



Economic and Air Quality Benefits of Electric Vehicles in Nevada

By Mike Salisbury
September 2014

EXECUTIVE SUMMARY

Electric vehicles (EVs) help create jobs and provide economic and air quality benefits to Clark and Washoe Counties and the state of Nevada overall. In order to maximize these potential benefits for all Nevada residents, the state should consider adoption of policies that overcome barriers to greater numbers of people acquiring them.

EVs provide economic benefits to the state by reducing fuel costs and shifting consumption away from imported oil to more locally produced electricity sources. These fuel savings become additional disposable income that will be spent mostly in the local economy, creating additional jobs in the state. At higher levels of market penetration, the fuel savings from EVs could produce thousands of jobs in Nevada in future years.

EV drivers can expect to save between \$1,000 and \$1,300 annually on fuel costs, totaling between \$11,600 and \$17,100 over the life of the vehicle, depending on the price of gasoline. The total economic benefit to the state of Nevada in reduced fuel costs could reach \$138 million per year by 2030.

The analysis in this report shows that, in Clark and Washoe Counties, EVs will improve air quality by reducing emissions of criteria pollutants compared to a comparable gasoline-fueled vehicle. In Washoe County, EVs will reduce levels of all pollutants compared to gasoline vehicles by 2015. In Clark County, EVs provide reductions of every pollutant except SO₂. By 2020, despite the new federal Tier III tailpipe emissions standards, EVs will continue to emit fewer pollutants than new gasoline vehicles in both counties. Reduction of all these pollutants provides public health benefits to the region by reducing respiratory ailments, especially in vulnerable populations such as children and the elderly.

Because of the substantial economic and air quality benefits, SWEEP recommends that the state of Nevada take more action to spur the adoption of EVs. Important policies the state could adopt to promote EVs include:

- Rebates for the purchase or lease of an EV or the installation of a public charging station;
- Allowing charging station owners to resell electricity to EV drivers;
- Expanded use of performance contracting to purchase EVs for government fleets;
- A statewide charging station funding source (tied to EV registration fees); and
- A registration fee that ensures EVs pay their fair share of roadway maintenance costs.

A suite of other policies that other southwestern state governments have implemented to support EVs can be found in the report, *Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card*.



Solar PV powered charging stations at NV Energy's Pearson Office Building in Las Vegas. (Photo courtesy of NV Energy.)

INTRODUCTION

There are currently 17 light-duty electric vehicles (EVs), including plug-in hybrid electric vehicles (PHEVs), available in the United States from large-scale vehicle manufacturers, with more models expected in coming years.¹ With so many diverse models available over the next few years, electric vehicles have the potential to play an important part in the transportation future of Nevada. The benefits of EVs compared to gasoline fueled vehicles include the following:

- *Greater efficiency:* Compared to gasoline powered internal combustion engines, electric vehicles can travel the same distance using approximately 24% less energy.²
- *Locally produced energy source:* Almost all of the petroleum and refined gasoline used in Nevada is imported, while electricity can be produced using clean energy resources that are abundant in the state, such as solar and geothermal.³
- *Reduced emissions:* EVs have the potential to reduce greatly harmful tailpipe emissions compared to gasoline powered vehicles.⁴
- *Reduced fuel cost:* Because of their higher efficiency and the low cost of electricity compared to gasoline per unit of energy, EV owners pay the equivalent of \$0.60 per gallon to drive their EVs.⁵

Furthermore, the energy and environmental benefits of electric vehicles are expected to increase as older power plants are retired and additional natural gas and renewable generation is constructed.⁶ Clark and Washoe Counties face air quality challenges, and light duty vehicle emissions are a significant source of pollutants that contribute to this problem. Supporting widespread adoption of electric vehicles is an important strategy for improving air quality in the state.

ECONOMIC BENEFITS FROM ELECTRIC VEHICLES

Job Creation Benefits

Nevada does not produce any oil and must import all its vehicle fuel from outside the state, meaning that almost all of the money spent on fuel—over \$5 billion annually—will leave the state's economy. The money saved from EVs' reduced fuel costs will result in consumers spending less disposable income on imported energy and more on local goods and services.

Producing and supplying energy is one of the least employment-intensive sectors of the economy, so shifting expenditures away from this sector and towards local goods and services will create more local jobs. An additional dollar of household spending will create 16 times more jobs than if that dollar were spent on fossil fuels.⁷ The jobs created by this additional spending are spread

throughout the economy, not focused in the vehicle or alternative fuel sectors; therefore, all income levels will benefit from the fuel savings benefits from electric vehicles.

Without the development of a detailed model based on regional and statewide data that could predict the employment benefits of EVs, it is not possible to provide precise estimates of this impact. However, one methodology provides an approximate estimate of the scale of employment benefits offered by EV fuel savings in Nevada.

In 2012, Dr. David Roland-Holst, an economist at the University of California, Berkeley, analyzed the economic and job creation impact of two EV market penetration scenarios for California.⁸ While the study focused on the impact of EV fuel savings in the California economy and the results may not be directly applicable to Nevada, the general scale of the economic and employment impacts should be applicable.

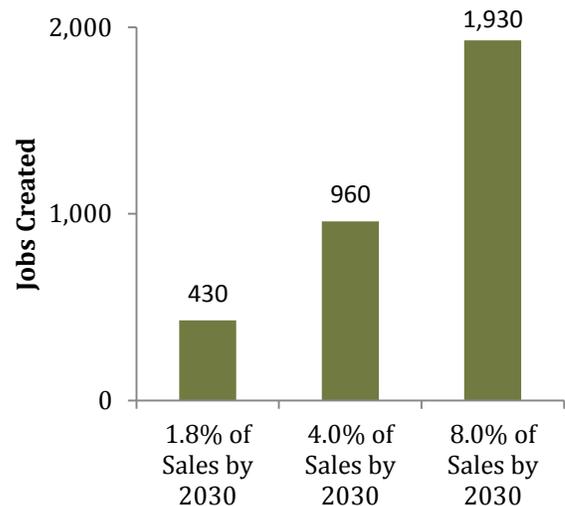
This analysis found that, if EVs comprise 15.4 percent of new vehicle sales by 2030, then nearly 50,000 additional jobs would be created in California from the fuel savings (compared to a baseline scenario). Allowing for less aggressive market penetration in Nevada and for the smaller number of vehicles in the state, we scaled down the equation to give an estimate of how many jobs could be created by the fuel savings from EVs.

The first “baseline” market penetration scenario comes from the U.S. Energy Information Administration (EIA) and is their forecast of EV sales in the Mountain region. Based on the percentage of vehicle registrations, we estimate that Nevada would account for 11 percent of vehicles sales in the region. By 2020, EIA forecasts that EVs will make up 0.9 percent of all new vehicles sales and by 2030, 1.8 percent of sales.⁹ This translates to approximately 0.3 percent of all light duty vehicles in 2020 and one percent of all light-duty vehicles in 2030. At this level of market penetration, 430 jobs would be created in Nevada by 2030 (see Figure 1).

A second “current trend” market penetration scenario was analyzed based on how Nevada’s vehicle sales compare with California’s. In 2013, electric vehicles in California made up 1.4% of all new vehicle registrations while in Nevada they made up 0.4%. If future sales in Nevada follow this trend of having a new sales rate 29 percent of California’s, EVs would make up 2.4 percent of all light-duty vehicle sales by 2020, increasing to 4 percent by 2030. At this level of market penetration, 960 jobs would be created in Nevada by 2030.

A third and more aggressive scenario looks at what the market penetration would be if Nevada sold about half as many vehicles as is required by the ZEV mandate currently adopted by eight

Figure 1 | Job Creation Potential in 2030 from Electric Vehicle Fuel Savings



states. California, Connecticut, Maryland, Massachusetts, New York, Oregon, Rhode Island and Vermont mandate that 15 percent of new vehicle sales to be zero emission vehicles (ZEV) by 2030. At this level of market penetration, 1,930 jobs would be created in Nevada by 2030. Figure 1 compares the job creation potential for each of the three market penetration scenarios.

Individual Vehicle and Economy-Wide Fuel Savings Benefits

Over the lifetime of the vehicle, higher upfront costs for EVs will be more than offset by significantly lower fuel costs than gasoline vehicles, bringing economic benefits to their owners that will in turn provide an economic benefit to the state. We analyzed the economic benefits of EVs based on two forecasts for the price of gasoline developed by the EIA: the Reference Case and the High Oil Price Case.¹⁰ The average price of electricity per kWh for Nevada customers taking advantage of NV Energy’s electric vehicle rate is estimated at \$0.053 per kWh.¹¹ The average rates were increased based on EIA’s projected increase in electricity prices for the Mountain region.¹² Table 1 shows the economic benefits for three types of EVs: a Toyota Prius Plug-in Hybrid (PHEV) with an electric range of 10 miles, a Chevrolet Volt extended range PHEV with an electric range of 40 miles and a fully electric Nissan Leaf with a range of 70 miles. Specific benefits estimated here include the incremental cost (minus the federal tax credit), the payback period, the lifetime fuel cost savings (total fuel savings minus the incremental cost), and the average annual savings for each vehicle in both the reference and high energy cost scenarios.

Applying the same three market penetration scenarios described above in the job creation section, the economic impacts to the entire economy are estimated in Table 2, which shows that the adoption of EVs in Nevada has the potential to provide between \$18 million and \$138 million in annual economic benefits to Nevada in 2030.

Table 1 | Economic Benefits of EVs Compared to a New Gasoline Passenger Vehicle¹³

Vehicle Type	Incremental Cost	Payback Period (Years)		Lifetime Savings		Average Annual Savings	
		Reference	High	Reference	High	Reference	High
Prius Plug-In	\$4,225	7	6	\$5,700	\$8,700	\$600	\$800
Volt	\$3,135	5	4	\$7,600	\$11,200	\$700	\$900
Leaf	\$4,590	5	4	\$11,600	\$17,100	\$1,000	\$1,300

Table 2 | Annual Fuel Cost Savings Benefits (Millions of \$)

Scenario	2020		2030	
	Reference	High	Reference	High
1.8% of Sales by 2030 (EIA Baseline)	\$4.9	\$6.8	\$18.0	\$24.1
4% of Sales by 2030 (Current Trend)	\$9.7	\$13.6	\$52.5	\$70.6
8% of Sales by 2030 (Half of ZEV Mandate)	\$10.4	\$24.0	\$57.2	\$138.2

ANALYSIS OF EMISSIONS FROM ELECTRIC VEHICLES IN CLARK AND WASHOE COUNTIES

SWEEP compared the emissions associated with five types of vehicles in two years, 2015 and 2020, using the GREET model developed by the Argonne National Laboratory.¹⁴ The vehicles include: a plug-in hybrid electric vehicle (PHEV) like the Toyota Prius Plug-in that has an electric range of 10 miles; an extended range PHEV like the Chevy Volt with an electric range of 40 miles; a battery electric vehicle (BEV) like a Nissan Leaf with a range of 70 miles; a compressed natural gas (CNG) vehicle like a Honda Civic CNG which gets 33 miles per gallon equivalent; and a traditional gasoline passenger vehicle with a fuel efficiency of 30 miles per gallon.¹⁵ The analysis focused on the lifecycle vehicle emissions that take place in Clark and Washoe Counties, which include the Las Vegas and Reno metropolitan areas where approximately 88 percent of Nevadans live.¹⁶ For a detailed description of the methodology, please refer to the Appendix at the end of the report.

The analysis evaluates emissions of the following criteria pollutants: ground-level ozone precursors, such as volatile organic compounds (VOCs) and nitrogen oxides (NO_x); particulate matter of 2.5 and 10 micrometers (PM_{2.5} and PM₁₀); carbon monoxide (CO); and sulfur dioxide (SO₂).¹⁷ The analysis also evaluates greenhouse gas (GHG) emissions.

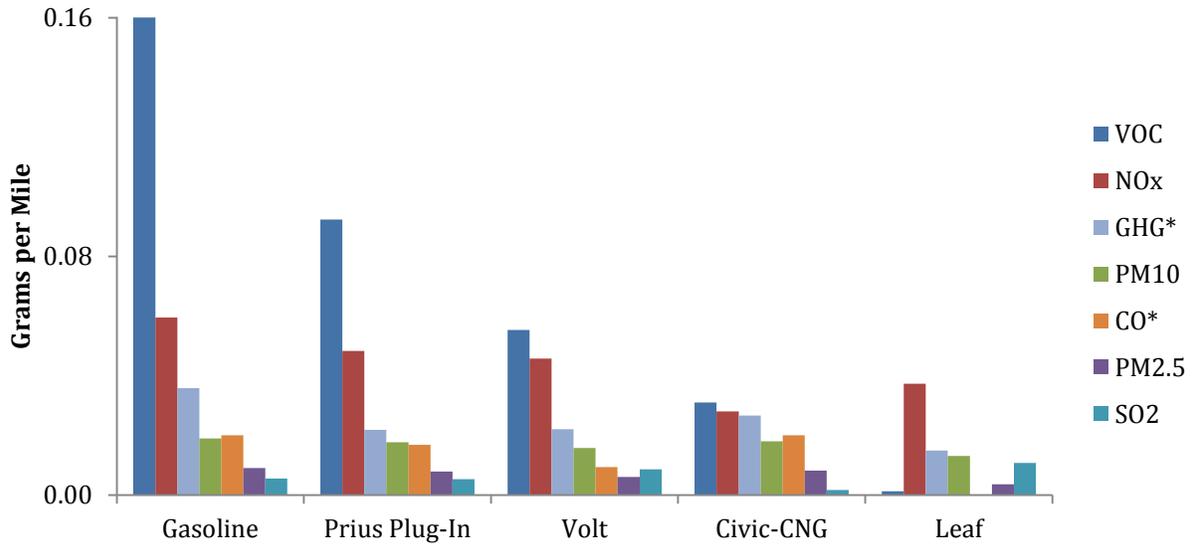
The PM₁₀ emissions are particularly important, as both counties currently exceed the EPA's standard for acceptable levels of PM₁₀ emissions. NO_x and VOC emissions are also important, as Clark County is currently close to being in non-attainment for permissible levels of ground-level ozone. The EPA is expected to issue new ozone standards in 2014, which may present additional challenges by lowering allowed ozone levels from 75 to 70 parts per billion (ppb) or lower.

Clark County Vehicle Emissions Results

In 2015, the Leaf provides significant reductions in all pollutants except SO₂ compared to a new gasoline vehicle meeting current fuel economy and tailpipe emissions standards.¹⁸ The Prius Plug-in and Volt have fewer emissions as well. The Civic CNG offers the greatest reduction in NO_x and SO₂ emissions.

For the seven pollutants analyzed, Figure 2 compares the emission rates (how many grams of pollutant are emitted during a mile of driving) and provides an emissions profile for each type of vehicle. Based on these emission rates, Table 3 shows the percent reduction of each pollutant compared to a gasoline vehicle. For each pollutant in Table 3, the vehicle with the greatest reduction compared to a gasoline vehicle is highlighted.

Figure 2 | Emission Rates of New 2015 Vehicles by Vehicle Type, Clark County



*The scale of emissions from CO and GHG has been changed so that all the pollutants could be placed in one chart. CO emission rates have been reduced by a factor of 100 so in fact numbers are around 2.0 grams per mile and GHG emission rates have been reduced by a factor of 10,000 so in fact numbers are around 300 grams per mile.

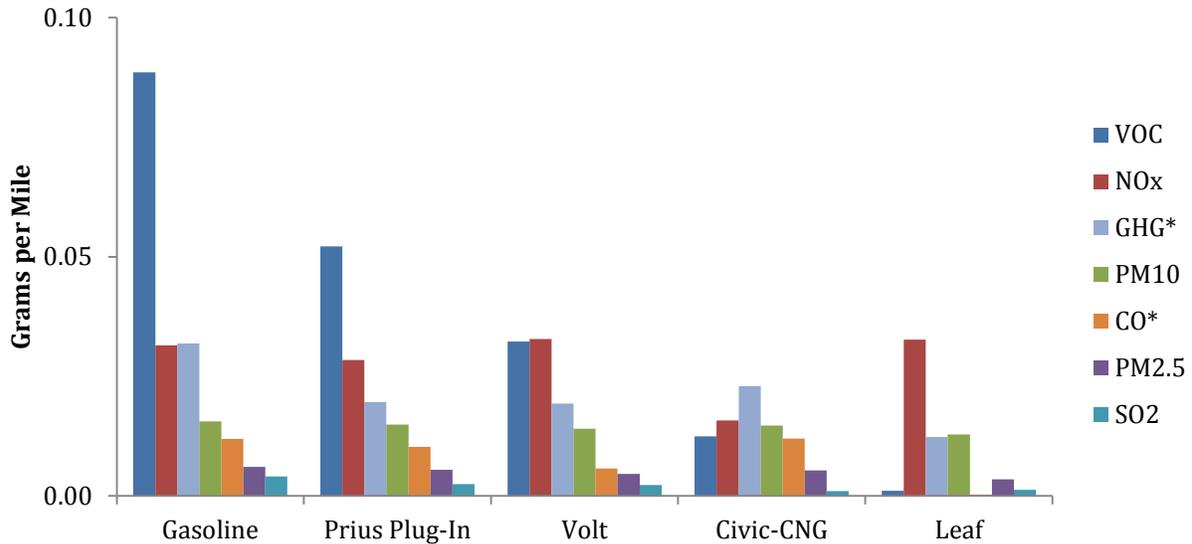
Table 3 | Percent Reduction in Emissions in 2015 Compared to New Gasoline Vehicle, Clark County

Pollutant	Leaf	Prius Plug-In	Volt	Civic CNG
VOC	-99%	-42%	-65%	-81%
NOx	-37%	-19%	-23%	-53%
PM10	-31%	-7%	-17%	-5%
PM2.5	-59%	-12%	-33%	-9%
SO ₂	94%	-4%	55%	-69%
CO	-99%	-16%	-53%	0%
GHG	-58%	-39%	-38%	-26%

An EV driven in Clark County will have lower emissions in 2020 than in 2015. That’s because the electricity mix in southern Nevada will be cleaner due to the retirement of the last coal-fired unit of the Reid Gardner power plant. However, because the federal Tier III tailpipe emission standards will significantly reduce emissions of all the criteria pollutants,¹⁹ the net emissions *benefit* of EVs compared to new gasoline vehicles in 2020 will actually be reduced in some cases compared to 2015.²⁰ Even with stricter tailpipe emissions regulations, though, EVs still offer emission advantages compared to gasoline vehicles for almost all pollutants.

Figure 3 compares the emission rates and provides an emissions profile for each type of vehicle. Table 4 shows the percent reduction of each pollutant compared to a gasoline vehicle; the vehicle with the greatest reduction is highlighted.

Figure 3 | Emission Rates of New 2020 Vehicles by Vehicle Type, Clark County



*The scale of emissions from CO and GHG has been changed so that all the pollutants could be placed in one chart. CO emission rates have been reduced by a factor of 100 so in fact numbers are around 2.0 grams per mile and GHG emission rates have been reduced by a factor of 10,000 so in fact numbers are around 300 grams per mile.

Table 4 | Percent Reduction in Emissions in 2020 Compared to New Gasoline Vehicle, Clark County

Pollutant	Leaf	Prius Plug-In	Volt	Civic CNG
VOC	-99%	-41%	-64%	-86%
NOx	4%	-10%	4%	-50%
PM10	-17%	-4%	-10%	-5%
PM2.5	-43%	-10%	-24%	-12%
SO ₂	-68%	-40%	-44%	-76%
CO	-98%	-14%	-52%	0%
GHG	-61%	-39%	-39%	-28%

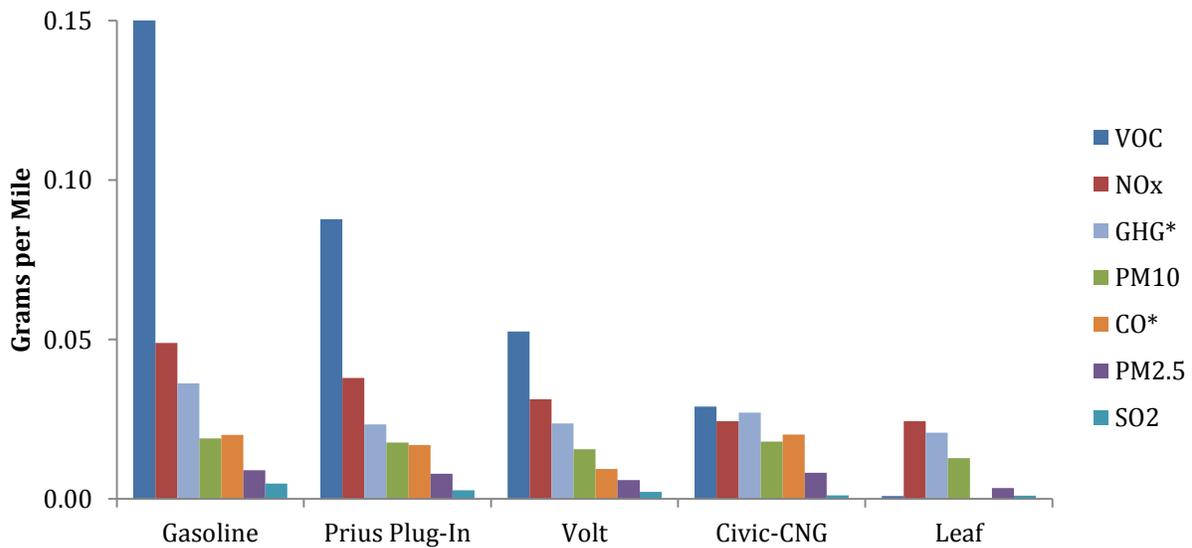
Washoe County Vehicle Emissions Results

In Washoe County, every type of electric vehicle has lower levels of pollutant emissions in 2015 compared to a gasoline vehicle. Even though a higher percentage of coal is used to produce electricity for Washoe County, the power plants are located outside of the county’s airshed, so EVs deliver even greater air quality benefits in Washoe County than in Clark County. The Leaf offers

the greatest level of emission reductions among the five vehicle types. The level of emission reductions for the Prius Plug-in and the Volt generally fall between those of the Leaf and the Civic CNG.

Figure 4 compares the emission rates and provides an emissions profile for each type of vehicle. Table 5 shows the percent reduction of each pollutant compared to a gasoline vehicle; the vehicle with the greatest reduction is highlighted.

Figure 4 | Emission Rates of New 2015 Vehicles by Vehicle Type, Washoe County



**The scale of emissions from CO and GHG has been changed so that all the pollutants could be placed in one chart. CO emission rates have been reduced by a factor of 100 so in fact numbers are around 2.0 grams per mile and GHG emission rates have been reduced by a factor of 10,000 so in fact numbers are around 300 grams per mile.*

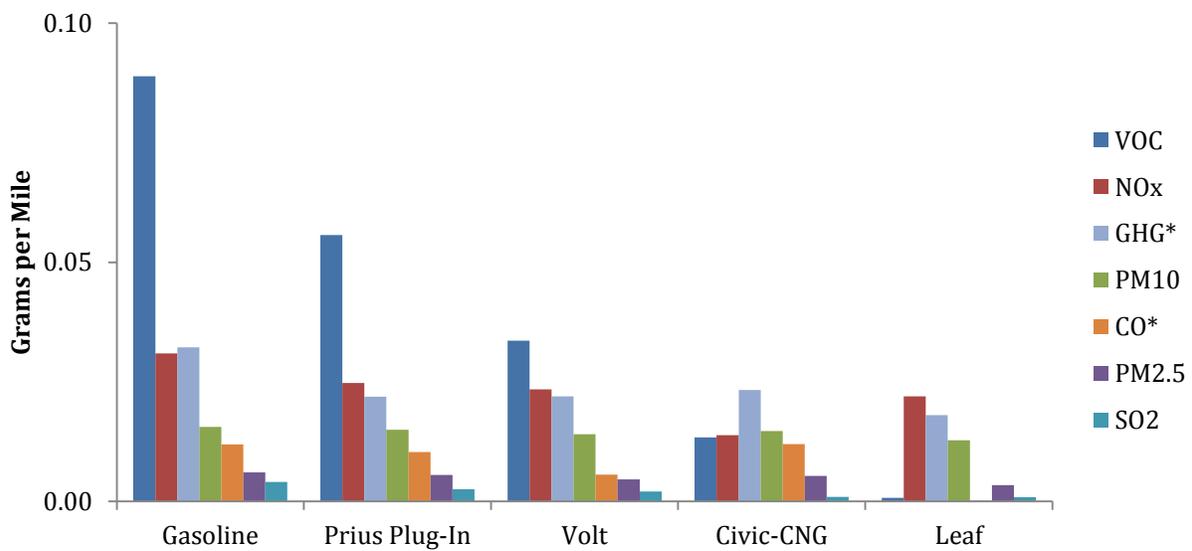
Table 5 | Percent Reduction in Emissions in 2015 Compared to New Gasoline Vehicle, Washoe County

Pollutant	Leaf	Prius Plug-In	Volt	Civic CNG
VOC	-99%	-45%	-67%	-82%
NOx	-59%	-36%	-48%	-59%
PM10	-33%	-7%	-18%	-5%
PM2.5	-62%	-13%	-35%	-9%
SO ₂	-82%	-51%	-60%	-80%
CO	-99%	-16%	-53%	0%
GHG	-42%	-35%	-34%	-25%

By 2020, EVs still hold an emissions advantage in Washoe County over gasoline vehicles, despite the implementation of the federal Tier III tailpipe emission standards. While methodology and data upon which we based our analysis projects forward only to 2020, it is worth noting that northern Nevada’s remaining coal plant, Valmy, is currently scheduled to be retired in 2025. This closure will greatly reduce GHG emissions from electric vehicles at that time.

Figure 5 compares the emission rates and provides an emissions profile for each type of vehicle. Table 6 shows the percent reduction of each pollutant compared to a gasoline vehicle; the vehicle with the greatest reduction is highlighted.

Figure 5 | Emission Rates of New 2020 Vehicles by Vehicle Type, Washoe County



*The scale of emissions from CO and GHG has been changed so that all the pollutants could be placed in one chart. CO emission rates have been reduced by a factor of 100 so in fact numbers are around 2.0 grams per mile and GHG emission rates have been reduced by a factor of 10,000 so in fact numbers are around 300 grams per mile.

Table 6 | Percent Reduction in Emissions in 2020 Compared to New Gasoline Vehicle, Washoe County

Pollutant	Leaf	Prius Plug-In	Volt	Civic CNG
VOC	-99%	-37%	-62%	-85%
NOx	-29%	-20%	-24%	-55%
PM10	-18%	-4%	-10%	-5%
PM2.5	-44%	-9%	-24%	-12%
SO ₂	-78%	-37%	-49%	-76%
CO	-99%	-13%	-53%	0%
GHG	-44%	-32%	-32%	-28%

Table 7 shows the percentage of each criteria pollutant generated by light-duty vehicles in Clark and Washoe Counties.²¹ Because such a large proportion of VOC, NO_x, and CO emissions are attributable to light duty vehicles, replacing gasoline vehicles with EVs (which offer dramatic reductions in each of these pollutants) should be effective at reducing both ground level ozone and carbon monoxide in both counties.

Table 7 | Light Duty Vehicle Emissions as a Percent of Total Emissions in Clark and Washoe Counties

	PM10	PM2.5	NO _x	SO ₂	CO	VOC ²²
Clark County	2%	3%	28%	4%	38%	17%
Washoe County	1%	3%	25%	2%	36%	28%

Clark and Washoe Counties are currently in attainment for the EPA's ozone standard. However, if the EPA adopts a stricter standard in 2014—as recommended by their scientific advisory panel—then both counties may no longer be in compliance.

As Clark and Washoe Counties develop plans to reduce ground-level ozone levels, increasing the numbers of electric vehicles on the road can play an important part in reducing emissions. This analysis demonstrates that a shift to electric vehicles will help both counties comply with both the current and new standards. Electric vehicles significantly reduce emissions of other pollutants as well.

Electric vehicles provide reductions of PM2.5, PM10 and SO₂ compared to gasoline vehicles, but light duty vehicles make up a relatively small portion of these emissions overall. Even with high levels of adoption, electric vehicles likely would not have a significant impact on overall emissions in the Counties.

Reducing the levels of all these criteria pollutants provides public health benefits to the region. Elevated levels of these pollutants lead to respiratory ailments such as aggravated and more frequent asthma attacks and decreased lung function, all of which increase hospital and emergency room visits.²³ Vulnerable populations such as children and the elderly are at greater risk from exposure to these pollutants.

EV POLICIES IN NEVADA

In 2014, SWEEP published *Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card*, which graded southwestern state governments on how much they had done to support EVs.²⁴ Nevada received a C, having adopted only six policies that support the adoption of EVs.

The two states (Colorado and Utah) with the most robust EV policies are those that have experienced the highest rate of EV adoption in the Southwest. Colorado, the state receiving the highest grade of an A-, had adopted 12 policies supporting EVs. Among these policies is a tax credit of up to \$6,000 for the purchase or lease of an EV as well as an EV infrastructure fund—capitalized by an annual fee on each EV—to invest in a network of charging stations. Utah, which received the second highest grade of a B+, has adopted a \$1,500 tax credit for the purchase or lease of an EV.

Figure 6 below shows EV registrations as a percentage of all new vehicle registrations in each of five southwestern states in the last two years. Nevada has a similar rate of adoption to Arizona and is ahead of New Mexico, but the state trails both Utah and Colorado.

Figure 6 | Electric Vehicles as a Percentage of New Vehicle Registrations²⁵

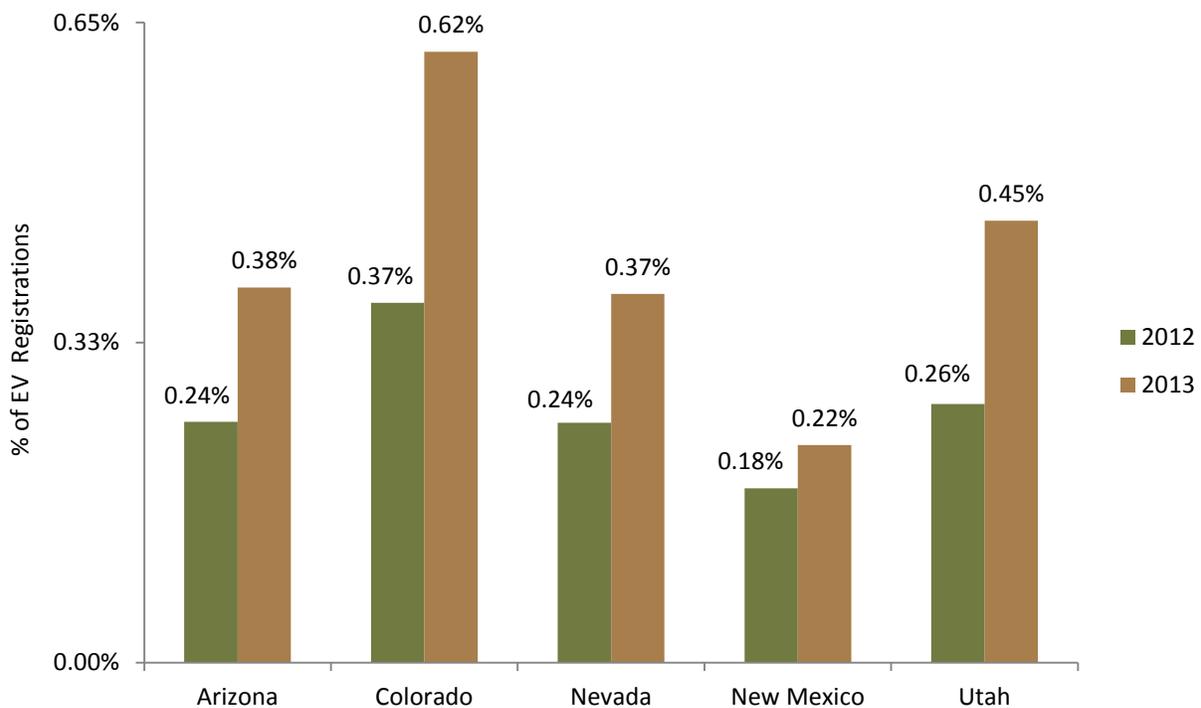


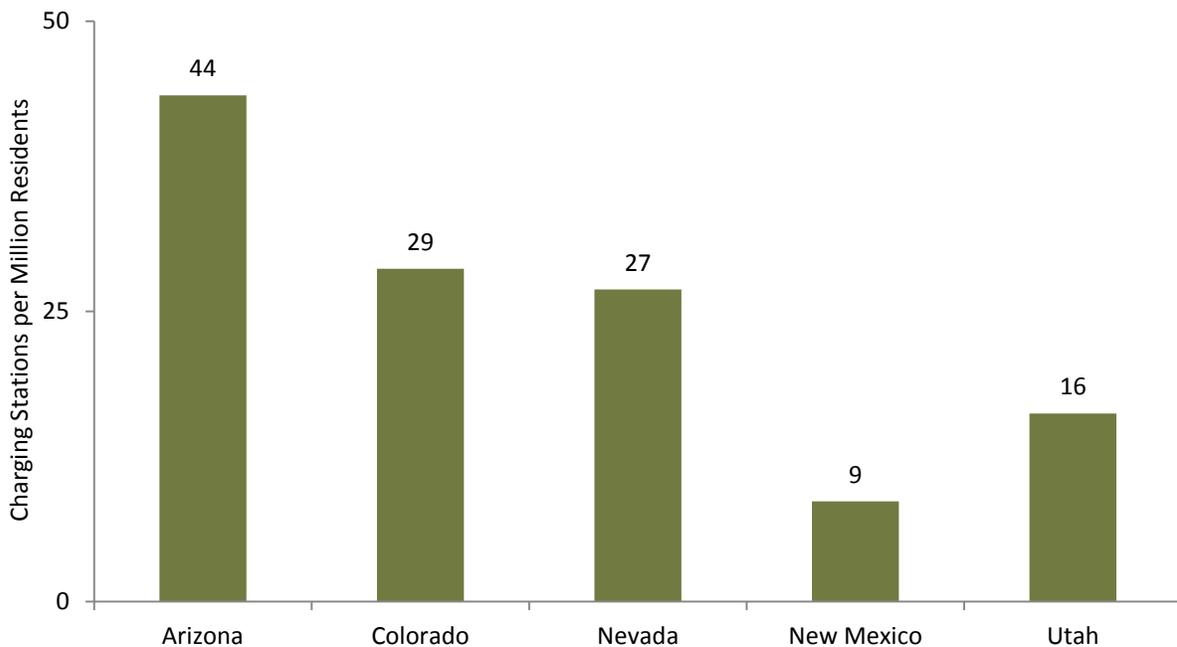
Figure 7 | Public Charging Stations per Million Residents²⁶

Figure 7 compares the number of publicly available charging stations per million residents in the southwestern states.²⁷ Arizona's number is somewhat inflated compared to other states as it received a significant amount of its charging stations essentially at no cost via the EV Project.²⁸ Due to the efforts of NV Energy, Nevada compares favorably with other states, which may indicate that public charging by itself is not sufficient to drive EV sales.

SWEEP recommends that the state of Nevada adopt the following policies that support EVs in order to increase the economic and air quality benefits detailed in this report. Each of these policies has been successfully adopted and proven effective in other states.

Rebate for Vehicle Purchase or Lease

One of the greatest barriers to wider adoption is the additional incremental cost of EVs. An upfront rebate would spur EV sales and put them within financial reach of a larger percentage of the population. Several states (Massachusetts, Illinois, Pennsylvania and California) offer EV rebates of \$2,000 to \$4,000. Combined with the federal tax credit for EVs, a rebate could eliminate almost all of the incremental cost to EV buyers. Nevada could also set up a sales tax exemption for EVs which both New Jersey and Washington currently offer. Because there is no income tax in Nevada, it is not possible to offer a tax credit for EVs as several other states such as Colorado and Utah do.

Energy Performance Contracting

Energy Performance Contracting (EPC) is a financing mechanism used to pay for energy efficiency improvements. The "loan" is then paid back by utility bill savings from using less energy. EPC has

been used to fund energy efficiency building improvements in Nevada's universities, hospitals and other public facilities. Extending this mechanism to acquisition of highly efficient and alternative fuel vehicles is an important and innovative use of performance contracting. EVs face the same issue as energy efficiency improvements for buildings: a higher capital cost, offset over time by savings in fuel and maintenance costs.

Deregulation of Electricity Sales to EVs

This policy would allow charging station owners and operators additional flexibility in how they provide and sell electricity to EV owners at public charging stations. Under current regulations, only entities regulated as utilities are able to sell electricity to the public on a \$/kWh basis. Allowing EVSE owners to charge by the kWh ensures that all vehicles are paying equitably for the energy they are receiving. Currently, 10 states (California, Washington State, Virginia, Colorado, Florida, Oregon, Minnesota, Illinois, Maryland, and Hawaii) have changed their laws to allow the re-sale of electricity to EV owners.

EV Infrastructure Fund and Registration Fee

Electricity sold to power EVs is not currently taxed as a transportation fuel, which means that EVs are contributing less than gasoline vehicles to the state's transportation fund for road maintenance. In addition, the lack of public charging stations creates "range anxiety" and inhibits consumers from purchasing EVs.

To address these two issues, the state could impose an additional registration fee on electric vehicles. In the early years, this fee will fund additional EV charging stations. As EV numbers grow to the point that they are impacting transportation funding, the fee transitions over to the road fund.

A suite of other policies that other southwestern state governments have implemented to support EVs can be found in the report referenced above, *Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card*.²⁹

CONCLUSION

Because EVs help create jobs and provide economic and air quality benefits to Clark and Washoe Counties and the state of Nevada overall, the state should consider adopting policies that overcome barriers to greater numbers of people acquiring them.

EVs provide economic benefits to the state by reducing fuel costs and shifting consumption away from imported oil to more locally produced electricity sources. These fuel savings become additional disposable income that will be spent mostly in the local economy, creating additional jobs in the state. At higher levels of market penetration, the fuel savings from EVs could produce thousands of jobs in Nevada in future years.

EV drivers can expect to save between \$1,000 and \$1,300 annually on fuel costs, totaling between \$11,600 and \$17,100 over the life of the vehicle, depending on the price of gasoline. The total economic benefit to the state of Nevada in reduced fuel costs could reach \$138 million per year by 2030.

Our analysis shows that, in Clark and Washoe Counties, EVs will improve air quality by reducing emissions of criteria pollutants compared to a comparable gasoline-fueled vehicle. In Washoe County, EVs will reduce levels of all pollutants compared to gasoline vehicles by 2015. In Clark County, EVs provide reductions of every pollutant except SO₂. By 2020, despite the new federal Tier III tailpipe emissions standards, EVs will continue to emit fewer pollutants than new gasoline vehicles in both counties. Reduction of all these pollutants provides public health benefits to the region by reducing respiratory ailments, especially in vulnerable populations such as children and the elderly.

Because of the substantial economic and air quality benefits, SWEEP recommends that the state of Nevada take more action to spur the adoption of EVs. Important policies the state could adopt to promote EVs include:

- Rebates for the purchase or lease of an EV or the installation of a public charging station;
- Allowing charging station owners to resell electricity to EV drivers;
- Expanded use of performance contracting to purchase EVs for government fleets;
- A statewide charging station funding source (tied to EV registration fees); and
- A registration fee that ensures EVs pay their fair share of roadway maintenance costs.

A suite of other policies that other southwestern state governments have implemented to support EVs can be found in the report, *Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card*.³⁰

APPENDIX: AIR QUALITY ANALYSIS METHODOLOGY

SWEEP performed the analysis using the *Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation (GREET)* fuel-cycle model developed by the Argonne National Laboratory with funding from the U.S. Department of Energy.³¹ New vehicles purchased in 2015 are analyzed to show which vehicles will have the most immediate impact regarding energy use and emissions.

The GREET model also calculates the amount of emissions occurring in urban areas to show which emissions would be most likely to contribute to air quality issues. To better represent the impact that electric and gasoline vehicles will have on air quality, SWEEP characterized the transportation energy system in Nevada to show exactly what emissions are likely to contribute to Clark and Washoe Counties' airshed. Note that in July of 2013, SWEEP released a multi-state analysis of emissions from electric vehicles, which arrives at slightly different conclusions for Nevada, as it analyzes *statewide* lifecycle emissions, and does not focus specifically on Las Vegas and Reno metropolitan areas.³²

The analysis also looks at how new vehicles purchased in 2020 perform in that year. It is assumed that these vehicles will meet the EPA's Tier III emission standards which will impact 2017 and later model years.³³ We assumed new gasoline and CNG vehicles purchased in 2020 will meet the CAFE fuel economy standards that will be in effect in 2020.

To estimate electricity generation mixes, SWEEP relied on the latest data from NV Energy regarding the electric mixes in their northern and southern regions to establish a baseline.³⁴ Then electricity mixes were adjusted to reflect the planned retirement of coal power plants (such as Reid Gardner) and the increase in renewable and energy efficiency sources under the state's Renewable Portfolio Standard. By 2015, three of the four power generation units at Reid Gardner will have been retired and by 2020 all of its units will be retired. By 2015, 20 percent of electricity will come from renewables and energy efficiency and this will increase to 22 percent by 2020. Table A-1 breaks down the baseline and projected electricity mixes used in the analysis for each scenario.

Table A-1 | Baseline and Forecast Electricity Mixes for Northern and Southern Nevada

	Coal	Natural Gas	Renewables	Nuclear
Northern Nevada				
2013	31%	48%	19%	2%
2015	30%	48%	20%	2%
2020	27%	49%	22%	2%
Southern Nevada				
2013	16%	67%	16%	1%
2015	4%	75%	20%	1%
2020	0%	77%	22%	1%

Regarding relevant upstream emissions from electricity generation, SWEEP calculated that in Clark County by 2015, 21 percent of coal plant emissions take place within the county and all of the natural gas plant emissions comes from within the county. By 2020, with the retirement of the last of Reid Gardner's units, there will be zero coal plant emissions in Clark County. For Washoe County, none of coal plant emissions take place in the County's airshed and all of the natural gas plant emissions take place in the county's airshed.

There are no refineries located in either Clark or Washoe Counties, so there are no upstream emissions attributable to gasoline vehicles. Likewise there is no energy extraction (mining or drilling) that takes place in Clark or Washoe Counties that would contribute to lifecycle urban emissions from vehicles.

ACKNOWLEDGEMENTS

The author would like to thank the following individual for their input and feedback on the report: Stan Hanel, Nevada Electric Vehicle Accelerator.

The author would also like to thank the following SWEEP staff members for their contributions: Will Toor, Suzanne Pletcher and Gene Dilworth.

ABOUT SWEEP

The Southwest Energy Efficiency Project is a public interest organization dedicated to advancing energy efficiency in Arizona, Colorado, Nevada, New Mexico, Utah and Wyoming. For more information, visit www.swenergy.org.

SWEEP's Transportation Program seeks to identify and promote the implementation of policies designed to achieve significant energy savings and reductions in greenhouse gas emissions from the transportation sector. SWEEP's work focuses on two general strategies: reducing vehicle miles traveled and improving vehicle fuel efficiency.

Questions or comments about this report should be directed to Mike Salisbury, Transportation Program Associate: msalisbury@swenergy.org.

ENDNOTES

- ¹ Hybrid Cars. 2014. June 2014 Dashboard. <http://www.hybridcars.com/june-2014-dashboard/>.
- ² Salisbury, M. and Toor, W. 2013. Transportation Fuels for the Southwest's Future: Life-cycle Energy Use and Environmental Impacts of Electric, Compressed Natural Gas, and Gasoline Vehicles. www.swenergy.org.
- ³ Energy Information Administration. 2014. Nevada: State Profile and Energy Estimates. <http://www.eia.gov/state/?sid=NV>.
- ⁴ Salisbury and Toor, 2013. Transportation Fuels.
- ⁵ This assumes that the EV driver is using NV Energy's Time-of-Use rate which is approximately half the cost per kWh as the regular residential rate. US Department of Energy. 2013. eGallon: Compare the costs of driving with electricity. Retrieved from <http://energy.gov/maps/egallon>.
- ⁶ Salisbury and Toor, 2013. Transportation Fuels.
- ⁷ Roland-Holst, D. 2012. Plug-in Electric Vehicle Deployment in California: An Economic Jobs Assessment
- ⁸ Ibid.
- ⁹ Energy Information Administration. 2013. Annual Energy Outlook. Table 48. Light-Duty Vehicle Sales by Technology Type – Mountain. High Oil Price Case. http://www.eia.gov/forecasts/aeo/data_side_cases.cfm.
- ¹⁰ In the last six years of the EIA's Annual Energy Outlook, the High Oil Price Case has actually more closely tracked with actual gasoline prices.
- ¹¹ NV Energy. 2014. NV Energy's Electric Vehicle Rate. <https://www.nvenergy.com/home/saveenergy/electricVehicle.cfm>.
- ¹² Energy Information Administration. 2014. Annual Energy Outlook, Reference Case. Table 3-8. Energy Prices by Sector and Source – Mountain. <http://www.eia.gov/forecasts/aeo/data.cfm#enprisec>.
- ¹³ A new gasoline passenger vehicle in 2015 is estimated to have an on-road efficiency of 30 mpg.
- ¹⁴ Argonne National Laboratory. 2012. Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation. Retrieved from <http://greet.es.anl.gov/>.
- ¹⁵ By 2020, a new average gasoline passenger vehicle is estimated to have a fuel economy rating of 33.8 mpg and the CNG vehicle a fuel economy rating of 37 mpg equivalent.
- ¹⁶ Nevada State Demographer. 2013. Nevada County Certified Population Estimates. <http://nvdemography.org/data-and-publications/estimates/>.
- ¹⁷ "The Clean Air Act requires EPA to set National Ambient Air Quality Standards for six common air pollutants. These commonly found air pollutants (also known as "criteria pollutants") are found all over the United States. They are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. These pollutants can harm your health and the environment, and cause property damage. Of the six pollutants, particle pollution and ground-level ozone are the most widespread health threats. EPA calls these pollutants "criteria" air pollutants because it regulates them by developing human health-based and/or environmentally-based criteria (science-based guidelines) for setting permissible levels. The set of limits based on human health is called primary standards. Another set of limits intended to prevent environmental and property damage is called secondary standards." US EPA, *What are the Six Common Air Pollutants*, available at: <http://www.epa.gov/airquality/urbanair/>.
- ¹⁸ A new gasoline passenger vehicle in 2015 is estimated to have an on-road efficiency of 30 mpg and would follow the current Tier II tailpipe emission standards.
- ¹⁹ DieselNet. 2014. Cars and Light-Duty Trucks-Tier 3. https://www.dieselnets.com/standards/us/ld_t3.php.
- ²⁰ A new gasoline passenger vehicle in 2020 is estimated to have an on-road efficiency of 33.8 mpg.
- ²¹ Environmental Protection Agency. 2013. Air Emission Sources. <http://www.epa.gov/air/emissions/index.htm>.
- ²² The VOC percentage only includes anthropogenic emissions and does not include biogenic VOC emissions for these are not controllable from a regulatory standpoint and are not included in emissions control plans.
- ²³ American Lung Association. 2013. Impacts on Your Health. <http://www.lung.org/healthy-air/outdoor/protecting-your-health/impacts-on-your-health/>.
- ²⁴ Salisbury, M. 2014. Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card. Southwest Energy Efficiency Project.

<http://www.swenergy.org/publications/documents/EV%20Report%20Card%20-%202014%20UpdateFNLBody.pdf>.

²⁵ IHS Automotive new vehicle registration data, CYE 2012 and 2013.

²⁶ Alternative Fuels Data Center. 2014. Alternative Fueling Station Locator. <http://www.afdc.energy.gov/locator/stations/>.

²⁷ The number of charging stations in Nevada as represented in Figure 3 is different from the number cited earlier in the section on NV Energy's Shared Investment Program. Figure 3 shows data from the Alternative Fuels Data Center (AFDC), while the numbers cited earlier come from a detailed analysis by Stan Hanel of the Nevada Electric Vehicle Accelerator. Mr. Hanel's work identifies a number of stations which are not picked up by AFDC so it appears that AFDC's numbers underrepresent the total number of stations and charge ports in the state. However, as this detailed on-the-ground analysis is not available for all southwestern states, we have relied on AFDC's data for our comparison between states, with the assumption that it is likely undercounting for all states.

²⁸ The EV Project was a public-private partnership that installed public and residential charging stations in major cities in ten states across the country. <http://www.theevproject.com/>.

²⁹ Salisbury, M. 2014. Policies to Promote Electric Vehicles in the Southwest: A State Government Report Card. Southwest Energy Efficiency Project.

<http://www.swenergy.org/publications/documents/EV%20Report%20Card%20-%202014%20UpdateFNLBody.pdf>.

³⁰Ibid.

³¹ Argonne National Laboratory. 2012. Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation. Retrieved from <http://greet.es.anl.gov/>.

³² Salisbury, M and Toor W. 2013. Transportation Fuels for the Southwest: life-Cycle Energy Use and Environmental Impacts of Electric, CNG and Gas Vehicles. <http://swenergy.org/publications/documents/Regional%20Fuel%20EmissionsFNL.pdf>.

³³ DieselNet. 2014. Cars and Light-Duty Trucks-Tier 3. https://www.dieselnets.com/standards/us/ld_t3.php.

³⁴ NV Energy. 2013. Power Content Label Northern Nevada and Power Content Label Southern Nevada. https://www.nvenergy.com/bill_inserts/.