

# Automatic Transmission Fluid: What does the future hold for them?



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## Abstract

Automatic transmission fluids (ATF) are ubiquitously used for decades and is salient in optimizing a vehicle's transmission. Internal combustion engine (ICE) vehicles incorporate various transmissions, each with distinctive systems and dedicated fluids. Due to a significant ICE contribute to greenhouse gases (GHG) emissions, Original Equipment Manufacturers (OEMs) are elevating environmental standards and becoming increasingly stringent. With an increase in pressure for an eco-friendly environment, there are growing incentives for hybrid and all electric vehicles. Specifically, China and the US are two major frontrunners in this novel field and will continue developing. In this paper, we will discuss the future and practicality of ATFs in respect to a growing trend towards electric vehicles.

## Introduction

Automatic transmission fluid (ATF) is used as a lubricant for a car's transmission to optimize performance, by acting as a coolant to prevent overheating and to provide pressure and torque for power [1]. Internal combustion engines (ICE) utilizes transmission fluids and contribute to 23% of greenhouse gases (GHG) emissions which elevates the issue to a prominent area of concern [2]. With the increased pressure by the Environmental Protection Agency (EPA) to reduce CO<sub>2</sub> emissions, Original Equipment Manufacturers (OEMs) are investing to incorporate alternative propulsion technologies for the future.

Company	Goal
Volkswagen Group	By 2030 there will be at least one electrified version of each of the more than 300 VW Group models.
Volvo	Every car Volvo launches from 2019 will have an electric motor, placing electrification at the core of Volvo's future business.
General Motors	At least 20 new all-electric models will be brought to market by 2023 – the next step towards a zero-emissions world.
Ford	Increase investments in electrification to \$11 billion by 2022 and expand electrified vehicle line-up with a total of 40 vehicles globally.
Honda	Striving to electrify two-thirds of global automobile unit sales in 2030.
Geely	Intelligent Power Strategy introduced, with promise to launch 30 new energy models by 2020.
Toyota	Aiming to achieve annual electrified vehicle sales of 5.5 million units by 2030 as part of its 'Environmental Challenge 2050'.

Table 1. Automotive vehicle company goals for the future [2]

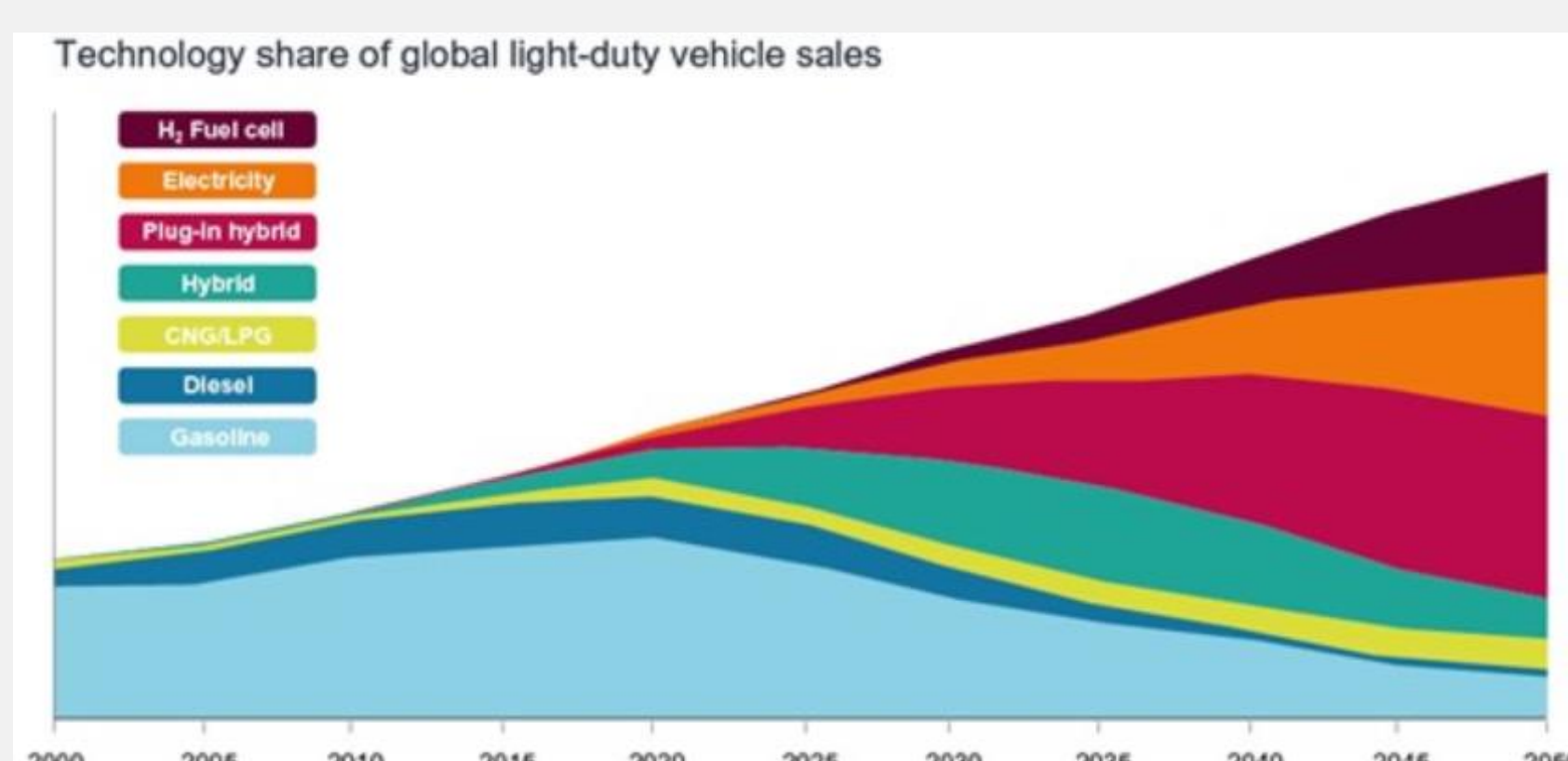


Figure 1. LDU trends

## ICE Vehicles

Ice vehicles have been dominating the economy for decades, specifically in the commercial transportation sector, and will continue to ascend. Petroleum base liquid fuels account for approximately 95% of transport energy and is projected to remain high despite the rise of EV and fuel cells [3]. With the goal to reduce GHG emissions, OEMs are leaning away from ICE and more toward electrification

## Hybrid Vehicles (Dual Clutch vs Continuous Variable Transmission)

While ICE vehicles continue to grow, electric vehicles are growing through partial electrification in the form of hybridization [3]. Dual clutch transmissions are of high interest, especially in China, because compared to AT, DCT incorporate fewer mechanical components and slipping elements and has greater degrees of freedom regarding gear ratios while improving fuel economy [4]. There are two types of DCTs: wet and dry clutch [4]. Dry clutch systems utilizes manual transmission fluids (MTF) while wet clutch systems utilizes enhanced DCT fluid (DCTF) which has both the gear protection quality of MTF and the clutch friction control of ATF [4]. Continuous variable transmissions (CVT) are foreseen to be popular for small automotive markets more affordable than DCT but lacks the gear shifting sensation which is unnerving for many [5]. CVT allows for infinite number of gear ratios and can achieve maximum power out of small engines hastily. Currently, CVT uses CVT fluid which has a higher complexity than ordinary ATFs and are focused on advocating friction to avoid the belts from slipping on the pulley system.

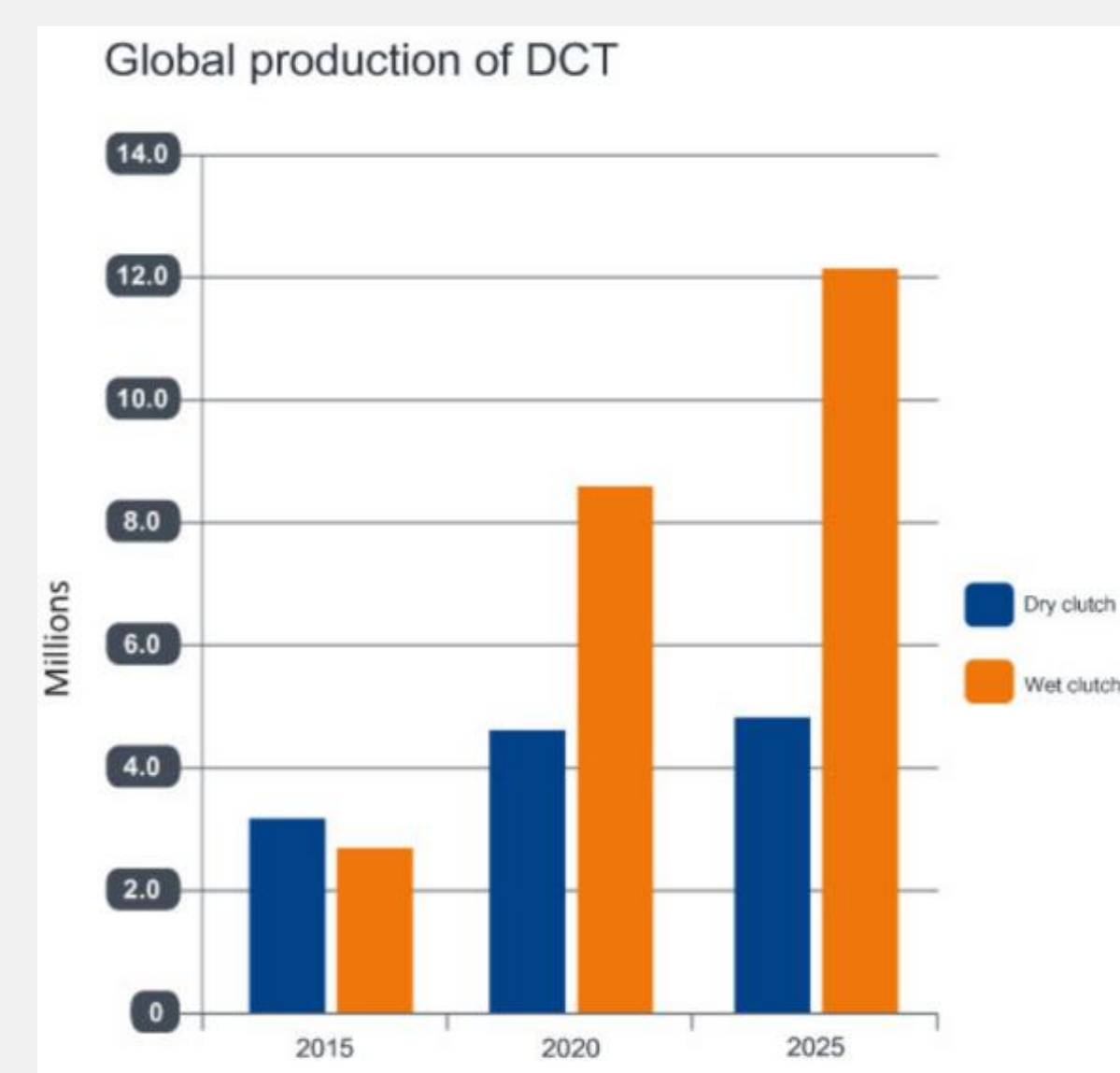


Figure 2. Global production of DCT [4]

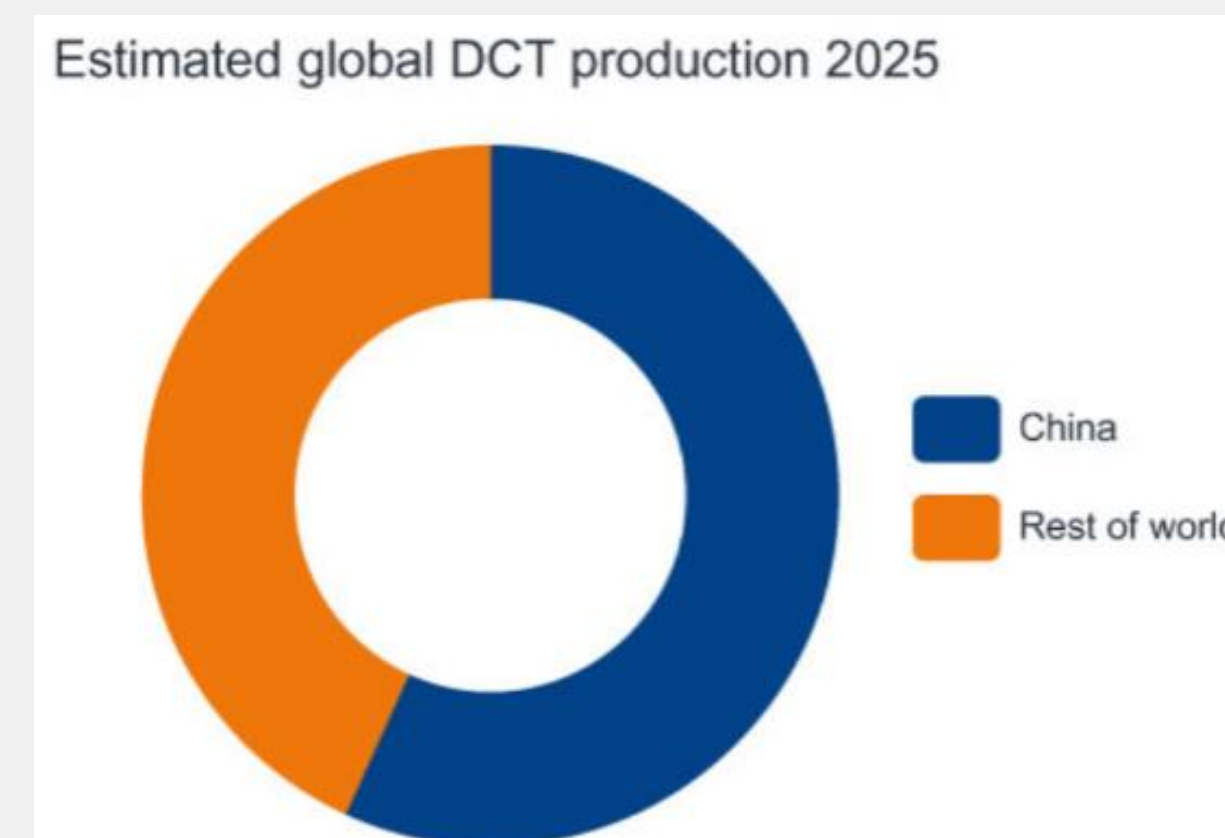


Figure 3. Global production of DCT vs China [4]

DCTF must deliver a number of specific performance benefits	
Fluid requirements	Performance benefits
Precise friction performance	Ensures quick and shudder free operation, while providing the torque capacity for high energy launches
Durable wear control	Reduces potential for wear metals to interfere with friction control
Balanced synchroniser friction and wear control	Allows for necessary friction without unnecessary wear, for proper and consistent operation
Diverse material compatibility	Ensures materials, including copper, resin and plastic, are protected
Extreme pressure gear protection.	Prevents gear pitting and provides adequate scuffing performance without affecting soft metals
Extended oxidation Control	Enables extended drain intervals for "fill for life" service

Figure 4. DCTF Benefits [4]

## Foreign Competitors

The primary international competitor, China, is surpassing expectations and is on track to grow 5.3% over the next couple years [7]. Currently, China is focusing on fuel economy and is advocating AT as the desired technological option because AT is the most advanced technology compared to other transmissions and currently takes up more than 80% of the market share [8]. In 2018, China strongly pushed for EV by providing considerable subsidies and incentives which drove up production and sales. In 2020, China plans to phase out subsidies entirely which currently sets back the market. Nonetheless, in a couple years, the automotive market in China will settle down and resume its dominance in this field.



Figure 8. China's AT market forecast [8]

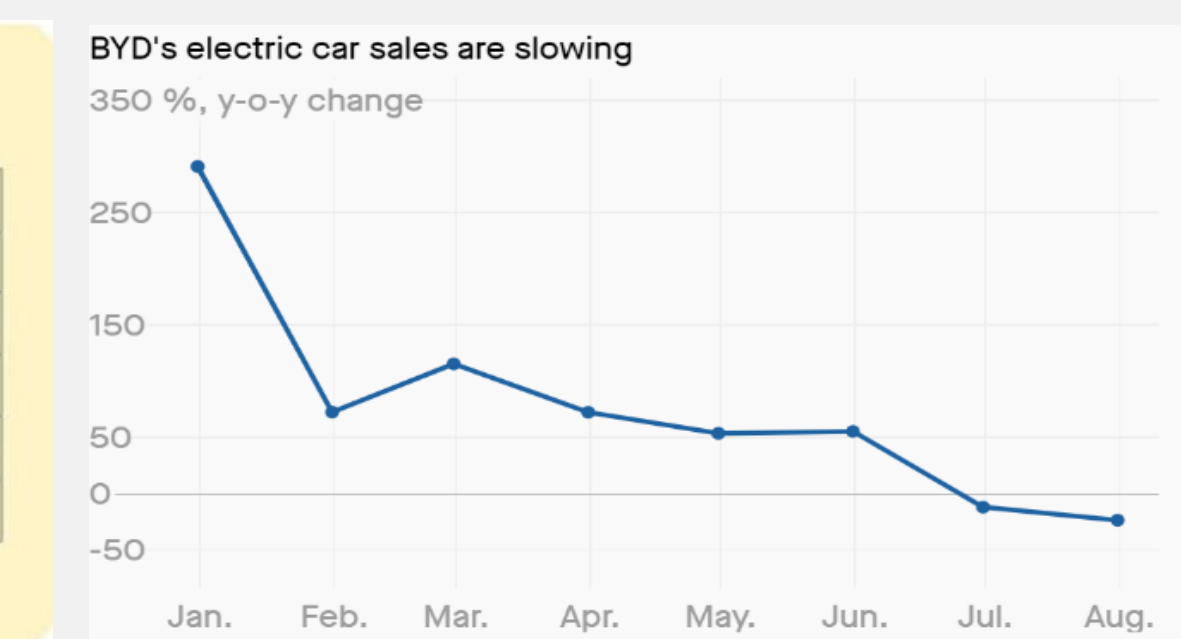


Figure 9. EV sales in 2019 [9]

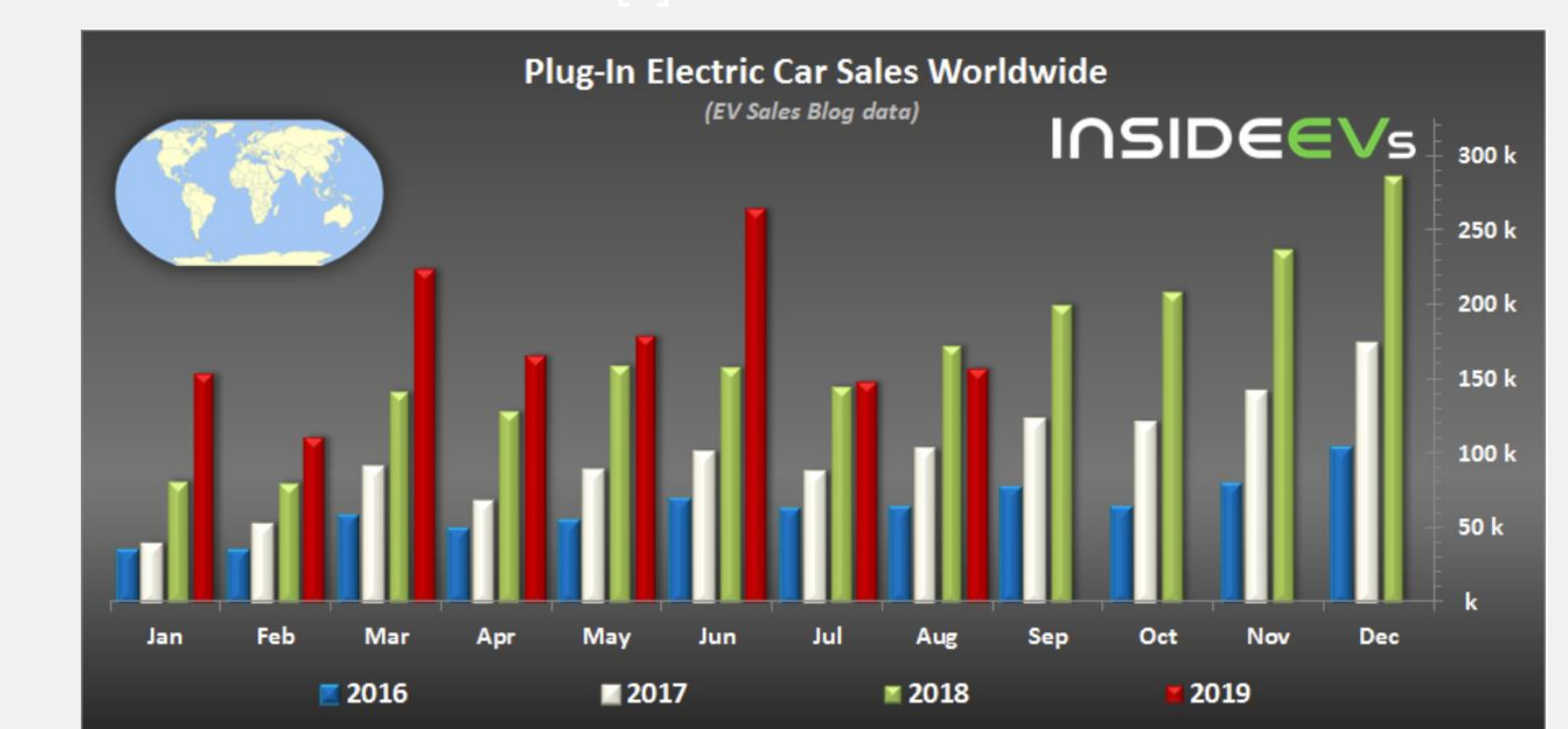


Figure 10. Global Plug-In Electric Car Sales [10]

## Electric Vehicles

Electric vehicles (EV) are also predicted to gain traction in the future. EV eliminate pollution from ICE but the technology is nascent and is continuing in its ascendancy in the industry due to demanding EPA regulations. EV is separated into two main facets: plug-in hybrid electric vehicle (PHEV) and battery electric vehicle (BEV). Currently, EV sales dropped significantly in the last couple months but the long-term forecast for the market is smooth and ever-growing due to growing incentives [6]. The current technical issue to address is the compatibility of the fluids with the electric motor material. Fluids must be modified to reach a balance between conducting and insulating electrical currents; if the conduction is too high, there is a risk of current leakage. If the fluid is too effective in insulating, it could potentially cause static build-up and discharge, which can damage the equipment.

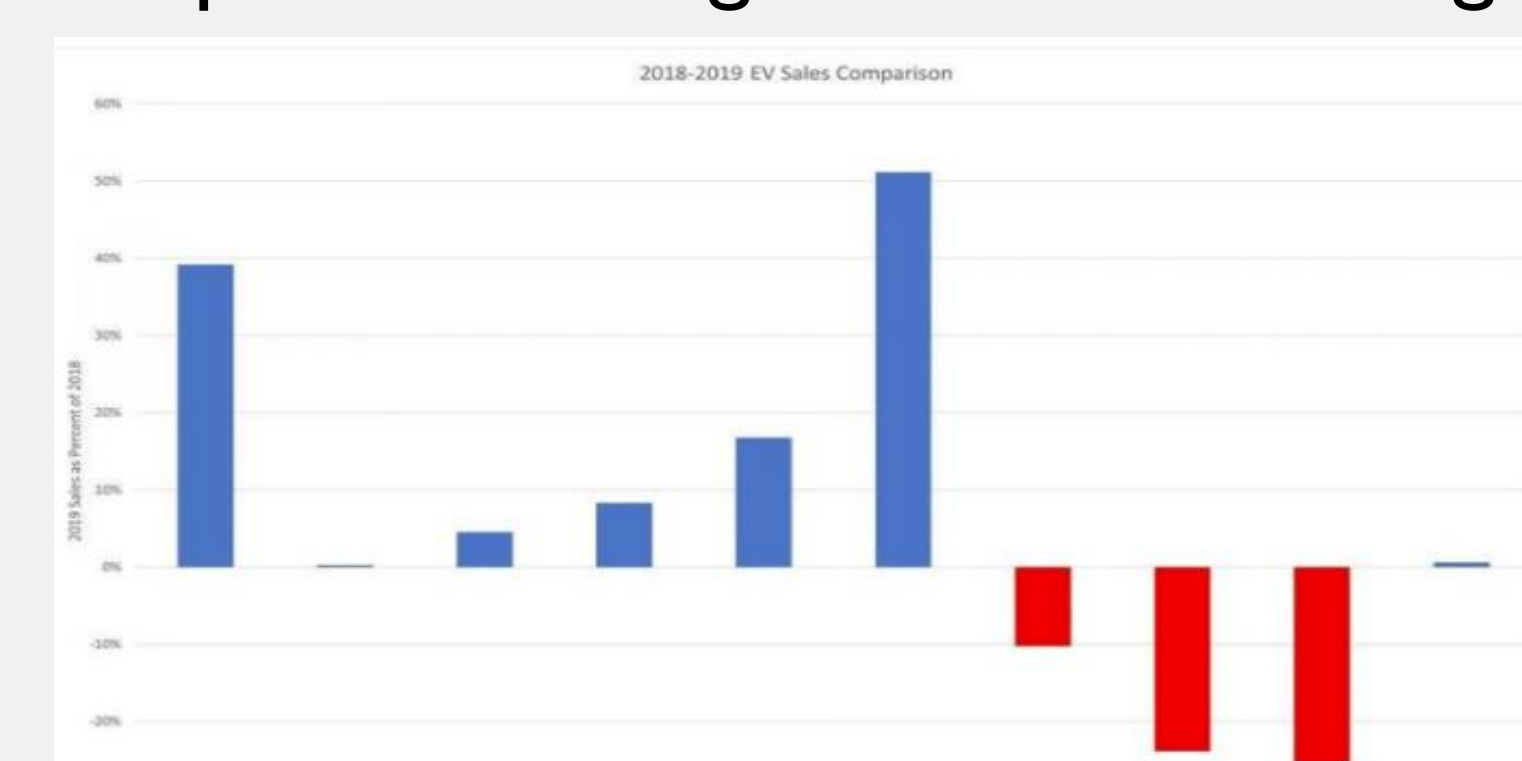


Figure 4. EV sales in 2018-2019 [6]

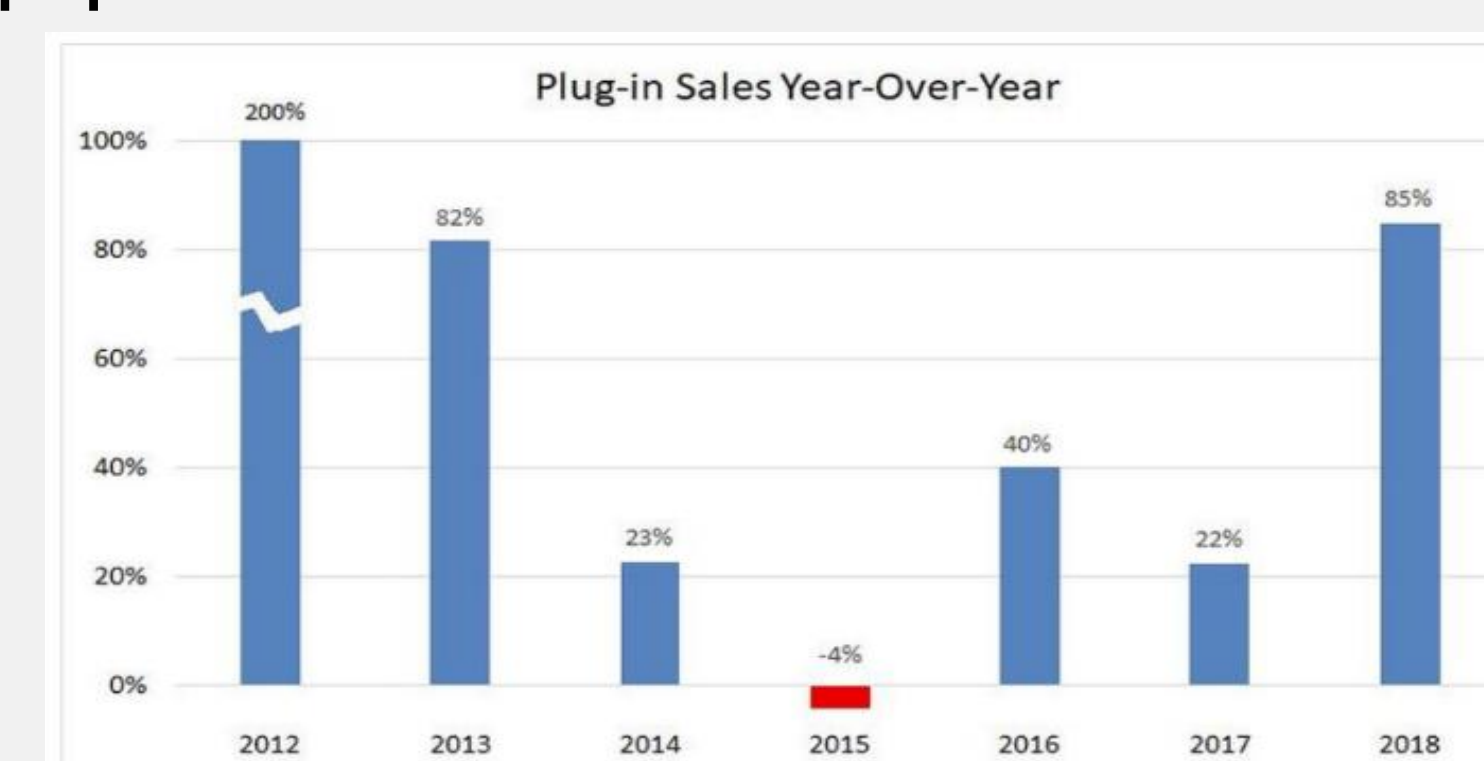


Figure 5. Plug-in sales in last few years [6]

## Conclusion

While AT vehicles are dominant, electric cars are on the rise and both will be prominent for years to come which shouldn't give ATF markets any reasons to worry for now.

## References

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## Acknowledgement

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