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RESALE VALUES OF ELECTRIC AND CONVENTIONAL VEHICLES: RECENT TRENDS AND INFLUENCE ON THE DECISION TO PURCHASE A NEW VEHICLE

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16. Abstract

This study was designed to investigate recent changes in vehicle resale value and the effect of resale value on consumer purchasing decisions regarding plug-in electric vehicles (PEVs). Specifically, the study investigated (1) resale value comparisons for recent model years of PEVs and comparable internal-combustion-engine (ICE) vehicles, and (2) consumer experience and opinions regarding the importance of vehicle resale value relative to other fundamental vehicle aspects for an individual's decision to purchase various vehicle types, including PEVs. Of interest were both types of PEVs, battery-electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs).

The results indicate that without accounting for the current federal tax rebate, both types of PEVs (i.e., BEVs and PHEVs) lose resale value faster than comparable ICE vehicles. However, when accounting for the federal tax rebate incentives for PEVs and the resulting effective reduction in purchase price, both BEVs and PHEVs tended to retain their relative resale value substantially better than without such an incentive, with PHEVs retaining resale value as well as their ICE counterparts.

Survey respondents named purchase price, fuel economy and fuel costs, and safety performance most often among the top three vehicle aspects that are important to them when considering the purchase of an ICE vehicle. For PEVs, the aspects named most often were maximum battery range, purchase price, and safety performance. While resale value did not feature prominently among the important aspects for purchasing either type of vehicles, it was more important for PHEVs than ICEs.

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Introduction

This study was designed to investigate recent changes in vehicle resale value and the effect of vehicle resale value on consumer purchasing decisions regarding plug-in electric vehicles (PEVs). Recent media reports suggest that purchasing and leasing behavior of new-car buyers may be influenced by factors such as buyer demographics (Edmunds, 2017a) and specific vehicle characteristics that are unique to plug-in electric vehicles of all types (Autoweek, 2018), including both battery-electric vehicles and plug-in hybrid electric vehicles.

Several examples of such demographic and vehicle-based factors that are likely to create a bias toward leasing PEVs, and away from purchasing both new and used PEVs, include the following:

- Younger consumers, who tend to be more accepting and interested in owning PEVs, are also more likely to lease versus purchase (Edmunds, 2017b).
- Leases generally offer more attractive, affordable monthly payments versus purchasing or financing a new vehicle, especially when the initial purchase price is relatively high as is often the case with PEVs (Edmunds, 2017b).
- Rapid technical advances with PEVs may lead owners to desire more frequent vehicle upgrades, a process made easier when leasing a vehicle. For example, in 2016 the average lease term was 36 months versus 69 months when financing a purchase (Edmunds, 2017b).
- Incentives such as tax credits and rebates are only available for new vehicles, potentially reducing the market for, and interest in, used PEVs.
- A combination of high initial purchase price, lack of purchasing incentives (i.e., tax credits)
 for used PEVs, and a desire by PEV owners to have the latest technology are all likely to
 contribute to substantial loss of resale value for PEVs. This potential loss of resale value
 creates an additional disincentive for purchasing PEVs (new or used).

This study investigated two aspects of resale value for PEVs: (1) resale value comparisons for recent model years of PEVs and comparable internal-combustion-engine (ICE) vehicles, and (2) consumer experience and opinions regarding the importance of vehicle resale value relative to other fundamental vehicle aspects for an individual's decision to purchase various vehicle types, including PEVs.

Method: Resale value trends

Raw data

Historical manufacturer suggested retail price (MSRP) data were obtained from the EPA (2018) website for matched pairs (see below) of plug-in electric vehicles (PEV) and internal-combustion-engine (ICE) vehicles. Typical resale-value estimates for the matched pairs of vehicles were obtained from Kelley Blue Book (KBB, 2018a) for model years 2011 through 2015. MSRP and resale values were collected in January 2018, and the values for each matched pair were obtained on the same day. The following criteria or assumptions, based on Kelley Blue Book definitions or estimates, were applied to each vehicle pair's resale value search:

- Vehicles were priced for "standard equipment"
- Vehicles were in "good" condition¹
- Typical mileage for each specific vehicle model and model year combination
- The lowest-priced body style was selected
- Vehicle color of silver as the default selection, with white selected for vehicles not offered in silver²
- Prices were for "private party value" (versus dealership trade in or sale)

Vehicles included in the analysis

Two different types of PEV matched pairs were included in the analysis: (1) battery-electric vehicle (BEV) and ICE matched pairs, and (2) plug-in hybrid electric vehicle (PHEV) and ICE matched pairs. A total of 11 matched pairs of BEV and ICE vehicles and 9 matched pairs of PHEV and ICE vehicles were included in the analysis. Table 1 shows the specific matched pairs of PEV and ICE vehicles selected for the analysis, including the specific PEV types and model years included. The following criteria were applied when selecting vehicles for inclusion:

¹ Per Kelley Blue Book, a vehicle in good condition "has some repairable cosmetic defects and is free of major mechanical problems" (applies to 54% of all Kelley Blue Book used vehicle listings).

² These two colors are the most common and best-selling colors for used vehicles. Kelley Blue Book identified 23% of used vehicles as being silver and 15% as being white (KBB, 2018b).

- Matched pairs of PEV and ICE models must have both been sold during model years
 2011 through 2015
- Sales of at least 1,000 vehicles for the PEV model within each matched pair for each model year (InsideEVs, 2018)
- PEVs that were only available for lease were excluded
- No high-priced, ultra-luxury vehicles (i.e., no vehicles with MSRP over \$100,000)

Whenever possible, PEVs were matched with the same exact make and model (i.e., the corresponding ICE version of the PEV). In cases where this was not possible, the PEV model was matched with a comparable ICE model in terms of size and performance, ideally from the same manufacturer. (For Tesla, a manufacturer with no ICE vehicles for comparison, a vehicle of comparable size and performance was selected from another manufacturer.)

Approach

Retained value as a percentage of MSRP was calculated for all PEV and ICE vehicle models included in the analysis. The calculation involved computing resale value as a percentage of MSRP. Additionally, a secondary calculation was performed to adjust for the current maximum potential federal tax rebate allowed for most PEV buyers during the model years examined (DOE, 2018). The secondary calculation was similar to the first calculation, but with an additional step of subtracting the maximum rebate of \$7,500 from each MSRP.

Table 1
Matched pairs of PEV and ICE vehicles included in the analysis.

Make & model	Type	Model year(s)
BMW i3 BEV	BEV	11100.01 y 001 (0)
Mini Paceman	ICE	2014-2015
Chevrolet Spark EV	BEV	
Chevrolet Spark	ICE	2014-2015
Fiat 500e	BEV	
Fiat 500	ICE	2013-2015
Ford Focus EV	BEV	
Ford Focus	ICE	2012-2015
Kia Soul EV	BEV	2017
Kia Soul	ICE	2015
Mercedes-Benz B-Class EV	BEV	2014 2015
Mercedes-Benz C-Class	ICE	2014-2015
Mitsubishi i-MiEV	BEV	2014
Mitsubishi Mirage	ICE	2014
Nissan Leaf	BEV	2011 2015
Nissan Sentra	ICE	2011-2015
Smart fortwo coupe EV	BEV	2012 2015
Smart fortwo coupe	ICE	2013-2015
Tesla S	BEV	2012 2015
BMW 7 Series	ICE	2012-2015
Toyota RAV4 EV	BEV	2012 2014
Toyota RAV4	ICE	2012-2014
BMW i3 REX	PHEV	2014 2015
Mini Paceman	ICE	2014-2015
Cadillac ELR	PHEV	2014
Cadillac CTS	ICE	2014
Chevrolet Volt	PHEV	2011 2015
Chevrolet Cruze Eco	ICE	2011-2015
Ford C-Max Energi	PHEV	2013-2015
Ford Focus	ICE	2013-2013
Ford Fusion Energi	PHEV	2012 2015
Ford Fusion	ICE	2013-2015
Porsche Cayenne S E-Hybrid	PHEV	2015
Porsche Cayenne	ICE	2013
Porsche Panamera S E-Hybrid	PHEV	2014-2015
Porsche Panamera	ICE	2014-2013
Toyota Prius PHV	PHEV	2012-2015
Toyota Yaris	ICE	2012-2013
Volkswagen e-Golf	PHEV	2015
Volkswagen Golf	ICE	2013

Results: Resale value trends

General trends

In general, ICE vehicles included in this analysis retained their resale value better than the paired PEV models. Figure 1 summarizes the resale value trends for each vehicle type.³ A typical PEV included in this analysis lost resale value faster than its ICE counterpart. For example, a 6-year-old ICE had a similar retained resale value as a 4- or 5-year-old PEV (either BEV or PHEV). Loss of resale value for BEVs tends to occur somewhat faster than PHEVs of similar age. For example, the average difference (over the years) between retained resale values for ICEs and PHEVs was -8.5%, while the average difference between ICEs and BEVs was -12.7%.

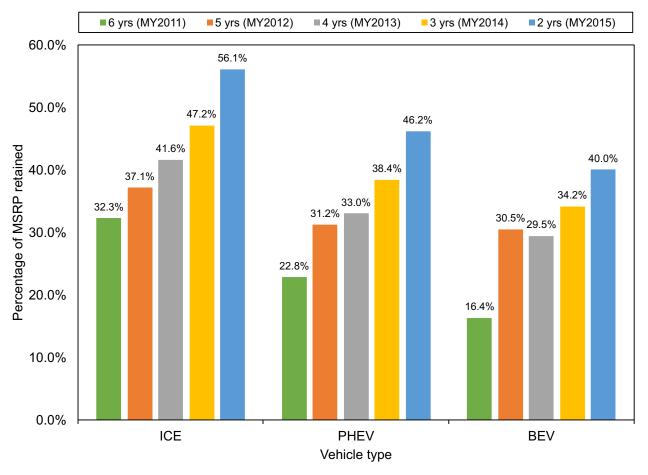


Figure 1. Resale value trends for recent model years, by vehicle type.

³ The resale values for the two sets of ICE vehicles showed very similar decreases. Therefore, the two sets were combined.

Tax-rebate-adjusted trends

When accounting for possible federal tax rebates (currently up to \$7,500), retained resale value for the analyzed PEV models remain closer to comparable paired ICE models. Figure 2 summarizes the tax-rebate-adjusted, resale-value trends for each vehicle type. After accounting for maximum possible tax rebates (which are likely to play an important role in the perceived upfront costs for purchasing a PEV), PHEV models appear to suffer no additional loss in retained resale value compared to ICE models, with an average difference of 0% for the time span examined. (However, the differences begin to accelerate as the vehicles age, with the oldest PHEV models losing around 4% versus comparable ICEs.) For BEV models of PEVs, while still losing resale value faster than ICEs or PHEVs, retained resale values remain closer to those for ICE models than values that do not account for the tax rebate. There is an average difference of -5.7% for the years examined, with the difference accelerating as vehicles age.

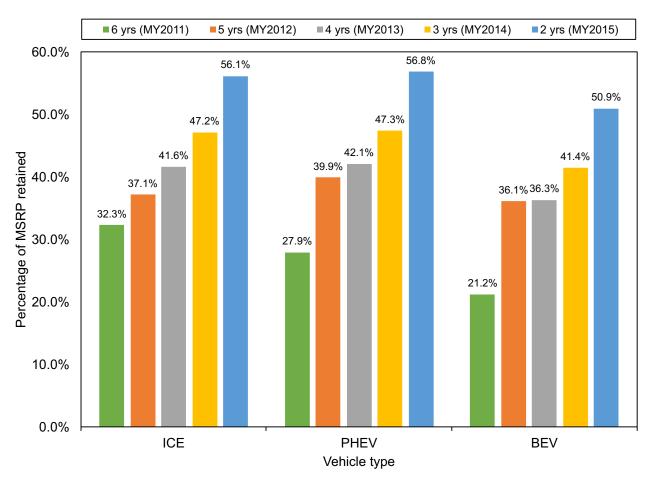


Figure 2. Tax-rebate-adjusted, resale-value trends for recent model years, by vehicle type.

Method: Consumer survey

Survey instrument

An online survey was conducted using SurveyMonkey (www.surveymonkey.com). A questionnaire was developed to examine several topics related to consumer experience and opinions concerning purchasing a new vehicle. The text of the questionnaire is included in the appendix. The survey was performed in February 2018.

Respondents

SurveyMonkey's Audience tool was used to recruit respondents 18 years and older from SurveyMonkey's respondent database in the United States. Respondents were screened and those who have never purchased or leased a new automobile, nor would ever consider purchasing or leasing a new automobile, were excluded. Fully completed surveys were received for 725 respondents. The margin of error at the 95% confidence level for the overall results is +/-3.6%. Demographic breakdowns for the respondents are presented in Table 2. The age and gender breakdowns are similar to the latest U.S. Census demographics for age and gender. Figure 3 shows each U.S. Census region and the corresponding states.

Table 2 Demographic breakdowns for the 725 respondents.

Demo	graphic aspect	Percent
Gender	Female	51.9
Gender	Male	48.1
	18 to 29	17.1
A go group	30 to 44	24.6
Age group	45 to 59	30.1
	60 or older	28.3
	\$0 to \$24,999	9.5
	\$25,000 to \$49,999	16.4
	\$50,000 to \$74,999	16.4
	\$75,000 to \$99,999	13.9
Income	\$100,000 to \$124,999	9.9
mcome	\$125,000 to \$149,999	5.7
	\$150,000 to \$174,999	3.7
	\$175,000 to \$199,999	1.4
	\$200,000 or more	4.7
	Prefer not to answer	13.4
	New England	8.2
	Middle Atlantic	12.2
	East North Central	15.7
	West North Central	5.3
U.S. region	South Atlantic	20.0
	East South Central	6.0
	West South Central	8.9
	Mountain	7.9
	Pacific	15.8

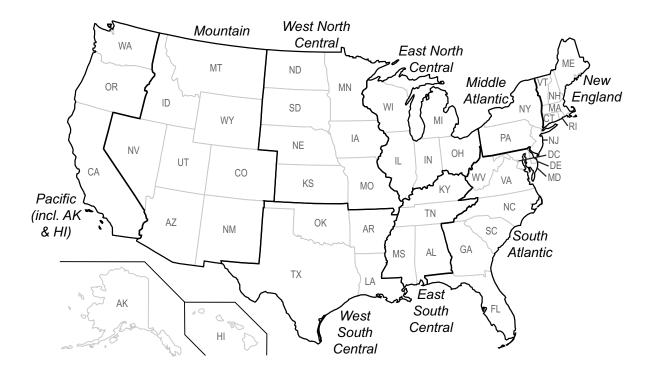


Figure 3. U.S. Census regions.

Previous experience purchasing or leasing a new vehicle (Q1)

In addition to the typical demographic breakdowns shown in Table 2, we also examined the data for trends related to previous experience purchasing or leasing a new vehicle, comparing groups of respondents who have previously purchased or leased a new vehicle (i.e., owners) with respondents who have not previously purchased or leased a new vehicle but would consider doing so in the future (i.e., non-owners). Table 3 shows a breakdown of respondents by purchasing and leasing experience.

Table 3
Breakdown of respondents by previous new vehicle purchase or lease experience.⁴

Vehicle purchase or lease experience	Response	N	Percent
Previously purchased or leased a new vehicle (i.e., owners)	Q1 = 1	549	75.7
Would consider purchasing or leasing a new vehicle (i.e., non-owners)	Q1 = 2	176	24.3

⁴ The specific text labels corresponding to each numeric response code for Q1 are located in the appendix.

Results: Consumer survey

Experience with or consideration for purchasing or leasing new vehicles

Previous experience purchasing or leasing a new vehicle – Vehicle types (Q2)

Respondents with previous experience purchasing or leasing a vehicle most frequently had purchased gasoline or diesel passenger cars (77.8%). The second most frequent experience was purchasing gasoline or diesel light trucks (27.9%), followed by leasing gasoline or diesel passenger cars (19.5%). (The percentages sum to greater than 100% because respondents could select more than one vehicle type.) Figure 4 summarizes the results for all respondents, while Table 4 presents complete summaries of responses by gender and age.

Males were more likely than females to have ever purchased a gasoline or diesel light truck (35.4% vs. 20.6%), while female respondents were more likely than males to have ever leased a gasoline or diesel passenger car (23.1% vs. 15.7%). As respondent age increased, the likelihood of ever having purchased a gasoline or diesel passenger car or light truck both increased. Conversely, as respondent age decreased, the likelihood of ever having leased a gasoline or diesel passenger car increased.

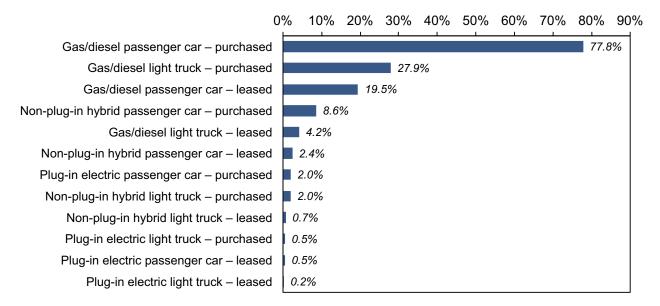


Figure 4. Summary of responses to Q2 for respondents with previous experience purchasing or leasing a vehicle: "Which of the following types of NEW vehicles have you ever purchased or leased?" (The percentages sum to greater than 100% because respondents could select more than one vehicle type.)

Table 4
Percentage of responses, by gender and age, to Q2 for respondents with previous experience purchasing or leasing a vehicle: "Which of the following types of NEW vehicles have you ever purchased or leased?" The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents could select more than one vehicle type.)

Dagnanga	Gen	der		Total			
Response	Female	Male	18-29	30-44	45-59	60+	Totat
Gas/diesel passenger car – purchased	76.2	79.5	54.5	70.9	81.0	86.3	77.8
Gas/diesel light truck – purchased	20.6	35.4	9.1	27.6	30.4	31.1	27.9
Gas/diesel passenger car – leased	23.1	15.7	30.9	20.5	19.0	15.8	19.5
Non-plug-in hybrid passenger car – purchased	7.5	9.7	14.5	7.9	7.6	8.2	8.6
Gas/diesel light truck – leased	2.1	6.3	3.6	6.3	3.3	3.8	4.2
Non-plug-in hybrid passenger car – leased	2.1	2.6	9.1	0.8	2.2	1.6	2.4
Plug-in electric passenger car – purchased	2.1	1.9	5.5	3.1	1.1	1.1	2.0
Non-plug-in hybrid light truck – purchased	1.8	2.2	1.8	3.1	2.2	1.1	2.0
Non-plug-in hybrid light truck – leased	0.4	1.1	1.8	0.8	1.1	0.0	0.7
Plug-in electric light truck – purchased	0.4	0.7	3.6	0.8	0.0	0.0	0.5
Plug-in electric passenger car – leased	0.7	0.4	1.8	1.6	0.0	0.0	0.5
Plug-in electric light truck – leased	0.4	0.0	0.0	0.8	0.0	0.0	0.2

Consideration for purchasing or leasing a new vehicle – Vehicle types (Q3)

Respondents without any previous experience purchasing or leasing a vehicle most frequently would consider purchasing gasoline or diesel passenger cars (60.2%). The second most frequent response was consideration of purchasing non-plug-in hybrid passenger cars (48.3%), followed by consideration for purchasing plug-in electric passenger cars (35.8%). (The percentages sum to greater than 100% because respondents could select more than one vehicle type.) Figure 5 summarizes the results for all respondents, while Table 5 presents complete summaries of responses by gender and age.

Males were more likely than females to say they would consider purchasing a plug-in electric passenger car (46.9% vs. 26.3%).

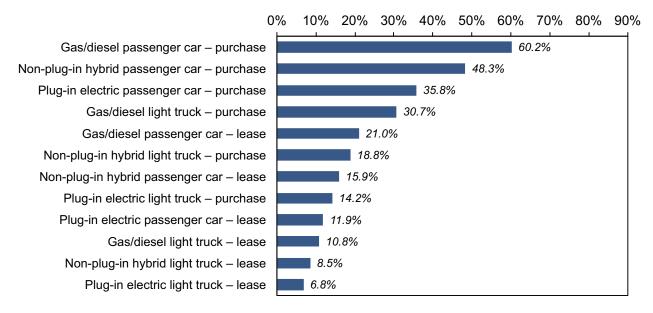


Figure 5. Summary of responses to Q3 for respondents without any previous experience purchasing or leasing a vehicle: "Which of the following types of NEW vehicles would you consider purchasing or leasing in the future?" (The percentages sum to greater than 100% because respondents could select more than one vehicle type.)

Table 5
Percentage of responses, by gender and age, to Q3 for respondents without any previous experience purchasing or leasing a vehicle: "Which of the following types of NEW vehicles would you consider purchasing or leasing in the future?" The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents could select more than one vehicle type.)

Dagnanga	Gen	der		Total			
Response	Female	Male	18-29	30-44	45-59	60+	Totat
Gas/diesel passenger car – purchase	61.1	59.3	63.8	51.0	73.5	50.0	60.2
Non-plug-in hybrid passenger car – purchase	47.4	49.4	56.5	43.1	32.4	59.1	48.3
Plug-in electric passenger car – purchase	26.3	46.9	42.0	35.3	26.5	31.8	35.8
Gas/diesel light truck – purchase	32.6	28.4	31.9	35.5	32.4	13.6	30.7
Gas/diesel passenger car – lease	23.2	18.5	30.4	15.7	14.7	13.6	21.0
Non-plug-in hybrid light truck – purchase	13.7	24.7	20.3	17.6	20.6	13.6	18.8
Non-plug-in hybrid passenger car – lease	13.7	18.5	23.2	13.7	14.7	0.0	15.9
Plug-in electric light truck – purchase	7.4	22.2	17.4	15.7	11.8	4.5	14.2
Plug-in electric passenger car – lease	9.5	14.8	18.8	7.8	8.8	4.5	11.9
Gas/diesel light truck – lease	8.4	13.6	14.5	9.8	11.8	0.0	10.8
Non-plug-in hybrid light truck – lease	5.3	12.3	13.0	7.8	5.9	0.0	8.5
Plug-in electric light truck – lease	2.1	12.3	11.6	3.9	5.9	0.0	6.8

Important vehicle aspects when considering purchasing a new vehicle

Top three vehicle aspects – gasoline or diesel passenger car (Q4)

The most frequent vehicle aspect mentioned among the top three aspects when considering purchasing a new gasoline or diesel passenger car was the purchase price (64.1%), although a majority also mentioned fuel economy and fuel costs (58.3%) as a top aspect. Just less than half (45.2%) of all respondents mentioned safety, ranking as the third most frequently mentioned aspect. (The percentages sum to greater than 100% because respondents were asked to select three aspects.) Figure 6 summarizes the results for all respondents, while Table 6 presents complete summaries of responses by gender, age, and vehicle ownership (groupings based on responses to Q1).

Female respondents were more likely than males to mention safety (52.7% vs. 37.2%). Vehicle owners were less likely than non-owners to mention fuel economy and fuel costs (56.3% vs. 64.8%).

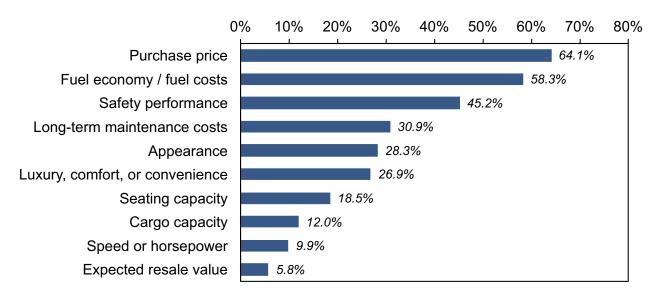


Figure 6. Summary of responses to Q4: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new gasoline or diesel PASSENGER CAR." (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

Table 6
Percentage of responses, by gender, age, and vehicle ownership, to Q4: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new gasoline or diesel PASSENGER CAR." The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

	Geno	der		Age				Vehicle ownership		
Aspect	Female	Male	18- 29	30- 44	45- 59	60+	Owner	Non- owner	Total	
Purchase price	64.4	63.9	65.3	59.6	63.8	67.8	63.2	67.0	64.1	
Fuel economy / fuel costs	60.9	55.6	57.3	56.2	59.2	60.0	56.3	64.8	58.3	
Safety performance	52.7	37.2	38.7	42.7	43.1	53.7	45.5	44.3	45.2	
Long-term maintenance costs	26.6	35.5	37.9	25.3	32.6	29.8	29.5	35.2	30.9	
Appearance	27.9	28.7	27.4	30.9	33.0	21.5	31.0	19.9	28.3	
Luxury, comfort, or convenience	22.9	31.2	23.4	33.1	21.1	29.8	27.3	25.6	26.9	
Seating capacity	19.4	17.5	25.0	23.6	17.0	11.7	18.2	19.3	18.5	
Cargo capacity	13.0	10.9	12.1	11.2	12.4	12.2	12.8	9.7	12.0	
Speed or horsepower	7.4	12.6	10.5	10.7	11.0	7.8	10.0	9.7	9.9	
Expected resale value	4.8	6.9	2.4	6.7	6.9	5.9	6.2	4.5	5.8	

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Single most important vehicle aspect – gasoline or diesel passenger car (Q5)

When asked to identify the most important vehicle aspect from the three selected in Q4, the aspect most frequently selected remained the purchase price (33.5%). While safety ranked third most frequently mentioned among the top three aspects (Q4), it was the second most frequently selected as being the most important vehicle aspect (19.7%), with fuel economy and fuel costs (second most frequently mentioned in Q4) selected as being most important third most often (19.4%). Figure 7 summarizes the results for all respondents. (In addition to identifying the most important vehicle aspect, this question also asked about the reason for that being the case. Given that this additional detail was not provided by a substantial portion of respondents, the results were not analyzed. This was also the case for analogous questions Q7, Q9, and Q11 to follow.)

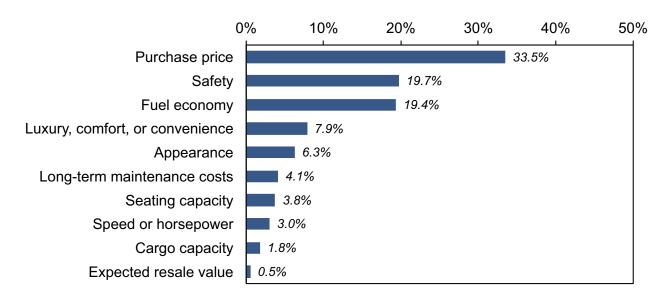


Figure 7. Summary of responses to Q5: "Which is the most important vehicle aspect to you when considering purchasing a new gasoline or diesel PASSENGER CAR and why?"

Top three vehicle aspects – gasoline or diesel light truck (Q6)

The most frequent vehicle aspect mentioned among the top three aspects when considering purchasing a new gasoline or diesel light truck was the purchase price (61.0%), although a majority also mentioned fuel economy and fuel costs (55.2%) as a top aspect. Slightly less than half (41.7%) of all respondents mentioned safety, ranking as the third most frequently mentioned aspect. (The percentages sum to greater than 100% because respondents were asked to select three aspects.) Figure 8 summarizes the results for all respondents, while Table 7 presents complete summaries of responses by gender, age, and vehicle ownership (groupings based on responses to Q1).

Female respondents were more likely than males to mention safety (50.0% vs. 32.7%). The youngest two age groups mentioned fuel economy and fuel costs most frequently (62.1% and 56.2%, respectively), as did non-owners of vehicles (60.8%).

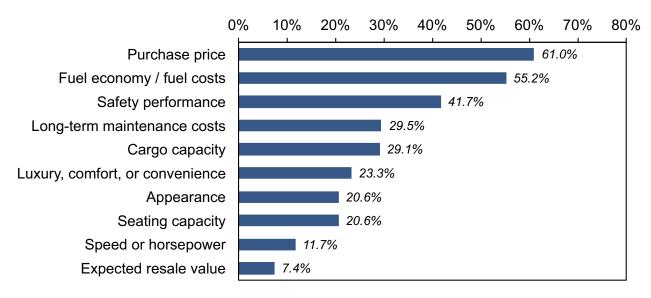


Figure 8. Summary of responses to Q6: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new gasoline or diesel LIGHT TRUCK." (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

Table 7
Percentage of responses, by gender, age, and vehicle ownership, to Q6: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new gasoline or diesel LIGHT TRUCK." The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

	Geno	der		Αş	ge		Vehicle		
Aspect	Female	Male	18- 29	30- 44	45- 59	60+	Owner	Non- owner	Total
Purchase price	60.6	61.3	51.6	55.6	67.4	64.4	61.9	58.0	61.0
Fuel economy / fuel costs	58.5	51.6	62.1	56.2	51.4	54.1	53.4	60.8	55.2
Safety performance	50.0	32.7	41.9	39.3	36.7	48.8	41.7	41.5	41.7
Long-term maintenance costs	26.6	32.7	29.8	28.7	29.4	30.2	27.7	35.2	29.5
Cargo capacity	26.1	32.4	26.6	20.8	35.3	31.2	30.6	24.4	29.1
Luxury, comfort, or convenience	21.0	25.8	24.2	27.5	17.9	24.9	22.6	25.6	23.3
Appearance	21.3	19.8	19.4	25.3	21.6	16.1	21.7	17.0	20.6
Seating capacity	22.3	18.6	22.6	26.4	20.2	14.6	21.5	17.6	20.6
Speed or horsepower	7.2	16.6	16.1	9.6	14.2	8.3	12.2	10.2	11.7
Expected resale value	6.4	8.6	5.6	10.7	6.0	7.3	6.7	9.7	7.4

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Single most important vehicle aspect – gasoline or diesel light truck (Q7)

When asked to identify the most important vehicle aspect from the three selected in Q6, the vehicle aspect most frequently selected remained the purchase price (28.6%). While safety ranked third most frequently mentioned for Q6, it was the second most frequently selected as being the most important vehicle aspect (18.9%), with fuel economy and fuel costs (second most frequently mentioned in Q6) selected as being most important third most often (18.2%). Figure 9 summarizes the results for all respondents.

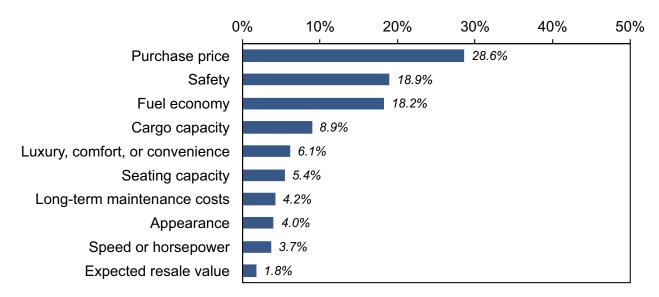


Figure 9. Summary of responses to Q7: "Which is the most important vehicle aspect to you when considering purchasing a new gasoline or diesel LIGHT TRUCK and why?"

Top three vehicle aspects – plug-in electric passenger car (Q8)

The most frequent vehicle aspect mentioned among the top three aspects when considering purchasing a new plug-in electric passenger car was maximum battery range (64.8%), although a majority also mentioned purchase price (59.4%) as a top aspect. Slightly more than one-third (36.8%) of all respondents mentioned safety, ranking as the third most frequently mentioned aspect. (The percentages sum to greater than 100% because respondents were asked to select three aspects.) Figure 10 summarizes the results for all respondents, while Table 8 presents complete summaries of responses by gender, age, and vehicle ownership (groupings based on responses to Q1).

Female respondents were more likely than males to mention safety (42.3% vs. 30.9%). The second oldest age group mentioned purchase price most frequently (69.3%). The youngest and second oldest age groups were more likely to mention long-term maintenance costs (38.7% and 34.9%, respectively) as their third most frequent aspect (versus safety as the third most frequent overall), as were non-owners of vehicles (41.5%).

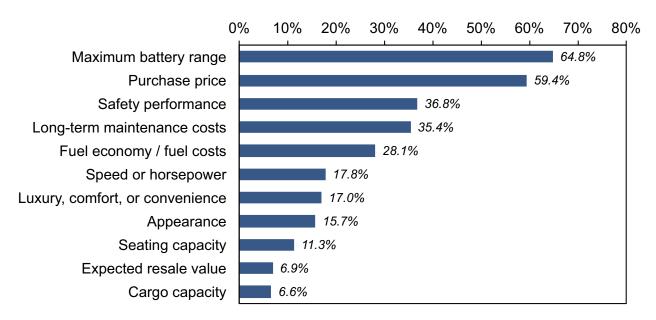


Figure 10. Summary of responses to Q8: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new plug-in electric PASSENGER CAR." (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

Table 8

Percentage of responses, by gender, age, and vehicle ownership, to Q8: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new plug-in electric PASSENGER CAR." The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

	Gene	der		Age Vehicle ownership				ownership	
Aspect	Female	Male	18- 29	30- 44	45- 59	60+	Owner	Non- owner	Total
Maximum battery range	63.0	66.8	65.3	59.6	64.2	69.8	65.4	63.1	64.8
Purchase price	59.8	59.0	45.2	52.2	69.3	63.9	61.0	54.5	59.4
Safety performance	42.3	30.9	35.5	37.6	31.2	42.9	36.6	37.5	36.8
Long-term maintenance costs	34.3	36.7	38.7	36.0	34.9	33.7	33.5	41.5	35.4
Fuel economy / fuel costs	27.7	28.7	30.6	30.9	24.8	27.8	29.0	25.6	28.1
Speed or horsepower	17.8	17.8	15.3	15.2	22.5	16.6	18.8	14.8	17.8
Luxury, comfort, or convenience	14.6	19.5	16.9	18.0	16.1	17.1	171.5	15.3	17.0
Appearance	16.2	15.2	19.4	18.5	15.6	11.2	15.3	17.0	15.7
Seating capacity	11.7	10.9	16.9	14.0	10.6	6.3	10.4	14.2	11.3
Expected resale value	6.1	7.7	8.9	7.9	6.0	5.9	6.2	9.1	6.9
Cargo capacity	6.4	6.9	7.3	10.1	5.0	4.9	6.4	7.4	6.6

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Single most important vehicle aspect – plug-in electric passenger car (Q9)

When asked to identify the most important vehicle aspect from the three selected in Q8, the order of the most frequently selected vehicle aspects remained unchanged: maximum battery range (40.5%) was most frequently selected as the most important aspect, purchase price (25.1%) as the second most frequently selected, and safety (13.6%) third most often. Figure 11 summarizes the results for all respondents.

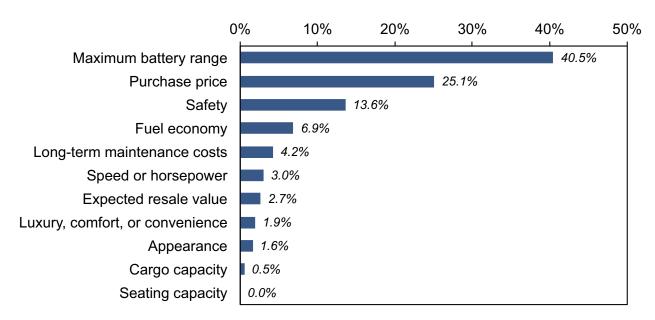


Figure 11. Summary of responses to Q9: "Which is the most important vehicle aspect to you when considering purchasing a new plug-in electric PASSENGER CAR and why?"

Top three vehicle aspects – plug-in electric light truck (Q10)

The most frequent vehicle aspect mentioned among the top three aspects when considering purchasing a new plug-in electric light truck was maximum battery range (61.9%), although a majority also mentioned purchase price (56.0%) as a top aspect. About one-third of all respondents (34.3%) mentioned safety, which ranked as the third most frequently mentioned aspect. (The percentages sum to greater than 100% because respondents were asked to select three aspects.) Figure 12 summarizes the results for all respondents, while Table 9 presents complete summaries of responses by gender, age, and vehicle ownership (groupings based on responses to Q1).

Female respondents were more likely than males to mention safety (39.4% vs. 28.9%). The second oldest age group mentioned purchase price most frequently (62.4%). Males (32.1%), the youngest age group (34.7%), and non-owners of vehicles (36.4%) were more likely to mention long-term maintenance costs as their third most frequent aspect (versus safety as the third most frequent overall).

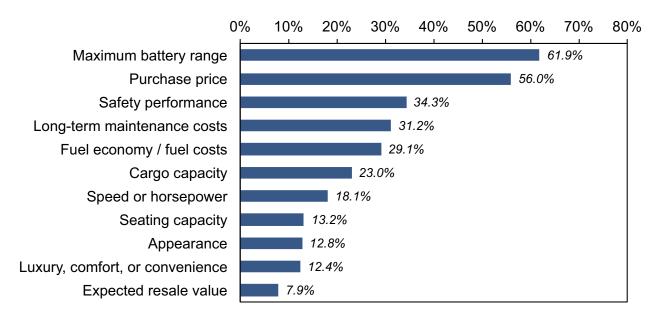


Figure 12. Summary of responses to Q10: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new plug-in electric LIGHT TRUCK." (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

Table 9
Percentage of responses, by gender, age, and vehicle ownership, to Q10: "Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new plug-in electric LIGHT TRUCK." The most frequent response for each group is shown in **bold**. (The percentages sum to greater than 100% because respondents were asked to select three aspects.)

	Geno	der		Age Vehicle ownership					
Aspect	Female	Male	18- 29	30- 44	45- 59	60+	Owner	Non- owner	Total
Maximum battery range	61.7	62.2	61.3	52.2	61.5	71.2	61.9	61.9	61.9
Purchase price	56.4	55.6	42.7	52.2	62.4	60.5	58.3	48.9	56.0
Safety performance	39.4	28.9	27.4	34.3	33.0	40.0	35.2	31.8	34.3
Long-term maintenance costs	30.3	32.1	34.7	31.5	29.8	30.2	29.5	36.4	31.2
Fuel economy / fuel costs	30.9	27.2	26.6	34.3	29.8	25.4	30.4	25.0	29.1
Cargo capacity	16.2	30.4	23.4	19.7	23.9	24.9	23.3	22.2	23.0
Speed or horsepower	19.7	16.3	17.7	18.0	21.6	14.6	18.2	17.6	18.1
Seating capacity	13.8	12.6	19.4	20.8	9.6	6.8	12.0	17.0	13.2
Appearance	13.6	12.0	14.5	16.9	13.3	7.8	12.0	15.3	12.8
Luxury, comfort, or convenience	10.9	14.0	20.2	12.9	9.2	10.7	12.2	13.1	12.4
Expected resale value	7.2	8.6	12.1	7.3	6.0	7.8	6.9	10.8	7.9

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Single most important vehicle aspect – plug-in electric light truck (Q11)

When asked to identify the most important vehicle aspect from the three selected in Q10, the order of the most frequently selected vehicle aspects remained unchanged. Maximum battery range (33.9%) was the most frequently selected as the most important aspect, purchase price (26.1%) as the second most frequently selected, and safety (15.2%) third most often. Figure 13 summarizes the results for all respondents.

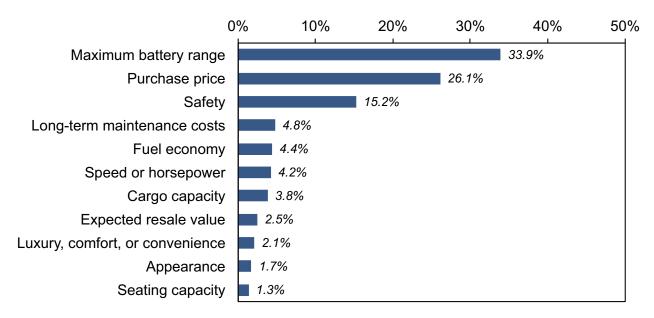


Figure 13. Summary of responses to Q11: "Which is the most important vehicle aspect to you when considering purchasing a new plug-in electric LIGHT TRUCK and why?"

Vehicle disposal (Q12)

Two-thirds (66.1%) of respondents who own (or have owned) a new vehicle report trading in those vehicles to a dealership when they are done driving them. Other frequent disposal methods include selling on the private market (28.2%) and gifting or selling to family or friends (21.5%). (The percentages sum to greater than 100% because respondents were asked to select all applicable disposal methods.) Figure 14 summarizes the results for all respondents, while Table 10 presents complete summaries of responses by gender and age.

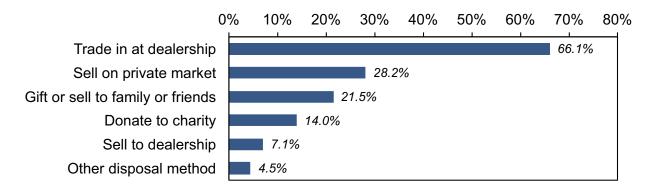


Figure 14. Summary of responses to Q12: "When you are done driving a vehicle that you OWN, how do you typically dispose of it?"

Table 10
Percentage of responses, by gender and age, to Q12: "When you are done driving a vehicle that you OWN, how do you typically dispose of it?" The most frequent response for each group is shown in **bold**.

Agnost	Gender		Age				Total
Aspect	Female	Male	18-29	30-44	45-59	60+	Totat
Trade in at dealership	66.4	65.9	64.1	73.1	61.0	67.2	66.1
Sell on private market	28.3	28.1	28.2	27.8	32.0	24.7	28.2
Gift or sell to family or friends	23.4	19.7	23.1	22.2	20.3	21.8	21.5
Donate to charity	11.1	16.9	10.3	13.9	11.0	17.8	14.0
Sell to dealership	7.0	7.2	23.1	13.0	4.1	2.9	7.1
Other disposal method	4.9	4.0	2.6	0.9	5.8	5.7	4.5

Previous resale value experience (Q13)

A majority (55.8%) of respondents who own (or have owned) a new vehicle reported that their previous experience with expected resale value was about what they expected it would be when disposing of a vehicle. Around one-third (34.7%) found their vehicle's resale value to be lower than expected, while about one in ten (9.5%) found it to be higher than expected. Figure 15 summarizes the results for all respondents, while Table 11 presents complete summaries of responses by gender and age.

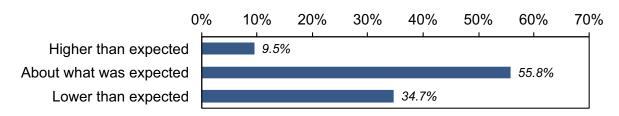


Figure 15. Summary of responses to Q13: "For any vehicles that you have OWNED, please describe your previous experience with expected resale value when disposing of the vehicle."

Table 11
Percentage of responses, by gender and age, to Q13: "For any vehicles that you have OWNED, please describe your previous experience with expected resale value when disposing of the vehicle." The most frequent response for each group is shown in **bold**.

Agnast	Geno	der	Age			Total	
Aspect	Female	Male	18-29	30-44	45-59	60+	10141
Higher than expected	9.4	9.6	17.9	8.3	6.4	11.5	9.5
About what was expected	55.3	56.2	43.6	55.6	61.0	53.4	55.8
Lower than expected	35.2	34.1	38.5	36.1	32.6	35.1	34.7

Influence of resale value on purchasing of plug-in electric vehicles (Q14)

The final sample size for this question was too small for analysis (n=13).

Key Findings

Resale value trends

- Without accounting for the current federal tax rebate, both types of PEVs (i.e., BEVs and PHEVs) lose resale value faster than comparable ICE vehicles.
- For the vehicles included in this analysis, BEVs tended to lose resale value faster than PHEVs of the same age or model year.
- Differences in resale value relative to ICE vehicles across all model years averaged -8.5% for PHEVs and -12.7% for BEVs.
- When accounting for the federal tax rebate incentives for PEVs and the resulting effective reduction in purchase price, PEVs tended to retain their relative resale value substantially better than without such an incentive.
- When accounting for the federal tax rebate, PHEVs retained resale value equally as well as their ICE counterparts (i.e., 0% average difference), and BEVs improved to an average of -5.7% difference in resale value compared to ICEs (versus -12.7% without the rebate).

Experience or consideration for purchasing a new vehicle

- Three out of four (75.7%) respondents had previously purchased or leased a new vehicle.
- The majority of those with prior purchasing or leasing experience had purchased a gasoline or diesel passenger car (77.8%).
- Less than 4% of all vehicles respondents had purchased or leased were plug-in electric vehicles (passenger cars and light trucks).
- Of the 24.3% of respondents who had not previously purchased or leased a new vehicle, a majority (60.2%) would consider purchasing a gasoline or diesel passenger car in the future.
- A sizeable proportion of those who had not previously purchased or leased a new vehicle were more likely to say they would consider purchasing a non-plug-in hybrid passenger car (48.3%) or a plug-in electric passenger car (35.8%) than a gasoline or diesel light truck (30.7%).
- For respondents who had not previously purchased or leased a new vehicle but would consider doing so in the future, leasing was less popular than purchasing for each vehicle type (as was also the case for those with previous experience purchasing or leasing a vehicle).

Top vehicle aspects when purchasing a gasoline or diesel vehicle

- For both gasoline or diesel passenger cars and light trucks, respondents consistently named (1) purchase price, (2) fuel economy and fuel costs, and (3) safety performance most often among *the top three* vehicle aspects that are important to them when considering the purchase of a gasoline or diesel vehicle.
- These same three vehicle aspects were also ranked on the top for both vehicle types when respondents were asked to select *the single most important* vehicle aspect. (However, the ranking differed slightly: safety performance ranked second and fuel economy and fuel costs ranked third.)

Top vehicle aspects when purchasing a plug-in electric vehicle

- For both plug-in electric passenger cars and light trucks, respondents named (1) maximum battery range, (2) purchase price, and (3) safety performance most often among *the top three* vehicle aspects that are important to them when considering the purchase of a PEV.
- These same three aspects, in the same rank order, were also ranked as the most important
 vehicle aspects for both vehicle types when respondents were asked for the single most
 important aspect, followed by long-term maintenance costs, and fuel economy and fuel
 costs.

Importance of resale value when purchasing a new vehicle

- For three out of the four different vehicle types (gas/diesel passenger cars, gas/diesel light trucks, and plug-in electric light trucks), expected resale value was the least frequently mentioned vehicle aspect (when asked for the top three aspects) when purchasing a new vehicle. For plug-in electric passenger cars, it was second to last in frequency.
- Expected resale value was also the least frequently selected as being *the single most* important vehicle aspect when purchasing a new gas/diesel passenger car or light truck.
- However, for plug-in electric passenger cars and light trucks, expected resale value was
 selected as the single most important vehicle aspect more frequently, ranking seventh and
 eighth most important, respectively (both out of eleven total vehicle aspects).

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Appendix: Questionnaire

INTROI	DUCT	TION		
		cting a survey about the different factors that people consider to be important when a new vehicle.		
In this survey when we use the term <i>vehicles</i> , we mean passenger cars (any type) and light trucks (pickup trucks, SUVs, minivans, or vans).				
Q1.		ve you ever personally purchased or leased a NEW vehicle, or would you ever nsider personally purchasing or leasing a NEW vehicle in the future?		
		[1] Yes – previously purchased or leased a new vehicle → Go to Q2		
		[2] Yes – would consider purchasing or leasing a new vehicle → Go to Q3		
		[3] No → Disqualify		
Q2. V	Which	of the following types of NEW vehicles have you ever purchased OR leased?		
		select all that apply, but do NOT include any new vehicles that you did not ally purchase or lease (such as a company car).		
		Plug-in electric passenger car – Purchased		
		Plug-in electric light truck – Purchased		
		Non-plug-in hybrid passenger car – Purchased		
		Non-plug-in hybrid light truck – Purchased		
		Gasoline or diesel passenger car – Purchased		
		Gasoline or diesel light truck – Purchased		
		Plug-in electric passenger car – Leased		
		Plug-in electric light truck – Leased		
		Non-plug-in hybrid passenger car – Leased		
		Non-plug-in hybrid light truck – Leased		
		Gasoline or diesel passenger car – Leased		
		Gasoline or diesel light truck – Leased		

FOR THOSE WHO ANSWERED Q2 → SKIP Q3, GO TO Q4

Q3.	Which of the following types of NEW vehicles would you consider purchasing OR leasing in the future?				
	Please select all that apply.				
	☐ Plug-in electric passenger car – Purchased				
	☐ Plug-in electric light truck – Purchased				
	☐ Non-plug-in hybrid passenger car — Purchased				
	☐ Non-plug-in hybrid light truck – Purchased				
	☐ Gasoline or diesel passenger car – Purchased				
	☐ Gasoline or diesel light truck – Purchased				
	☐ Plug-in electric passenger car – Leased				
	☐ Plug-in electric light truck – Leased				
	☐ Non-plug-in hybrid passenger car – Leased				
	☐ Non-plug-in hybrid light truck – Leased				
	☐ Gasoline or diesel passenger car – Leased				
	☐ Gasoline or diesel light truck – Leased				
Q4.	Please select the TOP 3 most important vehicle aspects to you when considering <u>purchasing</u> a new <i>gasoline or diesel</i> PASSENGER CAR.				
	Even if you have never purchased a new <i>gasoline or diesel</i> PASSENGER CAR, please think about how important each vehicle aspect would be to you if you were to purchase this type of vehicle in the future.				
	☐ Appearance				
	☐ Cargo capacity				
	☐ Expected resale value				
	☐ Fuel economy / fuel costs				
	☐ Long-term maintenance costs				
	☐ Luxury, comfort, or convenience				
	☐ Purchase price				
	☐ Safety performance				
	☐ Seating capacity				
	☐ Speed or horsepower				

5.	Which is the most important vehicle aspect to you when considering purchasing a new <i>gasoline or diesel</i> PASSENGER CAR and why?				
<u>)</u> 6.	Please select the TOP 3 most important vehicle aspects to you when considering <u>purchasing</u> a new <i>gasoline or diesel</i> LIGHT TRUCK (pickup truck, SUV, minivan, or van).				
	Even if you have never purchased a new <i>gasoline or diesel</i> LIGHT TRUCK, please think about how important each vehicle aspect would be to you if you were to purchase this type of vehicle in the future.				
	☐ Appearance				
	☐ Cargo capacity				
	☐ Expected resale value				
	☐ Fuel economy / fuel costs				
	☐ Long-term maintenance costs				
	☐ Luxury, comfort, or convenience				
	☐ Purchase price				
	☐ Safety performance				
	☐ Seating capacity				
	☐ Speed or horsepower				
7.	Which is the most important vehicle aspect to you when considering purchasing a new <i>gasoline or diesel</i> LIGHT TRUCK and why?				

Q8.	Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new <i>plug-in electric</i> PASSENGER CAR.					
	Even if you have never purchased a new <i>plug-in electric</i> PASSENGER CAR, please think about how important each vehicle aspect would be to you if you were to purchase this type of vehicle in the future.					
	☐ Appearance					
	☐ Cargo capacity					
	☐ Expected resale value					
	☐ Fuel economy / fuel costs					
	☐ Long-term maintenance costs					
	☐ Luxury, comfort, or convenience					
	☐ Maximum battery range					
	☐ Purchase price					
	☐ Safety performance					
	☐ Seating capacity					
	☐ Speed or horsepower					
Q9.	Which is the most important vehicle aspect to you when considering purchasing a new <i>plug-in electric</i> PASSENGER CAR and why?					

Q10.	Please select the TOP 3 most important vehicle aspects to you when considering purchasing a new <i>plug-in electric</i> LIGHT TRUCK.
	Even if you have never purchased a new <i>plug-in electric</i> LIGHT TRUCK, please think about how important each vehicle aspect would be to you if you were to purchase this type of vehicle in the future.
	□ Appearance
	☐ Cargo capacity
	☐ Expected resale value
	☐ Fuel economy / fuel costs
	☐ Long-term maintenance costs
	☐ Luxury, comfort, or convenience
	☐ Maximum battery range
	□ Purchase price
	☐ Safety performance
	☐ Seating capacity
	☐ Speed or horsepower
Q11.	Which is the most important vehicle aspect to you when considering purchasing a new <i>plug-in electric</i> LIGHT TRUCK and why?
F	FOR THOSE WHO NEVER OWNED A VEHICLE (BASED ON Q1) → SKIP Q12 AND Q13, GO TO Q14
Q12.	When you are done driving a vehicle that you OWN, how do you typically dispose of it?
	Please select all that apply, but do NOT include any vehicles that you did not personally own (such as a company car).
	☐ Trade-in at dealership
	☐ Sell to dealership
	☐ Sell on private market
	☐ Donate to charity
	☐ Gift or sell to family or friends
	☐ Other (please describe):

Q13.	For any vehicles that you have OWNED, please describe your previous experience with <i>expected resale value</i> when disposing of the vehicle.
	Please select ONE option that best describes your experience.
	☐ Resale value was usually HIGHER than I expected
	☐ Resale value was usually about what I expected
	☐ Resale value was usually LOWER than I expected
	FOR THOSE WHO NEVER OWNED AN <u>ELECTRIC</u> VEHICLE (BASED ON Q2) → SKIP Q14, GO TO THANKS
Q14.	For PLUG-IN ELECTRIC vehicles that you have OWNED or LEASED, how important was the <i>expected resale value</i> to you when deciding whether to purchase or lease?
	Please select ONE option that best describes your experience.
	☐ Expected resale value was an important factor in my decision to PURCHASE
	☐ Expected resale value was not an important factor in my decision to purchase versus lease
	☐ Expected resale value was an important factor in my decision to LEASE
THA	NKS

Thank you for completing this survey!