

EQUINOX CENTER

HEALTHY ENVIRONMENT STRONG ECONOMY VIBRANT COMMUNITIES



Background Report on Electric Vehicles

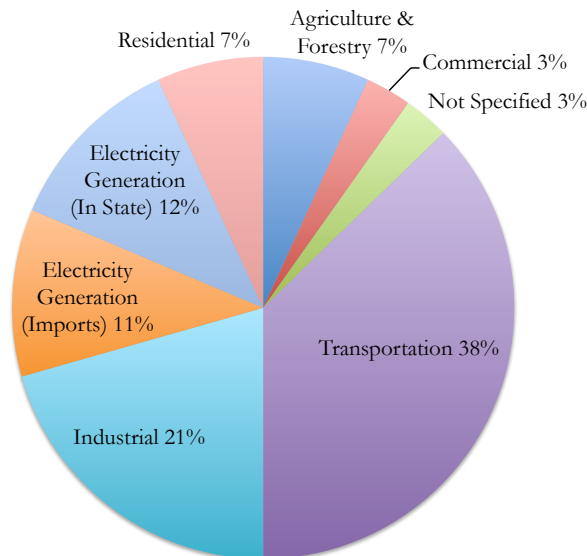
January 2014

Executive Summary

Electric vehicles (EV) could bring economic and environmental benefits, such as increased job growth and reductions in greenhouse gas (GHG) emissions, to communities across the country, including San Diego, according to a new Equinox Center analysis. EVs reduce transportation fuel costs through more efficient vehicle technology, freeing up cash many owners would spend on other goods and services, which would create more jobs according to Dr. David Roland-Holst of U.C. Berkeley. Further analysis of job losses in the traditional auto sector would need to be done to gain a more comprehensive understanding of net job gains from increased EV sales.

In addition to job growth, electric vehicles would reduce emissions from transportation. According to the California Air Resources Board, 38 percent of California’s GHG emissions came from transportation in 2010. For San Diego County, transportation contributed 43 percent to the County’s total GHG emissions.

Figure 1: 2010 California GHG Emissions by Sector



Source: California Air Resources Board, 2013

Studies compiled by Electrification Coalition and PricewaterhouseCoopers show electric vehicles generate 27 to 52 percent less GHG emissions than internal combustion engines. Further, the State of California has established statutory targets for reducing GHG emissions that must be met statewide through Assembly Bill (AB) 32. As such, Governor Brown, in Executive Order B-16-2012, stated:

“California should encourage the development and success of zero-emission vehicles to protect the environment, stimulate economic growth and improve the quality of life in the State.”

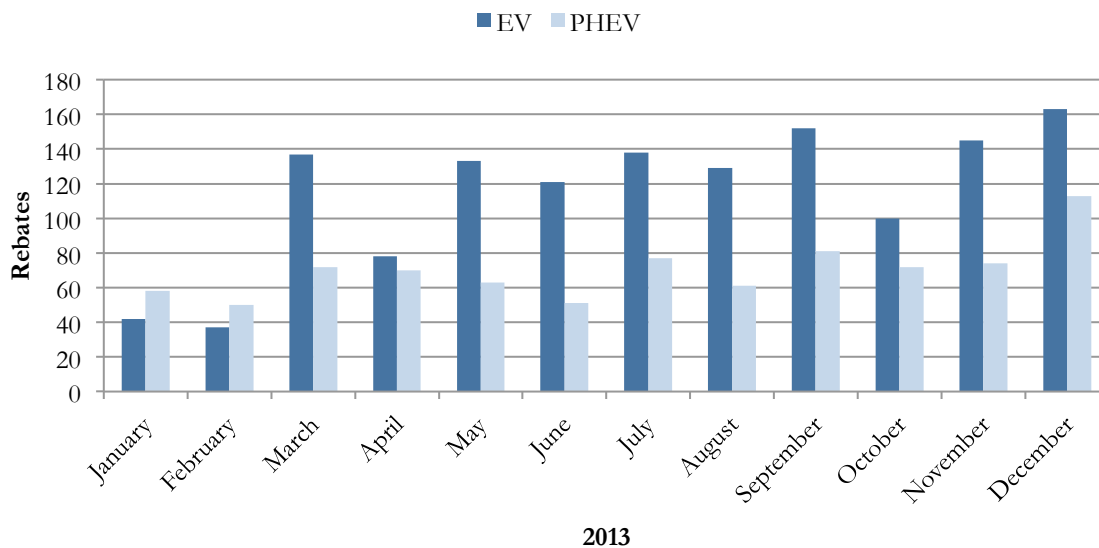
Background on Electric Vehicles

There has been significant governmental support for electric vehicles at the federal and state level, both in providing loans to manufacture EV components and in providing EV purchasers with tax, rebate and other incentives. Through the 2009 American Recovery and Reinvestment Act, \$2.4 billion in loans were issued to the first U.S. electric vehicle factories, according to the U.S. Department of Energy. An additional \$2 billion in grants were issued to support 30 factories that produce EV parts. President Obama, in his 2011 State of the Union address, set a goal of putting 1 million electric vehicles on the road by 2015.

California's EV Market

California is at the forefront of the electric vehicle market. As of October 2012, California drivers bought approximately one-quarter of all EVs sold in the United States. The San Diego region is home to approximately 20 percent of EVs owned in California, as well as car2go, the nation's largest all-electric car-sharing program, according to the California Center for Sustainable Energy (CCSE).

Figure 12: CVRP Rebates, San Diego County 2013



Source: CCSE CVRP Data, 2013

Financial Incentives

To stimulate consumer behavior and build the necessary momentum for the EV industry to thrive, both the federal and California state government, along with San Diego Gas & Electric Co. (SDG&E), have created rebates and incentives to support EV purchases. The Recovery Act established a federal income tax credit of up to \$7,500 for purchasers of electric vehicles. In California, consumers are eligible to receive an additional \$2,500 rebate through the Clean Vehicle Rebate Project. SDG&E also provides a super off-peak discount rate at 16 cents per kilowatt-hour (compared to 29 cents during peak times) for charging electric vehicles. This

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makes EVs like the Nissan Leaf S competitively priced with the Toyota Camry, Hyundai Sonata and Honda Accord.

Challenges

Electric vehicles rely on a charging infrastructure that remains underdeveloped and limited, leading to consumer anxiety over driving range. Within San Diego County, EV charging accessibility has been hindered by a lack of zoning and parking ordinance coordination for installing electric vehicle service equipment. According to a CCSE survey provided to 16 jurisdictions, only the City of San Diego stated it had adopted infrastructure requirements that meet best practices. This, combined with an electric vehicle's initial up-front cost, explains why consumers have been slow to purchase electric vehicles. Further analysis would help determine which hurdle – establishing more charging stations, increasing support for research and development to improve EV technology and lower manufacturing costs, or providing additional tax and rebate incentives for EV purchases – carries the most weight for consumers, which would help policymakers determine how best to allocate resources to increase EV sales.

The EV market has thrived due to generous governmental funding and support for EV purchases and infrastructure. Given the U.S. government's fiscal constraints and political pressure to generate quick results, there is concern that governmental funding for electric vehicles – a necessary long-term investment – could end before the EV market is able to sustain itself. Despite this concern, private entities are successfully exploring options that could allow the EV market to become more profitable and self-sustaining. Tesla Motors is building out its own network of supercharging stations around the country, and ChargePoint has demonstrated an ability to also build a large EV charging network through crowdfunding and financing by others, according to a recent Forbes article tracking the company's success.

Conclusion

Federal and state governments have provided financial incentives to stimulate consumer behavior and support electric vehicle adoption. At the local level, SDG&E provides a further incentive through its discounted off-peak charging rates. These incentives help offset the initial up-front cost of an EV, which remains one of several challenges to greater EV adoption. This, in addition to limited EV charging infrastructure and public awareness, as well as a lack of regional policy plans for EV zoning and parking, must be addressed for the EV market to grow and for municipalities to effectively achieve reductions in GHG emissions from transportation.

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Introduction

Over the past few years, electric vehicles (EVs) have received significant governmental support for their potential economic and environmental benefits, such as increased job growth and reductions in greenhouse gas (GHG) emissions. The public sector has supported the EV market through loans to EV component manufacturers and through consumer tax, rebate and other incentives to encourage EV purchases. Challenges remain however to the widespread adoption of electric vehicles, such as the relatively high up-front cost of EVs, limited EV charging infrastructure, public awareness and acceptance of EVs, and regional policy coordination for public charging stations. In addition to highlighting these challenges, this Equinox Center report seeks to inform the public on: (1) the current state of EVs; (2) state-mandated targets and policies for GHG emissions; (3) government-sponsored financial incentives for EVs; (4) current EV market trends; and (5) the *potential* gains from increased EV adoption.

Background on Electric Vehicles

Both at the national and state level, EVs¹ are gaining popularity as a tool for reducing GHG emissions within transportation. Federal and state governments are also promoting the EV market as an opportunity to increase jobs and to enhance national security by reducing foreign oil imports. Since the global recession of 2009, there has been renewed interest in creating lighter, more fuel-efficient vehicles, especially after the government bailout of the auto industry, which had lost its competitiveness to foreign auto manufacturers.

Electric vehicles are one vehicle type that has regained interest and received significant governmental support. In June 2009, the U.S. Department of Energy (DOE) issued a \$465 million loan to Tesla Motors. The DOE also lent money to support Nissan's U.S.-based manufacturing of electric vehicles.² This lending program to develop more fuel-efficient vehicles, which dates to the Bush Administration, has continued under President Obama. In his 2011 State of the Union address, President Obama set a goal of putting 1 million electric vehicles on the road by 2015.³

The president has sought to advance the electric vehicle market nationally through investments in EV manufacturing and EV charging infrastructure. Through the 2009 American Recovery and Reinvestment Act, \$2.4 billion in loans were issued to the first U.S. electric vehicle factories, located in Tennessee, Delaware and California.⁴ An additional \$2 billion in grants were made to support 30 factories that produce EV components, such as batteries and motors. These grants, which companies have been matching dollar for dollar, will allow for the production of 500,000 EV batteries annually by December 2014.⁵

¹ Electric vehicles also may be referred to as plug-in electric vehicles (PEV) or battery-electric vehicles (BEV). These terms, as well as zero-emissions vehicles, are used interchangeably and differ from hybrid, or plug-in hybrid electric vehicles (PHEVs), which are part electric and part gasoline-powered.

² The Energy Collective. "[Tesla's Early Loan Repayment Earns Praise From Energy Department.](#)" May 24, 2013.

³ US Department of Energy. "[One Million Electric Vehicles By 2015.](#)" February 2011.

⁴ Ibid.

⁵ Ibid.

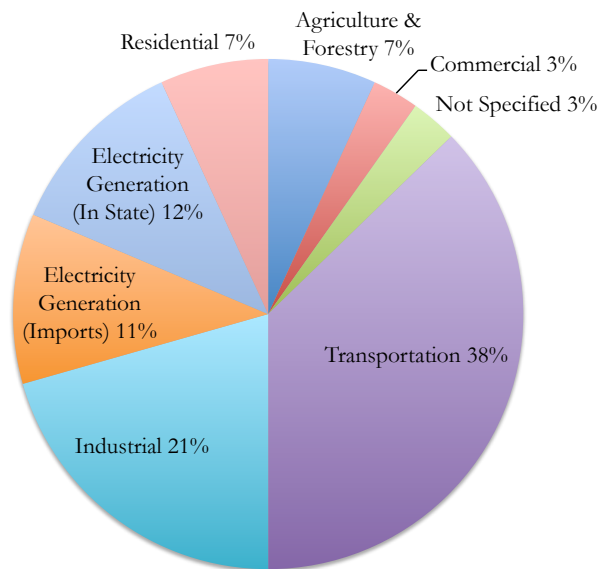
California State Targets

Reduce Greenhouse Gas Emissions

In recognizing the impact of climate change on increased droughts, wildfires and reductions to our shoreline, California has passed important environmental legislation, specifically Assembly Bill 32, to reduce GHG emissions. AB 32 established a cap-and-trade program, and created statutory targets for reducing statewide GHG emissions.⁶ This was preceded by Executive Order S-3-05 in 2005, which requires the State of California to reduce GHG emissions “equaling 80 percent less than 1990 levels” by 2050.⁷ In San Diego, nearly all municipalities have completed a baseline inventory for GHG emissions. As for setting GHG reduction targets, Chula Vista, Encinitas, National City, San Diego and San Diego County already have done so, with Escondido and Del Mar in progress.

In Executive Order B-16-2012, Governor Brown further echoed this requirement by specifying reductions in GHG emissions from the transportation sector.⁸ This order is supported by data from the California Air Resources Board, which identified transportation as the biggest contributor to California’s GHG emissions at 38 percent in 2010 (see Figure 1).⁹ In 2010 for San Diego County, transportation accounted for 43 percent of GHG emissions (see Figure 2).¹⁰ Given that transportation is the biggest contributor to GHG emissions at both the state and county level, reducing auto emissions would make significant progress toward reaching state-mandated targets for GHG emissions.

Figure 1: 2010 California GHG Emissions by Sector



⁶ California Air Resources Board. “[Assembly Bill 32: Global Warming Solutions.](#)”

⁷ California Department of Transportation. “[Executive Order S-3-05.](#)” June 2005.

⁸ Office of Governor Edmund G. Brown Jr. “[Executive Order B-16-2012.](#)” March 23, 2012.

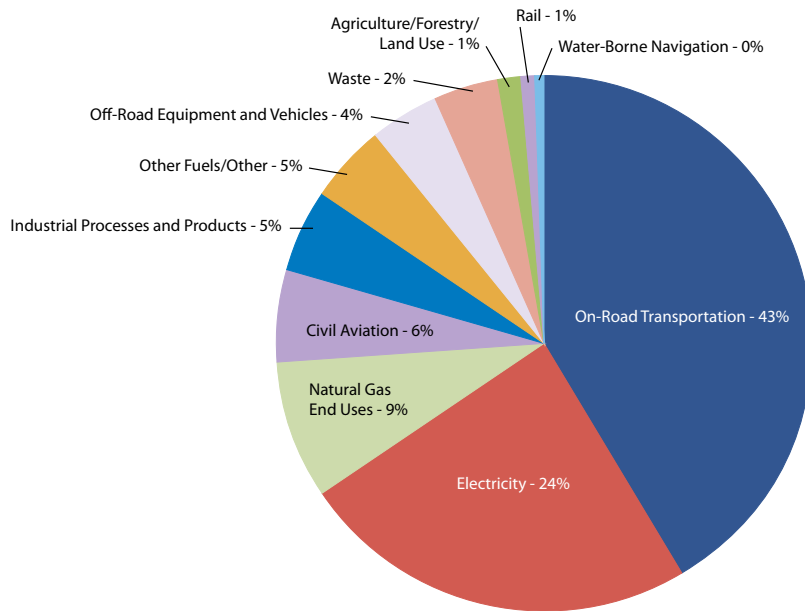
⁹ California Air Resources Board. “[Greenhouse Gas Inventory Data.](#)” March 21, 2013.

¹⁰ Energy Policy Initiatives Center, University of San Diego. “An Analysis of Regional Emissions and Strategies to Achieve AB 32 Targets Revised and Updated to 2010.” March 2013.

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Figure 2: 2010 San Diego County GHG Emissions by Sector



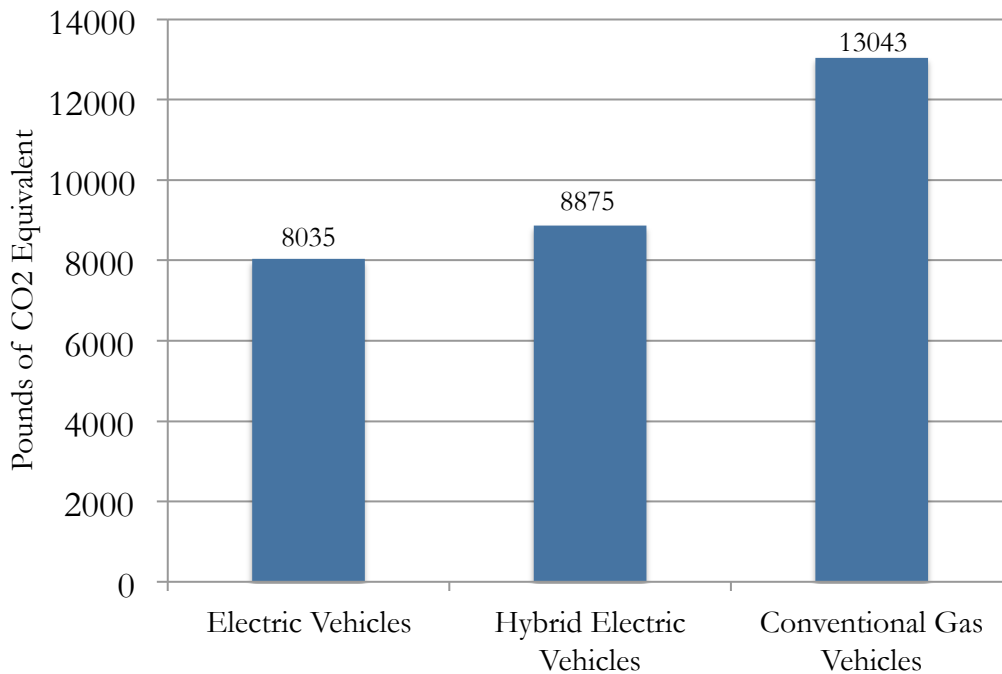
Source: Energy Policy Initiatives Center, 2013 San Diego County Updated GHG Inventory

As such, **one viable solution for significantly reducing GHG emissions from transportation would be to promote greater adoption of electric vehicles.** Studies compiled by the Electrification Coalition and Price Waterhouse Coopers have found that electric vehicles create 27 to 52 percent lower GHG emissions overall than internal combustion engines based on an average grid mix.¹¹ To be sure, the national average in pounds of CO₂ emitted per year in the U.S. by EVs and conventional gas vehicles are approximately 8,035 and 13,043 pounds (Figure 3 on the next page), a difference of 40 percent.¹²

¹¹ Electrification Coalition and PwC. “[State of the Plug-in Electric Vehicle Market.](#)” July 25, 2013.

¹² US Department of Energy. “[Emissions From Hybrid and Plug-In Electric Vehicles.](#)”

Figure 3: Annual Emissions per Vehicle (National Averages)



Source: U.S. Department of Energy, Alternative Fuels Data Center

Increase Adoption of Zero-Emission Vehicles

In March 2012, Governor Brown issued Executive Order B-16-2012, stating:

“California should encourage the development and success of zero-emission vehicles to protect the environment, stimulate economic growth and improve the quality of life in the State.”¹³

The executive order outlines benchmarks for the State of California, which includes placing more than 1.5 million zero-emission vehicles on California roads and displacing 1.5 billion gallons of petroleum fuels by 2025. According to Governor Brown, this will be achieved through state support for zero-emission vehicle infrastructure and integration of EV charging into the state electric grid. Further, research and development (R&D) and component manufacturing for zero-emission vehicles will be expanded in California.¹⁴

Governor Brown extended some of these policy measures on Sept. 28, 2013 by signing a series of clean transportation bills.¹⁵ This included, among other measures, extending the Clean Vehicle Rebate Project (CVRP) program by providing \$30 million in additional funding, and extending to 2024 programs aimed at reducing auto emissions. Governor Brown also introduced new policy by creating the Electric Vehicle

¹³ Office of Governor Edmund G. Brown Jr. “[Executive Order B-16-2012](#).” March 23, 2012.

¹⁴ Ibid.

¹⁵ Office of Governor Edmund G. Brown Jr. “[Governor Brown Signs Electric Vehicle Legislation](#).” September 28, 2013.

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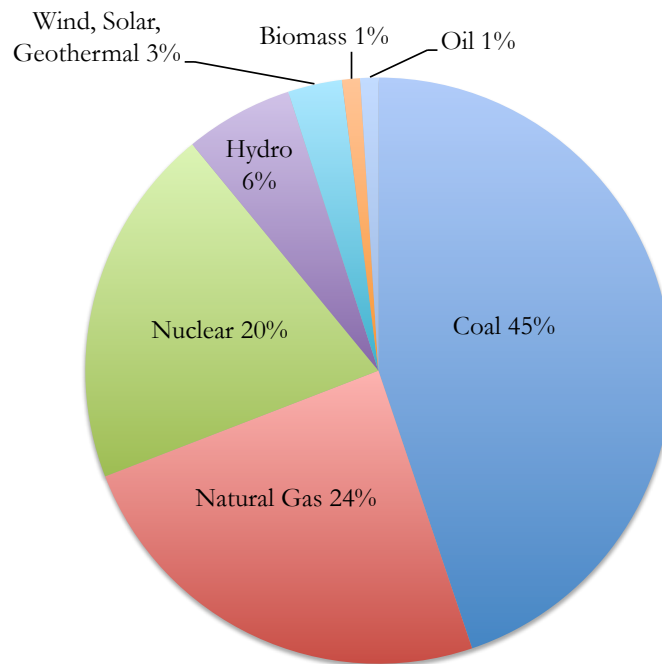
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Charging Stations Open Access Act, which requires that standards be developed to equip multi-family housing units with EV charging infrastructure.

GHG Emissions & Electricity Generation – An Issue for California?

Although changing to electric vehicles would greatly reduce GHG emissions from transportation, generating electricity in the U.S. still creates GHG emissions. In 2011, electricity generation created 33 percent of total GHG emissions – greater than transportation at 28 percent – with more than 70 percent of electricity coming from burning fossil fuels.¹⁶

Figure 4: 2010 US Electricity Grid Mix



Source: Union of Concerned Scientists, 2012 State of Charge Report

Some states, such as Indiana, Ohio, North Dakota and Wyoming, still burn coal to generate more than half of their electricity.¹⁷ As a result, electric vehicles could still create significant GHG emissions “upstream” depending on *where* and *when* they are being charged. California’s use of cleaner power would actually allow for significant overall reductions in GHG emissions through increased EV ridership. Although coal accounted for 7.5 percent of total electricity in California for 2012, natural gas generated 43.4 percent of electricity.¹⁸ For San Diego County, more than 50 percent of energy consumed in 2009 came from natural gas.¹⁹ Though

¹⁶ US Environmental Protection Agency. “[Sources of Greenhouse Gas Emissions.](#)”

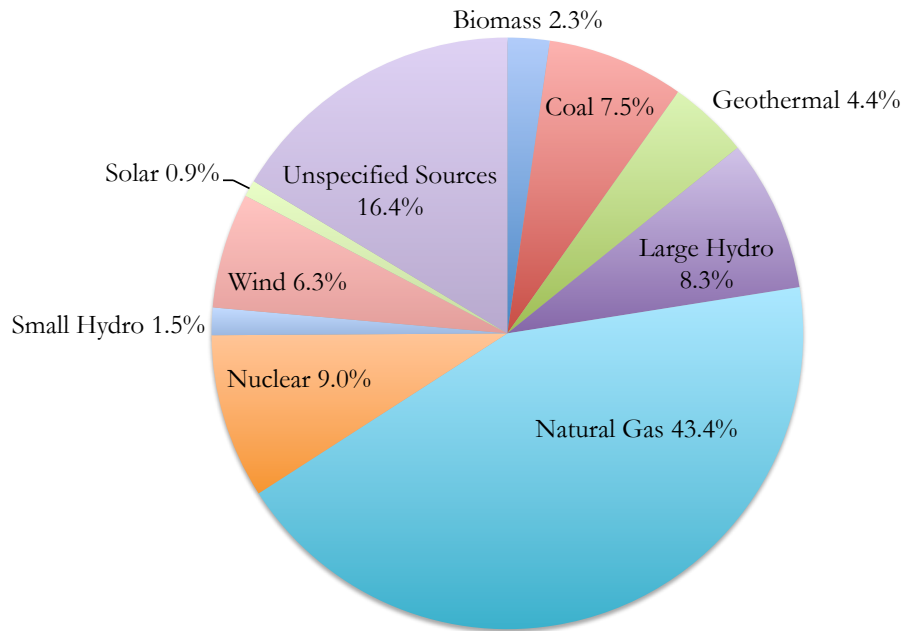
¹⁷ US Department of Energy. “[Greenhouse Gas Emissions for Electric Vehicles.](#)”

¹⁸ California Energy Almanac. “[Total System Power For 2012.](#)”

¹⁹ Equinox Center. “[San Diego Energy-Regional Overview.](#)”

natural gas is a cleaner fuel source than coal, it still has the potential to leak methane – a greenhouse gas – during production and involves fracking, a controversial extraction technique.²⁰

Figure 5: 2012 California Total Electricity System Power



Source: California Energy Almanac 2012

According to the Union of Concerned Scientists’ 2012 State of Charge report, which analyzed the upstream impact of electric vehicles on GHG emissions in the U.S., California was rated as one of the best locations for electric vehicles to have the biggest impact on reducing overall GHG emissions.²¹ This is supported by the fact that only 12 percent of California’s GHG emissions in 2010 came from in-state electricity generation (Figure 1).

Job Growth

In addition to providing reductions in GHG emissions, electric vehicles could potentially create more jobs through EV manufacturing and fuel cost savings. Although both areas are covered to some extent in the following section, this report seeks to only highlight some of the potential economic gains from increased EV adoption. Further analysis accounting for job losses in the traditional auto sector would need to be done to gain a more comprehensive understanding of net job gains from increased EV adoption. The net employment effects of investing in electric vehicles also must be considered relative to the next best use of the same level of investment, both of which are beyond the scope of this background report.

²⁰ NPR. “[Natural Gas May Be Easier On Climate Than Coal, Despite Methane Leaks.](#)” September 16, 2013.

²¹ Union of Concerned Scientists. “[2012 State of Charge Report.](#)” 2012.

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EV Parts Manufacturing

The increased manufacturing of EV parts to meet greater demand for EVs would require both investments in equipment and technology and would require more skilled labor. In 2010, Ford announced that it would invest \$450 million in battery vehicles on top of the \$550 million it previously invested. According to Ford, this investment would create as many as 1,000 new jobs in Michigan and involve bringing lithium-ion battery production back to Michigan from Mexico.²²

General Motors announced in 2011 that it also would invest \$325 million to support EV components production at its Warren, Michigan plant.²³ This investment, supported by the United Auto Workers union – which represents workers in the auto and heavy truck industry²⁴ – would add or retain approximately 418 jobs. According to UAW Vice President Joe Ashton, “these good paying, middle class jobs are very important for the State of Michigan and the Metro Detroit area.”²⁵ GM, however, did not disclose the exact number of net jobs that would result from this investment. Further, it remains to be seen how many jobs would be lost in the traditional auto sector, given that electric vehicles have fewer moving parts and might require less servicing (i.e. oil changes, timing belt replacements, etc.) than a traditional combustion engine vehicle.

Fuel Cost Savings

By reducing transportation fuel costs through more efficient vehicle technology, EVs could allow households to spend more on other consumer goods and services.²⁶ According to Dr. David Roland-Holst, an economics professor at UC Berkeley, expenditures on new vehicle technology and consumer goods create more jobs per dollar than the fossil fuel supply chain. This is based on each sector’s job intensity, with oil and gas being the lowest in California.

Figure 6: Index of Job Intensity by Sector

Sector	Job Index
Agriculture	20
Construction	42
Oil & Gas	1
Vehicle Manufacturing	5
Vehicles Sales & Service	19
Wholesale & Retail Trade	29
Other Service	34

Source: California Employment Development Department Dataset

²² The Detroit Bureau. “[Ford Investing Another \\$450 Million in Battery Vehicles.](#)” January 2010.

²³ General Motors. “[GM to Invest \\$325 Million in Electric Vehicle Parts Manufacturing.](#)” 2011.

²⁴ UAW. “[United Auto Workers Union.](#)”

²⁵ Ibid.

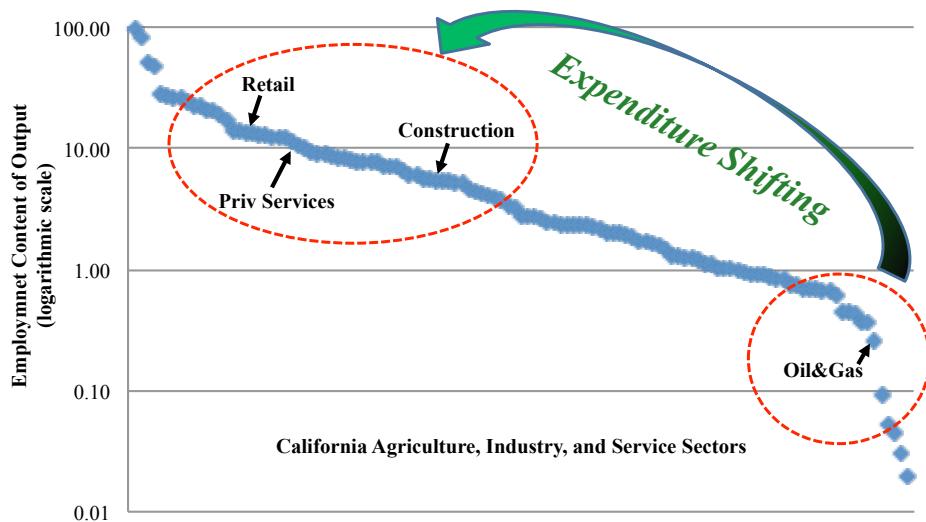
²⁶ David Roland-Holst. “[Plug-in Electric Vehicle Deployment in California.](#)” September 2012.

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Figure 6, taken from Dr. Roland-Holst’s report, measures the number of jobs per million dollars of revenue and is indexed to the job intensity of California’s petroleum sector. According to the report, “a dollar that goes to increasing California household spending is 16 times as job-intensive as the same dollar going to the fossil fuel supply chain.”²⁷ This expenditure shift from oil and gas to other consumer goods/services is further illustrated in Figure 7, which shows economic activity divided into 124 different sectors, with the lowest to highest job intensity from right to left.

Figure 7: Expenditure Shifting



Source: Dr. Roland-Holst, California Employment Development Department Dataset

These new expenditures would have strong “multiplier” effects on gross state product (GSP) and create more jobs.²⁸ Utilizing the Berkeley Energy and Resources (BEAR) model, a statewide economic forecasting model, Dr. Roland-Holst predicts that increasing EV market share – which is currently about 4 percent²⁹ – to 15 percent by 2025 could increase GSP by \$5 billion and create close to 50,000 net jobs by 2030.³⁰ These figures could rise significantly, to almost 100,000 net jobs and \$7 billion in GSP, if electric vehicles could achieve 45 percent market share by 2030.

²⁷ Ibid.

²⁸ Ibid.

²⁹ Electric Drive Transportation Association. “[Electric Drive Sales](#).” 2013.

³⁰ David Roland-Holst. “[Plug-in Electric Vehicle Deployment in California](#).” September 2012.

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Figure 8: Employment Effects by Sector (in Thousands)

Sector	PEV 15%	PEV 45%
Agriculture	0	0
Other Primary	0	0
Oil and Gas	-2	-6
Electric Gen and Dist	1	3
Natural Gas Dist	0	0
Other Utilities	0	0
Processed Food	0	0
Construction - Residential	1	2
Construction – NonRes	2	5
Light Industry	3	6
Heavy Industry	1	3
Machinery	0	0
Technology	2	4
Electronic Appliances	0	0
Automobiles and Parts	1	2
Trucks and Parts	0	0
Other Vehicles	0	1
Wholesale, Retail Trade	15	30
Transport Services	2	4
Other Services	23	45
New Employment	51	104
Total Net Jobs	49	98

Source: David Roland-Holst

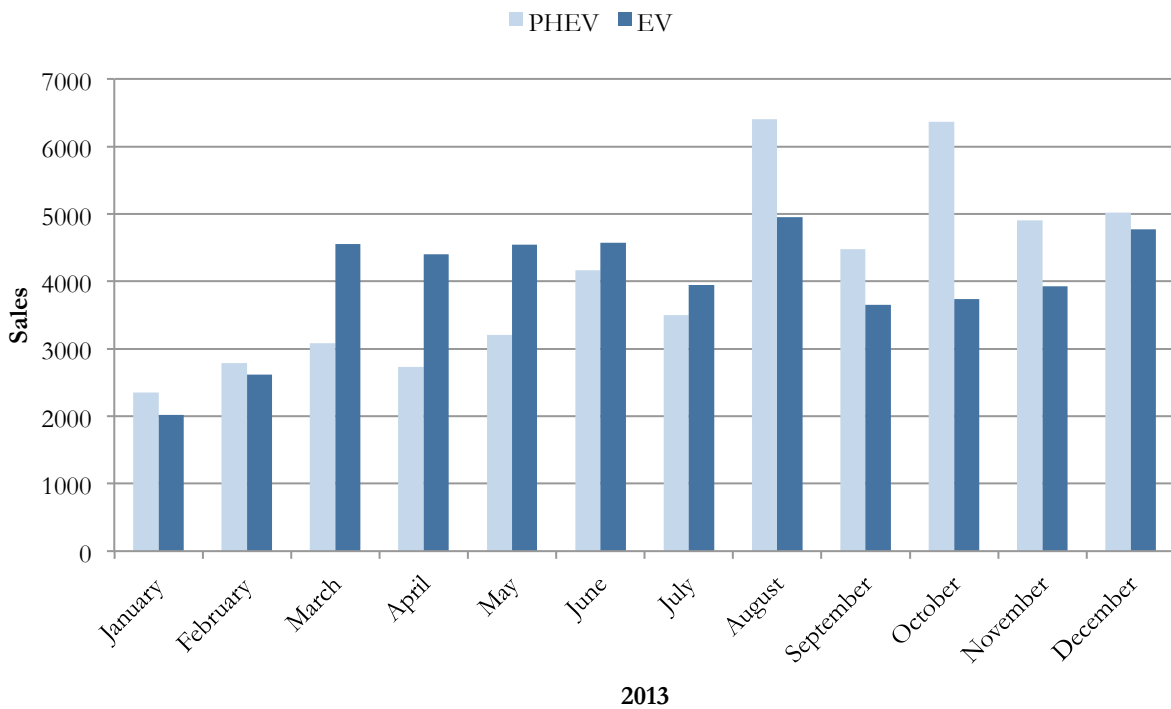
However, as with all models, this is a forecast and cannot account for individual decision-making and heterogeneous spending habits, which impact the overall changes in employment resulting from increased fuel savings. This model also holds the price of gasoline constant at \$4 per gallon,³¹ despite inevitable changes in consumer demand for gas and electricity as a result of switching to electric-powered vehicles, which would impact prices and overall fuel savings. As such, these conclusions for job growth should be accepted with caution and viewed as potential economic gains from greater EV adoption.

³¹ For other fuels, the model follows EIA forecasts. The model also assumes state and federal incentive programs will be retired linearly by 2020. The spillover effects from fuel cost savings are not discounted into the future, but rather are assessed when realized, in constant (2010) dollars.

Current EV Market

EVs currently comprise a small share of the auto market, but are poised to expand domestically, setting the U.S. on pace to become the largest EV market in the world by 2020.³² According to Navigant Research – a market research firm providing analysis on global clean tech markets – electric vehicles should continue to grow in popularity due to rising gasoline prices, leading to forecasted sales of 1.8 million vehicles annually in the largest 102 U.S. cities by 2020.³³ Nationally, EVs surpassed plug-in hybrid electric vehicle (PHEV)³⁴ sales for five consecutive months in 2013, from March to July (see Figure 9). The combined total sales for August, the best month in 2013 for PHEV and EV sales, were 11,363.³⁵

Figure 9: 2013 National PHEV & BEV Sales



Source: Electric Drive Transportation Association, 2013

California in particular is at the forefront in adopting electric vehicles. As of October 2012, California drivers bought approximately one-quarter of all EVs sold in the United States. The San Diego region makes up more than 20 percent of EVs owned in California and hosts car2go, the nation’s largest all-electric car-sharing

³² New York Daily News. “[US Set to Become Largest EV Market By 2020.](#)” January 22, 2013.

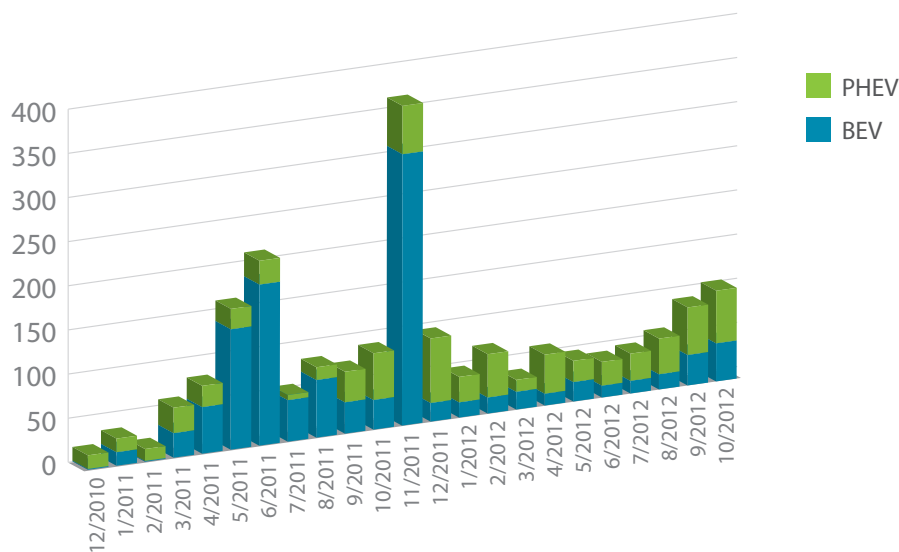
³³ Ibid.

³⁴ Plug-in hybrids such as the Chevy Volt have both an electric motor and an internal combustion engine, which can be used when the car’s electric battery is depleted.

³⁵ Electric Drive Transportation Association. “[Electric Drive Sales.](#)” 2013.

program.³⁶ According to ChargePoint, the largest electric vehicle network in the U.S., San Diego was ranked No. 3 in the top 10 metropolitan areas for EVs.³⁷ This and other cities' rank are highly correlated with investments in EV infrastructure, according to ChargePoint.³⁸ As illustrated in Figure 11, the launch of car2go in San Diego in November 2011 led to a sharp increase in EV sales that month, which are also referred to as battery-electric vehicles (BEV). The car2go car-sharing program was also launched in Chula Vista in July 2013.³⁹

Figure 10: San Diego EV Adoption by Month, 2010-2012



Source: California Center for Sustainable Energy, 2013 San Diego Regional PEV Readiness Plan

Financial Incentives

Government support has been crucial for stimulating greater electric vehicle adoption. Given the relatively high up-front cost of electric vehicles and limited EV charging infrastructure, consumers remain cautious in adopting EVs. For one, EV manufacturing is still done on a relatively small scale. Second, EV component parts, specifically lithium-ion batteries, are technologically new and therefore still expensive to produce.⁴⁰ These two aspects make the up-front cost of EVs high. The public sector has attempted to absorb some of this cost to consumers by providing EV rebates and tax incentives, which remains critical as electric vehicle producers seek to drive down the cost of EVs and make them more cost-competitive.

Currently, EV purchasing decisions are greatly driven by their perceived environmental benefits. According to Figure 12 (on the next page), collected and created by the California Center for Sustainable Energy (CCSE), consumers rated environmental benefits the highest at 94 percent in combined extreme and somewhat

³⁶ California Center for Sustainable Energy. "San Diego Regional Plug-in Vehicle Readiness Plan: Phase One Regional PEV Assessment."

³⁷ Jesse Berst, Smart Grid News. "[Top 10 US Hotspots for Electric Vehicles.](#)" January 7, 2014.

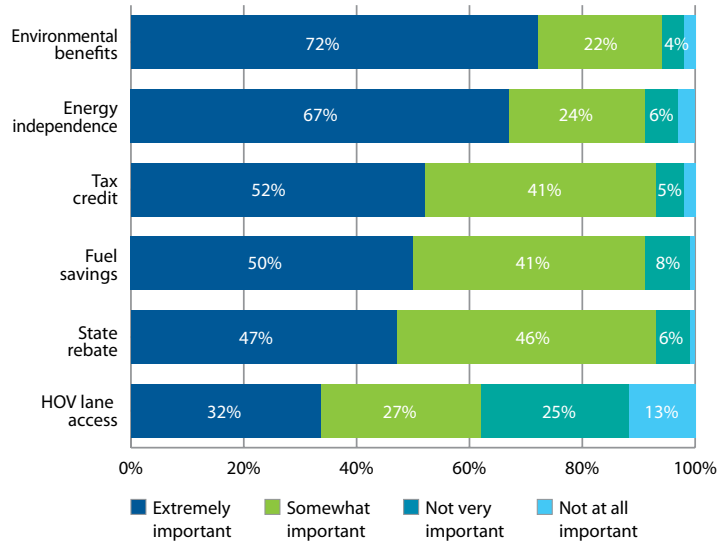
³⁸ Ibid.

³⁹ U-T San Diego. "[Car2go Revs up in Chula Vista.](#)" July 8, 2013.

⁴⁰ NPR. "[Making The Shift To Electric Vehicles.](#)" 2012.

important categories. Tax credits and fuel savings ranked second overall at 93 percent when combining the two categories.

Figure 11: Importance of Motivations on Vehicle Purchasing Decisions



Source: California Center for Sustainable Energy, 2013 California PEV Driver Survey Results

Federal

The Recovery Act established a federal income tax credit of up to \$7,500 for purchasers of electric vehicles.⁴¹ Close to 40 U.S. states also have adopted other measures to promote EV usage, such as waived emissions inspections, high occupancy vehicle (HOV) privileges,⁴² additional tax rebates and preferred purchase programs.⁴³ Further, the Department of Energy is working to provide seed funding on a competitive basis to help communities across the country with EV infrastructure investments and fleet conversions, partnerships with major employers/retailers, and with EV workforce training.⁴⁴

State of California

In addition to the federal tax credit, consumers who purchase or lease an EV in California are eligible to receive up to \$2,500 in rebate money through the Clean Vehicle Rebate Project (CVRP). Some hybrid vehicles however may only qualify for a \$1,500 rebate, depending on the battery size. CVRP is funded by the California Air Resources Board and is administered statewide by CCSE.⁴⁵ As of Sept. 28, 2013, Governor Brown extended this funding by signing Senate Bill 359, which will provide an additional \$30 million.⁴⁶

⁴¹ US Department of Energy. "[Federal Tax Credits for Electric Vehicles.](#)"

⁴² Assembly Committee on Transportation. "[High Occupancy Vehicles: Bill Analysis.](#)" April 27, 2009.

⁴³ US Department of Energy. "[One Million Electric Vehicles By 2015.](#)" February 2011.

⁴⁴ Ibid.

⁴⁵ California Center for Sustainable Energy. "[Clean Vehicle Rebate Project FAQ.](#)"

⁴⁶ Office of Governor Edmund G. Brown Jr. "[Governor Brown Signs Electric Vehicle Legislation.](#)" September 28, 2013.

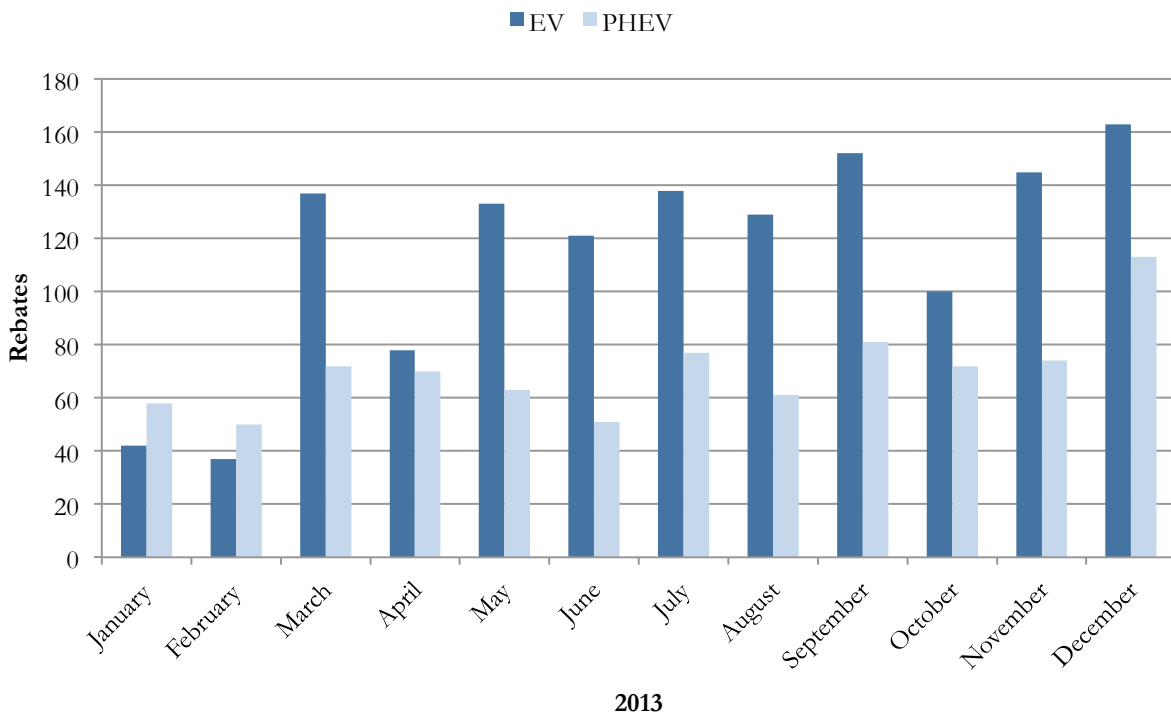
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Within the past four years, the CVRP rebate program has supported the purchase of more than 20,000 electric vehicles in California. With this rebate, a 2013 Nissan Leaf S costs closer to \$26,300.⁴⁷ After saving an additional \$7,500 in federal income tax, middle-market EVs like the Nissan Leaf are more competitively priced with 2013 midsize car models, such as the Hyundai Sonata, Honda Accord and Toyota Camry.⁴⁸

The number of rebates for EVs has indeed picked up within the past year in San Diego County, surpassing hybrids (Figure 12). These numbers further indicate an overall increase in EV sales for San Diego County within the last year.

Figure 12: CVRP Rebates, San Diego County 2013



Source: CCSE CVRP Data, 2013

San Diego Gas & Electric Co.

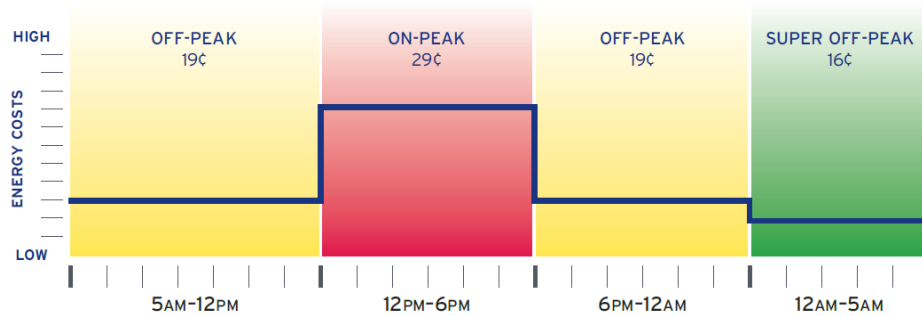
San Diego Gas & Electric Co. has developed an electric rate structure for EV owners known as the Electric Vehicle Time-of-Use (EV-TOU) rate. This structure provides an incentive for EV owners to charge their vehicles during off-peak hours at lower rates as compared to default residential electric rates, thus providing a further incentive to encourage electric vehicle adoption.⁴⁹ Rates listed in Figure 14 (on the next page) are per kilowatt-hour and represent the summer EV-TOU-2 rate as of September 1, 2013.

⁴⁷ Nissan Vehicles. “[2013 Nissan Leaf S Cost.](#)”

⁴⁸ US News. “[Affordable Midsize Cars.](#)” 2013.

⁴⁹ Drive Clean CA. “[SDG&E Discount Incentive.](#)”

Figure 13: San Diego Gas & Electric's Electric Rate Structure



Given that a Nissan Leaf S can drive up to 100 miles per 29 kWh (kilowatt hour),⁵⁰ it would cost \$8.41 per 100 miles driven if charged during on-peak hours and \$4.64 during super off-peak hours. Driving 10,000 miles would cost \$841 and \$464 respectively, a savings of \$377 for charging during super off-peak hours. By comparison, at \$4 a gallon, a gasoline-powered vehicle averaging 25 miles would cost \$16 per 100 miles driven. The result is that consumers could save approximately \$1,136 for every 10,000 miles driven with an EV at the super off-peak rate.

Challenges

EV Charging Infrastructure & Initial Cost

Electric vehicles rely on charging infrastructure that is still underdeveloped in many regions, leading to consumer anxiety over driving range. This, combined with an electric vehicle's initial up-front cost, makes consumers cautious about investing in electric vehicles. Further analysis on which of these is more critical to consumers will help policymakers determine how to best allocate resources to increase EV adoption, whether it be in establishing more charging stations, increasing support for R&D to improve EV technology and lower manufacturing costs, or through providing additional tax and rebate incentives for EV purchases.

Despite already producing EVs that can drive more than 200 miles on a full charge,⁵¹ Tesla is addressing driving range concerns by installing its own supercharge stations to provide free charging⁵² for Tesla vehicle owners. Currently, there are nine supercharging stations in California and 10 in the rest of the United States, all of which can provide a full charge within 75 minutes. Tesla is planning to increase its coverage by installing more charging stations around the U.S. and expects to cover 98 percent of the U.S. population by 2015.⁵³

Public Awareness & Acceptance

Consumer knowledge is another challenge to growing the electric vehicle market. An IBM survey found that 45 percent of respondents felt they had little understanding of electric vehicles.⁵⁴ Respondents to a different

⁵⁰ US Department of Energy. "Nissan Leaf S Fuel Economy." 2013.

⁵¹ Tesla Motors. [Tesla Driving Range Interactive Tool](#).

⁵² This service is available for the Model S with an 85 kWh battery. The 60 kWh Model S can be fitted with supercharging capability for \$2,000 or \$2,500 if enabled after delivery.

⁵³ Tesla Motors. "Tesla Supercharger Stations."

⁵⁴ Electrification Coalition and PwC. "State of the Plug-in Electric Vehicle Market." July 25, 2013.

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survey administered by the National Academy of Science felt they had “almost no experience” with electric vehicles.⁵⁵ Companies such as Nissan and Cadillac, and organizations like CCSE, therefore are trying to create more consumer engagement through EV events and test-drives. These and other sponsors hosted Electric Vehicle Day in San Diego on Sept. 28, 2013, which allowed attendees to test-drive some of the newest EVs on the market.⁵⁶

EV Zoning & Parking Ordinances

In San Diego County, EV charging accessibility has been hindered by a lack of zoning and parking ordinance coordination for installing electric vehicle service equipment (EVSE).⁵⁷ According to a CCSE survey provided to 16 jurisdictions, only one – the City of San Diego – stated they had adopted infrastructure requirements that meet best practices. Coronado, one of the jurisdictions surveyed, stated they are in the process of adopting requirements for EVSE, while almost half of the respondents have just started to consider how to adapt EVSE requirements.⁵⁸ Four of the jurisdictions surveyed have yet to consider requirements for EVSE. These are Santee, National City, Del Mar and El Cajon.

According to the survey, 89 percent of jurisdictions polled indicated that they would benefit from having other city or agency infrastructure requirements for EVs available as reference. CCSE therefore has recommended using the City of San Diego’s Technical Policy 11B-1 as a guideline for jurisdictions to follow. *Technical Policy 11B-1: Accessibility to EV Charging Stations* provides city accessibility guidelines for EVSE installations. The document was created to ensure “uniform and consistent enforcement by review and inspection staff” of EVSE installations.⁵⁹

Future Governmental Funding for EVs

The EV market has been able to thrive due to generous governmental funding and support for EV purchases and infrastructure. Given the US government’s fiscal constraints and political pressure to generate quick results, there is concern that governmental funding for electric vehicles – a necessary long-term investment – could end before the EV market is able to sustain itself. Ecotality, a publicly traded company that produced electric vehicle charging stations, filed for bankruptcy because of poor earnings and an inability to report annual profits since going public in 2005.^{60,61} This occurred on Sept. 17, 2013 and was preceded by payment suspensions from the Department of Energy, which had awarded Ecotality nearly \$100 million in grant funding four years ago. Despite this concern, private entities are successfully exploring options that could allow the EV market to become more profitable and self-sustaining. ChargePoint, for example, has demonstrated the ability to build a large EV charging network through crowdfunding and financing by others.⁶²

⁵⁵ Ibid.

⁵⁶ [2013 Electric Vehicle Day](#)

⁵⁷ This is a term used by CCSE to refer to private and public electric vehicle charging stations.

⁵⁸ Ibid.

⁵⁹ California Center for Sustainable Energy. “San Diego Regional Plug-in Vehicle Readiness Plan: Phase One Regional PEV Assessment.”

⁶⁰ Reuters. “[ECotality May File For Bankruptcy.](#)” August 12, 2013.

⁶¹ Stempel, Jonathan. “[Ecotality Files For Bankruptcy.](#)” Reuters Online. September 17, 2013.

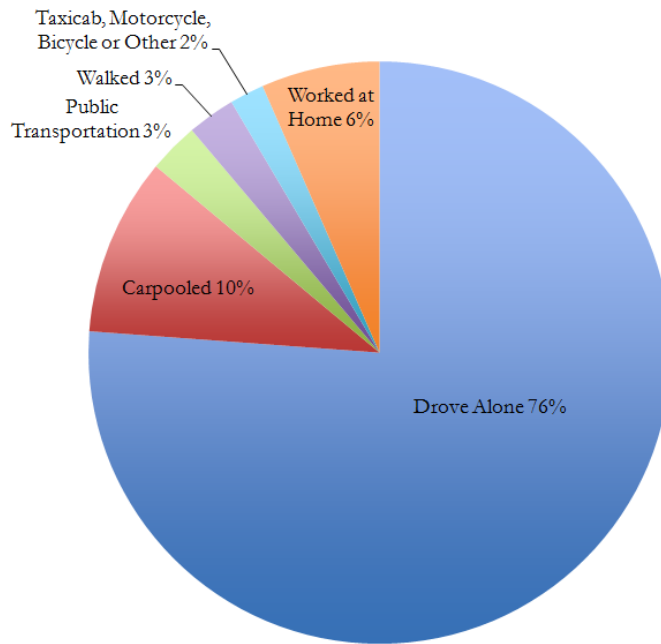
⁶² Peter Kelly-Detwiler, Forbes. [ChargePoint: Building Out The Electricity Highway.](#)” January 22, 2014.

Conclusion

Greater EV adoption could significantly reduce GHG emissions and allow the State of California to reach its state-mandated targets. This is especially true for San Diego County, where:

- 43 percent of GHG emissions came from transportation in 2010 and
- 76 percent of drivers still prefer to drive alone when commuting to work (see Figure 14)

Figure 14: 2012 Surveyed Commuting Preferences for San Diego County



Source: US Census, 2012 American Community Survey

Public and private entities have argued that electric vehicles could create more jobs through greater investment in EV manufacturing and increased fuel cost savings. However, further analysis would need to be done to determine job losses in the traditional auto sector to gain a more comprehensive assessment of net job gains due to greater electric vehicle adoption. Regardless, both the federal and California state government have provided financial incentives to stimulate consumer behavior and support electric vehicle adoption. At the local level, SDG&E provides a further incentive through its discounted charging rates. These combined incentives are provided to offset the initial up-front cost of an EV, which remains one of several challenges to greater EV adoption. This, in addition to limited EV charging infrastructure and public awareness, as well as regional policy planning for EV zoning and parking, must be addressed for the EV market to grow and for municipalities to effectively achieve reductions in GHG emissions from transportation.