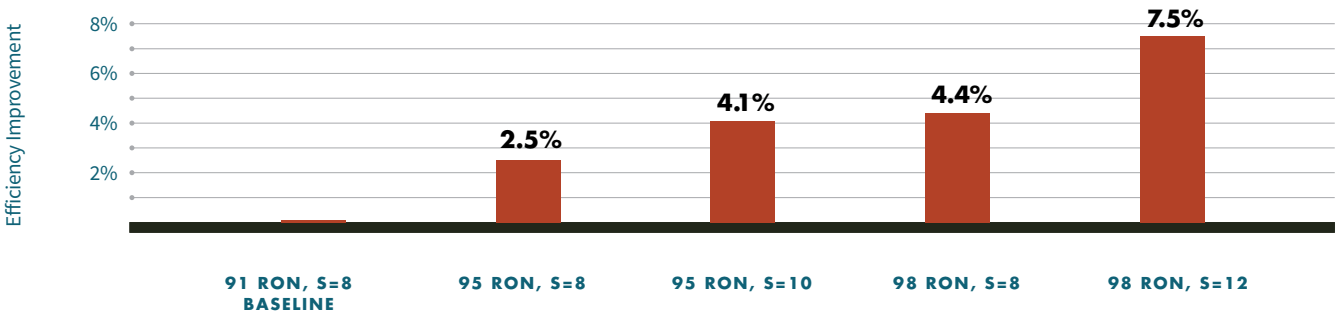
During the 115th Congress, a coalition of automobile manufacturers and refiners sought legislation to raise the bar on fuel octane to 95 RON (research octane number), which would be essentially equivalent to today's 91 pump octane.[5]

The ability of higher octane to enable improved engine efficiency is supported by sound science. The U.S. Department of Energy's Co-Optimization of Fuels and Engines Initiative research estimates that higher octane fuels, with a greater spread between the RON and MON (known as sensitivity), can enable the design of engines with high compression ratios and turbo boosting that can increase efficiency by up to 7.5%. Although the policy pursued last Congress was unsuccessful for a variety of reasons, automotive engineers are still looking for ways to fuel new engines with a higher octane fuel to deliver greater performance and efficiency with lower emissions. The question remains how (or when) to get there.[6]

5 This is expressed as the antiknock index and calculated by averaging the fuel's measured RON with its measured motor octane number, or MON.

6 Fuels Institute, *Analysis of the Potential for Increasing Octane in the U.S. Fuel Supply*, March 21, 2019, https://www.fuelsinstitute.org/Research/Analysis-of-the-Potential-for-Increasing-Octane-in.

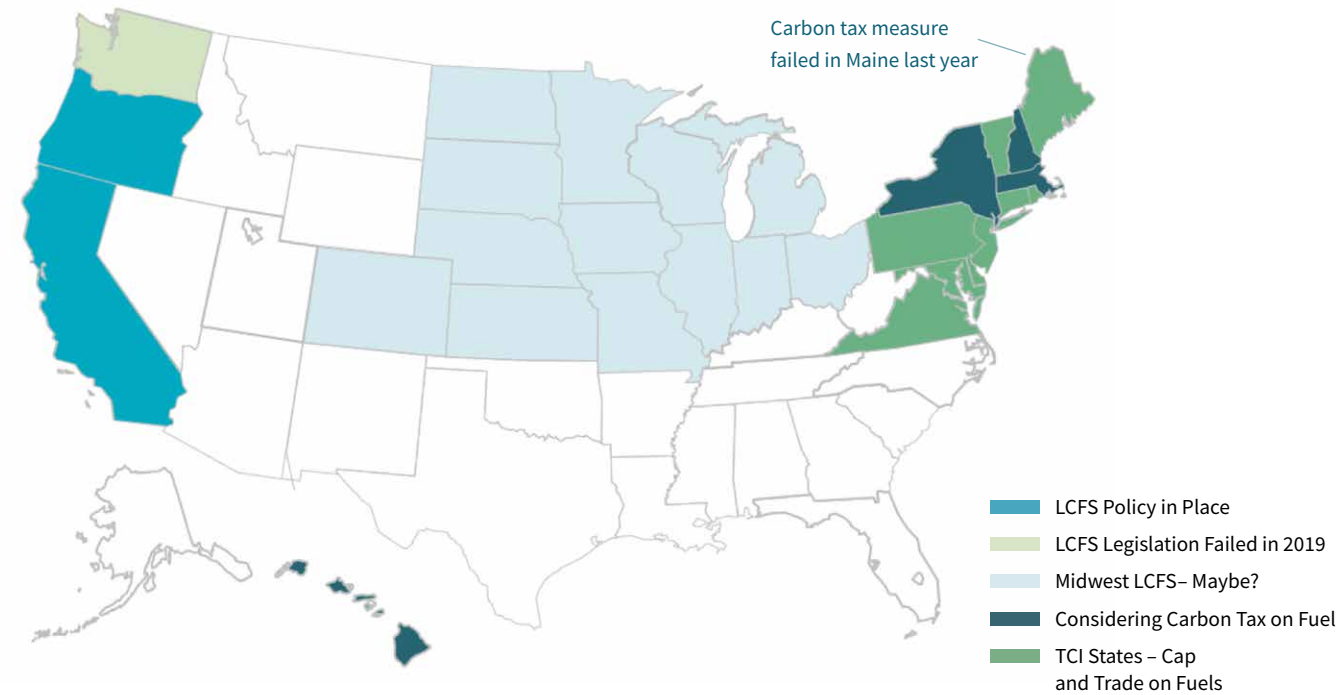
FIGURE 11: OCTANE EFFICIENCY



Source: U.S. EIA Annual Energy Outlook 2018

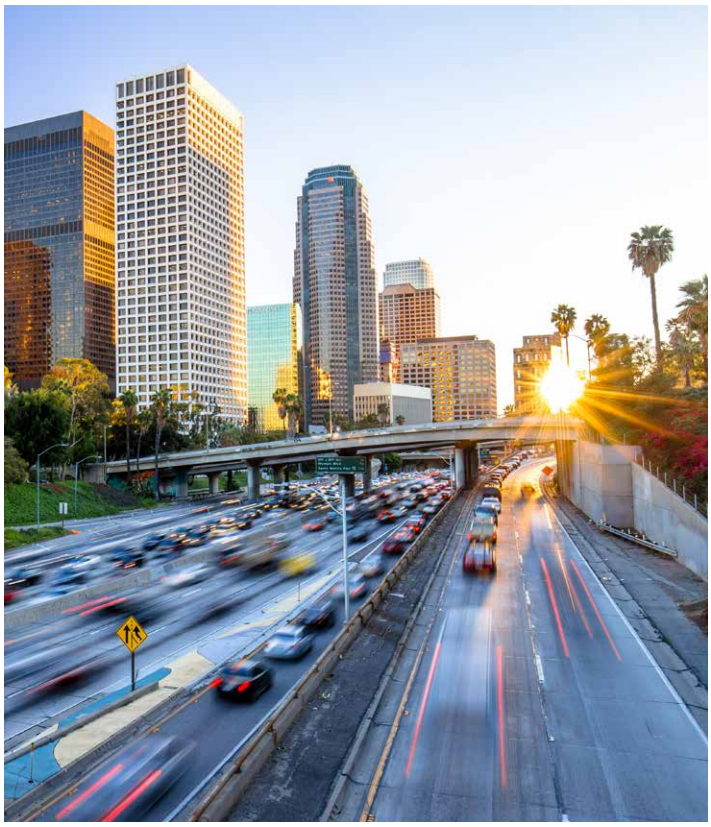
Meanwhile, as the effort to reduce carbon emissions continues, one tool that states and regions have considered are programs that require the industry to deliver to the market fuels with lower carbon intensity. The California Low Carbon Fuel Standard (LCFS) is the first fully implemented program of its type in the nation and is viewed by many as a model for success. Consequently, many other states and regions are working to develop similar programs. Specifically, Oregon has done so, Washington has made a valiant attempt to do so, a collection of midwestern governors have signed a memorandum of understanding (MOU) to explore a regional regulation, and the Transportation and Climate Initiative in the Northeast seems to be a combination of a low-carbon program and a carbon tax.

FIGURE 12: U.S. PROGRAMS THAT REQUIRE MARKET FUELS WITH LOWER CARBON INTENSITY



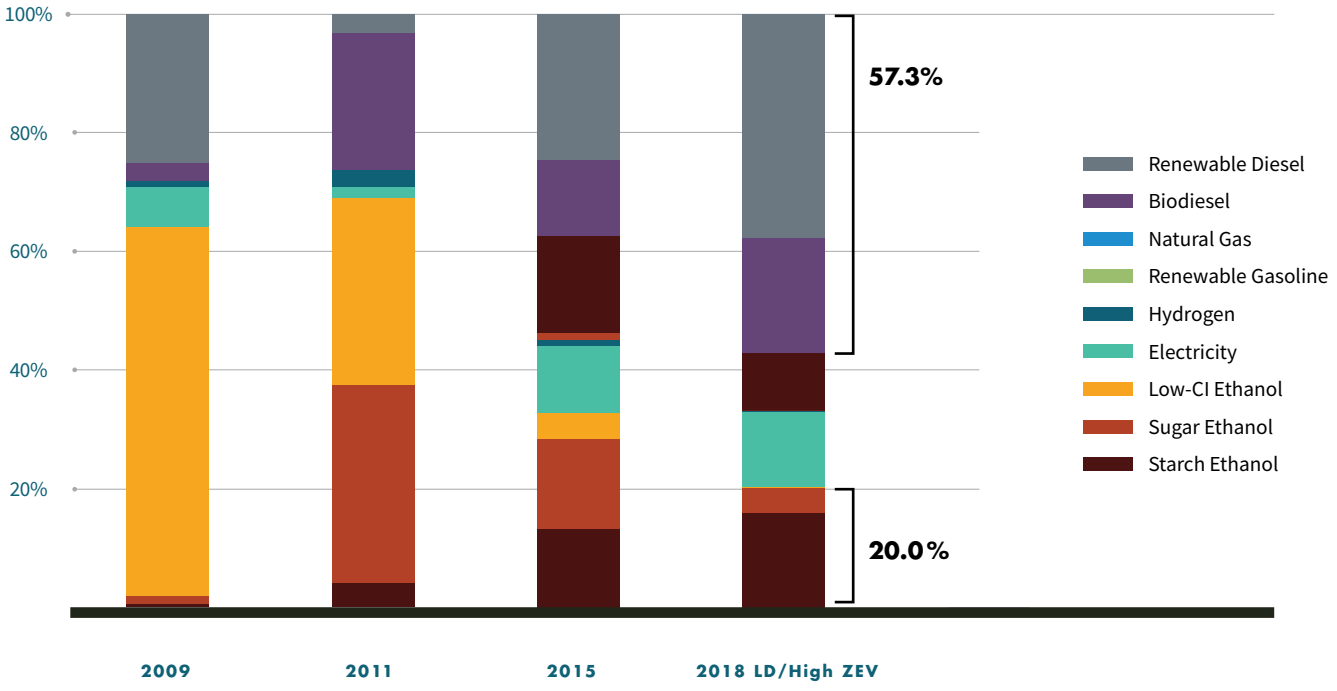
Source: Future Fuel Strategies

The lessons learned from analyzing the California LCFS program provide some insight into what might result should such programs spread to other regions. California has found that the greatest contributor to reducing the carbon intensity of its fuel supply has been through increased use of biofuels. The latest projection estimates that 80% of the required carbon reduction in 2020 would be satisfied by using ethanol, biodiesel, and renewable diesel. If the California LCFS program serves as the foundation for other programs, it is likely that biofuels will assume a much more significant role in the overall U.S. transportation market in the coming years.[7]



7 Fuels Institute, *Market Reactions to Low Carbon Fuel Standard Programs*, February 22, 2019, https://www.fuelsinstitute.org/Research/Market-Reactions-to-Low-Carbon-Fuel-Standard-Progr.

FIGURE 13: CALIFORNIA'S EVOLVING PROJECTED LCFS CREDIT POOLS FOR 2020 COMPLIANCE



Source: Fuels Institute Report by Trinity Consulting and Stillwater Associates

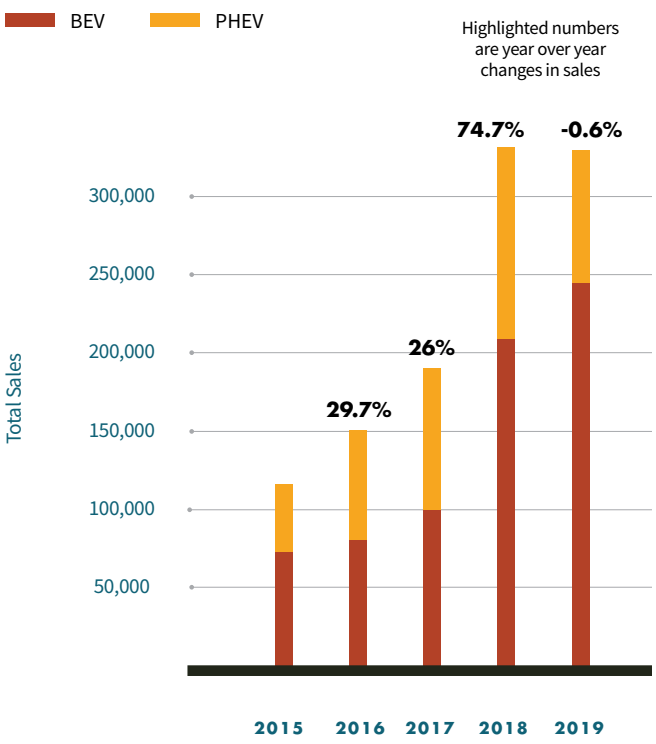
The State Of Vehicle Electrification

The momentum of public opinion, government policy, and the leaders of the automobile industry indicate that the future for electric vehicles will be bright. The technology that will enable electric vehicles to satisfy a growing segment of the transportation market is developing rapidly, and soon consumers will have a competitive economic choice between similarly equipped vehicles powered by traditional or electrified powertrains.

As the market grapples with reducing carbon emissions and the transportation industry seeks sustainable solutions, it is essential to understand the fundamentals of the market and to make business decisions based upon facts and realistic expectations for the future. This requires taking a fresh look at the data. There are many exciting developments in this space, and electric vehicles are becoming more capable, affordable, and convenient (e.g., charge times are coming down), but they are still in the early stages of market growth.

Even with the expansion of sales of plug-in vehicles over the past five years, there has been inconsistency in market penetration. The year-over-year change in sales of plug-in hybrid electric vehicles (PHEV) and battery electric vehicles (BEVs) since 2015 shows the challenges of penetrating the vast LDV market.

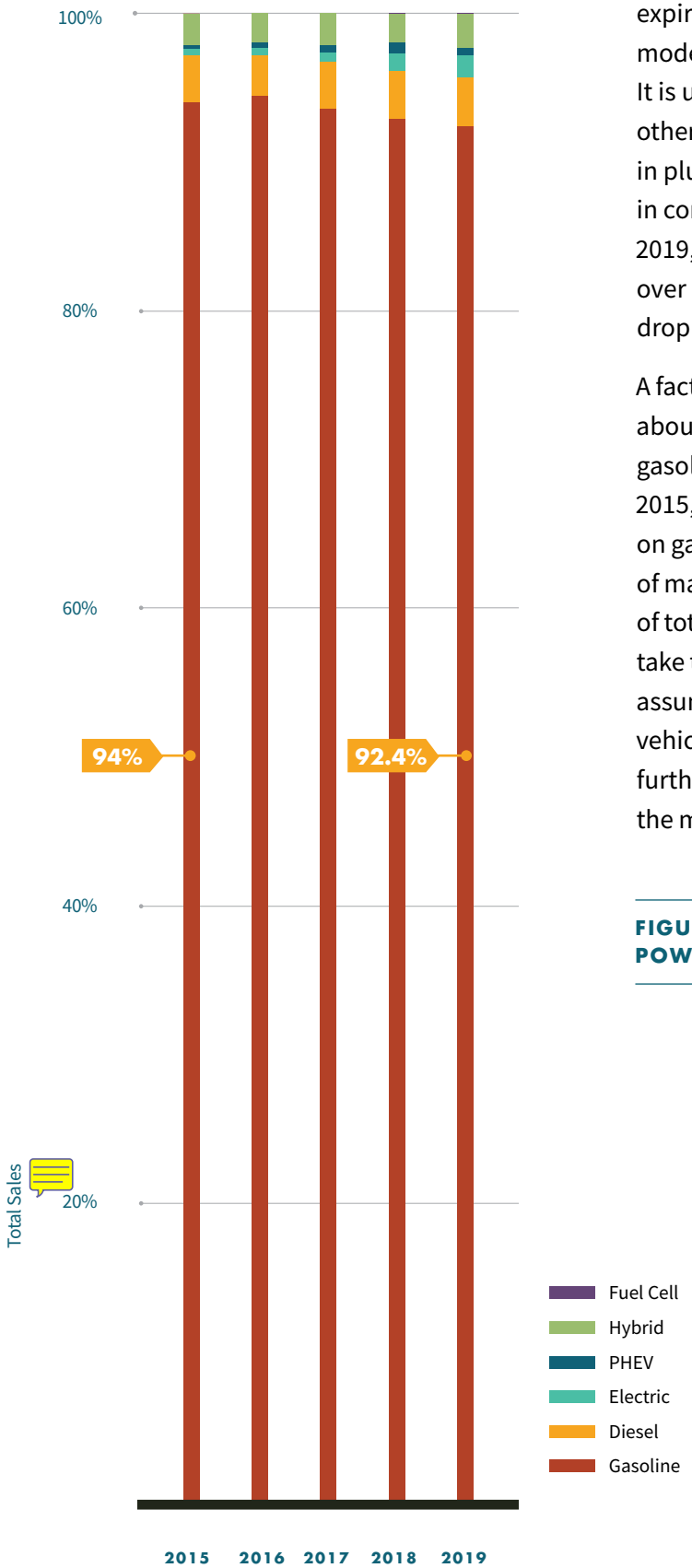
FIGURE 14. PLUG-IN ELECTRIC VEHICLES SOLD



Source: Fuels Institute

Plug-in vehicle sales in 2018 beat 2017 by 75%, and many assumed this rate of growth would continue — this optimism was supported by rapid technology advancements and the introduction of more models to the market. By June 2019, sales of BEVs were up 96% over the previous year, and it seemed indeed like 2019 was going to be an exceptional year. But then everything slowed down, and overall plug-in sales for the year ended lower than in 2018.

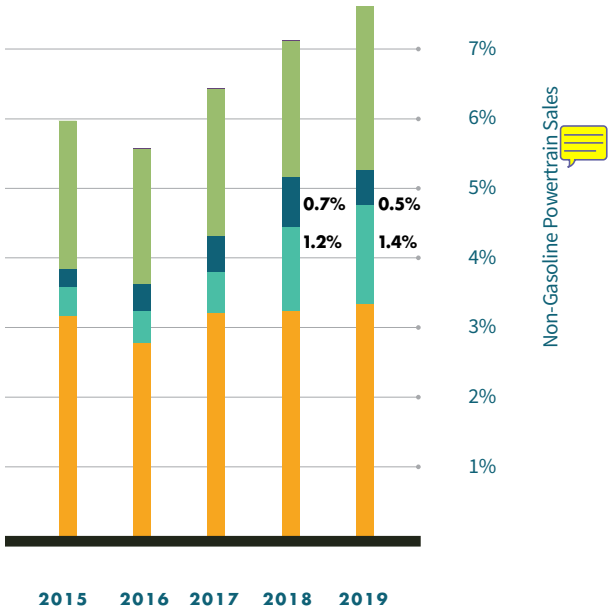
FIGURE 15. SHARE OF SALES BY POWERTRAIN



There are a variety of potential explanations for this, but one that should be considered is the expiration of the federal tax credit for electrified models offered by Tesla and General Motors (GM).[8] It is uncertain how this policy affected sales, what other factors may have contributed to the decline in plug-in vehicle sales, or how trends may continue in coming years. One interesting fact to note about 2019, however, is that BEVs ended the year up 17.1% over 2018 while PHEVs dragged down the sector by dropping 30.6%.

A fact that is often missing from the discussions about transitioning to an electrified future is that gasoline-powered ICEs remain dominant. Since 2015, sales of vehicles equipped to run exclusively on gasoline-powered ICEs have yielded just 1.6% of market share and continue to represent 92.4% of total LDV sales. Reflecting on how long it will take to transition the market to a new technology assuming 100% immediate conversion of all new vehicles, the dominance of the gasoline engine further demonstrates the challenge of transitioning the market to something new.

FIGURE 16. SHARE OF SALES OF NON-GASOLINE POWERTRAINS



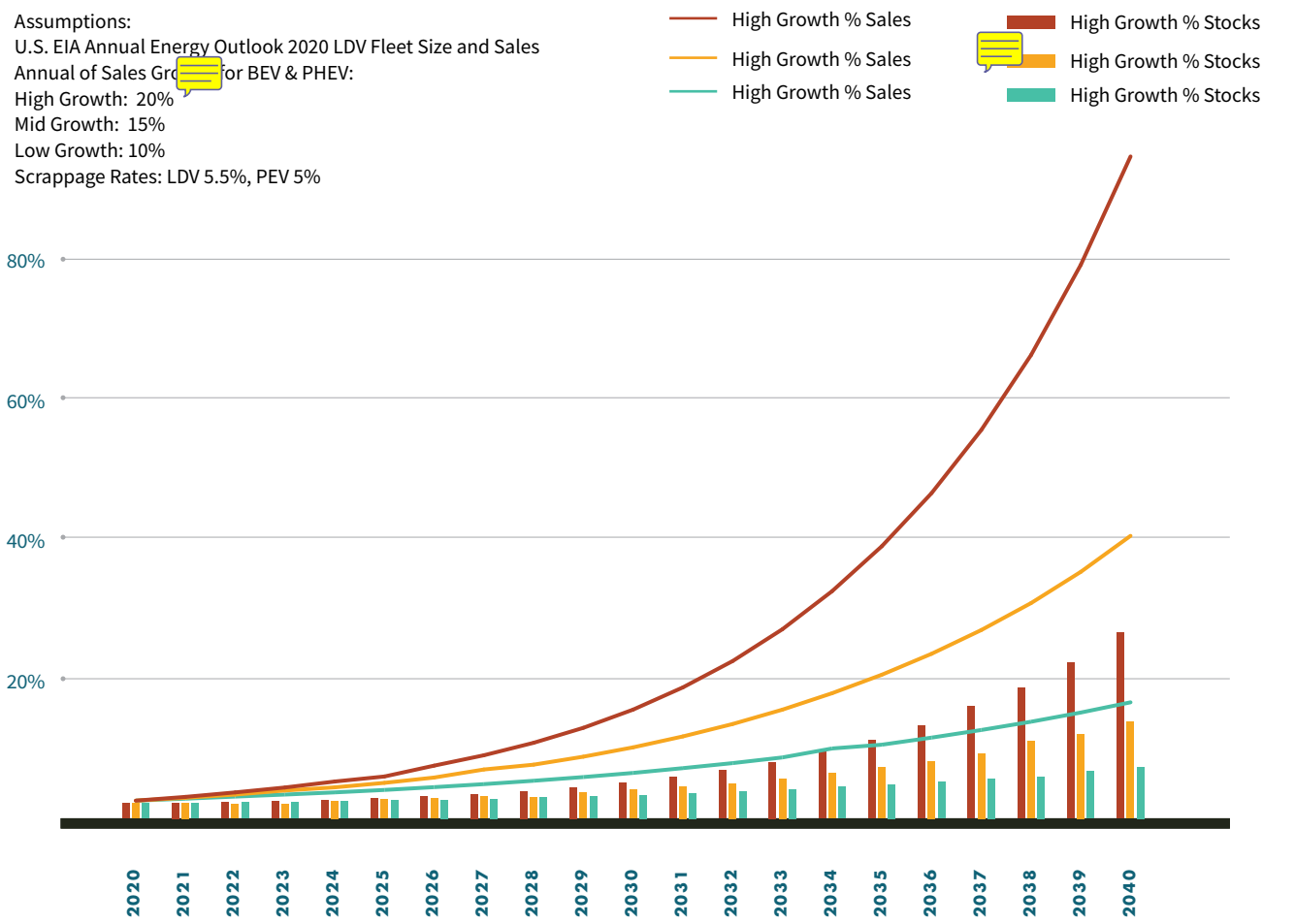
Source: Fuels Institute

8 Once a manufacturer sells 200,000 qualified electrified vehicles, the federal tax credit phases out for additional vehicles sold by that manufacturer. The tax credit is still available to other manufacturers until they reach the 200,000-unit threshold.

When analyzing the market for non-gasoline-powered vehicles, slight shifts in consumer purchasing behavior become apparent. In the electrified sector, BEVs did gain some market share, but at the expenses of PHEVs. Combined, they still represented only 1.9% of sales — the same market share they commanded in 2018. This is not to say that electrified vehicles do not have a promising future — they certainly do, especially considering interest from both automakers and policymakers and the number of new models expected to be introduced in the coming years. But as for right now, they are still struggling to gain market share.

Even if PHEVs and BEVs were to continue recording strong year-over-year sales, it would take many years before they would significantly impact the overall LDV fleet. Figure 17 presents three scenarios (Low, Mid and High) in which PHEV and BEV sales would increase by 10%, 15% or 20%, respectively, every year from 2020 through 2040. (No assumptions were made in creating this chart other than as stated that sales would increase by a consistent percentage every year.) In these scenarios, electric vehicle sales could capture between 16.6% and 94.5% of LDV sales. However, given fleet turnover rates, the number of plug-in electrified vehicles on the road would represent between 7.4% and 26.6% of the fleet. As mentioned before, the LDV market is large and currently dominated by gasoline-powered ICEs, and it will take many years of sales expansion to change the dynamics of the market.

FIGURE 17: POTENTIAL GROWTH OF BATTERY ELECTRIC AND PLUG-IN HYBRID VEHICLES

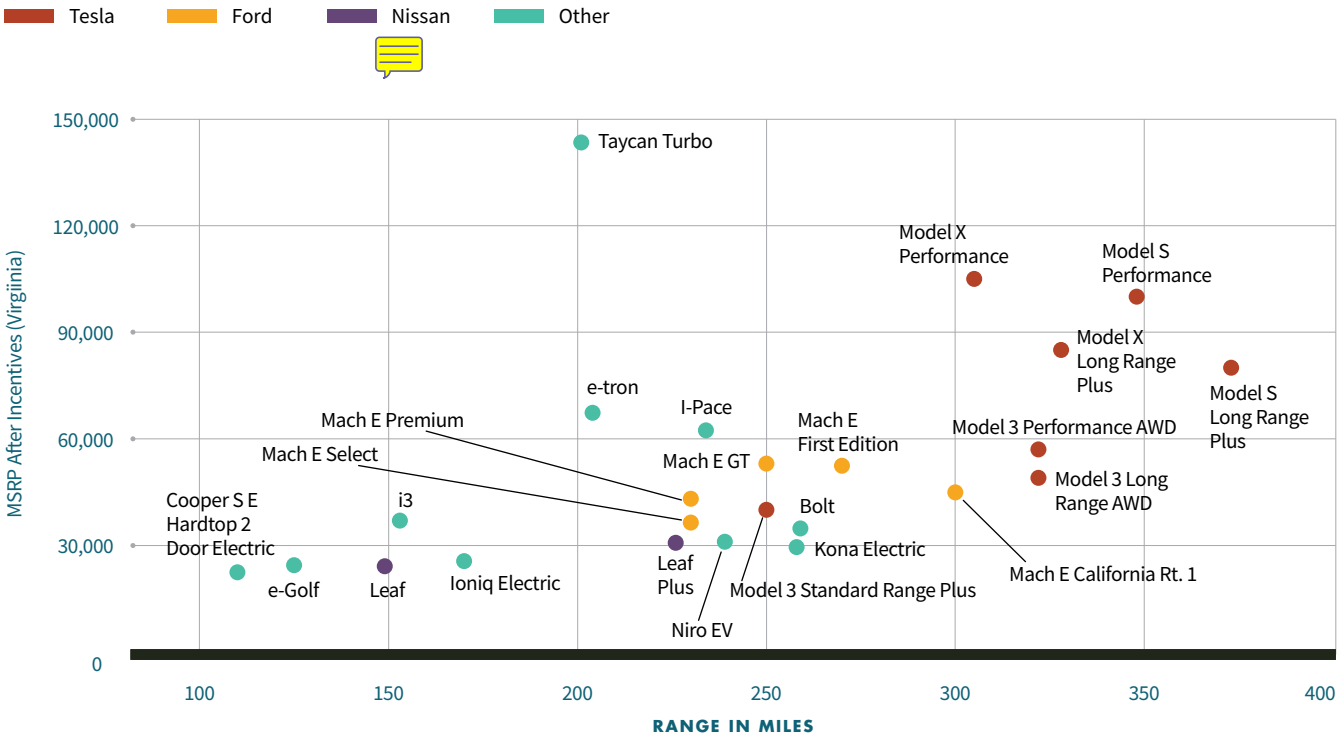


Source: Fuels Institute

ELECTRIFIED VEHICLES ARE OVERCOMING CONSUMER CONCERNS

Despite the slow start and the challenges facing electric vehicles (EVs) in their quest to penetrate the LDV market, there is tremendous cause for optimism about their future. Research indicates that consumers who are not yet ready to purchase an electric vehicle primarily are concerned with range, recharge time, and purchase price. The EV market has responded. Vehicles are consistently delivering more than 200 miles per charge, with GM most recently announcing a battery system for its BEVs that will deliver 400 miles per charge. In addition, batteries are becoming more durable, and fast charging is much more of a viable option. Tesla has announced that their new V3 Supercharging system will be able to deliver up to 75 miles of range in five minutes of charge time.

FIGURE 18: 24 BEVS AVAILABLE IN 2020

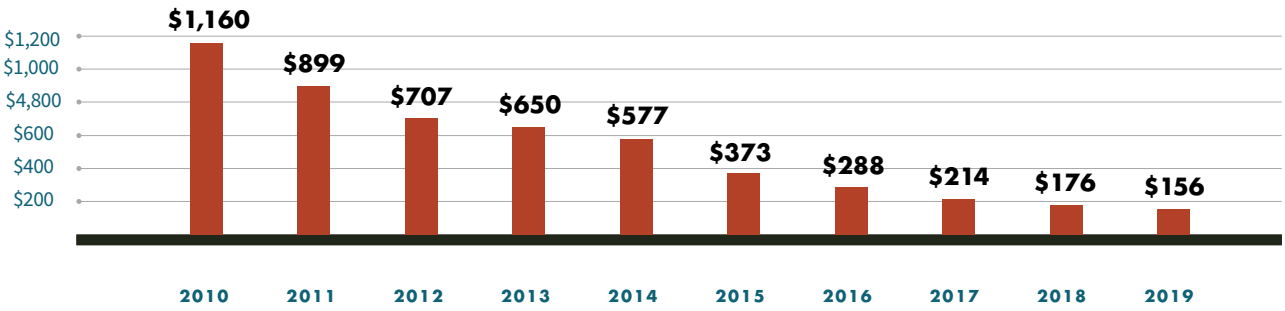


Source: Plug-In America (PlugStar.com)

Despite these advancements, purchase price remains a challenge. The majority of vehicles available in 2020 that offer 200 miles or more of range are also priced $40,000 or higher and average $44,272 (excluding the three vehicles with MSRPs of $100,000 or more). This purchase price may be outside the realm of affordability for most families to achieve a scale of mass adoption. Adding to this challenge is the fact that the federal tax credit of $7,500 is limited to the first 200,000 units sold by a manufacturer and already has expired for Tesla and GM. That being said, prices are coming down and are expected to continue to decline as batteries become more affordable. Since 2014, the price per kilowatt-hour of BEV batteries has come down 73%.

Within a few years, consumers will have the option to purchase a BEV that is priced competitively with a comparable ICE vehicle, has a range of 250 miles or more, and can substantially recharge within 15 minutes. Add the fact that maintenance for a BEV is significantly less expensive than for an ICE and the option of an electric vehicle could be attractive for many customers. This reality leads to many optimistic forecasts for the future of the EV market.

FIGURE 19: PRICE OF ELECTRIC VEHICLE BATTERIES ($/KWH)



Source: CarGurus, Bloomberg NEF, Statista

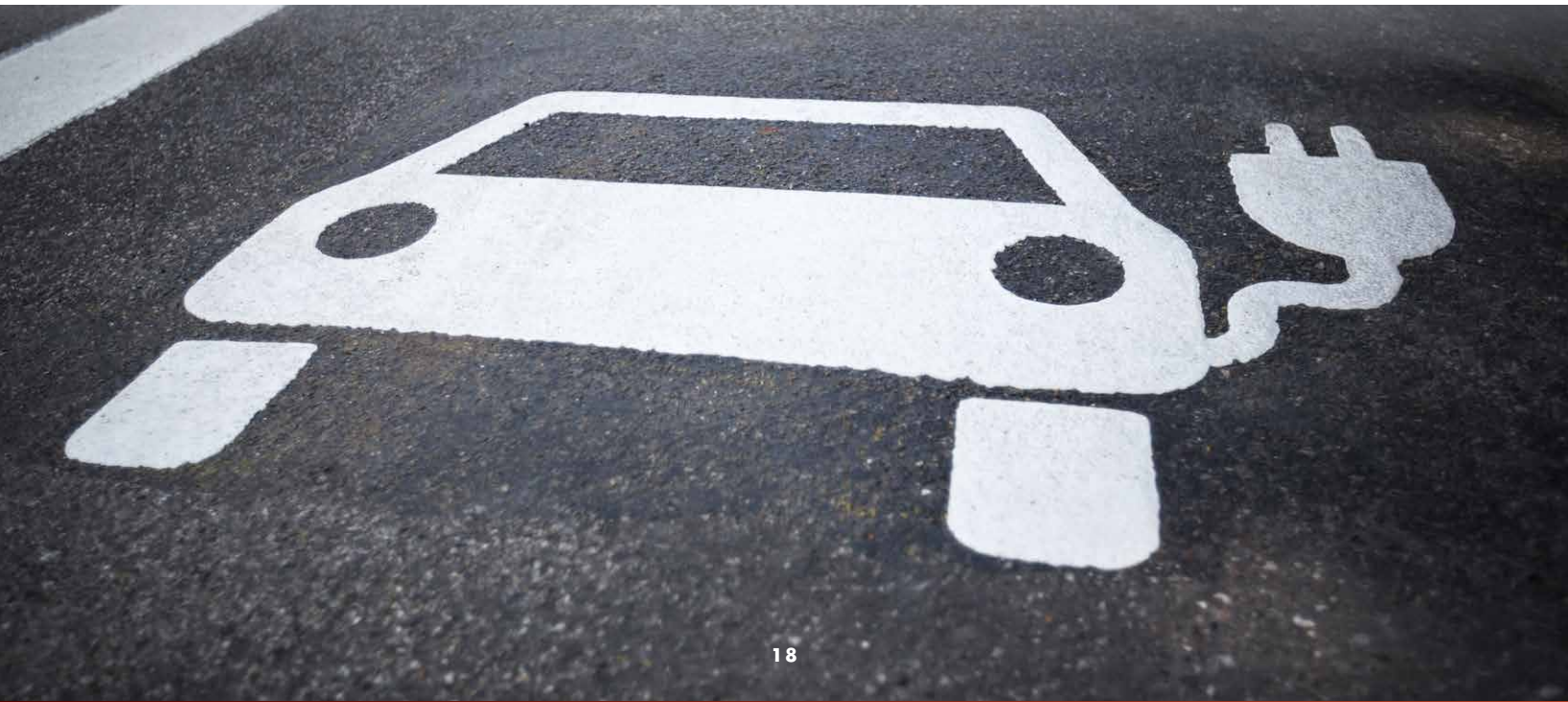
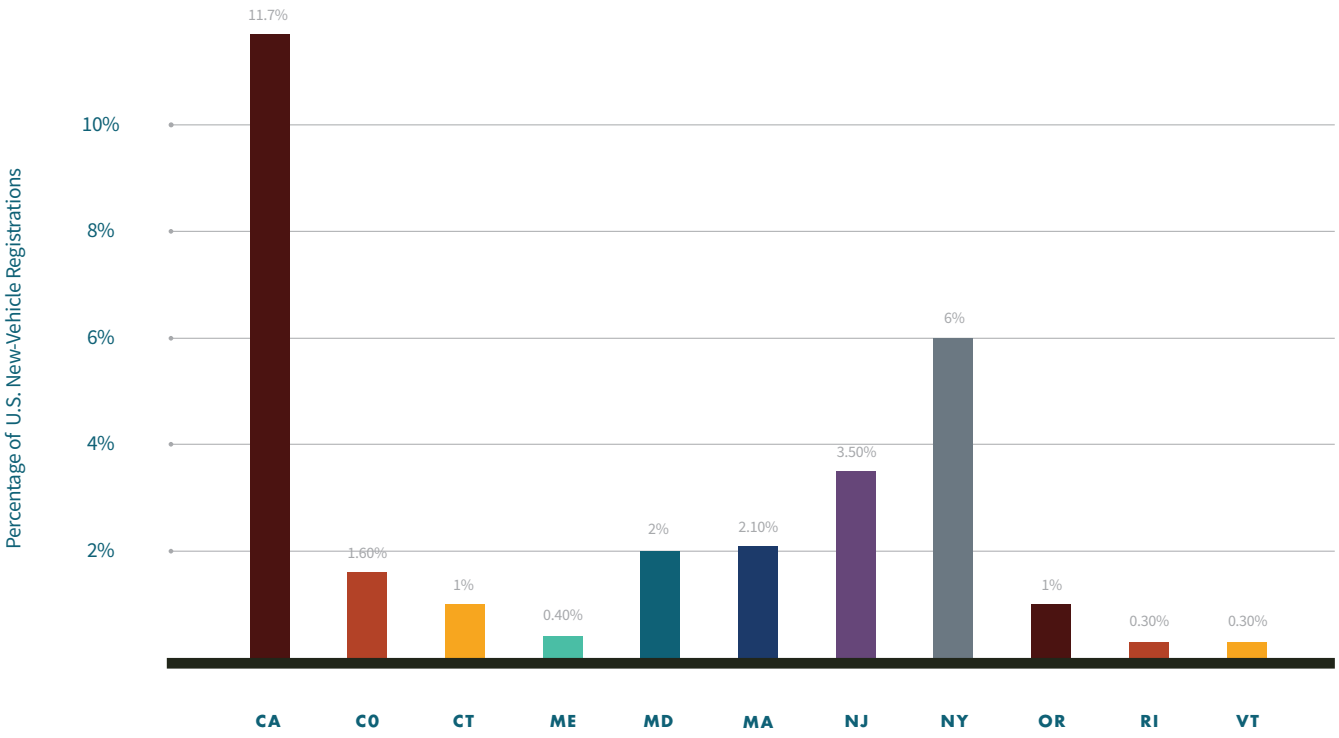


FIGURE 20: MULTI-STATE ZEV TASK FORCE SHARE OF U.S. NEW VEHICLE REGISTRATIONS—2018



Source: HCX with information from the CRE

In addition to these market forces creating opportunities for electrified vehicles, government policies also provide momentum. California's Zero-Emission Vehicle (ZEV) Program requires most automobile manufactures to ensure a certain percentage of their sales into the state are ZEV.[9] Qualified vehicles generate credits based upon their electric driving range. California increases the credits required each year from 4.5% in 2018 to 22% in 2025. California estimates that compliance with the 2025 requirement will equate to about 8% of new vehicles sold being ZEVs and plug-in hybrids.

Ten other states have signed an MOU with California establishing the Multi-State ZEV Task Force,[10] committing to have at least 3.3 million ZEVs operating on their roadways by 2025. Signatories to the MOU include Colorado, Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont. According to the National Automobile Dealers Association,[11] in 2018 these states combined to represent 30% of new registered vehicles in the U.S., creating a strong incentive for vehicle manufacturers to increase production and delivery of electrified vehicles into these markets.

9 "Zero-Emission Vehicle Program," California Air Resources Board, accessed June 3, 2020, https://ww2.arb.ca.gov/our-work/programs/zero-emission-vehicle-program.

10 Multi-State ZEV Task Force (website), accessed June 3, 2020, https://www.zevstates.us/.

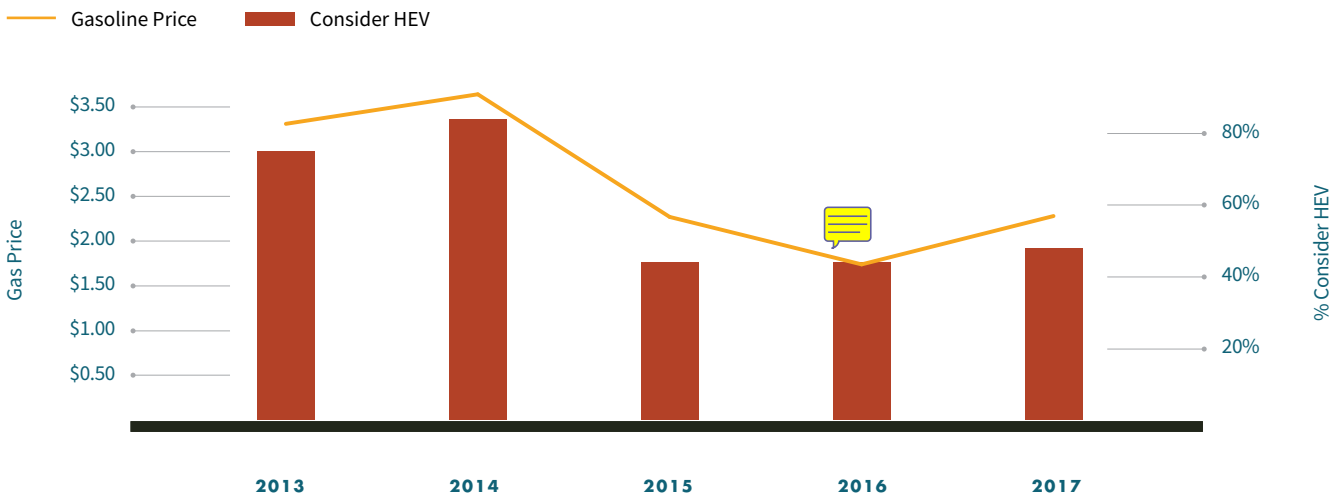
11 "Auto Retailing: State by State," National Automobile Dealers Association, accessed June 3, 2020, https://www.nada.org/statedata/.

Within a few years, there will be a competitively priced BEV with a range of 250 miles or more that can substantially recharge within 15 minutes. Add lower maintenance costs and the option of an electric vehicle could be attractive for many customers.

IMPACT OF RETAIL GASOLINE PRICES

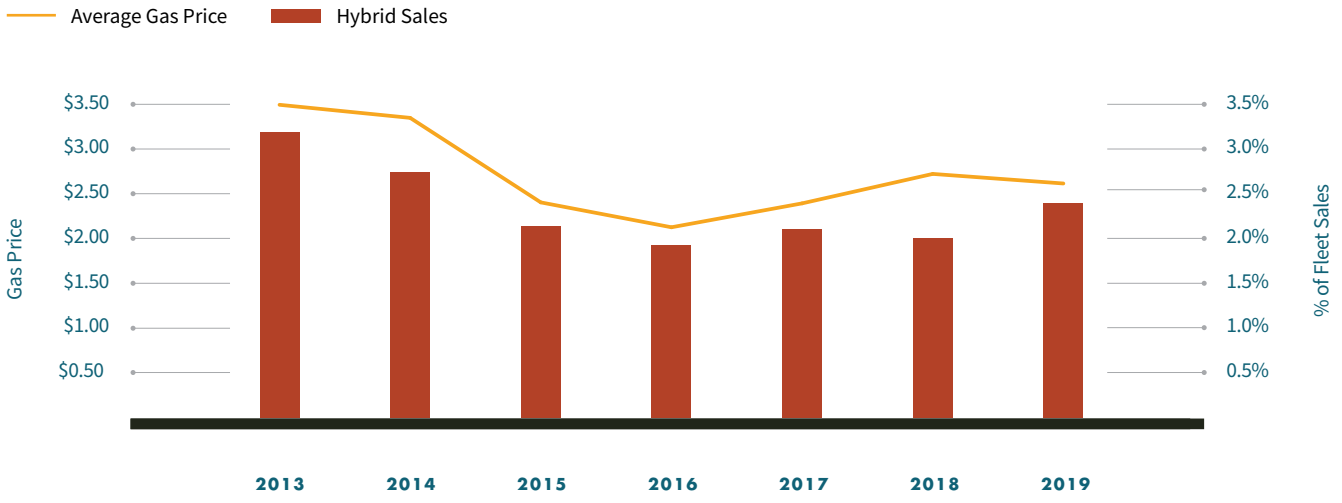
Fuels Institute research has demonstrated that consumers are most focused on alternative-fueled vehicles when retail gasoline prices are high. For example, during a consumer survey in 2014, when gasoline was $3.64 per gallon, 84% of consumers said they would consider a hybrid electric vehicle (HEV) for their next purchase. However, during a survey in 2016, when gasoline was $1.74, only 44% of consumers said they would consider an HEV. Likewise, HEVs garnered their greatest share (3.2%) of the LDV sales market in 2013 when the average price of gasoline was $3.49, but that share dropped to 1.9% in 2016 when gasoline prices averaged $2.13.[12]

FIGURE 21: INTEREST IN HYBRID ELECTRIC VEHICLES AND GAS PRICES



Source: Fuels Institute, PSB, OPIS

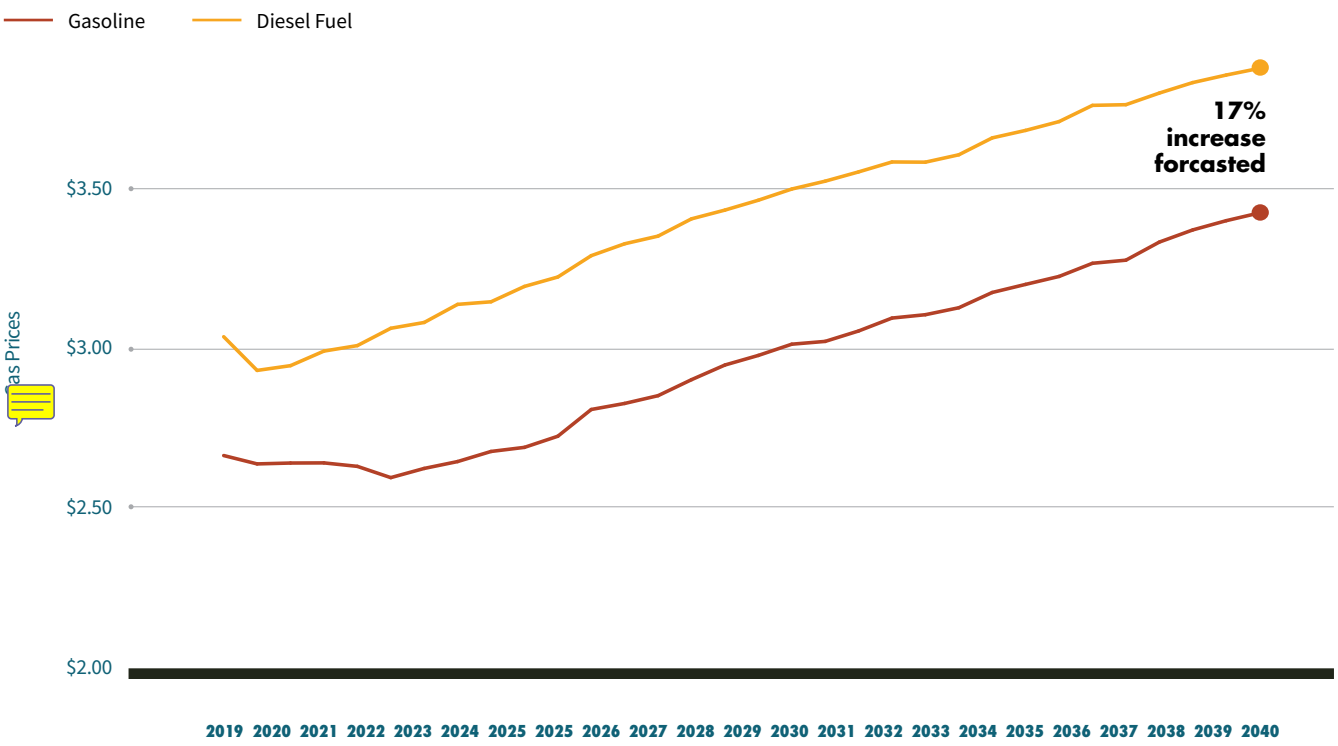
FIGURE 22: SALES OF HYBRID ELECTRIC VEHICLES AND GAS PRICES



Source: OPIS, Wards Inteligence

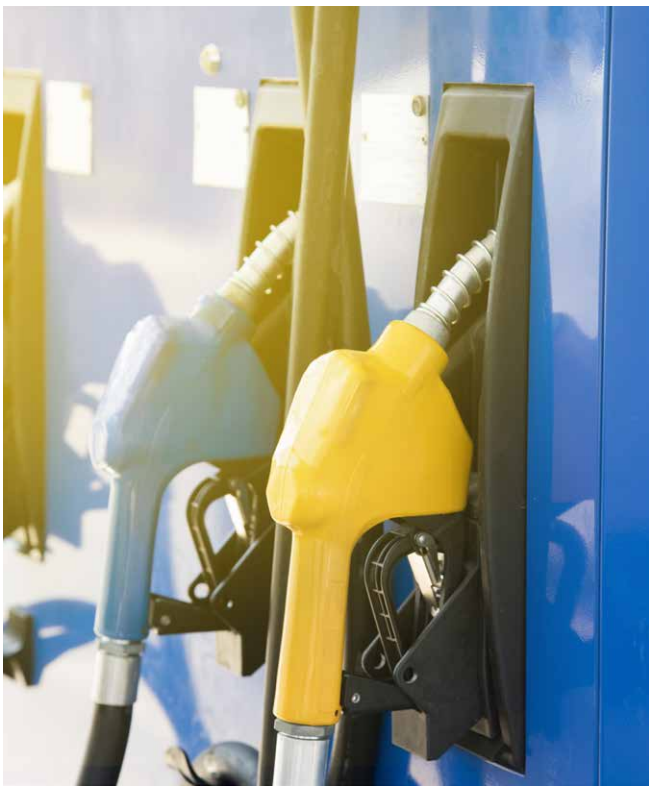
12 Fuels Institute, *Consumers and Alternative Fuels 2017*, December 08, 2017, https://www.fuelsinstitute.org/Research/Consumers-and-Alternative-Fuels-2017.

FIGURE 23: GASOLINE AND DIESEL PRICES FORECAST

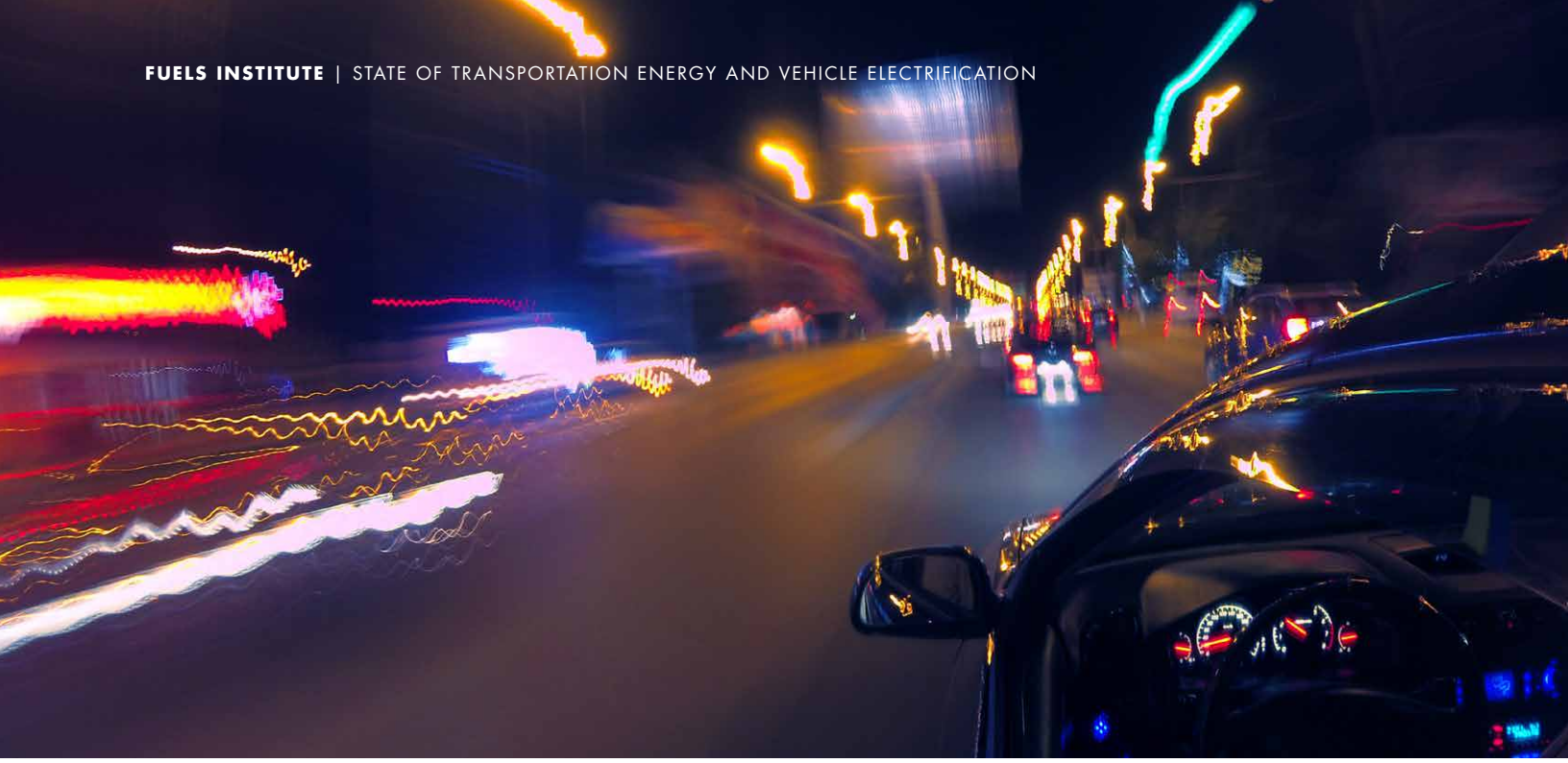


Source: U.S. Energy Information Administration

Of course, market dynamics have evolved over the past several years, and the attraction of electric vehicles for current customers may not be directly related to fuel prices. But if EVs are to gain a scale of mass adoption, consumers will consider the retail price of fuel as a metric in their search for their next vehicle. If the advancements in fuel efficiency result in a drop in demand for liquid fuels as projected by the EIA, then the impact on retail pump prices would likely be to the advantage of consumers. *EIA's Annual Energy Outlook 2020* projects that gasoline prices could climb 16.5% and diesel fuel 18.0% by 2040, putting gasoline at about $3.10 per gallon and diesel at about $3.59. It is unclear whether these prices will be sufficiently high to strengthen the appeal of alternative powertrains like EVs.[13]



13 U.S. Energy Information Administration, Annual Energy Outlook 2020, January 29, 2020, https://www.eia.gov/outlooks/aeo/.



Conclusions

The future of transportation energy will be a mix of different powertrains leveraging different sources of energy, the majority of which presumably will be lower in carbon intensity and more beneficial to the environment. But the transition to new powertrains or energy sources will take time. This is not due to opposition to such technologies or resources but because the market is substantial, and it will simply take time to transition.

The pace of that transition, however, could be accelerated through government policies that drive adoption of new technologies, market forces that combine to reduce the cost of entry for new technologies (such as fleets purchasing large quantities of electrified vehicles), or fuel economics compelling consumers to seek more efficient and lower cost mobility options.

At the end of 2019, these accelerating factors were not wielding significant influence over the market, and the transition to alternatives beyond traditional powertrains and liquid fuels was minimal. However, there are signals that some fundamentals may be evolving to create opportunities for the new technology to gain greater market share in the coming years. It is a dynamic worthy of frequent evaluation to better understand the market forces at work, the trends affecting consumers and the data that tells the true story of change.

About the Fuels Institute

The Fuels Institute, founded by NACS in 2013, is a 501(c)(4) non-profit research-oriented think tank dedicated to evaluating the market issues related to vehicles and the fuels that power them. By bringing together diverse stakeholders of the transportation and fuels markets, the Institute helps to identify opportunities and challenges associated with new technologies and to facilitate industry coordination to help ensure that consumers derive the greatest benefit.

The Fuels Institute commissions and publishes comprehensive, fact-based research projects that address the interests of the affected stakeholders. Such publications will help to inform both business owners considering long-term investment decisions and policymakers considering legislation and regulations affecting the market. Research is independent and unbiased, designed to answer questions, not advocate a specific outcome. Participants in the Fuels Institute are dedicated to promoting facts and providing decision makers with the most credible information possible so that the market can deliver the best in vehicle and fueling options to the consumer.

For more about the Fuels Institute, visit fuelsinstitute.org

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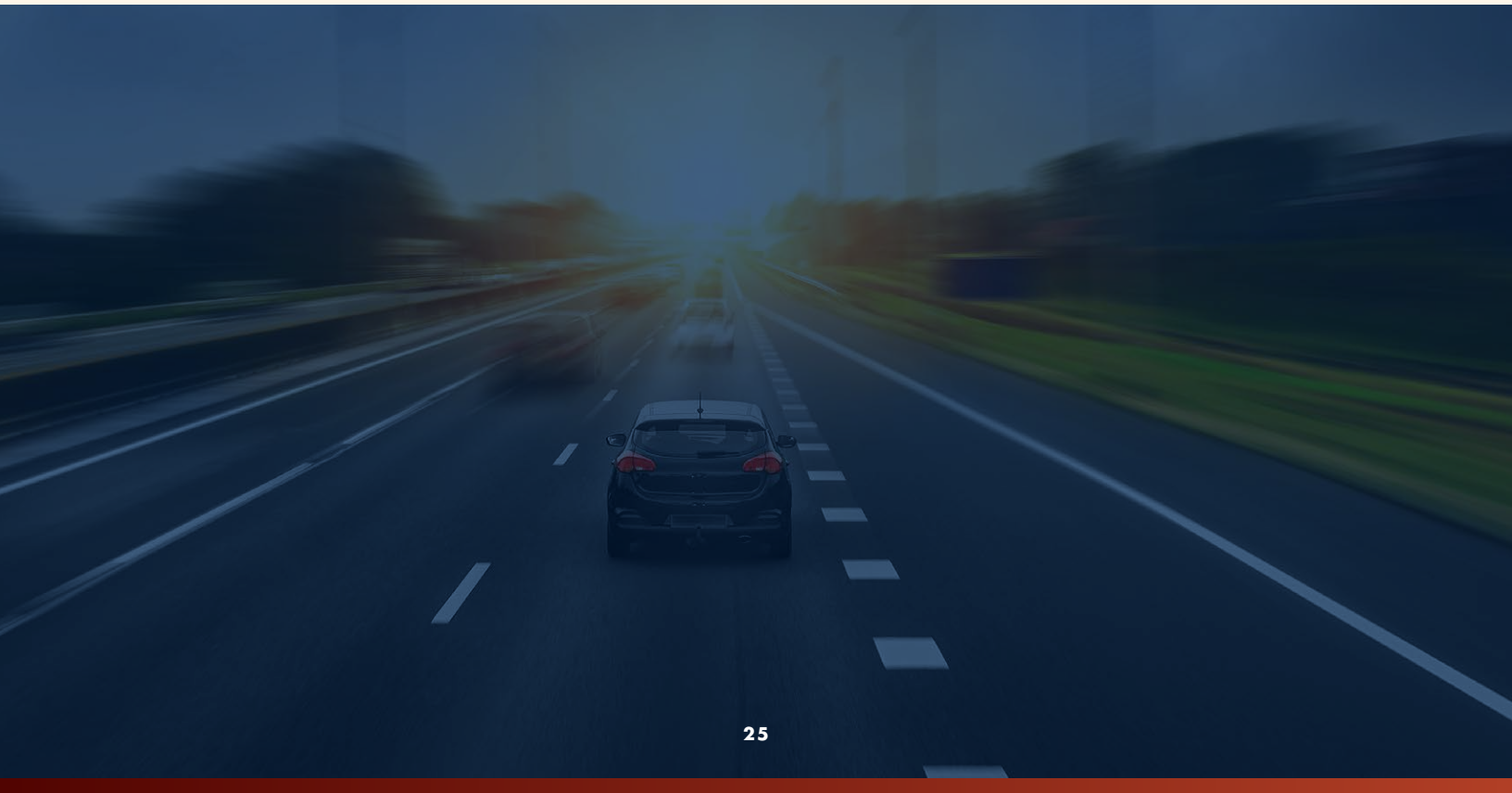
The Fuels Institute was founded in 2013 by NACS, the international association that advances convenience and fuel retailing. Through recurring financial contributions and daily operational support, NACS helps the Fuels Institute to invest in and carry out its work to foster collaboration among the various stakeholders with interests in the transportation energy market and to promote a comprehensive and objective evaluation of issues affecting that market and its customers both today and in the future. NACS was founded August 14, 1961, as the National Association of Convenience Stores and represents more than 2,100 retail and 1,600 supplier company members.

www.convenience.org



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