

Just Charge It: Electric Vehicle Incentives¹

This IPRO report examines the state policy and consumer responses to the growing market of electric vehicles.

Definitions:

Alternative Fuel Vehicle (AFV): Uses “alternative” fuels such as biodiesel, denatured alcohol, electricity, hydrogen, methanol, mixtures of up to 85 percent methanol or denatured alcohol, natural gas, or propane. Fuel cell vehicles and hybrid electric vehicles fall under this category. In general, vehicles that achieve a significant reduction in petroleum consumption fall under this category.²

Zero Emission Vehicle (ZEV): Emits no emissions from an on-board source of power, of which an electric vehicle is just one example.³

Electric Vehicle (EV): “propelled by an electric motor (or motors) powered by rechargeable battery packs.”⁴

Hybrid Vehicles: “powered by an internal combustion engine or other propulsion source that can be run on conventional or alternative fuel and an electric motor that uses energy stored in a battery.”⁵

Battery Electric Vehicle (BEV): “[V]ehicles propelled solely by electric motors. The source of power stems from the chemical energy stored in battery packs which can be recharged on the electricity grid.”⁶ A BEV’s energy (i.e. fuel) is stored in an internal electric motor.

Plug-in Hybrid Electric Vehicle (PHEV): “[V]ehicles that can use, independently or not, fuel and electricity, both of them rechargeable from external sources.”⁷ A PHEV is often a BEV supplemented by an internal combustion engine, “to increase the driving range.”⁸

Rebate: A rebate is a return of some part of an original payment for some service or merchandise. In other terms, it is a partial refund.⁹

Tax Credit: “A direct reduction in the amount of income taxes...[owed] by the amount of the credit...[received]” on the purchase of a certain good or service as identified by the IRS or by a local or state government.¹⁰

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² “Alternative Fuel Vehicles (AFVs).” *GSA*. U.S. General Services Administration, n.d. Web. 4 Dec. 2011.

³ “Zero Emission Vehicle.” *Glossary of Air Pollution Terms*. California Air Resources Board, n.d. Web. 4 Dec. 2011.

⁴ “Electric Vehicles.” *Fuelconomy.gov*. U.S. Department of Energy, n.d. Web. 4 Dec. 2011.

⁵ “Hybrid Electric Vehicles Basics.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, n.d. Web. 4 Dec. 2011.

⁶ Nemry, Françoise, Guillaume Leduc, Almudena Muñoz. *Plug-in Hybrid and Battery-Electric Vehicles: State of the Research and Development and Comparative Analysis of Energy and Cost Efficiency*. European Commission: Joint Research Centre-Institute for Prospective Technological Studies. Seville: European Communities, 2009. Web. 4 Dec. 2011.

⁷ Ibid.

⁸ Ibid.

⁹ “Rebate.” *Dictionary.com*. Dictionary.com, LLC, n.d. Web. 4 Dec. 2011.

Overview

As evidence of environmental deterioration becomes more prevalent and concerns about the human impact on such deterioration intensify, consumers and states seeking to reduce their carbon footprints have increasingly turned to electric vehicles (EV) as a form of green transportation. Currently 17 states and the District of Columbia have introduced programs to integrate electric vehicles on to their roads. Five states (Pennsylvania, Massachusetts, New York, Texas, and Connecticut) are considering these programs. The programs and incentives these states offer are among the following:¹¹

- Allowing electric vehicles to use carpool or high occupancy lanes at all times (six states).
- Offering tax credits or cash rebates for the buyer of an EV (15 states).
- Offering a tax credit or rebate for the equipment and installation costs of charging stations (four states).
- Waiving sales tax for the buyers of EVs (two states).

Electric vehicles have increased in production and popularity since the 1960s when they began to appear as alternatives to standard gas-based automobiles.¹² Today, companies as varied as Ford, Hyundai, Audi, Toyota, Mitsubishi, and Volkswagen produce some type of electric vehicle.¹³ In addition, consumers can choose from a variety of EV styles: they can choose a BEV, HEV, or PHEV,¹⁴ and from there they can browse a selection of sedans, pick-up trucks, mini coopers, and even SUVs. Consumers also now have the choice to purchase electric motorbikes, while companies and governments can increasingly turn to electric semis and electric-hybrid buses.¹⁵ For a break down comparison of an electric vehicle versus a gas-powered vehicle, see Figure 1.

Existing Policies

As electric vehicles continue to grow in popularity around the country, many states have taken action to provide more incentives for citizens to purchase an EV. All existing state policies fall into one of the following four categories, and this section aims at exploring each policy program in more detail.

Rebate or Income Tax Benefit

Many state incentives revolving around rebates or tax credits concern the purchasing of EVs or the conversion of a vehicle into an EV. However, each state's rebate and tax credit policies have their own nuances. Some states include a wide variety of EVs into the mix, while others restrict these benefits to specific types of EVs. For example, Georgia provides a tax credit of up to 20 percent of the purchase or lease of a new Zero Emission Vehicle (ZEV), but that percentage drops to 10 percent if the vehicle is an Alternative Fuel Vehicle (AFV). Hybrid electric vehicles are not included

¹⁰ Clark, Ken. "Tax Credit; Definition and Overview of the Term." *About.com*. The New York Times Company, n.d. Web. 4 Dec. 2011.

¹¹ "State and Federal Incentives." *pluginamerica.org*. Plug In America, n.d. Web. 4 Dec. 2011.

¹² "History of Electric Vehicles." *Energy Efficiency and Renewable Energy*. U.S. Department of Energy, n.d. Web. 4 Dec. 2011.

¹³ "Plug-in Vehicle Tracker: What's Coming, When." *pluginamerica.org*. Plug in America, n.d. Web. 4 Dec. 2011.

¹⁴ "Types of Electric Vehicles." *tva.gov*. Tennessee valley Authority, n.d. Web. 4 Dec. 2011.

¹⁵ "Plug-in Vehicle Tracker: What's Coming, When." *pluginamerica.org*. Plug in America, n.d. Web. 4 Dec. 2011.

in the AFV definition; pure electric vehicles are covered under the ZEV definition.¹⁶ Most rebate and tax credit amounts waver between \$1,500 and 6,000.¹⁷

In West Virginia the tax credit can climb to \$7,500 for vehicles less than 26,000 lbs. However, for vehicles that exceed this wait, the tax credit could possibly increase to \$25,000.¹⁸ These numbers increase when infrastructure (e.g. the purchase and instillation of charging stations) is involved. For residential infrastructure, the tax credit can be up to \$10,000, for commercial uses it can be up to \$250,000, and for publicly accessible charging, the number tops out at a possible \$312,500.¹⁹ It is worth nothing that while Tennessee offers a fair amount in terms of a rebate—\$2,500—this rebate is only applicable to the first 1,000 vehicles sold in the state.²⁰

Sales Tax Exemption

New Jersey and Washington have pursued a sale tax exemption policy. Five additional states (Texas, Pennsylvania, New York, Massachusetts and Connecticut) are considering this incentive.²¹ In New Jersey, these exemptions are applicable only to vehicles that qualify as ZEVs, including hybrid electric vehicles.²² In Washington this policy is broader in scope: Battery Electric Vehicles (BEV) benefit from a 6.5 percent sales tax exemption, while Plug-In Hybrid Electric Vehicles (PHEV) are exempt from a motor vehicle sales tax of 0.3 percent. Tax exemptions are also available for charging station parts and labor costs.²³

Carpool Lane Access

Carpool lane access for EVs is an incentive used by six states. Under this policy, EVs are allowed to use the carpool lane regardless of the number of passengers that the vehicles are carrying.²⁴ In California, carpool lane access is restricted to hydrogen, electric, and plug-in hybrid electric vehicles.²⁵ New York and Massachusetts are considering carpool lane access, and Hawaii is also considering adding this incentive to its EV policy agenda, which already includes policies in practice, such as EV purchase and charging station equipment and installation rebates.²⁶

Infrastructure Incentives²⁷

Infrastructure incentives tie in with rebates and tax credits in that this aforementioned policy is applied not to vehicle purchases but instead (or also) to the costs of buying and installing charging stations, whether at home, at a business, or in a public space. Currently, six states incorporate infrastructure into their EV policy, while Pennsylvania is considering this type of incentive. Each

¹⁶ “Georgia Incentives and Laws for Tax Incentives.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 12 Dec. 2011.

¹⁷ “State and Federal Incentives.” *pluginamerica.org*. Plug In America, n.d. Web. 4 Dec. 2011.

¹⁸ “West Virginia: Alternative Fuel Vehicle (AFV) Tax Credit.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 12 Dec. 2011.

¹⁹ *Ibid.*

²⁰ *Ibid.*

²¹ “State and Federal Incentives.” *pluginamerica.org*. Plug In America, n.d. Web. 4 Dec. 2011.

²² “New Jersey: Zero Emissions Vehicle (ZEV) Tax Exemption.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 12 Dec. 2011.

²³ “State and Federal Incentives.” *pluginamerica.org*. Plug In America, n.d. Web. 4 Dec. 2011.

²⁴ *Ibid.*

²⁵ “California: High Occupancy Vehicle (HOV) Lane Exemption.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 12 Dec. 2011.

²⁶ “State and Federal Incentives.” *pluginamerica.org*. Plug In America, n.d. Web. 4 Dec. 2011.

²⁷ *Ibid.*

state has its own tailored policy; most states are concerned mostly with charging station installation, while others include equipment and labor costs as well.

Federal Policy

The American Recovery and Reinvestment Act of 2009 dedicated covers many aspects of energy independence and renewable energy technologies, for plug-in electric vehicles. Section 1141-1144, “modifies the qualified plug-in electric drive motor vehicle tax credit” and “modifies the qualified plug-in electric drive motor vehicle tax credit.”²⁸

State Case Study: California

California’s EV policy incorporates a two-pronged strategy: rebates and carpool lane access. The first part of this strategy was put into place by the Clean Vehicle Rebate Project (CVRP).²⁹ Under the CVRP, a rebate of up to \$2,500 is allowed per light-duty vehicle. The project targets individuals and business owners who want to purchase zero-emission vehicles or PHEVs. In order to fund these rebates, \$11.1 million was appropriated for fiscal year 2009-2011, of which \$8.7 million remains.³⁰ In order to pursue this rebate, ZEV/PHEV owners follow three steps, which require verifying the legibility of the vehicle and submitting various documents (e.g. proof of California residency and proof of vehicle registration) for review. Carpool lanes are formally called High Occupancy Vehicle (HVOs) lanes.³¹ Qualifying AFVs are allowed to use these lanes even if the vehicles are occupied only a single occupant. In order to take advantage of this incentive, owners must first qualify their vehicle as an AFV.³²

California is an exception case in the electric vehicle debate not because it has the “largest” number of incentive programs; instead, it is the widespread use of EVs and the breadth and depth of California’s existing programs that distinguish it from other states. California boasts over 500 electric charging stations; the nearest other states have between 101 and 200.³³ In 2007, California had over 25 percent of all new hybrid registrations in the United States the rest of the “top ten” states had less than six percent of the registrations, respectively.³⁴ When seeking ways to market AFVs—especially EVs—automakers often make it a priority to tap into the environmentally conscious populace of California.³⁵

²⁸ “American Recovery and Reinvestment Act of 2009.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 12 Dec. 2011.

²⁹ “Clean Vehicle Rebate Project.” *energycenter.org* California Center for Sustainable Energy, n.d. Web. 4 Dec. 2011.

³⁰ Ibid.

³¹ “Eligible Vehicles: Single Occupant Carpool Lane Use Stickers.” *CA.gov*. California Environmental Protection Agency: Air Resources Board, 30 Nov. 2011. Web. 4 Dec. 2011.

³² A list of qualifying vehicle models and manufacturers can be found at <http://www.arb.ca.gov/msprog/carpool/carpool.htm#vehicles>.

³³ “Electricity Charging Station Locations.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 4 Dec. 2011.

³⁴ “Top Ten States for new Hybrid Registrations, 2007.” *Energy Efficiency and Renewable Energy*. U.S. Department of Energy, 12 May 2008. Web. 4 Dec. 2011.

³⁵ Doggett, Scott. “California Extends by 4 Years Period That Green-Car Drivers Can Use Carpool Lanes.” *AutoObserver.com*. Edmunds Inc., 7 July 2010. Web. 4 Dec. 2011.

Costs and Benefits to a Consumer of an Electric Vehicle

Costs

Financial

An EV's initial price for purchase can be very expensive (the latest models of the Nissan Leaf cost between \$35,000 and \$37,000).³⁶ Charging station equipment, installation, and labor and maintenance costs can be expensive as well. In addition, the actual battery packs of EVs are expensive, and the cost goes up due to need for one or multiple replacements.³⁷ A lead-acid battery in an EV would need to be replaced every three years at a cost of approximately \$8,000. The alternative battery, lithium-ion, is also very costly, though it increases driving range.³⁸

Logistical

EVs usually have a less expansive driving range than regular combustion engine cars. The EV driving range can be anywhere from 40 to 120 miles per charge. However, the cheaper battery—lead-acid—also results in a lower driving range (less than 100 miles). In order to increase that range, the more expensive lithium-ion battery must be purchased.³⁹ In addition, while gas vehicles can fully refuel in minutes, it can take four to eight hours for a battery pack to be fully recharged, and even an 80 percent recharge can take 30 minutes.⁴⁰ The niche market status of EVs means that public charging stations are not readily available in most areas and even in some states.⁴¹ Finally, EV batteries can be large and heavy, “resulting in less room for cargo or passengers” within the vehicle.⁴²

Benefits

Financial

While EVs are initially expensive, their “fuel” costs are much smaller than gas vehicles. While it can take \$3 (sometimes closer to \$4) per gallon of gasoline, powering a plug-in hybrid electric vehicle can cost “the equivalent of roughly 75 cents per gallon of gasoline.”⁴³ In addition, “[a] 2005 study by the United States Department of Energy’s Pacific Northwest National Laboratory estimated that three-quarters of the country’s current small vehicle fleet could be charged by our existing electrical grid without building new power plants.”⁴⁴ In all, EV owners pay an average \$15 per month electricity cost for their vehicles, compared to \$50 per month for gasoline; in addition, EVs often avoid costly maintenance issues (e.g. oil changes, tune-ups).⁴⁵

³⁶ “Nissan Leaf™: Price Estimator.” *NissanUSA.com*. Nissan USA, n.d. Web. 4 Dec. 2011.

³⁷ “Electric Vehicles.” *Fuelconomy.gov*. U.S. Department of Energy, n.d. Web. 4 Dec. 2011.

³⁸ “Clean Alternative Fuels: Electric Vehicles.” *epa.gov*. United States Environmental Protection Agency, March 2002. Web. 12 Dec. 2011.

³⁹ *Ibid.*

⁴⁰ “Electric Vehicles.” *Fuelconomy.gov*. U.S. Department of Energy, n.d. Web. 4 Dec. 2011.

⁴¹ “Electricity Charging Station Locations.” *Alternative Fuels and Advanced Vehicles Data Center*. U.S. Department of Energy, 15 June 2011. Web. 4 Dec. 2011.

⁴² “Clean Alternative Fuels: Electric Vehicles.” *epa.gov*. United States Environmental Protection Agency, March 2002. Web. 12 Dec. 2011.

⁴³ “Electric Vehicles—How Much Does It Cost Per Charge?” *scientificamerican.com*. Scientific American, Inc., 13 March 2009. Web. 12 Dec. 2011.

⁴⁴ *Ibid.*

⁴⁵ “Clean Alternative Fuels: Electric Vehicles.” *epa.gov*. United States Environmental Protection Agency, March 2002. Web. 12 Dec. 2011.

*Environmental*⁴⁶

If run on the correct power source, EVs can significantly reduce pollution (as compared to gas-guzzling internal combustion engine vehicles). EVs are powered by lithium-ion (Li-ion) batteries. The battery in and of itself is only a moderate environmental burden. Thus, the source of power used to charge the battery influences the car's environmental impact. If electricity is generated exclusively by coal-fired power stations, the amount of pollution from the Li-ion battery increases three-fold. However, if the source is purely hydroelectric, the pollution figure improves by 40 percent in relation to the Li-ion battery.

Data and Analysis

The compiled data from across the web in order to test the relationship between the number of EVs in a state and possible incentives offered.^{47, 48, 49, 50} Our goal was to determine what factors were strongly associated with governments offering incentives for the vehicle or the charging station or even if these policies were put into place based on public demand.

- Overall there was a significant relationship between the number of EVs in a states and incentives offered at the one percent confidence level (see in Table 1).
- At the five percent confidence level, the number of charging stations, the state offering any type of incentive, and especially fiscal incentives were all significant to the number of EVs in each state (shown in Table 1).
- These results also show that the political party in control of the legislature and the political party of governor have no effect on the number of EVs in a state. Therefore, we cannot conclude that the ideological stance of these bodies has any affect on this topic.

Table 1
Regression for the Number of Electric Vehicles in a State

Independent Variable	Coefficient	P>t
Number of Charging Stations	1.04 (0.4869)	0.038**
Democratic Legislature?	0.159 (0.2689)	0.556
Democratic Governor?	0.251 (0.3665)	0.497
Incentive Offered	1.45 (0.5046)	0.006***
Average Gas Price	0.453 (1.025)	0.66
Fiscal Incentive	-0.992 (0.5704)	0.089*

Probability > F = 0.006***

R-squared = 0.33

Adjusted R-squared = 0.239

⁴⁶ Quick, Darren. "Just How Environmentally Friendly are Electric Vehicles?" gizmag.com. Gizmag, 31 August 2010. Web. 4 Dec. 2011.

⁴⁷ "Estimated Number of Electric Vehicles in Use, by State and User Group" eia.gov. U.S. Energy Information Administration. April 2010. Web. Dec 2011

⁴⁸ "Electric Charging Station Locations." www.afdc.energy.gov. Department of Energy, 15 June 2011. Web. Dec. 2011

⁴⁹ "State Governors." netstate.com. NetState.com. 21 September 2011. Web. Dec 2011.

⁵⁰ "State and Federal Incentives." pluinamerica.org. Plug In America, n.d. Web. 4 Dec. 2011.

Standard Error in parenthesis

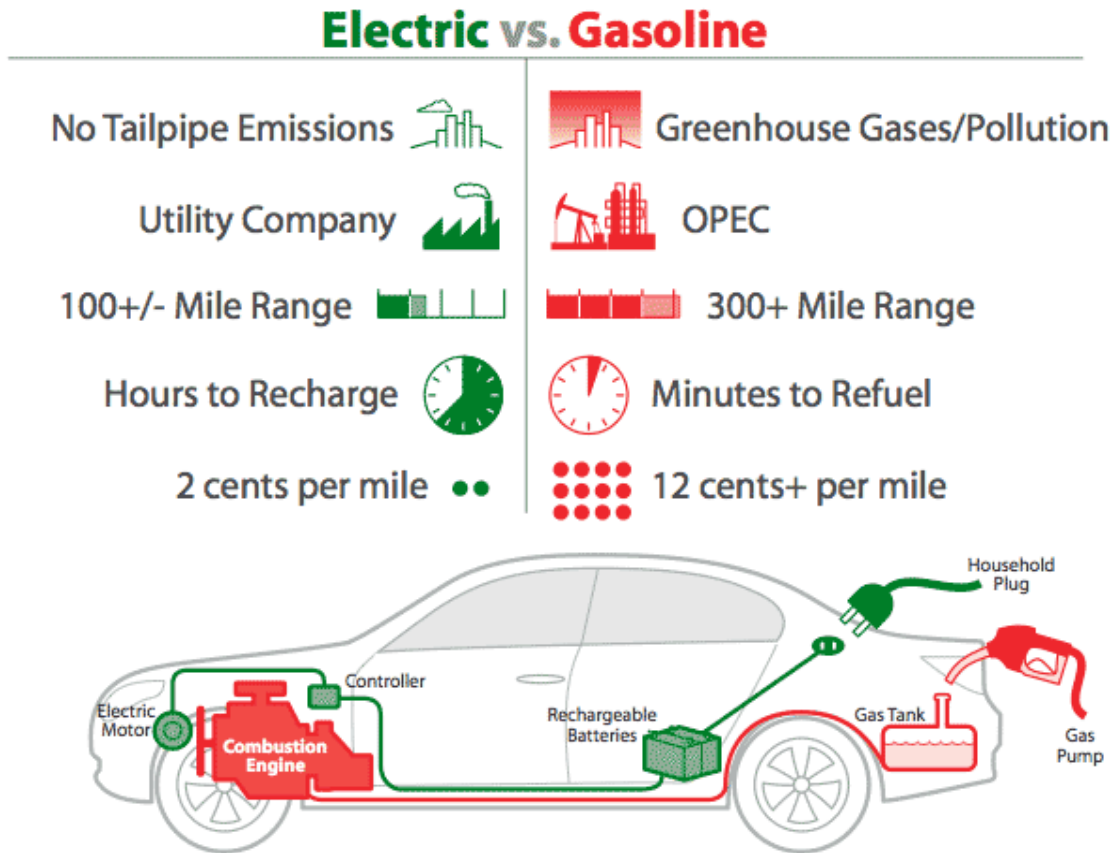
Significance Levels:

*=0.10

**=0.05

***=0.01

Figure 1⁵¹



This report was prepared in December 2011 by the Iowa Policy Research Organization (IPRO), a non-partisan public policy undergraduate group at the University of Iowa. For additional research on this or other issues, please visit our website at <http://www.uiowa.edu/~ipro/> or contact rene-rocha@uiowa.edu.

⁵¹ "Electric Cars: A Definitive Guide." *hybridcars.com*. HybridCars.com, n.d. Web. 4 Dec 2011.