

J.D. POWER



PERSPECTIVE

SPRING 2017

ALTERNATIVE POWERTRAINS:

Analysis of Recent Market Trends &

Value Retention

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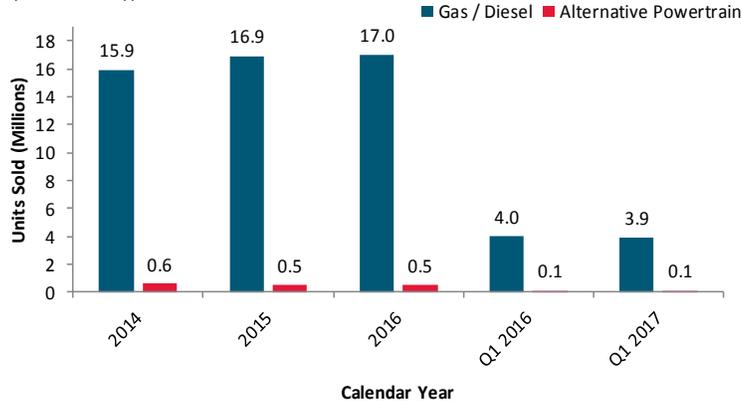
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INTRODUCTION

It’s somewhat hard to believe, but alternative powertrain vehicles have been available for mass market consumption in the United States for over 18 years. Honda released the two-door, two-passenger Insight in 1999 followed by Toyota’s four-door, five-passenger Prius in 2000. As the years went on, alternative powertrain vehicles picked up steam in the U.S. with the addition of new models from a handful of different manufacturers.

This report serves as J.D. Power Valuation Services’ annual assessment of alternative powertrain vehicles with a specific focus on used vehicle prices. Specifically, this is an update on how powertrains powered solely by internal combustion gas or diesel engines have performed in the U.S. versus alternatives (such as hybrids, plug-in hybrids, and electrics). The update will also highlight how these vehicles have performed in the used vehicle marketplace from a value retention point of view.

Automobile Industry Sales Comparison
By Powertrain Type



Source: WardsAuto

NEW VEHICLE SALES ANALYSIS

Over the past few years, new sales of all powertrain types improved by rates of 5.8% in both 2014 and 2015 before slowing to 0.4% in 2016. During these same periods, alternative powertrain sales performed much differently. In 2014 and 2015, alternative powertrain deliveries declined 2.5% and 14.5%, respectively, before leveling off in 2016 when sales ticked up by a slight 0.1%. However, alternative powertrain sales are showing signs of improvement in 2017. Compared to Q1 2016, alternative powertrain

Total Automobile Industry Sales Comparison

Powertrain Type	CY 2014	CY 2015	CY 2016	Q1 2016	Q1 2017
Gas / Diesel	15,861,813	16,906,149	16,974,345	3,974,583	3,885,267
Hybrid	452,507	373,359	338,867	72,048	82,674
Electric	64,772	72,374	80,039	13,485	26,390
Plug-in Hybrid	55,441	43,815	70,681	12,034	19,208
Natural Gas	751	486	3	0	1
Fuel Cell	2	108	1,085	106	410

Source: WardsAuto

Total Market Share Comparison

Gas / Diesel versus Alternative Powertrains

Powertrain Type	CY 2014	CY 2015	CY 2016	Q1 2016	Q1 2017
Gas / Diesel	96.5%	97.2%	97.2%	97.6%	96.8%
Alternative Powertrains	3.5%	2.8%	2.8%	2.4%	3.2%

Source: WardsAuto

Alternative Powertrain Market Share Comparison

Powertrain Type	CY 2014	CY 2015	CY 2016	Q1 2016	Q1 2017
Hybrid	78.9%	76.2%	69.1%	73.8%	64.2%
Electric	11.3%	14.8%	16.3%	13.8%	20.5%
Plug-in Hybrid	9.7%	8.9%	14.4%	12.3%	14.9%
Natural Gas	0.1%	0.1%	0.0%	0.0%	0.0%
Fuel Cell	0.0%	0.0%	0.2%	0.1%	0.3%

Source: WardsAuto

sales grew by 31.7% in Q1 2017 (while total new sales declined by 1.4%).

Even with new vehicle alternative powertrain models being added to the marketplace over the past few years, overall market share remains extremely small. In 2014, alternative powertrain sales represented 3.5% of total deliveries, but declined to 2.8% in 2015 and 2016. While alternative powertrain vehicles have been readily available for years, the majority of retail consumers remain hesitant or unwilling to give up gas and diesel platforms for nontraditional powertrains.

Within the alternative powertrain hierarchy, hybrids remain the most prevalent non-gasoline or non-diesel vehicle type sold over the past 3-year period. Market share

for this group averaged 74.7% over the course of 2014 to 2016. However, it's important to note that overall hybrid share has shrunk considerably over this period. The decline in share was gradual at first—dropping from 78.9% in 2014 to 76.2% in 2015—before it fell more dramatically in 2016 to 69.1%.

At the brand level, and similar to last year's report, Toyota continues to be the biggest player in the conventional hybrid marketplace. In 2016, Toyota models accounted for 63.7% of all hybrid deliveries in the U.S. During this same period, the Toyota Prius was the highest volume selling hybrid model with over 113K deliveries. However, the Prius' full-year tally was down 20% from 2015's 142K unit figure.

The second and third most popular alternative powertrain types in 2016 were electrics and plug-in hybrids. The two groups accounted for 16.3% and 14.4% of total alternative powertrain sales for the year, respectively. The duo's combined 2016 share of 30.7% was a significant improvement compared to 2014 and 2015 share averages of 21% and 23.7%, respectively. While electric and plug-in hybrid sales improved significantly in 2016, the increases were due in large part to a greater selection of new models and significant redesigns, like the Chevrolet Volt.

Electric vehicle sales have grown steadily over the past three year period. In 2014, deliveries grew by 36.1% before improving by impressive, yet somewhat lesser figures: 11.7% in 2015 and 10.6% in

2016. Plug-in hybrids saw sales fall by 21% in 2015 (55K units in 2014 to less than 44K units in 2015) before increasing by 61.3% in 2016. In 2016, Chevrolet was the biggest player among plug-in hybrids. The brand managed to grow Volt deliveries by 60.7% to nearly 25K units. In terms of individual model market share, the Volt represented 35% of all plug-in hybrids sold in 2016, followed by the Ford Fusion at 22.5%. Together, these two models represented 57.6% of total plug-in sales, or more than 40K of the 70K total plug-in hybrids sold in all of 2016.

ALTERNATIVE POWERTRAIN LOYALTY

An analysis of vehicle disposal data—or alternative powertrain loyalty—provides a glimpse into the dynamics of the alternative powertrain market and gives an idea about what’s going on in terms of vehicle replacement sales. Looking first at electric vehicles, the percentage of disposals across powertrain types has been somewhat consistent over the past few years. The most noticeable change was the increase of electric disposals in 2016, meaning more electric owners swapped their vehicles out for new electric units. A similar pattern occurred for both electric/hybrid and hybrid disposals, where there were sizeable increases in same powertrain type disposals and purchases. Across all powertrain types, gasoline units remain the primary disposal type.

Alternative Powertrain Loyalty Comparison

Powertrain Type Purchased	Disposal Type	CY 2013	CY 2014	CY 2015	CY 2016	YTD 2017	CY 2013 - CY 2016 Avg.
Electric	Gas	84.1%	87.7%	83.0%	76.3%	63.4%	82.8%
	Hybrid	8.9%	7.6%	8.7%	8.2%	12.8%	8.4%
	Electric	4.2%	3.1%	3.4%	12.9%	15.9%	5.9%
	Diesel	1.6%	1.2%	3.7%	1.6%	0.5%	2.0%
	Electric/Hybrid	1.0%	0.3%	0.9%	1.0%	7.0%	0.8%
Electric/Hybrid	Gas	75.8%	78.2%	75.2%	74.4%	71.2%	75.9%
	Hybrid	20.1%	16.9%	15.4%	13.2%	15.2%	16.4%
	Electric/Hybrid	1.8%	2.5%	6.4%	9.0%	9.9%	5.0%
	Diesel	1.4%	1.6%	2.0%	2.6%	2.3%	1.9%
	Electric	0.8%	0.6%	0.8%	0.8%	1.3%	0.7%
	Natural Gas	0.1%	0.1%	0.2%	0.1%	0.1%	0.1%
Hybrid	Gas	78.1%	74.7%	69.8%	65.3%	65.3%	72.0%
	Hybrid	21.1%	24.4%	29.4%	33.8%	33.3%	27.2%
	Diesel	0.8%	0.7%	0.7%	0.5%	0.5%	0.7%
	Electric/Hybrid	0.0%	0.1%	0.1%	0.3%	0.7%	0.1%
	Electric	0.0%	0.0%	0.0%	0.1%	0.2%	0.1%
	Natural Gas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: J.D. Power

FEDERAL ALTERNATIVE POWERTRAIN TAX CREDITS

Federal tax credits have always been an attractive benefit to buyers purchasing new alternative powertrain vehicles. However, understanding which vehicles and how much credit each is eligible for is somewhat complicated. Currently, only electric and plug-in hybrid vehicles qualify for federal

income tax credits. The formerly popular clean diesel and conventional hybrid credits expired at the end of 2010.

As of today, only electric and plug-in hybrid vehicles purchased new qualify for a federal income tax credit of up to \$7,500. The total credit amount varies based on the capacity of the battery used to power the vehicle. For example, according to information on www.fueleconomy.gov, a 2017 Kia Soul EV qualifies for the full \$7,500 credit, whereas a 2017 Kia Optima plug-in only qualifies for a credit of up to \$4,919.

Another point to consider is the mandatory phase out for each manufacturer’s available credit. More specifically, the credit begins to phase out for vehicles at the beginning of the second calendar quarter after the manufacturer has sold 200K eligible plug-in electric vehicles (i.e., plug-in hybrids and electrics) in the United States as counted from January 1, 2010. The IRS will announce when a manufacturer exceeds this production figure and will announce the subsequent phase out

schedule (example to the left). Looking at overall plug-in electric vehicle sales, it appears Tesla and General Motors will be the first two manufacturers to hit the 200k unit mark sometime around Q2 of 2018. Nissan is estimated to hit 200K units around Q1 2019, followed by Ford in Q4 2019, while Toyota and BMW phase outs should begin in Q1 2020.

Example

200,000th plug-in electric drive vehicle produced by the manufacturer on February 12, 2010.				Phase out starts beginning of second calendar quarter after 200,000-vehicle mark reached.				Beginning of fourth calendar quarter after 200,000-vehicle mark reached, credit decreases again.				Credit ends beginning sixth calendar quarter.								
Full Credit Amount				50% of Full Amount				25% of Full Amount				No Credit								
Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
2010												2011								

EIA FUEL PRICE FORECAST & FUTURE FUEL ECONOMY STANDARDS

Per the U.S. Energy Information Administration (EIA) forecast for “Gasoline Regular Grade Retail Price Including Taxes, U.S. Average,” found in the organization’s “Short-Term Energy Outlook,” fuel prices are expected to grow from roughly \$2.30 per gallon in February 2017 to \$2.51 per gallon in July before falling to \$2.24 per gallon by December. Looking further out, the EIA expects prices to average \$2.40 per gallon in 2018 and \$2.44 per gallon in 2018.

With average regular grade gas prices expected to remain around or under \$2.50 per gallon in the U.S. over the short-term, there is little reason to believe that buyers who are sensitive to high gasoline expenses will be inclined to choose an alternative powertrain vehicle over a traditional gas-powered automobile due to the cost of fuel. However, it’s entirely possible that even with low gas prices expected in the coming years, some environmentally-conscious consumers will continue to actively purchase electrics or plug-in hybrids.

Certainly, manufacturers are betting on the fuel-efficient technology. The rapid pace of EV model introductions is due in large part to current Corporate Average Fuel Economy (CAFE) standards. Intended to reduce U.S. dependence on foreign oil as well as greenhouse gas emissions, the Obama administration increased CAFE standards to 35.5 miles per gallon (mpg) through the 2016 model year. By 2025, CAFE standards require an average fleet efficiency of 54.5 mpg. In March 2017, however, President Trump announced his team will be conducting a review of the increases in U.S. fuel economy standards put in place by the Obama administration.

ALTERNATIVE POWERTRAIN VALUE RETENTION

Depreciation represents a major factor in a vehicle’s overall cost of ownership. This section aims to examine how alternative powertrains are currently performing in the used vehicle market by measuring their individual value retention.

On the new side of the market, alternative segments generally have weaker demand and higher incentives than their gasoline-powered counterparts. These two hindrances carry over directly to the used market, which means prices of used alternative powertrain models fall at much higher rates than for their gasoline counterparts.

The higher rate of depreciation means EV, plug-in hybrid, and traditional hybrid retained value is frequently inferior to competitive gas models. Looking at the most recent 3-year-old retention figures by powertrain type (3-month average from March to May 2017), gasoline equipped models have retained at a rate of 52.1%, followed by hybrids at 46.4%. Trailing much further behind, plug-in hybrid and EV value retention reached 36.9% and 26.9%, respectively. Looking back, 2016 and 2015 retention results for the same period were similar; however, electric vehicle retention was more volatile because of new models being added.

The following tables provide a complete summary of 3-year-old model (2014) hybrid, plug-in hybrid, and electric vehicle retained value by vehicle segment. All calculations are a function of the most recent 3-month 2017 average of NADA Used Car Guide’s average trade-in value (March to May 2017) divided by a vehicle’s typically-equipped MSRP, 2016 and 2015 retention averages for the same periods are included as well for reference. Note a vehicle’s rate of depreciation—and ultimately retention—is in part a product of the level of discounts when new. As such, MSRPs do not include any incentives or rebates available at the time of purchase.

Electric Vehicles		Retained Value (%)		
3-Year-Old Value Retention (3-Month Avg. March - May)		2017	2016	2015
Make	Model			
BMW	i3 Series	29.1%		
Chevrolet	Spark	21.8%		
Fiat	500	20.0%	25.3%	
Ford	Focus	25.0%	20.3%	32.4%
Mercedes-Benz	B Class	24.6%		
Mitsubishi	i-MiEV	16.0%		21.9%
Nissan	Leaf	19.7%	24.8%	25.7%
Smart	FORTWO	17.7%	21.5%	
Tesla	Model S	48.9%	52.2%	61.5%
Toyota	RAV4	31.4%	40.6%	48.3%
	Electric Average	26.9%	34.4%	42.2%

Source: J.D. Power Valuation Services

Hybrid Vehicles

3-Year-Old Value Retention (3-Month Avg. March - May)

Retained Value (%)

Make	Model	2017	2016	2015
Acura	RLX	39.0%		
Acura	ILX	45.0%	49.4%	
Audi	Q5	61.7%	59.1%	
BMW	5 Series	45.4%	38.6%	43.8%
BMW	3 Series	43.2%	41.7%	
BMW	7 Series	34.8%	40.4%	37.7%
Buick	Lacrosse	36.2%	40.9%	43.6%
Buick	Regal	37.1%	38.5%	40.8%
Cadillac	Escalade		50.8%	49.8%
Chevrolet	Malibu	40.9%	43.4%	
Chevrolet	Impala	44.3%		
Chevrolet	Silverado		56.1%	59.1%
Chevrolet	Tahoe		53.3%	56.2%
Ford	C-Max	40.5%	40.5%	
Ford	Fusion	47.4%	50.9%	45.9%
Ford	Escape			56.8%
GMC	Denali		55.9%	56.9%
GMC	Sierra		55.6%	58.7%
GMC	Yukon		53.0%	55.5%
Honda	Civic	45.5%	48.5%	50.1%
Honda	Insight	40.7%	45.8%	49.0%
Honda	Accord	50.4%		
Honda	CR-Z	41.3%	47.7%	46.9%
Hyundai	Sonata	41.2%	43.4%	49.9%
Infiniti	Q70	37.6%	42.8%	42.5%
Infiniti	QX60	52.4%		
Infiniti	Q50	43.8%		
Kia	Optima	40.6%	45.3%	50.4%
Lexus	LS	52.8%	49.9%	52.3%
Lexus	GS	48.7%	44.0%	
Lexus	RX	55.7%	54.2%	56.0%
Lexus	ES	49.6%	51.0%	
Lexus	CT	39.9%	42.3%	53.5%
Lexus	HS			53.6%
Lincoln	MKZ	38.2%	44.7%	40.9%
Mercedes-Benz	E Class	38.7%	38.8%	
Mercedes-Benz	S Class		43.4%	40.8%
Nissan	Pathfinder	46.7%		
Porsche	Cayenne	52.3%	49.9%	55.4%
Porsche	Panamera		46.8%	55.1%
Subaru	XV Crosstrek	57.8%		
Toyota	Prius	51.9%	52.6%	60.4%
Toyota	Camry	45.5%	50.4%	60.4%
Toyota	Highlander	66.8%	60.3%	65.8%
Toyota	Avalon	48.0%	52.7%	
Volkswagen	Jetta	39.6%	42.4%	
Volkswagen	Touareg	50.9%	44.0%	48.0%
	Hybrid Average	46.4%	48.4%	51.4%

Source: J.D. Power Valuation Services

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Electric/Hybrid Vehicles

3-Year-Old Value Retention (3-Month Avg. March - May)		Retained Value (%)		
Make	Model	2017	2016	2015
BMW	i8 Series	61.7%		
BMW	i3 Series	33.7%		
Cadillac	ELR	30.6%		
Chevrolet	Volt	32.7%	29.4%	32.5%
Ford	C-Max	35.0%	32.8%	
Ford	Fusion	37.7%	37.6%	
Honda	Accord	34.2%		
Porsche	Panamera	54.7%		
Toyota	Prius	45.8%	38.0%	50.5%
Electric/Hybrid Average		36.9%	33.5%	33.5%

Source: J.D. Power Valuation Services

AT J.D. POWER VALUATION SERVICES (FORMERLY NADA USED CAR GUIDE)

What's New

J.D. Power is pleased to offer a new **Residual Values** product suite designed to help manufacturers, captive finance companies, and lenders make informed decisions on residual setting, lease support, and risk management. This benchmark product incorporates industry-leading data from three trusted sources. Coupled with a seasoned team of data scientists and analysts, the product suite's sophisticated valuation forecast methodology provides a fresh, reliable approach based on objective expertise and complete transparency. For more information go to www.nada.com/residualvalues.

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We've moved the NADA Used Car Guide offices just a block down the street from our old place of operations. Please note our new address in the footer of this report.

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J.D. Power is a global leader in consumer insights, advisory services, and data and analytics to help clients measure and improve the key performance metrics that drive growth and profitability. J.D. Power's industry benchmarks, robust proprietary data, advanced analytics capabilities, and reputation for independence and integrity has established the company as one of the world's most well-known and trusted providers of consumer and market insights for more than a dozen industries. Established in 1968, J.D. Power is headquartered in Costa Mesa, California, and has 17 global locations serving North/South America, Asia Pacific, and Europe.

About J.D. Power Valuation Services (formerly NADA Used Car Guide)

J.D. Power Valuation Services (formerly NADA Used Car Guide) is a leading provider of vehicle valuation products, services and information to businesses. Its team collects and analyzes over 1 million combined automotive and truck wholesale and retail transactions per month, and delivers a range of guidebooks, auction data, analysis and data solutions. J.D. Power acquired NADA Used Car Guide in 2015, forming a powerful combination that brings the automotive industry rich data sets, strong analytics and over 130 years of market experience. Residual Values is the first product to be launched by J.D. Power Valuation Services.

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CONSULTING SERVICES

J.D. Power Valuation Services’ market intelligence team leverages a database of nearly 200 million automotive transactions and more than 100 economic and automotive market-related series to describe the factors driving current trends to help industry stakeholders make more informed decisions. Analyzing data at both wholesale and retail levels, the team continuously provides content that is both useful and usable to the automotive industry, financial institutions, businesses and consumers.

Complemented by J.D. Power Valuation Services’ analytics team, which maintains and advances its internal forecasting models and develops customized forecasting solutions for automotive clients, the market intelligence team is responsible for publishing white papers, special reports and the Used Car & Truck Blog. Throughout every piece of content, the team strives to go beyond what is happening in the automotive industry to confidently answer why it is happening and how it will impact the market in the future.

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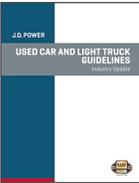
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ADDITIONAL RESOURCES



Guidelines

Updated monthly with a robust data set from various industry sources and J.D. Power Valuation Services’ proprietary analysis, Guidelines provides the insight needed to make decisions in today’s market.



Perspective

Leveraging data from various industry sources and J.D. Power Valuation Services’ analysts, Perspective takes a deep dive into a range of industry trends to determine why they are happening and what to expect in the future.



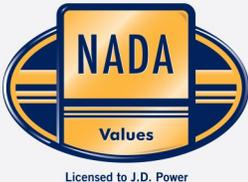
White Papers

J.D. Power Valuation Services’ white papers and special reports aim to inform industry stakeholders on current and expected used vehicle price movement to better maximize today’s opportunities and manage tomorrow’s risk.



Used Car & Truck Blog

Written and managed by the Market Intelligence team, the Used Car & Truck Blog analyzes market data, lends insight into industry trends and highlights relevant events.



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