Federal revenue estimates for potential changes to the plug-in electric drive vehicle tax credit

Prepared for American Fuel & Petrochemical Manufacturers

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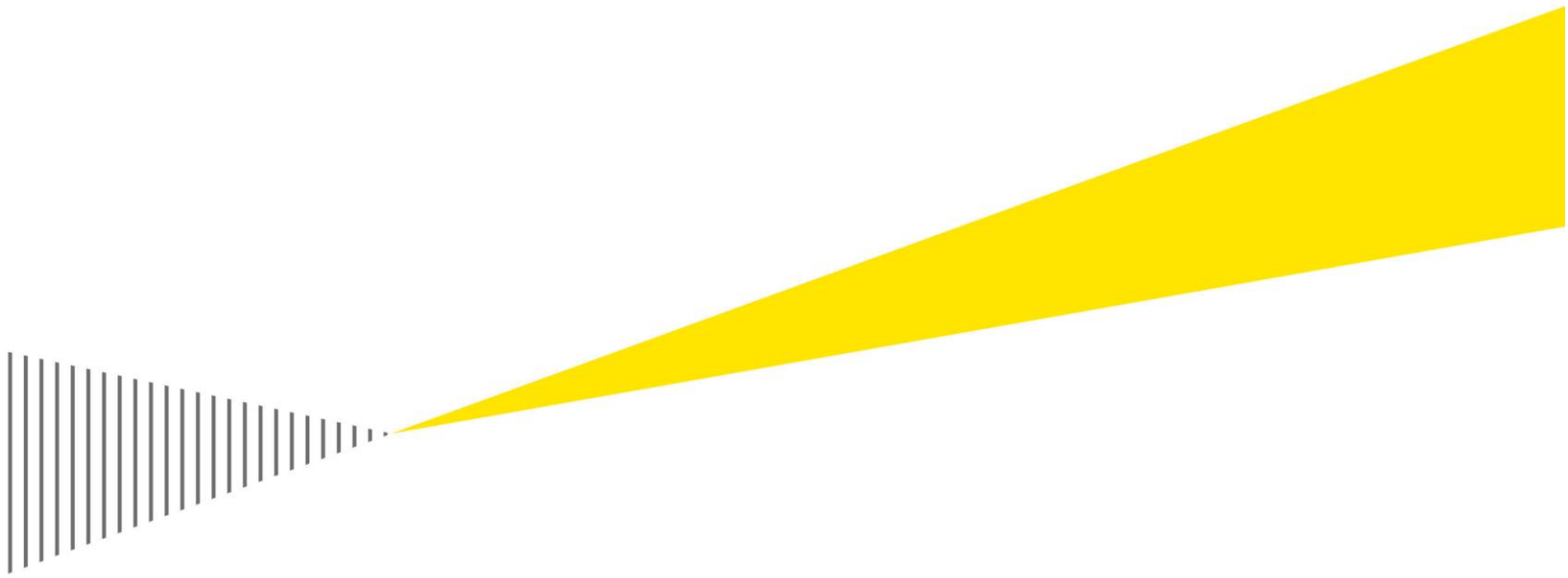

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Executive summary

This report estimates the impact of potential changes to the plug-in electric drive motor vehicle tax credit to federal revenues.

Under current law, the maximum amount available to purchasers of vehicles qualifying for the credit is $7,500 per vehicle. The credit is available for the first 200,000 qualifying vehicles an individual manufacturer sells. Once a manufacturer reaches the 200,000 vehicle cap, the credit phases out for that manufacturer's vehicles. The credit amount is calculated based on the kilowatt capacity of the battery in a qualifying vehicle. The credit is $2,500 plus $417 for vehicles with at least 5 kilowatt hours of capacity and an additional $417 per kilowatt hour of capacity in excess of 5 kilowatt hours, up to a maximum of $7,500 per vehicle.

This report examines the federal revenue cost of the following potential changes to the credit:

1. *Increase vehicle cap from 200,000 to 500,000 qualifying vehicles.* This policy is estimated to cost $6.6 billion over the first five years (2019-23) and $15.2 billion over the 10-year budget window (2019-28). The cost per additional vehicle sold because of the higher cap would range from $22,400 to $34,400 depending on the year.

2. *Remove vehicle cap.* This policy is estimated to cost $11.0 billion over the first five years (2019-23) and $46.4 billion over the 10-year budget window (2019-28). The cost per additional vehicle sold because of the higher cap would range from $30,800 to $34,400 depending on the year.

3. *Increase vehicle cap from 200,000 to 600,000 qualifying vehicles, reduce maximum credit from $7,500 to $7,000 for these additional 400,000 qualifying vehicles, and shorten phase out.* This policy, which can be found in the Driving America Forward Act, is estimated to cost $6.3 billion over the first five years (2019-23) and $15.7 billion over the 10-year budget window (2019-28). The cost per additional vehicle sold because of these credit modifications would range from $23,000 to $33,900 depending on the year.

These three proposals would expand the credit by increasing or removing the per manufacturer vehicle credit. Increases to the vehicle cap would both encourage additional purchases and result in some of the revenue cost going to those who would have purchased an electric vehicle in the absence of the credit incentive.

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I. Introduction

This report estimates the federal revenue effect of potential changes to the plug-in electric drive motor vehicle tax credit (the "electric vehicle tax credit").[1]

Under current law, the maximum credit is $7,500 per qualifying vehicle. The credit is available for the first 200,000 qualifying vehicles produced by an individual manufacturer. Once a manufacturer reaches the 200,000 vehicle cap, the credit is phased out over six quarters as follows:

- 100% of credit in current (1st) and next (2nd) quarter
- 50% of credit in following two (3rd and 4th) quarters
- 25% of credit in following two (5th and 6th) quarters
- 0% of credit thereafter

The credit amount is calculated based on the kilowatt capacity of the battery in a qualifying vehicle. The credit is $2,500 plus $417 for vehicles with at least 5 kilowatt hours of capacity, and an additional $417 per kilowatt hour of capacity in excess of 5 kilowatt hours. The maximum credit is $7,500 per vehicle. The electric vehicle tax credit applies to electric vehicles (EVs) and plug-in hybrid electric vehicles (PHEVs), but not to hybrid electric vehicles (HEVs).[2]

In this report, three potential expansions of the electric vehicle tax credit are modeled:

1. Increase vehicle cap from 200,000 to 500,000 qualifying vehicles per manufacturer
2. Remove vehicle cap
3. Increase vehicle cap from 200,000 to 600,000 qualifying vehicles per manufacturer, reduce maximum credit from $7,500 to $7,000 for these additional 400,000 qualifying vehicles, and shorten phase out (100% of credit in quarter 600,000 sales is reached and following quarter, 50% in subsequent quarter, and 0% thereafter)

II. Current-law baseline for electric vehicle tax credit

The current-law baseline reflected in this report incorporates a projection of the number of qualifying vehicles by manufacturer and estimates of the average price and credit amount by vehicle type.

A. Projection of qualifying vehicles

To project the number of qualifying vehicles, this report relies on historical sales data for EVs and PHEVs through June 2018[3] and then projects sales quarterly through 2028 using US Department of Energy projections. Sales of qualifying vehicles are projected through 2028 based on the reference case of the US Energy Information Administration's (EIA) Annual Energy Outlook 2018 (AEO).[4]

Sales of qualifying vehicles projected over the 2019-28 period are displayed in Table 1. The table displays both annual and cumulative sales. This report estimates that in 2019 approximately 288,000 qualifying vehicles will be sold. Of these 288,000 vehicles, it is estimated that 176,000 (61%) will be EVs and 112,000 (39%) will be PHEVs. Both the number and composition of qualifying vehicles is projected to change over time. This analysis projects that in 2028 nearly 1.1 million qualifying vehicles will be sold and that EV's share of the market will rise from 61% in 2019 to 85% in 2028.

Table 1. Annual and cumulative sales of plug-in electric drive vehicles, by type (thousands)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Vehicle sales (annual)	**288**	**403**	**503**	**597**	**687**	**757**	**883**	**943**	**1,001**	**1,067**
Electric vehicles	176	280	374	464	547	609	734	790	843	904
Plug-in hybrid electric vehicles	112	123	129	133	140	147	149	153	158	163
Vehicle sales (cumulative)*	**1,303**	**1,707**	**2,209**	**2,806**	**3,493**	**4,250**	**5,133**	**6,077**	**7,078**	**8,145**
Electric vehicles	705	986	1,359	1,823	2,370	2,980	3,714	4,504	5,347	6,251
Plug-in hybrid electric vehicles	598	721	850	983	1,123	1,270	1,419	1,573	1,730	1,894

*Cumulative sales after December 31, 2009.
Note: Estimates are for calendar years. Figures may not sum due to rounding.
Source: EY analysis.

Table 2 shows the projection of cumulative sales of qualifying vehicles by manufacturer. This report assumes that manufacturers maintain their 2018 market share of: (1) EVs, and (2) PHEVs through 2028. The 2018 market share is computed with 2018 data through June 2018, the most recent data at the time of the analysis. This approach is used because of the significant uncertainty over how the composition of manufacturers in the qualifying vehicle market will change over time.

Table 2 highlights cumulative qualifying vehicle sales over 200,000, 500,000, and 600,000 per manufacturer. Each cumulative sum represents the sales of all qualified vehicles by an individual manufacturer. By the end of 2019, two manufacturers are projected to reach the 200,000-vehicle cap and by the end of 2028, it is projected that eight manufacturers will reach the 200,000-vehicle

cap. The first manufacturer is estimated to reach 500,000 in cumulative sales of qualifying vehicles by the end of 2020. By the end of 2028, four manufacturers are projected to reach 500,000 cumulative qualifying vehicle sales. Similarly, the first manufacturer is estimated to reach 600,000 in cumulative sales of qualifying vehicles by the end of 2021. By the end of 2028, four manufacturers are projected to reach 600,000 cumulative qualifying vehicle sales.

Table 2. Projection of cumulative sales of plug-in electric drive vehicles, by manufacturer (thousands)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028
Vehicle sales (Cumulative)*	**1,303**	**1,707**	**2,209**	**2,806**	**3,493**	**4,250**	**5,133**	**6,077**	**7,078**	**8,145**
American Honda Motor Co., Inc.	56	72	89	106	125	144	164	184	205	227
Audi of America, LLC	12	15	18	21	24	28	31	35	38	42
BMW of North America	110	144	185	230	282	337	400	467	536	611
FCA North America Holdings, LLC	31	44	61	82	108	136	170	206	245	287
Ford Motor Company	125	139	153	168	185	203	222	242	262	284
General Motors, LLC	237	289	353	428	514	609	720	837	962	1,095
Hyundai	12	17	23	30	38	46	56	66	76	88
Kia Motors America, Inc.	18	26	35	45	56	69	83	98	113	130
Mercedes-Benz USA, LLC	24	30	39	48	58	69	82	95	109	124
Mitsubishi Motors North America, Inc.	10	14	19	24	29	34	40	45	51	57
Nissan North America	146	175	213	260	316	378	453	533	619	712
Porsche Cars North America, Inc.	13	17	21	25	29	33	38	42	47	52
Tesla, Inc.	355	531	765	1,057	1,400	1,782	2,243	2,739	3,268	3,836
Toyota Motor Sales, U.S.A., Inc.	126	158	192	227	264	302	341	381	423	466
Volkswagen Group of America	16	19	23	29	35	43	51	61	71	82
Volvo Cars of North America, LLC	13	17	21	26	30	36	41	46	51	57

Cumulative sales of at least 200k Cumulative sales of at least 500k Cumulative sales of at least 600k

*Cumulative sales after December 31, 2009.
Note: Analysis assumes that each manufacturer retains its 2018 market share of: (1) EVs and (2) PHEVs through 2028. 2018 market share is computed with 2018 data through June 2018, which was the most recent data at the time of the analysis. Figures may not sum due to rounding.
Source: EY analysis.

B. Average price and credit amount, by vehicle type and manufacturer

Table 3 displays the estimated average price and credit amount by manufacturer for EVs and PHEVs assumed for this analysis. The price of each qualifying vehicle model sold by a manufacturer was collected for each manufacturer and then aggregated to total EVs and PHEVs sold by a manufacturer (i.e., weighted by model sales). This analysis assumes that the average price per manufacturer for EVs and PHEVs is constant through 2028.

The credit amount for each qualifying model is reported by the Internal Revenue Service and, for this analysis, is weighted by sales.[5] Based on their battery capacity, all manufacturers' EVs qualify for the maximum $7,500 credit. The average credit for PHEVs across all manufacturers, however, is $5,366 because of variation in battery capacity. Based on the credit and price for all manufacturers as shown in Table 3, the electric vehicle tax credit is estimated to reduce the price of both EVs and PHEVs by an average of approximately 14% ($7,500 / $52,006 and $5,366 / $37,699).

Table 3. Average price and credit amount, by vehicle type and manufacturer in 2018

	Electric vehicles		Plug-in hybrid electric vehicles	
	Price	**Credit**	**Price**	**Credit**
All manufacturers	**$52,006**	**$7,500**	**$37,699**	**$5,366**
American Honda Motor Co., Inc.	--	--	30,963	7,500
Audi of America, LLC	--	--	39,500	4,502
BMW of North America	44,450	7,500	57,395	4,507
FCA North America Holdings, LLC	37,529	7,500	--	--
Ford Motor Company	29,120	7,500	30,559	4,007
General Motors, LLC	37,474	7,500	34,257	7,500
Hyundai	29,500	7,500	27,538	4,664
Kia Motors America, Inc.	33,950	7,500	30,450	4,674
Mercedes-Benz USA, LLC	19,348	7,500	53,995	3,995
Mitsubishi Motors North America, Inc.	--	--	34,595	5,836
Nissan North America	29,990	7,500	--	--
Porsche Cars North America, Inc.	--	--	90,133	5,033
Tesla, Inc.	61,953	7,500	--	--
Toyota Motor Sales, U.S.A., Inc.	--	--	27,300	4,502
Volkswagen Group of America	30,495	7,500	--	--
Volvo Cars of North America, LLC	--	--	43,272	5,002

-- This manufacturer did not sell this vehicle type in 2018.
Note: This analysis computes the weighted average price and credit amount for electric vehicles and plug-in hybrid electric vehicles based on a weighted average of the vehicles sold in 2018 through June. June 2018 data were the most recent available at the time of this analysis.
Source: EY analysis.

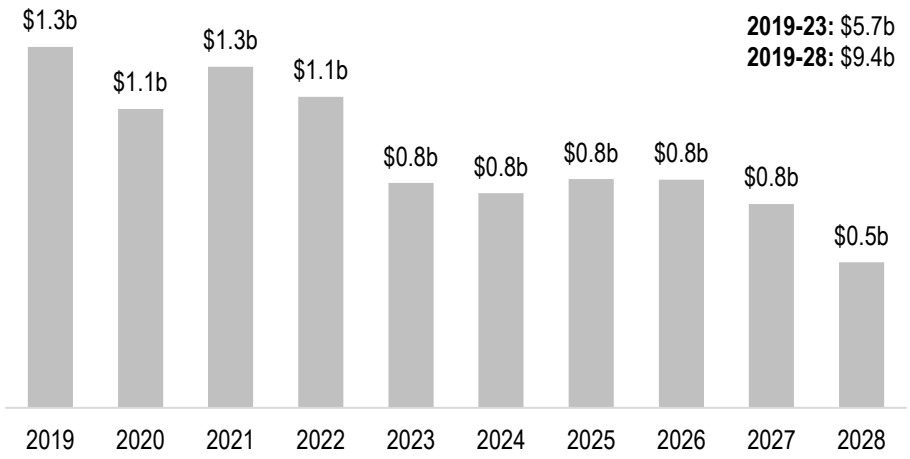
C. Projected current-law baseline for claimed credits

Figure 1 shows the projected current-law baseline against which the potential changes to the electric vehicle tax credit are estimated. This baseline incorporates total sales (Table 1), and the average credit amount of EVs and PHEVs (Table 3). Credit-qualifying sales are reduced to account for the phase-out of the credit once a manufacturer reaches cumulative sales of 200,000 qualifying vehicles (Table 2).

Two aspects of the current-law baseline are particularly noteworthy: (1) annual qualifying vehicle sales increase over time, which increases total credits claimed, and (2) some manufacturers reach the 200,000 vehicle cap, resulting in the credit being phased-out for those manufacturers, which reduces the total revenue cost of the credit. For example, the number of total credits claimed falls by about $200 million from 2019 ($1.3b) to 2020 ($1.1b). The year-over-year reduction in the current-law baseline occurs despite an overall increase in qualifying vehicle sales from 2019 (288,000) to 2020 (403,000), as shown in Table 1. The reason for the net reduction is that two manufacturers reached the 200,000 vehicle cap, which triggers the phase-out of their credit, as seen in Table 2. Between 2019 and 2020, the reduction in credits from the phase-out more than offsets the increase in the number of credits claimed due to a higher level of total sales (assuming each manufacturer's the market share remains fixed). Between 2020 and 2021, the amount of credits claimed is estimated to increase (from $1.1b in 2020 to $1.3b in 2021) because the increase in sales dominates over the per manufacturer cap.[6] The more general trend over the

budget window is for the amount of credits claimed to gradually decline as the per manufacturer vehicle cap becomes more binding across manufacturers.

Figure 1. Current-law baseline: Estimated total credits claimed



Note: Estimates are for calendar year. Figures may not sum due to rounding.
Source: EY analysis.

III. Federal revenue effect of potential changes to the electric vehicle tax credit

The federal revenue effect of each of the three proposals modeled in this report is estimated in three steps. First, the change in credits claimed is estimated assuming no changes in behavior (i.e., the static revenue effect). Specifically, this is the difference between the credits claimed under each potential change to the electric vehicle tax credit relative to the current-law baseline, assuming the sales of qualifying vehicles remain unchanged. Second, the change in credits claimed due to the change in sales of qualifying vehicles is estimated (i.e., the inducement effect or behavioral response). Sales are estimated to increase in response to an expansion of the credit and the commensurate reduction in the after-tax cost or price of qualifying vehicles.[7] Third, the liability effect – the sum of the first two steps – is adjusted from a calendar year to a fiscal year basis.[8]

This report relies on economic research analyzing the responsiveness of vehicle sales to its after-tax price to estimate the behavioral response associated with changes to the credit.[9] This analysis assumes the same responsiveness of consumers to changes in automobile prices found in the economic literature, which is a price elasticity of demand of -3, meaning a 1% decrease in the after-tax price of qualifying electric vehicles results in a 3% increase in sales of qualifying vehicles.[10] This price elasticity is applied to the percentage change in the after-tax vehicle price (computed from Table 3) to estimate the change in purchased vehicles under each proposal analyzed.

Table 4 displays the federal revenue estimates for:

1. Increasing the per manufacturer vehicle cap from 200,000 to 500,000 qualifying vehicles
2. Removing the per manufacturer vehicle cap
3. Increasing the per manufacturer vehicle cap from 200,000 to 600,000 qualifying vehicles, reducing the maximum credit from $7,500 to $7,000 for these additional 400,000 qualifying vehicles, and shortening the phase out (100% of credit in quarter 600,000 sales is reached and following quarter, 50% in subsequent quarter, and 0% thereafter)[11]

Increasing the vehicle cap to 500,000 qualifying vehicles is estimated to cost $15.2 billion over the 10-year budget window, while removing the cap would cost $46.4 billion over the 10-year budget window. The third proposal, which can be found in the Driving America Forward Act, would cost $15.7 billion over the 10-year budget window.

Table 4 also displays an estimate of the number of additional qualifying vehicles purchased, as well as the revenue cost per additional vehicle, resulting from these two potential changes to the electric vehicle tax credit. Proposals that increase or eliminate the per manufacturer vehicle cap would increase vehicle sales by lowering the after-tax price of qualifying vehicles. Increased vehicle sales increase claimed credits and the revenue cost of a proposal.

The revenue cost per additional vehicle provides a measure of the credit's efficiency for expanding the electric vehicle market. As displayed in Table 4, the federal revenue cost per additional vehicle purchased under the proposed changes to the credit – depending on the year and whether the

proposal would increase or remove the per manufacturer vehicle cap – ranges from $22,400 to $34,400. This metric indicates the cost to the taxpayer for each additional electric vehicle estimated to be purchased under an expansion of the credit.

Table 4. Federal revenue estimate: Increase or remove per manufacturer vehicle cap ($b)

	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2019-23	2019-28
Cap at 500,000 vehicles												
Change in credits without behavior (CY)	$0.6	$1.7	$1.5	$1.0	$1.4	$1.4	$1.2	$1.3	$1.1	$0.8	$6.2	$12.0
Change in credits from behavior (CY)	$0.2	$0.5	$0.4	$0.4	$0.6	$0.5	$0.5	$0.5	$0.3	$0.3	$2.0	$4.1
Liability effect (CY)	-$0.8	-$2.1	-$1.8	-$1.4	-$2.0	-$1.9	-$1.7	-$1.8	-$1.4	-$1.1	-$8.1	-$16.0
Federal revenue estimate (FY)	***-$0.2***	***-$1.1***	***-$2.0***	***-$1.7***	***-$1.5***	***-$2.0***	***-$1.8***	***-$1.7***	***-$1.7***	***-$1.3***	***-$6.6***	***-$15.2***
Remove 200,000 vehicle cap												
Change in credits without behavior (CY)	$0.6	$1.7	$2.2	$3.0	$4.0	$4.6	$5.5	$5.9	$6.4	$7.1	$11.6	$41.0
Change in credits from behavior (CY)	$0.2	$0.5	$0.6	$0.9	$1.2	$1.4	$1.6	$1.8	$2.0	$2.2	$3.4	$12.3
Liability effect (CY)	-$0.8	-$2.1	-$2.9	-$4.0	-$5.2	-$5.9	-$7.1	-$7.7	-$8.4	-$9.3	-$14.9	-$53.4
Federal revenue estimate (FY)	***-$0.2***	***-$1.1***	***-$2.3***	***-$3.1***	***-$4.3***	***-$5.4***	***-$6.2***	***-$7.3***	***-$7.9***	***-$8.6***	***-$11.0***	***-$46.4***
Cap at 600,000 vehicles; modify credit & phase out												
Change in credits without behavior (CY)	$0.3	$1.5	$1.9	$0.8	$1.3	$1.6	$1.4	$1.2	$1.4	$1.3	$5.9	$12.7
Change in credits from behavior (CY)	$0.1	$0.4	$0.5	$0.3	$0.5	$0.6	$0.5	$0.4	$0.5	$0.4	$1.8	$4.3
Liability effect (CY)	-$0.4	-$1.9	-$2.3	-$1.1	-$1.8	-$2.2	-$1.9	-$1.6	-$1.9	-$1.8	-$7.7	-$17.0
Federal revenue estimate (FY)	***-$0.1***	***-$0.8***	***-$2.0***	***-$2.0***	***-$1.3***	***-$1.9***	***-$2.1***	***-$1.8***	***-$1.7***	***-$1.9***	***-$6.3***	***-$15.7***
Addendum: Estimated change in qualifying vehicles and federal revenue cost per additional vehicle												
Cap at 500,000 vehicles												
Change in qualifying vehicles (thousands)	22	62	58	56	84	80	73	78	61	50	282	624
Federal revenue cost per additional vehicle ($)	$34,400	$34,400	$31,500	$24,600	$24,200	$23,600	$23,400	$23,400	$22,500	$22,400	$28,800	$25,700
Remove 200,000 vehicle cap												
Change in qualifying vehicles (thousands)	22	62	83	122	167	190	227	246	269	302	456	1,691
Federal revenue cost per additional vehicle ($)	$34,400	$34,400	$34,400	$32,300	$31,300	$31,300	$31,300	$31,300	$31,100	$30,800	$32,700	$31,600
Cap at 600,000 vehicles; modify credit & phase out												
Change in qualifying vehicles (thousands)	13	57	70	46	78	90	80	72	82	75	265	664
Federal revenue cost per additional vehicle ($)	$33,000	$33,900	$33,400	$23,500	$23,700	$24,000	$23,300	$23,000	$23,100	$23,500	$28,900	$25,600

*Less than $0.05b in magnitude.
CY: Calendar year; FY: Fiscal year
Note: Analysis assumes a price elasticity of demand of -3.0 for qualifying vehicles. Figures may not sum due to rounding.
Source: EY analysis.

IV. Caveats and limitations

Any modeling effort is only an approximate depiction of the economic forces it seeks to represent, and the economic model developed for this analysis is no exception. Although various limitations and caveats might be listed, several are particularly noteworthy:

- **There is significant uncertainty in projecting sales of EVs and PHEVs.** Sales of qualifying vehicles are projected in this report based primarily on the reference case of the EIA's AEO. Actual sales of qualifying vehicles may differ from this projection.
- **There is significant uncertainty in projecting the price and credit amount of qualifying vehicles.** The price of and credit amount for EVs and PHEVs in 2018 was aggregated by manufacturer and then assumed to be constant through 2028. Actual price and credit amounts may differ from this projection.
- **There is significant uncertainty in projecting the market share of manufacturers.** This report assumes that each manufacturer retains its 2018 market share of EVs and PHEVs through 2028. Market shares may differ from this projection.
- **Not all available credits are likely to be used.** This report assumes taxpayers will use all available credits. It is possible that some taxpayers, particularly those with lower incomes, will not have sufficient tax liability to fully use their available electric vehicle tax credit.
- **The responsiveness of sales of qualifying vehicles to their after-tax cost is uncertain.** A review of the economic literature suggests the price elasticity of demand for vehicles is in the range of approximately -2 to -4. A central estimate of -3 is used in this analysis. The actual price elasticity of demand for qualifying vehicles may differ from this assumption.

Endnotes

[1] The credit originates from interest in promoting energy independence and the development of electric vehicles more than a decade ago. The Energy Independence and Security Act of 2007 included incentives for the development of plug-in vehicles. The Energy Improvement and Extension Act of 2008 included all types of plug-in electric vehicles (both battery only and plug hybrid electrics) that met certain battery size criteria and created the first non-refundable tax credit for at least the first 250,000 plug-in vehicles sold. The American Recovery and Reinvestment Act of 2009 set the quantity at which the credit would begin to phase out at 200,000 per manufacturer.

[2] Each of these vehicle types is at least partially powered by electricity. EVs are fully powered by electricity and do not contain an internal combustion engine. EVs are recharged by being plugged into the electric grid (e.g., at home or at a public ch-arging station). PHEVs contain both an electric drive and an internal combustion engine. PHEVs are designed such that the internal combustion engine is used when the battery is low or additional power is needed. Like EVs, PHEVs are recharged by being plugged into the electric grid. HEVs are similar to PHEVs, but they rely primarily on their internal combustion engine for energy. In particular, the battery of a HEV is recharged by capturing the energy generated in braking instead of being charged by being plugged into the electric grid.

[3] Historical sales data for 2010 through June 2018 were collected directly from manufacturers by Baum and Associates. The US Department of Energy and Argonne National Lab have also used these data – which are sorted by model of qualifying vehicle. This report uses these data to calculate cumulative sales of qualifying vehicles from the beginning of 2010 through June 2018.

[4] Sales of EVs are assumed to be equal to the sales projected by the AEO. Sales of PHEVs are projected by applying the growth rate of PHEVs and HEVs in the AEO. The AEO is not sufficiently detailed to separately forecast PHEVs and HEVs.

The EIA develops the AEO using the National Energy Modeling System (NEMS), a detailed energy model capturing the interactions between economic changes, technological changes, energy supply, and energy demand. The reference case of the AEO relies on the views of prominent forecasters to project economic, demographic, and technological variables and generally assumes that current law is unchanged. See US Energy Information Administration, *Annual Energy Outlook 2018*, February 6, 2018.

[5] See Qualified Plug-In Electric Drive Motor Vehicles (IRC 30D), https://www.irs.gov/businesses/irc-30d-new-qualified-plug-in-electric-drive-motor-vehicle-credit.

[6] The model does not allow for consumers to switch brands in response to differential availability of the incentives as some models hit the cap and others not, as manufacturers' market shares are fixed throughout the budget window. This may happen in actual markets.

[7] Conversely, consumers would purchase fewer qualifying vehicles if the credit were reduced or eliminated due to the corresponding increase in the after-tax price of qualifying vehicles. It is customary for these types of inducement effects to be incorporated into conventional revenue estimates of tax policy changes by the Joint Committee on Taxation.

Consistent with recent research on electric vehicle tax credits, this analysis assumes that any changes to the credit are passed forward to consumers through changes in after-tax prices. See, Erich Muehlegger and David Rapson, (2018), "Subsidizing Mass Adoption of Electric Vehicles: Quasi-Experimental Evidence from California," NBER Working Paper No. 25359.

[8] This adjustment it intended to reflect the cash flow impact following the federal government's October 1st through September 31st fiscal year.

[9] A review of the literature suggests the price elasticity of demand for vehicles is in the range of approximately -2 to -4. A central estimate of -3 is used in this analysis. See Pinelopi Koujianou Goldberg, (1995), "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica* 63(4): 891-951; Steven Berry, James Levinsohn, and Ariel Pakes, (1995), "Automobile Prices in Market Equilibrium," *Econometrica* 63(4): 841-890; Patrick McCarthy, (1996), "Market Price and Income Elasticities of New Vehicle Demands," *The Review of Economics and Statistics* 78(3): 543-547; Pinelopi Goldberg and Frank Verboven, (2001), "The Evolution of Price Dispersion in the European Car Market," *Review of Economic Studies* 68(4): 811-848; and Kenneth Train and Clifford Winston, (2007), "Vehicle Choice Behavior and the Declining Market Share of U.S. Automakers," *International Economic Review* 48(4): 1469-1496. Similar results have been found when examining the

price elasticity of demand specifically for EVs. See, for example, Erich Muehlegger and David Rapson, (2018), "Subsidizing Mass Adoption of Electric Vehicles: Quasi-Experimental Evidence from California," NBER Working Paper No. 25359.

[10] A review of the literature suggests the price elasticity of demand for vehicles is in the range of approximately -2 to -4. A central estimate of -3 is used in this analysis. See Pinelopi Koujianou Goldberg, (1995), "Product Differentiation and Oligopoly in International Markets: The Case of the U.S. Automobile Industry," *Econometrica* 63(4): 891-951; Steven Berry, James Levinsohn, and Ariel Pakes, (1995), "Automobile Prices in Market Equilibrium," *Econometrica* 63(4): 841-890; Patrick McCarthy, (1996), "Market Price and Income Elasticities of New Vehicle Demands*," The Review of Economics and Statistics* 78(3): 543-547; Pinelopi Goldberg and Frank Verboven, (2001), "The Evolution of Price Dispersion in the European Car Market," *Review of Economic Studies* 68(4): 811-848; and Kenneth Train and Clifford Winston, (2007), "Vehicle Choice Behavior and the Declining Market Share of U.S. Automakers," *International Economic Review* 48(4): 1469-1496. Similar results have been found when examining the price elasticity of demand specifically for EVs. See, for example, Erich Muehlegger and David Rapson, (2018), "Subsidizing Mass Adoption of Electric Vehicles: Quasi-Experimental Evidence from California," NBER Working Paper No. 25359.

[11] This is the change to the electric vehicle tax credit proposed in the Driving America Forward Act. Section 3 of the Driving America Forward Act includes an extension of the credit for new qualified fuel cell motor vehicles. Section 3 is not included in this estimate. The Driving America Forward Act allows a maximum electric vehicle tax credit of up to $7,500 for a manufacturer's first 200,000 vehicles and a maximum credit of $7,000 thereafter. Once a manufacturer reaches 600,000 qualifying vehicles sales the credit phases out for that manufacturer. In particular, the second quarter following the quarter in which the manufacturer reaches 600,000 sales of qualifying vehicles the credit amount is reduced 50%. The following quarter the credit amount is reduced to zero. Analysis assumes the Driving America Forward Act is effective July 1, 2019.