Costly Subsidies for the Rich

Quantifying the Subsidies Offered to Battery Electric Powered Cars

WAYNE WINEGARDEN, PH.D.

PACIFIC RESEARCH INSTITUTE

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Wayne Winegarden

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Pacific Research Institute
101 Montgomery Street, Suite 1300
San Francisco, CA 94104
Tel: 415-989-0833
Fax: 415-989-2411
www.pacificresearch.org

Download copies of this study at www.pacificresearch.org.

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Executive Summary

The federal, state, and local governments in the U.S. offer manufacturers and consumers of electric vehicles (EVs) a wide range of subsidies. These subsidies include:

- Federal manufacturing grants and loans for the purchase of electric vehicles and the necessary infrastructure worth $40.7 billion over the lifetime of the programs;
- Federal tax credits for the purchase of electric vehicles, which are worth up to $7,500 per consumer, with a total budgetary cost of up to $2.0 billion over the lifetime of the program;
- State and local tax credits for the purchase of electric vehicles that are worth up to $7,500 per consumer (in parts of California);
- State and local tax credits to purchase and install EV charging stations, particularly fast technology charging stations; and,
- State and local perks including access to HOV lanes regardless of the number of passengers in a vehicle, free charging stations, and free meter parking (available in Hawaii).

Additionally, California, along with the nine states that have adopted California's policy, mandates that zero emission vehicles (ZEVs) comprise a set percentage of the automobile market. The mandated minimum market share for ZEVs is currently scheduled to grow from 4.5 percent of sales in 2018, to 22 percent of the market by 2025; and Governor Brown is even contemplating a complete ban on sales of cars with internal combustion engines after 2040. Complying with these mandates requires companies to maintain ZEV credits that equal their share of the mandate, based on the company's specific sales. Acquiring sufficient credits requires manufacturers that do not sell enough ZEVs to either sell ZEVs in California at a loss, purchase credits from companies whose ZEV sales exceed their credit requirements, or pay a $5,000 fine per credit that the company is short.

Consequently, the sales mandate has become a subsidy to companies, such as Tesla, that sell more ZEV qualified vehicles than required by the mandate; and, a penalty on companies whose ZEV sales fall short of the required mandate. The $700 million earned by Tesla via these credit sales, which do not even account for all the credits Tesla has amassed, exemplifies that these subsidies and penalties can be substantial.

There are also distributional impacts from these EV subsidies. IRS Statistics of Income data illustrate that, for the 2014 tax year, 78.7 percent ($207.1 million) of the federal consumer tax credits were received by households with an adjusted gross income (AGI) of $100,000 or above. A further 20.5 percent of the tax credits ($54.1 million) were received by households with an AGI between $50,000 and $100,000. Therefore, over 99 percent of the total tax credits went to households with an AGI above $50,000. Further, the tax credit data indicate that the manufacturing subsidies, which also benefit the consumers of EVs, primarily benefit households who are in the top-half of income-earners.

These data reveal that not only is the size of the EV subsidies substantial, they favor certain competitors over others, and primarily benefit upper income households.

Introduction

The federal, state, and local governments offer a wide array of subsidies that lower the costs of manufacturing electric vehicles (EVs), and reduce the cost of purchasing and owning an EV. These lower costs incent consumers to purchase more EVs than otherwise.

Subsidy advocates argue that artificially stimulating the demand for EVs (their *raison d'etre*) is necessary because significant reductions in U.S. greenhouse gas emissions (GHG) require a robust EV market; but, without subsidies, a robust EV market will not develop.

Specifically, these advocates claim that the EV market must reach a certain size threshold (or growth threshold) to attain the potential manufacturing efficiencies that will lower their cost of production. Reaching the growth threshold also enables additional production innovations that will further decrease the costs of producing EVs and increase their affordability. Once a sufficiently large number of EVs are on the road, there will also be stronger incentives to invest in the required support infrastructure (e.g. electric charging stations) that furthers the viability of the EV market.

A problem arises, however, because without a well-developed support infrastructure, and without the affordability enabled by greater economies of scale, consumers are unable, or unwilling, to purchase EVs. This is the Catch-22 that subsidies are supposed to fix – EVs will become affordable once the market becomes larger, but the market cannot become larger because EVs are unaffordable. Government subsidies reduce the costs of EVs, and encourage more consumers to purchase these cars today. These increased purchases generate momentum that is supposed to power the EV industry past the growth threshold.

Starting with the impact of EVs on GHG emissions, there are several studies that question whether EVs will, universally, create a net environmental benefit, or do so efficiently.

There are important flaws in this "government subsidy" logic, however. Starting with the impact of EVs on GHG emissions, there are several studies that question whether EVs will, universally, create a net environmental benefit, or do so efficiently. For example, one study regarding EVs in Canada concluded that "subsidies for the purchase of electric vehicles have little effect on GHG emissions and are much more expensive than other incentive measures that achieve the same results."[1] Other researchers have argued that considering the entire life-cycle of an EV, and the specific power generating source of the electricity used to charge it, EVs may not provide significant reductions in greenhouse gas emissions in all markets.[2]

Furthermore, artificially stimulating the demand for EVs introduces several economic distortions that harm overall consumer welfare. First, since the subsidies create an excessive demand for more expensive EVs relative to the demand for hybrid cars or the demand for gasoline powered cars, a larger than optimal amount of resources is being devoted toward transportation services – opportunities that could have created value elsewhere in the economy are lost. These lost opportunities are a cost on the economy that lowers overall economic growth and reduces overall well-being.

Second, there is the risk that the increased productivity and scale the subsidies are supposed to create will never materialize. This leads to an open-ended subsidy of EVs regardless of its value that is akin to an entitlement program. The government supported ethanol programs exemplify that, in practice, temporary government support programs rarely sunset even when the programs impose net costs on the economy.

Third, there is the risk that the price distortions created by the subsidies inhibit the development of alternative technologies that could be a more effective environmental solution. For instance, electric vehicle batteries are made from lead acid, lithium-ion, or nickel-hydride that could be carcinogenic, impose negative impacts on the environment in mining communities, and create disposal issues once the battery has been fully used. Given these risks the best alternative to lower greenhouse gas emissions could be other technologies, such as significantly more fuel-efficient cars or the development of hydrogen cars.[3] The development of these alternative technologies are hampered by the existence of the EV subsidies.

Finally, EV subsidies also represent a wealth transfer from lower-income people to higher-income people and, therefore, could have negative consequences on overall income distribution.

The changes to purchasing decisions in response to changes in EV subsidies confirm that these subsidies are significantly distorting people's decisions. For example, after Hong Kong eliminated its tax break for EVs in April 2017, registrations of new Tesla electric cars in Hong Kong fell from 2,939 to zero.[4] Similarly, after Georgia eliminated its $5,000 EV subsidy in 2015, EV sales fell 89 percent in two months.[5] These drastic sales reductions are an indication that the demand for EVs is based solely on the distortions created by government subsidies.

Since EVs are subsidized in many direct, and indirect, ways, it is beneficial to quantify the value of these benefits offered to EV owners, as well as document any distributional impacts associated with these subsidies, which is the purpose of this report.

This report quantifies the total dollar value of the federal and state subsidies available to offset the costs of purchasing, and owning, an EV; as well as the subsidies paid to the manufacturers of EVs that offset the cost of production and development. The subsidies evaluated will include tax credits for buyers and financial payments to the industry. Other benefits, such as dedicated HOV access and reduced parking fees will also be noted.

Once a dollar value has been estimated, the study will quantify the distribution of these benefits by evaluating IRS Statistics of Income data to determine the average income of the tax filers claiming the federal EV tax credits. These results will be used as a proxy for the average income of the families receiving the federal and state EV subsidies.

It is important to recognize that the large number of overlapping subsidies from the federal, state, and local governments makes it difficult to comprehensively capture every possible subsidy; therefore, the total subsidies discussed below should be understood as a conservative accounting of these available subsidies. Furthermore, there is the problem of how to treat other types of subsidies, such as the $1.2 billion Volkswagen will invest in charging stations across the U.S. over the next 10 years due to their settlement agreement related to the diesel emissions cheating scandal.[6] In what follows, a strict definition of government subsidy is adopted so expenditures such as the very sizeable charging station investments that Volkswagen will be enabling, which can be viewed as a subsidy for the industry, will not be included.

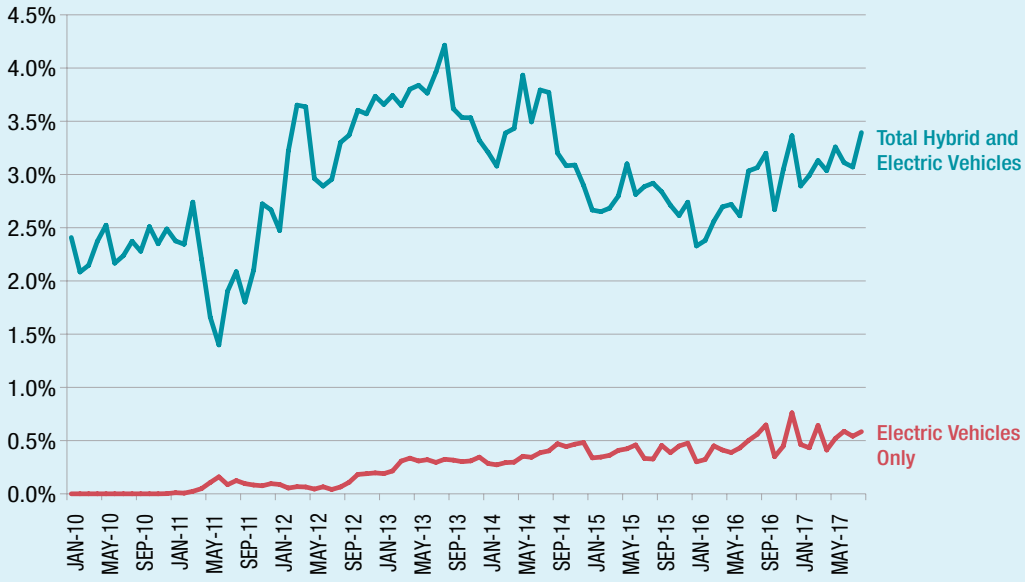
It is also important to note upfront that the purpose of this paper is to provide information regarding the size, and distributional impacts, of EV subsidies. Whether EVs are, or can become, viable products, or even the new technological standard for automobiles, is a separate question. Many automobile manufacturers and investors believe that EV vehicles are, in fact, the future. For example, "Toyota Motor Corp is working on an electric car powered by a new type of battery that significantly increases driving range and reduces charging time, aiming to begin sales in 2022".[7] If successful, then Toyota's innovations could radically transform the electric vehicle market. It is also possible that Toyota's hoped-for innovations will not meet expectations and the current technological constraints on the EV industry will persist. These questions of market viability differ from the question addressed in this paper regarding the size and distributional impacts from subsidizing the EV technology.

Background on the Electric Vehicle Market

Electric vehicles are powered solely by energy that is stored in its rechargeable battery, which are, in turn, recharged using standard household electricity. Electric vehicles do not use any fossil fuels to operate, which separates these vehicles from hybrids that use a combination of gasoline and electricity to power the vehicle.[8]

Electric vehicles came onto the market starting in 2010 and, as illustrated in Figure 1, now average around 0.5 percent of the total vehicle market. As of August 2017, a total of 351,642 electric vehicles have been sold in the U.S.; including electric vehicles and plug-in hybrids, a total of 676,180 vehicles have been sold in the U.S., or about three percent of the total vehicle market.[9]

Figure 1
All Hybrid Vehicles & Electric Vehicles Share of Total Vehicle Market
January 2010 through August 2017



Sources: Electric Drive Transportation Association and St Louis Fed, FRED

The total market share for all electric and hybrid vehicles (both plug-in hybrids and non-plug-in hybrids) peaked at just over 4 percent in August 2013, and has been on a general downward trend since, even if the upward trend in sales since early 2016 is included, see Figure 1. The combination of declining total hybrid and electric vehicle sales, but rising electric vehicle sales, indicates that consumers are substituting electric vehicles for hybrid vehicles, but this consumption switching has not been strong enough to fully offset the declining demand for hybrid vehicles.

Along with growth in sales, model choice in the electric vehicle market has been expanding as well. According to plugincars.com, as of 2017, "there are more than 20 models [of electric cars] offered from more than a dozen different brands".[10]

The value proposition that electric vehicles offer customers is clear: a car that requires no fossil fuels. There are drawbacks to electric vehicles as well. Electric cars are more expensive than their fossil fuel powered competitors, the range of electric cars tends to be significantly shorter, and the time it takes to recharge an electric car is substantial. Table 1 illustrates these realities by presenting the electric cars with the longest driving range per charge and the starting price for these cars, see Table 1.[11]

Table 1
Electric Vehicles with Longest Driving Range
2017

Car Manufacturer & Brand	Driving Range per Charge (in miles)	Starting Price
2017 Fiat 500e	84.0	$31,800
2017 Mercedes-Benz B250e	87.0	$39,900
2017 Kia Soul EV	93.0	$32,250
2017 Nissan Leaf	107.0	$30,680
2017 BMW i3	114.0	$42,400
2017 Hyundai Ioniq Electric	124.0	$22,200
2017 Volkswagen e-Golf	126.0	$28,995
2017 Chevrolet Bolt EV	238.0	$36,620
2017 Tesla Model X	295.0	$85,500
2017 Tesla Model S	335.0	$68,000
Average 10 Electric Cars Longest Range	160.3	$41,835

Source: U.S. News and World Report

In comparison, gas-powered vehicles averaged 24.8 miles per gallon in 2015.[12] Since the average gas-powered car has around a 12- to 15-gallon tank, these cars can, consequently, drive 298 to 372 miles per tank of gasoline. The average driving distance of the electric vehicle with the longest driving ranges can go around one-half that distance (160 miles). Further, the starting price for electric cars is $41,835 – significantly more than the average price for a new vehicle ($34,077) and the average price for a new small car ($20,000).[13]

The distance restrictions and time required to recharge an electric vehicle also alters the value of electric vehicles to consumers compared with gas-powered vehicles. As the Congressional Budget Office noted, "long-distance travel requires frequent recharging, which is difficult because recharging can take hours."[14]

Illustrating the recharging obstacle based on the breakdown performed by FleetCarma.com, it would take between 5 and 10 hours to recharge a 2017 Nissan Leaf using standard recharging technologies; and about an hour to recharge based on Fast Charging technologies.[15] These charging times are similar for other models as well, and are significantly larger than the "less than 10 minutes" FleetCarma.com estimated it takes (on average) to refill a gas-powered vehicle.[16] Consequently, while recharging an electric vehicle at night after driving it around town may be feasible, the long charging times make electric cars unsuitable for driving long distances where the car would need to be recharged in the middle of the trip.

Due to this current charging constraint on electric vehicle usage, electric vehicles provide consumers with narrower transportation services than fossil fuel powered vehicles (e.g. electric vehicles provide consumers with the ability to drive around town, but not the ability to drive long distances). Technological advances could reduce, or eliminate, this charging constraint over time, of course; however, it is a binding constraint as of the 2017 model year.

Based on the current state of the technology, EVs are also unprofitable to produce. As documented by Bloomberg News, manufacturers generally lose money selling electric vehicles at their current price points, citing as an example that "General Motors Co. stands to lose as much as $9,000 on every Chevrolet Bolt that leaves a showroom once the all-electric subcompact starts rolling out."[17] Companies sell electric vehicles at a loss, in part, due to regulations, such as California's requirement that a company sell non-polluting vehicles in order to have the right to sell other vehicles in the large California market.

Companies sell electric vehicles at a loss, in part, due to regulations, such as California's requirement that a company sell non-polluting vehicles in order to have the right to sell other vehicles in the large California market.

Of course, the manufacturer subsidies lower the effective cost of production. It logically follows that the manufacturers' losses per vehicle would be even higher than those reported by Bloomberg without these large manufacturer subsidies. The consumer subsidies also artificially reduce the manufacturers' losses per vehicle by reducing the net sales price, and cost of ownership, to the buyer of an EV vehicle. Consequently, it is material to note that even with the large government support, EV manufacturers still lose money producing these vehicles.

Quantifying Government Support

There are many federal, state, and local subsidy programs that benefit consumers and manufacturers of electric vehicles.

Federal Programs

Starting with the federal programs, according to the Congressional Budget Office (CBO) "federal policies to promote their [electric vehicles] manufacture and purchase include tax credits for buyers of new electric vehicles, financial support for the industry that produces them, and programs that promote efforts to educate consumers about electric vehicles and improve the infrastructure for recharging them. The Congressional Budget Office (CBO) estimates that such policies, some of which also support other types of fuel-efficient vehicles, will have a total budgetary cost of about $7.5 billion through 2019."[18] Table 2 breaks down these costs to the government.

Table 2
Electric Vehicle Total Federal Budgetary Costs Over Program Lifespan

	Budgetary Cost (in billions)
Electric Drive Vehicle Battery and Component Manufacturing Initiative	$2.0
Transportation Electrification Initiative	$0.4
Advanced Technology Vehicles Manufacturing Program	$3.1
Total Federal Electric Vehicle Manufacturing Programs	**$5.5**
Maximum Value of $7,500 Tax Credit	$2.0
Total Federal Electric Vehicle Programs	**$7.5**

These budgetary expenditures encompass a wide variety of federal programs. As listed in Table 2, the federal government has allocated $2.0 billion in grants that are provided through the Electric Drive Vehicle Battery and Component Manufacturing Initiative. The American Recovery and Reinvestment Act of 2009 (ARRA), funded these grants that support manufacturing investments in the areas of: electric vehicles, electric batteries, other electric vehicle parts, and battery recyclers.

The federal government has also allocated $0.4 billion in grants that are provided through the Transportation Electrification Initiative, also funded by ARRA. These grants support electric vehicle demonstration, deployment, and education projects.

Up to $25 billion in loans have been authorized via the Advanced Technology Vehicles Manufacturing Loan Program. This program provides loans to automakers and parts manufacturers to support investments that these companies are making in low emission technologies. Out of the $25 billion authorized, $16 billion has not yet been committed.

It is important to note that not all of the loans from the Advanced Technology Vehicles Manufacturing Loan Program will directly support electric vehicles. For instance, Ford Motor Corporation borrowed $5.9 billion in order to fund, among other projects, development of Ford's EcoBoost™ engine.[19] However, Ford, as is typical with most major automobile manufacturers, invests in many low emissions technology projects, including $4.5 billion the company is planning on spending on electric vehicle development.[20] Investment funds are of course fungible, and the federal support of EcoBoost plays an indeterminate role in enabling Ford to raise the necessary funds to invest in its electric manufacturing programs. Due to this funding interchangeability across low emission technologies, and the fact that these preferential loans are a clear subsidy that benefits these companies, the full value of the low emission technology loans are evaluated.

The loan guarantees can also apply to the electric vehicle infrastructure as well. For instance, loan guarantees of up to $4.5 billion are available from the federal government to support electric vehicle charging facilities.[21]

Finally, the federal government provides consumers of electric vehicles a federal income tax credit of up to $7,500 for the purchase of a qualified electric vehicle. This tax credit was also created by ARRA.

In total, budgetary cost of these programs is $7.5 billion. These estimated costs do not necessarily represent the value of these subsidies to the manufacturers of electric vehicles, however. Specifically, the value of the grants and loans directed toward electric vehicle manufacturers is worth more to the manufacturers than the direct budgetary cost imposed on the government.

Due to this funding interchangeability across low emission technologies, and the fact that these preferential loans are a clear subsidy that benefits these companies, the full value of the low emission technology loans are evaluated.

As a quick digression, it is also important to emphasize that the value to the manufacturers is not the same as the value to the economy. The net value from the government expenditures must account for the negative impacts imposed on the economy from the taxes used to pay for the expenditures, which are a net negative for the economy. Additionally, the negative impacts from any distortions to the capital stock must also be considered. Combined, it is likely that while the recipients of the government subsidies receive a positive value, for the economy, the subsidies are net negative (e.g. the subsidies reduce overall economic growth). Such an analysis, while crucially important, is not considered below. Instead, the calculations below estimate the value of the subsidies to illustrate the full value of the support the battery electric vehicle industry receives from the government.

The value of the subsidies and loans the electric vehicle manufacturers receive is estimated based on the size of the support plus the financing costs avoided to obtain those funds through the private sector capital markets. It is, consequently, necessary to distinguish between the two grant programs (the Electric Drive Vehicle Battery and Component Manufacturing Initiative, and the Transportation Electrification Initiative) and the subsidized loan program (the Advanced Technology Vehicles Manufacturing Program), when estimating their value to the electric vehicle industry.

The total cost of the grant programs to the government is $2.4 billion, see Table 2. This $2.4 billion is, effectively, a gift from the government to the electric vehicle industry – the industry does not need to repay this money, nor does it need to raise this money from investors through the capital markets (either debt or

equity). Had the electric vehicle companies raised this $2.4 billion from investors, these firms would need to pay their investors a return on these invested funds. And, it is the financial benefit gained by not having to raise this money through the capital markets, and pay their investors an adequate return on their investment, that increases the value of these grants to the electric vehicle industry relative to the direct costs borne by the government.[22]

Accounting for both debt and equity forms of capital, the average cost of capital for companies in the U.S. is approximately 6.9 percent per year.[23] According to the Bureau of Economic Analysis, the average age of private nonresidential fixed assets in 2016 was 16.3 years.[24] Using an assumed 16-year payout, the electric vehicle industry would have needed to return $4.0 billion, on average, to the debt and equity investors in return for the $2.4 billion if they were not received in grants. Thus, based on these assumptions, the $2.4 billion in grants is worth $4.0 billion to these companies.

There is also a variance between the subsidized loan program's worth to the companies and its cost to the government. The government estimates that lending $25 billion to electric vehicle companies will cost the government $3.1 billion. This assumption means that the government expects to lend $25 billion to the electric vehicle industry, yet experience a loss on these loans. Put differently, once the government accounts for the subsidized lending rate, the expected loan defaults, and the other loan costs, they expect these costs to exceed the expected interest payments and return of the initial loans by $3.1 billion.[25]

While these expected losses are the costs to the government, the value calculation for the electric vehicle companies is significantly different.

While these expected losses are the costs to the government, the value calculation for the electric vehicle companies is significantly different. The value to the industry includes the $25 billion in working capital they can borrow plus the difference between the actual cost of capital they would have had to pay to raise this money in the private markets, and the subsidized cost of capital they are able to pay thanks to the government's subsidized loan program.

Using the same average cost of capital from above (6.9 percent) as the industry's cost of capital, and the average interest rate on a 10-year government bond (2.21 percent as of August 2017) as the subsidized interest cost, the subsidized loan program saves the electric vehicle companies $11.7 billion in potential financing costs (again, assuming a 16-year payout).[26] Consequently, the value of the subsidized loans to the electric vehicle industry is the access to the potential $25 billion in capital plus the interest cost savings of $11.7 billion for a total value of $36.7 billion.

Combining the value of the grants ($4.0 billion) and the value of the subsidized loans ($36.7 billion), the value of the manufacturer subsidies to the manufacturers is $40.7 billion over the lifetime of these programs.

Unlike the manufacturer programs, the value of the purchase subsidies through the $7,500 tax credit to the consumers are equal to the cost of providing these subsidies by the government. Consequently, the total estimated value of these subsidies to the consumers of electric vehicles is $2.0 billion.

Combined, the value of these federal subsidies to the recipients over the lifetime of these programs is an estimated $42.7 billion, see Table 3. This estimate is not complete because the manufacturers and consumers of electric vehicles receive additional subsidies at the state and local levels that provide additional value.

Table 3
Federal Electric Vehicle Program Total Value to Recipients Over Program Lifespan

	Budgetary Cost (in billions)
Electric Drive Vehicle Battery and Component Manufacturing Initiative	$3.3
Transportation Electrification Initiative	$0.7
Advanced Technology Vehicles Manufacturing Program	$36.7
Total Federal Electric Vehicle Manufacturing Programs	$40.7
Maximum Value of $7,500 Tax Credit	$2.0
Total Federal Electric Vehicle Programs	$42.7

In addition to subsidizing EVs directly, the federal government offered a 30 percent tax credit for businesses and individuals against the cost of electric vehicle charging equipment. The credit applied to conventional and wireless home charging stations and, if installed by year-end 2016, was worth up to $1,000 for individuals and $30,000 for businesses. Since the end of 2016, this federal tax credit is no longer available.

State and Local Programs

Similar to the federal programs, many states and localities offer consumers tax credits in order to incent the purchase of EVs, as well as the purchase and installation of charging stations for EVs, particularly charging stations with the fast charging technology. While a consumer incentive, many businesses also qualify for these tax credits including builders, apartment owners, or similar businesses.

Vehicles that qualify for the tax credits or rebates are typically electric vehicles, although some states apply the tax incentives to zero emission vehicles (ZEVs), or offer a lesser rebate for plug-in hybrid vehicles. These tax preferences will also include exemption from sales taxes for qualified purchases.

States and localities also offer electric vehicle owners other preferences beyond tax credits and rebates that include:

- Access to HOV lanes regardless of the number of people in the car,
- Access to free charging stations,
- Free workplace charging, particularly for federal and state employees,
- Preferred parking locations at many airports and garages, and
- Hawaii even offers free meter parking.

In total, tax preferences are offered in 26 states, plus Washington D.C. Appendix 1 summarizes these preferences.[27]

To get a sense of the additional benefits consumers can gain from the state and local tax credits in addition to the $7,500 federal tax credit, Table 4 adds the maximum state and local credits available in those states who offer them to the $7,500 federal tax credit. These benefits do not include the tax credits buildings or developers may have received to build charging stations, which of course benefit the consumers of electric vehicles as well. The privilege of unconditional HOV access or free parking (in the case of Hawaii) are also not valued, but also benefit consumers of EV vehicles.

To get a sense of the additional benefits consumers can gain from the state and local tax credits in addition to the $7,500 federal tax credit, Table 4 adds the maximum state and local credits available in those states who offer them to the $7,500 federal tax credit.

As Table 4 illustrates, the largest credits are available in some parts of Arizona, however these credits are limited to purchasers of the 2017 Nissan LEAF and were only available through September 2017. The next most generous state and local tax credits are provided in California ($15,000 maximum tax credit for low and moderate-income consumers; $13,000 for all other consumers subject to an income cap); and Colorado ($12,500 maximum tax credit).

Table 4
Federal Plus Maximum State and Local Tax Credits Available on Electric Vehicles

				Maximum Credit	
	Total Credit % of Price*	Total Credits	Federal Credit	State Credit	Local Credit
Alabama	17.9%	$7,500	$7,500		
Alaska	17.9%	$7,500	$7,500		
Arizona**	57.0%	$17,500	$7,500		$10,000
Arkansas	17.9%	$7,500	$7,500		
California***	35.9%	$15,000	$7,500	$4,500	$3,000
Colorado	29.9%	$12,500	$7,500	$5,000	
Connecticut	25.1%	$10,500	$7,500	$3,000	
Delaware	17.9%	$7,500	$7,500		
District of Columbia	17.9%	$7,500	$7,500		
Florida	19.7%	$8,250	$7,500		$750
Georgia	17.9%	$7,500	$7,500		
Hawaii	17.9%	$7,500	$7,500		
Idaho	17.9%	$7,500	$7,500		
Illinois	17.9%	$7,500	$7,500		
Indiana	17.9%	$7,500	$7,500		
Iowa	17.9%	$7,500	$7,500		
Kansas	17.9%	$7,500	$7,500		
Kentucky	17.9%	$7,500	$7,500		
Louisiana	21.5%	$9,000	$7,500	$1,500	
Maine	17.9%	$7,500	$7,500		
Maryland	25.1%	$10,500	$7,500	$3,000	
Massachusetts	23.9%	$10,000	$7,500	$2,500	
Michigan	17.9%	$7,500	$7,500		
Minnesota	17.9%	$7,500	$7,500		
Mississippi	17.9%	$7,500	$7,500		
Missouri	17.9%	$7,500	$7,500		
Montana	17.9%	$7,500	$7,500		
Nebraska	17.9%	$7,500	$7,500		
Nevada	17.9%	$7,500	$7,500		
New Hampshire	17.9%	$7,500	$7,500		
New Jersey	17.9%	$7,500	$7,500		
New Mexico	17.9%	$7,500	$7,500		
New York	22.7%	$9,500	$7,500	$2,000	
North Carolina	17.9%	$7,500	$7,500		
North Dakota	17.9%	$7,500	$7,500		
Ohio	17.9%	$7,500	$7,500		
Oklahoma	17.9%	$7,500	$7,500		
Oregon	17.9%	$7,500	$7,500		
Pennsylvania	20.3%	$8,500	$7,500	$1,000	
Rhode Island	23.9%	$10,000	$7,500	$2,500	
South Carolina	17.9%	$7,500	$7,500		
South Dakota	17.9%	$7,500	$7,500		
Tennessee	17.9%	$7,500	$7,500		
Texas	17.9%	$7,500	$7,500		
Utah	17.9%	$7,500	$7,500		
Vermont	20.8%	$8,700	$7,500		$1,200
Virginia	17.9%	$7,500	$7,500		
Washington	17.9%	$7,500	$7,500		
West Virginia	17.9%	$7,500	$7,500		
Wisconsin	17.9%	$7,500	$7,500		
Wyoming	17.9%	$7,500	$7,500		

** The price is the average sales price on the 10 electric vehicles with the longest driving range.*
*** Available on 2017 Nissan Leaf only for Salt River Project utility customers. Percentage of RSP calculation based on price of 2017 Nissan LEAF of $30,680*
**** Rebates on zero-emission hydrogen fuel cell vehicles, which are not considered here, are $5,000 (*https://cleanvehiclerebate.org/eng/eligible-vehicles*). The $4,500 figure is the rebate for lower-income consumers that includes the standard $2,500 rebate plus the additional $2,000 available to lower income consumers (*https://arb.ca.gov/msprog/lct/cvrp.htm*).*

As Table 4 also illustrates, these tax credits alone are around one-fifth of the average price of the top 10 electric vehicles with the longest driving range. In Arizona, where the credits are only available on the less expensive Nissan LEAF, the tax credits are equal to more than half of the price of the car.

Table 4 also illustrates that, in addition to the very generous federal manufacturing subsidies, the total federal, state, and local subsidies for consumers of electric vehicles are similarly generous. Given the generosity of these incentives, it is not surprising to see the significant drop off in sales in locations where the generosity of these subsidies is reduced (see, for instance, the 89 percent reduction in EV sales in Georgia following the expiration of the $5,000 tax credit in 2015 referenced above).

Given the generosity of these incentives, it is not surprising to see the significant drop off in sales in locations where the generosity of these subsidies is reduced.

State and local tax credits are also available for purchases of electric charging stations, and several municipal utilities offer rebates for customers who purchase qualified equipment. The Appendix summarizes the wide variety of state and local subsidies available for purchases of the charging equipment, which varies widely from $75 for the purchase of residential equipment in Arizona, all the way to tens of thousands of dollars for purchases made by businesses or multi-family residences in California.

In addition to the tax credits and tax rebates, California also applies a zero-emissions mandate on manufacturers. The mandate requires that zero emission vehicles (ZEVs) comprise a set percentage of all automobile sales in California by 2025. As described by the Union of Concerned Scientists, "the ZEV program assigns each automaker 'ZEV credits,' which represent the company's sales of electric cars and trucks. Automakers are then required to maintain ZEV credits equal to a set percentage of non-electric sales. The credit requirement is 4.5 percent of sales in 2018, rising to 22 percent in 2025."[28] Taking his cues from China, Governor Brown is even contemplating a complete ban on the sale of cars fueled by the internal combustion engine after 2040.

While California is the only state that can implement such rules (California has federal preemption), other states have the option to adopt California's standards. Nine other states follow California's requirement including: Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island, and Vermont.

Those companies who have excess credits (the total ZEV credits earned exceeding 4.5 percent of their total automobile sales in California) can save these unused credits from one year to the next. Companies that do not have enough credits are subject to a fine of $5,000 per credit the company is short. Instead of paying the fine, these companies that do not have sufficient ZEV credits can purchase the excess credits from those companies with a surplus.

The potential revenues that companies with a surplus of ZEV credits can earn are a subsidy to these companies. The subsidy is funded by the companies that do not have significant EV sales, and their customers; and, these subsidies can be quite substantial.

For instance, Tesla has been one of the largest beneficiaries of selling ZEVs. According to Trefis, "although the revenues from the sales of these [ZEV] credits are quite volatile, they are very lucrative, as Tesla essentially incurs no direct costs to earn them. For instance, during Q3'16 revenues from the sale of ZEV credits stood at $139 million, helping Tesla post a small profit instead of a sizable loss. ***Tesla has likely sold more than $700 million in credits so far, helping the company mitigate the extent of its overall losses***."[29] Furthermore, the $700 million in credits sold does not include the additional credits that Tesla has amassed and could still sell into the market, generating additional potential revenues.

The ZEV credits are, arguably, essential for keeping Tesla in business. Beyond Tesla, the ZEV credits provide a windfall source of revenues for other manufacturers who are able to exceed the ZEV sales thresholds, and a government imposed cost burden on those manufacturers that are unable to meet those thresholds. Effectively, the ZEV mandates give manufacturers of qualified vehicles the ability to expropriate some of the profits, or impose higher costs on the customers, of manufacturers who do not sell enough qualified vehicles. The costs on manufacturers from these sales mandates are not simply the sum of these costs, however. For some manufacturers, it could be profit maximizing to sell ZEV qualified vehicles into the California market at a loss in order to amass enough ZEV credits through qualified vehicle sales. These losses, while perhaps less costly than having to purchase a ZEV credit from other manufacturers (or pay the $5,000 per credit fine), are still a state government created cost on these car manufacturers.

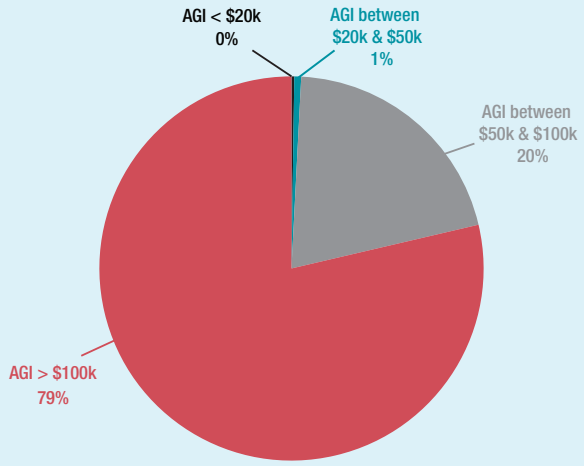
Who Benefits? The Distributional Impact from Government Subsidies for Electric Vehicles

Beyond documenting the size of the subsidies, it is also instructive to document their distributional impact. The tax credit offered on electric vehicles is known as the qualified plug-in electric vehicle tax credit (the aforementioned tax credit up to $7,500 for the purchase of a qualified electric vehicle). Data from the IRS Statistics of Income 2014 tax year (the latest data available) confirm that the majority of the dollar benefits from energy and electric car subsidies are paid to tax filers in the higher income tax brackets.[30]

In total, out of the 148.6 million returns filed in 2014, only 46,593 received the qualified plug-in electric vehicle tax credit – 0.03 percent of all tax returns filed during the year. In total, $263.3 million of qualified plug-in electric vehicle tax credits were received. Of these, 78.7 percent ($207.1 million) were received by

households with an adjusted gross income (AGI) of $100,000 or higher – and more than half of these revenues ($122.3 million) went to households with an AGI in excess of $200,000. A further 20.5 percent of the tax credits ($54.1 million) were received by households with an AGI between $50,000 and $100,000. Therefore, over 99 percent of the total tax credits go to households with an AGI above $50,000. Figure 2 summarize these data.

Figure 2
Electric Vehicle Plug-in Tax Credit Received by Adjusted Gross Income
2014 Tax Year



TOTAL TAX CREDIT PAID: $263.3 MILLION

Compared to the median household income in 2014 of $53,657, and accounting for the fact that AGI is typically less than the household income measured by the U.S. Census Bureau (AGI subtracts allowable IRS deductions, such as contributions to IRAs, from gross income) it is reasonable to conclude that the subsidies for electric vehicles benefit the top 50 percent of U.S. households, almost exclusively. Further, most of these subsidies were paid to households earning more than double the median income.

It is also important to note that the qualified plug-in electric vehicle tax credit is skewed toward wealthier households to a larger extent than other energy efficiency tax credits. For example, the residential energy tax credits provide a credit of 30 percent of the expenditures made for, among other qualified purchases, the purchase of qualified solar electric systems, solar water heaters, and small wind energy property.[31] For the 2014 tax year, 55.8 percent of the benefit went to households with an AGI in excess of $100,000; and 87.3 percent went to households with an AGI in excess of $50,000. Therefore, even the residential energy tax credit program, which heavily skews toward upper income households, does not benefit wealthier households to the same extent as the qualified plug-in electric vehicle program does.

Conclusion

While it is difficult to combine the benefits electric vehicle manufacturers and consumers receive into one aggregate number, the data reviewed above illustrate that these benefits are quite substantial.

From a manufacturer's perspective, the federal government has/intends to subsidize the industry by up to $40.7 billion over the lifetime of the program. Due to California's ZEV mandates, electric vehicle manufacturers can also expropriate the revenues of other manufacturers who have not met California's standards. These revenues can be quite substantial. With California's blessing, Tesla alone has been able to expropriate $700 million from other manufacturers by selling these credits.

There is also an additional $2 billion in subsidies available to consumers of electric vehicles from the federal government in the form of the qualified plug-in tax credit of up to $7,500 per purchase of a qualifying vehicle. State and local governments also provide tax credits for consumers that range up to $7,500 in parts of California. There are also federal and state subsidies that lower the costs from investing in the charging station infrastructure necessary for electric vehicles. Additionally, many states provide perks to owners of electric vehicles that include access to HOV lanes and free parking rights at public meters. While not quantifiable, these are tangible consumer benefits as well.

From a distributional perspective, most of the benefits from EV subsidies are received by higher income households.

From a distributional perspective, most of the benefits from EV subsidies are received by higher income households. Consequently, the subsidization of EVs has some reverse Robin Hood impacts where tax dollars are taken from all households (including lower-income households) and given to wealthier households.

The size, and distributional consequences, of the EV subsidies raises questions regarding their efficacy. At a bare minimum, these impacts argue that advocates for continued subsidization of the EV industry should have to justify why the benefits from these subsidies outweigh the costs.

Appendix 1

Summary of State and Local Tax Incentives for Electric Vehicles[32]

	Incentives & Rebates to Install Charging Stations	State-provided Customer Discounts	Locality/Utility-provided Customer Discounts	HOV Lane Access	Free Public Parking	Proposals for Additional Incentives
Arizona	$75 builder tax credit		$10,000 discount on 2017 Nissan LEAF through 9/30/2017			
California	Various local incentives (particularly for multi-family or mixed-use properties) to offset the costs of installing EV charging stations (particularly fast charging technologies). Incentives range from $500 up to $30,000. Offering agencies include: The Rancho Cucamonga Municipal Utility; The City of Palo Alto Utilities (CPAU); The Bay Area Air Quality Management District (BAAQMD) Charge! program; The Sacramento Municipal Utility District (SMUD) Commercial Electric Charger Incentive Program; The Los Angeles Department of Water & Power (LADWP) Charge Up LA! Program; Property Assessed Clean Energy ("PACE") financing program; The Antelope Valley Air Quality Management District (AVQMD); The Santa Barbara County Air Pollution Control District Electric Vehicle Charging Station Infrastructure Program; The San Joaquin Valley Air Pollution Control District Charge Up! Program; The Burbank Water and Power (BWP) Electric Vehicle Charging Station Rebate; The Pasadena Water and Power (PWP) PEV Charger Rebate Program; and, The Glendale Water & Power EV Rebate Program. Grants for EV charging stations are periodically available through the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program.	$2,500 ZEV, $1,500 Plug-in Hybrids, $900 ZEV Motorcycles. $2,000 additional rebate for low- and moderate-income households. Subject to income caps. Zero-emission hydrogen fuel cell vehicles are eligible for a rebate up to $5,000.	San Diego Gas & Electric: $1,000 point of sale rebate for teachers and first responders; $10,000 discount on purchase of 2017 Nissan LEAF or any 2017 BMW i3. Redding Electric Utility: $1,000 account credit for purchases/leases qualified EV. Pacific Gas & Electric (PG&E): $500 rebate for owning eligible EV. Monterey Bay Air Resources District: $2,000 rebate EV, $1,000 plug-in hybrid, $500 electric motorcycles, $1,000 used EV, $500 used plug-in hybrid. Southern California Edison Clean Fuels Rewards: $450 rebate for driving a new, used, or leased EV or plug-in hybrid. San Joaquin Valley Air Pollution Control District: $3,000 for EV, $2,000 plug-in hybrids. Northern Sonoma County Air Pollution Control District: $3,000 for EV, $2,000 plug-in hybrids.	Yes		AB 134 (Chapter 254, Statutes of 2017) appropriated $140 million during the 2017-18 fiscal year for electric car rebates.

Colorado	The Regional Air Quality Council Electric Vehicle and Charging Station Grant: Denver Metro Area: 80% of cost up to $3,260 for Level 2 single port charging stations, $6,260 for Level 2 dual port charging stations, $13,000 for DC Fast single connection charging stations, and $16,000 for DC Fast multiple connection charging stations. The Colorado Energy Office Electric Vehicle and Charging Station Grant (Outside the Denver Metro Area) covers 80% of the cost or up to $3,260 for Level 2 single port charging stations, $6,260 for Level 2 dual port charging stations, $13,000 for DC Fast single connection charging stations, and $16,000 for DC Fast multiple connection charging stations.	$5,000 tax credit on purchase of ZEV				
Connecticut		CHEAPR Program: $3,000 rebate for vehicles with 18kWh battery capacity; $1,500 for vehicles with 10 to 18 kWh battery capacity; $750 for vehicles with less than 10 kWh battery capacity.				
Delaware	Delaware Electric Vehicle Charging Equipment Rebate Program: rebate of 75% of the cost up to $2,500 for businesses and 75% of the cost up to $5,000 for workplaces to install Level 2 charging stations. Rebates are available for charging stations purchased between November 1, 2016 and June 30, 2018.					
District of Columbia	Income Tax Credit of 50% of the equipment and labor costs up to $10,000, for qualified public electric vehicle charging stations.					

Florida	ChargeUP! Sarasota County: Nonprofit and government organizations 50% rebate (maximum of $4,000); select businesses 25% rebate (maximum of $2,000). Orlando Utilities commission: $200 rebate to install Level 2 and DC Fast charging stations.		Jacksonville Energy Authority: $500 rebate battery capacity < 15kWh, $,1000 capacity >15kWh. Gulf Power: $750 incentive to offset cost of installing plug-in electric vehicle charging infrastructure. This program is limited to the first 1,000 participants and expires on December 31, 2018.	Yes ($5 a year charge)		
Georgia				Yes		
Hawaii				Yes	Yes	
Idaho	Idaho Power: Incentive of 50% of project costs (maximum of $7,500), must be installed between April 1 and November 17, 2017.					
Iowa	Alliant Energy Level 2 Charging Station Rebate: $1,000 rebate for single-port Level 2; $1,500 for dual port. Available CY2017.					
Louisiana	State tax credit up to 36% for purchase and installation. Effective through June 30,2018.	Alternative Fuel Vehicle (AFV): 7.2% of vehicle cost, not to exceed $1,500. Tax credit available until June 30, 2018.				
Maryland	Maryland Energy Administration Electric Vehicle Recharging Equipment Rebate Program 2.0: 40% of costs, up to $4,000, for commercial EVSE equipment and installation, starting July 1, 2017.	$100 tax credit per kWh of battery capacity (min 5 KWh capacity), up to $3,000 maximum, effective July 1, 2017. Price cap of $60,000.		Yes		
Massachusetts	Massachusetts Electric Vehicle Incentive Program (MassEVIP): Rebate of 50%, up to $25,000, for Level 2 charging stations.	MOR-EV Program: $2,500 tax credit, applies to EV, Plug-in Hybrids				
Missouri	Alternative Fueling Infrastructure Tax Credit: 20% of costs, up to $20,000 for businesses.					
New Jersey	Electric Vehicle Workplace Charging Grant: $5,000 per Level 2 charging station, for workplaces.	Sales tax exemption for ZEV.		Yes		

New York	Alternative Fuels and Electric Vehicle Recharging Property Credit: Tax credit up to $5,000 for the purchase and installation of charging stations by businesses and corporations. Available through December 31, 2017.	New York State Energy Research and Development Authority (NYSERDA): up to $2,000 rebate for EV.				
Oklahoma	Alternative Fueling Infrastructure Tax Credit: up to 75% of the cost of an electric vehicle charging station, available through January 1, 2020 to corporations.					
Oregon	Residential Alternative Fuel Vehicle Infrastructure Tax Credit: Homebuilders rebate 50% of the costs, up to $750 of EV charging equipment. Available through December 31, 2017.					
North Carolina				Yes (expires September 30, 2019)		
Pennsylvania		Alternative Fuels Incentive Grant Program: $1,000 rebate for EV.				
Rhode Island		DRIVE program: Up to $2,500, based upon vehicle battery capacity.				
Texas	Austin Energy: Rebate of 50% of the cost, up to $4,000, for Level 2 charging stations for businesses and multifamily properties. Up to $10,000 for DC Fast Charger.					
Utah				Yes		
Vermont			Burlington Electric Department: $1,200 rebate EV, valid until December 31, 2017.			
Virginia				Yes ($25 fee)		
Washington	Electric vehicle charging infrastructure is exempt from state sales taxes through January 1, 2020.	Sales tax exemption, maximum cost of $42,500. Effective through July 1, 2019.				

Endnotes

1 Belzile, G. and Milke, M. (2017) "Are Electric Vehicle Subsidies Efficient?" *Montreal Economic Institute*, June.

2 For an approachable review of these issues see: Braun, P. (2015) "Don't look so smug: Your Tesla might be worse for the environment than a gas car" *Digital Trends*, April 23; https://www.digitaltrends.com/cars/hold-smugness-tesla-might-just-worse-environment-know/.

3 Okulski, T. (2011) "8 Reasons Why The Electric Car Will Not Be A Success Anytime Soon" *Business Insider*, December 9; http://www.businessinsider.com/the-electric-car-why-it-is-not-ready-for-mass-consumption-2011-12.

4 Higgins, T. and Rollet, C. (2017) "Tesla Sales Fall to Zero in Hong Kong After Tax Break Is Slashed" *the Wall Street Journal*, July 9.

5 Sandoval, M. (2017) "States should stop subsidizing costly electric vehicles for the rich" *The Hill*, March 27; http://thehill.com/blogs/pundits-blog/energy-environment/325857-states-should-stop-subsidizing-costly-electric-vehicles.

6 Duffer, R. (2017) "Chicago vehicle charging infrastructure boosted by VW settlement" *Chicago Tribune*, April 14; http://www.chicagotribune.com/classified/automotive/ct-chicago-ev-charging-stations-0415-20170415-story.html.

7 (2017) "Toyota set to sell long-range, fast-charging electric cars in 2022" *Reuters.com*, July 24; http://www.reuters.com/article/us-toyota-electric-cars-idUSKBN1AA035?il=0.

8 It is important to note that there are differences between traditional hybrids (that still rely on gasoline as the main fuel source) and plug-in hybrids (that is an electric motor that leverages the gasoline motor to extend its driving distance on a single charge).

9 Electric Drive Transportation Association; http://electricdrive.org/index.php?ht=d/sp/i/20952/pid/20952.

10 http://www.plugincars.com/cars?sort_by=field_msrp_value&sort_order=ASC.

11 Trop, J. (2017) "10 Electric Cars with the Longest Range" *U.S. News and World Report*, February 27; https://cars.usnews.com/cars-trucks/electric-cars-with-the-longest-range.

12 Durbin, D (2016) "U.S. average fuel economy at record high of 24.8 mpg" *Phys.org*, November 2; https://phys.org/news/2016-11-average-fuel-economy-high-mpg.html.

13 The average new vehicle price is from Edmunds.com (https://www.edmunds.com/about/press/average-vehicle-transaction-price-hits-all-time-high-in-2016-according-to-edmundscom.html); and average new price for a small car from Kelley Blue Book (https://www.kbb.com/car-news/all-the-latest/new-car-and-suv-buyers-guides/2000011533/).

14 (2012) "Effects of Federal Tax Credits for the Purchase of Electric Vehicles" *Congressional Budget Office*, September.

15 Schaal, E. (2016) "A Simple Guide to Electric Vehicle Charging" *Fleetcarma.com*, Posted August 3; http://www.fleetcarma.com/electric-vehicle-charging-guide/.

16 Schaal, E. (2016) "A Simple Guide to Electric Vehicle Charging" *Fleetcarma.com*, Posted August 3; http://www.fleetcarma.com/electric-vehicle-charging-guide/.

17 Welch, D. and Lippert, J. (2016) "GM's Ready to Lose $9,000 a Pop and Chase the Electric Car Boom" *Bloomberg*, November 30; https://www.bloomberg.com/news/articles/2016-11-30/gm-s-ready-to-lose-9-000-a-pop-and-chase-the-electric-car-boom.

18 (2012) "Effects of Federal Tax Credits for the Purchase of Electric Vehicles" *Congressional Budget Office*, September.

19 (2017) "Investing in American Energy: Advanced Technology Vehicles Manufacturing Loan Program" *U.S. Department of Energy Loan Programs Office*; https://energy.gov/sites/prod/files/2017/09/f36/ATVM_Program_Overview_2017.pdf.

20 Rogers, C. (2015) "Ford to Spend $4.5 Billion in Electric Vehicle Development: The company aims to bring 13 new electrified vehicles to market by 2020" *Wall Street Journal*, December 11; https://www.wsj.com/articles/ford-to-spend-4-5-billion-in-electric-vehicle-development-1449785859.

21 (2016) "FACT SHEET: Obama Administration Announces Federal and Private Sector Actions to Accelerate Electric Vehicle Adoption in the United States" https://obamawhitehouse.archives.gov/the-press-office/2016/07/21/fact-sheet-obama-administration-announces-federal-and-private-sector.

22 There are additional economic costs that arise when the government allocates scarce capital resources based on political decisions instead of economic realities. These negative impacts occur because politically allocated investments transfer resources from higher-valued uses to lower-valued uses, reducing the efficiency of the economy's capital stock. A less efficient capital stock reduces the economy's growth potential, consequently leading to slower income growth in the economy. From a growth perspective, these additional costs can be quite substantial. However, these impacts are not addressed in this analysis.

23 The 6.9 percent figure is the weighted average cost of capital for U.S. companies excluding the financial sector as calculated by Aswath Damodaran, NYU, Stern School of Business; http://www.stern.nyu.edu/~adamodar/New_Home_Page/data.html.

24 Bureau of Economic Analysis, National Income and Product Accounts, Table 4.9; www.bea.gov.

25 (2012) "Effects of Federal Tax Credits for the Purchase of Electric Vehicles" Congressional Budget Office, September.

26 The average interest rate on a 10-year government bond for August 2017 is from the St. Louis Federal Reserve Bank FRED data system: https://fred.stlouisfed.org/. The total interest and principal payments on $25 billion based on the weighted average cost of capital (6.92 percent) over 20 years sums to $46.2 billion. The total payments based on the 10-year treasury bond rate is $31.0 billion. The difference, $15.3 billion, is used as the estimated cost savings for the electric vehicle industry from the subsidized loan program.

27 The source for the state and local tax incentives is Chargepoint, www.chargpoint.com.

28 (2016) "What is ZEV?" Union of Concerned Scientists, Last Revised October 31; http://www.ucsusa.org/clean-vehicles/california-and-western-states/what-is-zev#.WdKGD2hSyUk.

29 Trefis Team (2017) "Tesla's Lucrative ZEV Credits May Not Be Sustainable" *Forbes.com*, September 1 (emphasis added); https://www.forbes.com/sites/greatspeculations/2017/09/01/teslas-lucrative-zev-credits-may-not-be-sustainable/#7b8945a76ed5.

30 See Table 3.3 of the IRS Statistics of Income (SOI), https://www.irs.gov/statistics/soi-tax-stats-individual-income-tax-return-form-1040-statistics.

31 For a more detailed description of the Residential Energy Efficient Property Credit see: https://www.irs.gov/credits-deductions/individuals/residential-energy-efficient-property-credit-section-25d-at-a-glance.

32 The data on state and local tax incentives is from Chargepoint, www.chargpoint.com, and the National Conference of State Legislatures, http://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx.

About the Author

Wayne H. Winegarden, Ph.D. is a Senior Fellow in Business and Economics, Pacific Research Institute, as well as the Principal of Capitol Economic Advisors and a Contributing Editor for EconoSTATS.

Dr. Winegarden has 20 years of business, economic, and policy experience with an expertise in applying quantitative and macroeconomic analyses to create greater insights on corporate strategy, public policy, and strategic planning. He advises clients on the economic, business, and investment implications from changes in broader macroeconomic trends and government policies. Clients have included Fortune 500 companies, financial organizations, small businesses, state legislative leaders, political candidates and trade associations.

Dr. Winegarden's columns have been published in the *Wall Street Journal, Chicago Tribune, Investor's Business Daily,* Forbes.com, and Townhall.com. He was previously economics faculty at Marymount University, has testified before the U.S. Congress, has been interviewed and quoted in such media as CNN and Bloomberg Radio, and is asked to present his research findings at policy conferences and meetings. Previously, Dr. Winegarden worked as a business economist in Hong Kong and New York City; and a policy economist for policy and trade associations in Washington D.C. Dr. Winegarden received his Ph.D. in Economics from George Mason University.

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