Colorado Public Utilities Commission

Docket No. 11I-704EG

Comments of Southwest Energy Efficiency Project

Exhibit 2

Ozone Precursor and GHG Emissions from Light Duty Vehicles Comparing Electricity and Natural Gas as Transportation Fuels

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The Southwest Energy Efficiency Project (SWEEP) submits this analysis comparing expected emissions of ozone precursors and greenhouse gas (GHG) emissions from gasoline, natural gas (NGVs) and electric vehicles (EVs) in support of its comment urging the Commission to adopt policies that optimize the opportunity offered by electric vehicle technology to achieve significant reductions in GHG emissions from the transportation sector, and contribute to the protection of public health by achieving major reductions in the vehicle contribution to ozone formation in the Denver Metropolitan and the North Front Range air sheds where violations of the national ambient air quality standard for ozone are occurring.

Executive Summary.

CO2 emissions from petroleum fueled vehicles in Colorado are expected to increase from 27 million metric tons in 2005 to 51 million metric tons in 2050 if actions are not taken to reverse this trend.[1] New federal fuel efficiency standards that will apply to new light duty vehicles (cars and light trucks) sold beginning in 2017 are expected to roughly offset the effects of population and VMT growth in Colorado by limiting gasoline consumption at 2.1 million gallons per year through 2040. But despite the fact that after 2025 the average vehicle will travel about 50 miles per gallon of gasoline, if further gains in fuel efficiency are not achieved, CO2 emissions from light duty vehicles will begin to rise again after 2040 because of continued VMT growth. These trends can be reversed if investments are made in converting the LDV fleet to battery power. These trends can only be slowed, but not reversed, if the LDV fleet is converted to natural gas.

Converting the light duty fleet to CNG vehicles by 2030 will reduce CO_2 emissions by about 26% compared to gasoline, whereas converting the fleet to electric vehicles will reduce CO_2 emissions by 33% even if

[1] See SWEEP Exhibit 1: *Colorado Transportation Blueprint for the New Energy Economy* (SWEEP, 2009).

electricity is generated using Colorado's current fuel mix of 60% coal. If coal electric generation is replaced by natural gas, CO_2 emissions for electric vehicles would be reduced 60% compared to CO2 emitted from CNG used as a vehicle fuel, and by nearly 80% compared to gasoline. If the electricity used by vehicles is generated from renewable sources such as wind, solar and geothermal energy, then light duty EV emissions of CO2 can be reduced by more than 80% before 2050.

Recent research indicates that the climate benefits of reducing CO2 emissions from coal-fired power plants by substituting natural gas will be offset by the increased emissions of methane released to the atmosphere during the production, processing, distribution and storage of natural gas. Methane has 20 times the climate forcing effect of CO2. Increasing the production of natural gas for use as a vehicle fuel, and expanding the distribution system to include thousands of private and commercial fueling stations to serve 4 million NGVs could potentially double the releases of methane to the atmosphere. Increased methane releases would likely negate the climate benefits that might be achieved by substituting natural gas for gasoline in vehicles.

Ozone pollution is the primary air pollution threat to public health in Colorado. Colorado violates the current national ambient air quality standard for ozone in the Denver Metropolitan and North Front Range air sheds. In 2011, EPA sent to the President a proposal to adopt a more protective ozone standard. Final action on that proposal has been deferred until 2013, but the protection of public health requires that national air quality standards become more protective. Further ozone reductions will be required later this decade.

Approximately 46% of the nitrogen oxide (NOx) and 25% of the volatile organic compounds (VOCs) that contribute to ozone formation on the Front Range are emitted from gasoline vehicles. The NOx emissions from motor vehicles can be reduced about 23% if gasoline vehicles are replaced with electric vehicles, and the tailpipe emissions are replaced with the NOx emitted from natural gas-fired power plants. In addition to lower emissions, the contribution of power plant NOx emissions to ozone formation is expected to be significantly less than the comparable emissions from tailpipes because NOx is not emitted together with VOCs, is not emitted at ground level, and will be emitted mostly at night if the PUC adopts effective policies to encourage vehicle charging during off-peak hours. Ozone formation does not occur in the absence of sunlight. If the electricity used to power EVs is generated from renewable sources, NOx emissions from power generation are eliminated, and NOx emissions from vehicles will be reduced by the ratio that EVs replace gasoline vehicles.

If the PUC implements policies designed to encourage consumers to replace gasoline vehicles with EVs, and to de-carbonize the generation of electric power, Colorado can reduce CO2 emissions from light duty vehicles by more than 80% before 2040, and most likely eliminate all violations of any more protective national ozone air quality standards that EPA may adopt.

Alternatives to Gasoline Fueled Light Duty Vehicles.
Alternatives to gasoline present significant opportunities for reducing ozone precursor emissions from the transportation sector, decreasing fuel use and GHG emissions, shifting fuels to domestic rather than foreign sources, creating jobs in Colorado, and retaining in the local economy resources that are now lost to importing fuels from other states and nations. The economic benefits to Colorado's economy could total $10 billion in lower transportation costs between now and 2035 if EVs replace gasoline vehicles. *See Exhibit 3.*

The conversion of most light duty vehicles to energy sources other than petroleum can be expected to occur between now and 2030 for a number of reasons. The rising cost of petroleum fuels and the reliability of supply later in this decade will be major factors driving this shift.[2] The key question for policy makers will not be whether petroleum fuels will be replaced, but with which alternative. The three most obvious options at this point are 1) compressed natural gas (CNG), 2) electric vehicles (EVs), and 3) replacement of fossil petroleum fuels with alternative liquid biofuels for use in internal combustion engines.

Given that current sources of biofuels (primarily corn-based ethanol) will not be able to provide the volume of fuel needed to fully replace petroleum fuels,[3] we consider here the two technology options that have sufficient domestic fuel supply to replace petroleum fuels—CNG and EVs. These are also the two alternative vehicle technologies offered to the consumer by original equipment manufacturers.

Summary of Conclusions.
Currently CNG vehicles and EVs offer all of the benefits listed above compared to gasoline powered vehicles. When CNG and EVs are compared to each other, EVs provide potentially greater benefits than CNG vehicles after a conversion of the fleet is complete if the generation of electric power is converted to non-polluting renewable sources. Only one CNG model is available to consumers now, but many more plug-in hybrid electric and pure EV models will soon be widely available in Colorado.[4] Electricity as a fuel is also much more accessible for most vehicle owners compared to access to natural gas fueling stations. Electricity is a less expensive fuel per mile driven, supply is reliable, and the price of electricity is not dependent on national or global markets, and is therefore more stable. EVs also nearly eliminate the tailpipe pollutants that cause motor vehicle-related health hazards, and offer the potential for achieving an 80% reduction in GHG emissions from light duty vehicles.

Natural gas can be used most effectively to power the transportation sector by replacing coal as a bridge fuel in power plants to generate electricity for battery powered vehicles until fossil fuels can be replaced by zero emission renewable sources of energy.

Energy Efficiency, Ozone Air Pollution and GHG Emissions Impacts.
Internal combustion engines burning gasoline or natural gas are much less efficient than electric motors. A CNG vehicle will use 1,000 cubic feet of natural gas to travel 230 miles, while the same amount of natural gas converted to electricity could power an electric vehicle for 374 miles, or 60% further. In addition to being a more efficient use of energy, using electricity to power a vehicle reduces tailpipe emissions to zero because no fuel is being combusted in the vehicle. If the electricity is being generated by a combustion process, then the emissions are shifted from the vehicle to the power plant. But power plant emissions of CO_2 and VOC are less than emissions from an internal combustion engine per unit of energy generated even if the electricity is generated from coal. Substituting natural gas for coal in the electric fuel mix will reduce nitrogen oxides (NOx) by 91%, virtually eliminate sulfur dioxide (SO_2) and mercury emitted from power plants, and reduce power plant CO_2 emissions by 62%.

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[2] SWEEP has prepared for DRCOG an economic analysis of the expected cost to the local economy of petroleum fuels as the primary source of energy for the regional light duty fleet. See "TRANSPORTATION POLICIES TO PROTECT THE DRCOG REGION FROM THE ECONOMIC SHOCKS OF RISING FUEL PRICES." Based on Energy Information Agency estimates, the cumulative cost of petroleum fuels to the local economy between 2010 and 2035 could nearly double from $83 to $156 billion.

[3] Approximately 40% of U.S. corn production is used annually in the production of ethanol which is a major factor in driving up the cost of food grains. Currently, ethanol is blended with gasoline, and supplies less than 10% of light duty vehicle fuel consumed in the U.S.

[4] See Attachment 1.

Table 1. Comparing Energy Used for Equivalent Travel: Gasoline and Natural Gas Internal Combustion Engines (ICE) and Electric Motors in Vehicle Technology

	Annual Energy Use (MMBTUs)	% Energy Reduction vs New ICE
New ICE	72.1	-
Natural Gas Vehicle	63.4	12%
PHEV	27.2	62%
BEV	13.9	81%

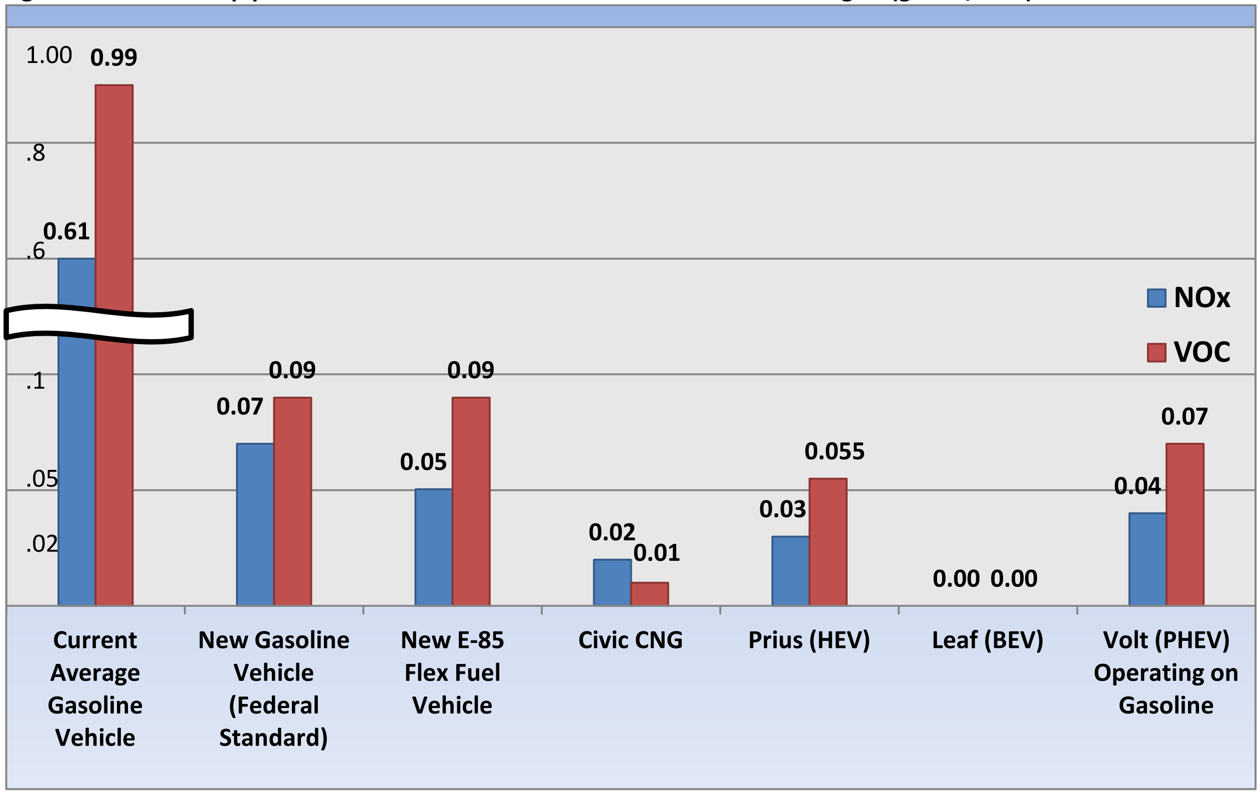
Comparing Ozone Precursor Emissions from Natural Gas and Electric Vehicles.

The Regional Air Quality Council (RAQC) estimates that mobile sources in the ozone nonattainment area contribute about 46% of the NOx and 25% of the VOC emissions that cause violations of the national air quality standard for ozone.

These NOx and VOC emissions from light duty vehicles would be reduced to zero if all miles were driven in electric vehicles. Electricity cannot be used for all vehicle miles travelled because of the limited battery range, but the best estimates are that 66-75% of all miles could be driven with battery power if all vehicles are pure EVs or plug-in electric hybrid vehicles (PHEV) that switch to liquid fuels after the battery charge has been drawn down.

With only one CNG and one PHEV model currently available it is difficult to draw conclusions on the tailpipe emission reductions of PHEVs and CNG vehicles in general. The CNG Honda Civic has emission rates for NOx of .02 grams per mile and for VOCs of .01 grams per mile. The Chevy Volt's tailpipe emission rates (when operating on gasoline) are .04 grams per mile for NOx and .07 grams per mile for VOCs. Assuming that the Volt will only be powered by gasoline for one-third of its miles would reduce tailpipe emissions to .013 grams per mile for NOx and .023 grams per mile for VOCs. By comparison, the Toyota Prius hybrid has emission rates of .03 grams per mile for NOx and .055 grams per mile for VOCs. All three vehicles emit less than the EPA standard for new gasoline vehicles (.07 grams per mile for NOx and .09 grams per mile for VOCs). Replacing traditional gasoline engines with these vehicles will reduce ozone precursors by 60% to 85%, depending on the share of VMT when PHEVs are operated on their gasoline power source.

Figure 1. Criteria Tailpipe Pollutant Emissions for Different Vehicle Technologies (grams/mile)



EPA does not currently recognize any emission reduction credit for States that adopt strategies designed to replace gasoline ICE vehicles with natural gas or hybrid electric vehicles. EPA recognizes that electric vehicles emit zero NOx and VOCs when operating on the battery, but has not developed any criteria for states to use in estimating the amount of VMT during a day when a PHEV will be operating on the battery. In its assessment of strategies available to reduce GHG emissions from the transportation sector,[5] EPA estimates that PHEV and pure EVs together will travel 66% of daily VMT on battery power generated from the grid. Using this assumption, an electric vehicle fleet will emit 35% less NOx and 130% more VOCs than a comparable natural gas powered vehicle fleet.

For battery powered electric vehicle miles, ozone precursor emissions are eliminated at the tailpipe, but are shifted to the power plant if the power is generated with fossil fuels. For power generated from an average uncontrolled coal-fired power plant in Colorado, net NOx emissions per mile travelled increase compared to tailpipe emissions from a gasoline vehicle and VOC emissions decrease. However, pollutants attributable to increased power supplied to electric vehicles may not contribute to ozone formation if 1) the power plant is outside the nonattainment area, 2) emissions are released above the mixing layer of the atmosphere rather than at ground level and will not mix with emissions from ground level sources for significant portions of the day, and 3) increased emissions are emitted at night during vehicle charging when ozone formation does not occur.

If natural gas replaces coal to generate the power for electric vehicles, net NOx emissions can be reduced as much as 23% compared to NOx emitted from gasoline vehicles. If the power is generated from renewable sources, both power plant and vehicle emissions of NOx and VOC, as well as SO_2 and mercury,

[5] EPA Analysis of the Transportation Sector: Greenhouse Gas and Oil Reduction Scenarios. February 10, 2010. Available at: http://www.epa.gov/oms/climate/GHGtransportation-analysis03-18-2010.pdf

are eliminated.

Comparing GHG Emissions from Natural Gas and Electric Vehicles.
CNG vehicles will reduce CO_2 emissions compared to gasoline, but emissions reductions will not continue after the gasoline fleet is replaced. GHG emissions from CNG vehicles will exceed 2005 levels by 2050 because of VMT growth. Electric powered vehicles offer the opportunity to offset much of the increased energy demand from VMT growth, and to achieve sustainable, long-term reductions in CO_2 that achieve the 80% target identified by Governor Ritter in the Colorado Climate Action Plan and the International Panel on Climate Change. The greatest advantage of electric vehicles is that they do not require the combustion of fossil carbon. GHG emissions linked to vehicles will drop as the carbon sources of power generated for the electric grid are replaced with renewable sources. The GHG emissions from PHEVs when using liquid fuels for the on-board power source will also drop as cellulosic biofuels are substituted for gasoline. Electric vehicles also require less energy because electric motors are inherently more efficient.

The figure and table below compares the CO_2 emissions resulting from several fuel scenarios:

Gasoline scenario (blue bars) – assumes gasoline vehicles meet the current fuel economy standards of 35.5 mpg by 2016 but no further improvements are made. Fuel economy improvements are overwhelmed by population growth and increased per capita VMT leading to increased fuel use and CO_2 emissions.

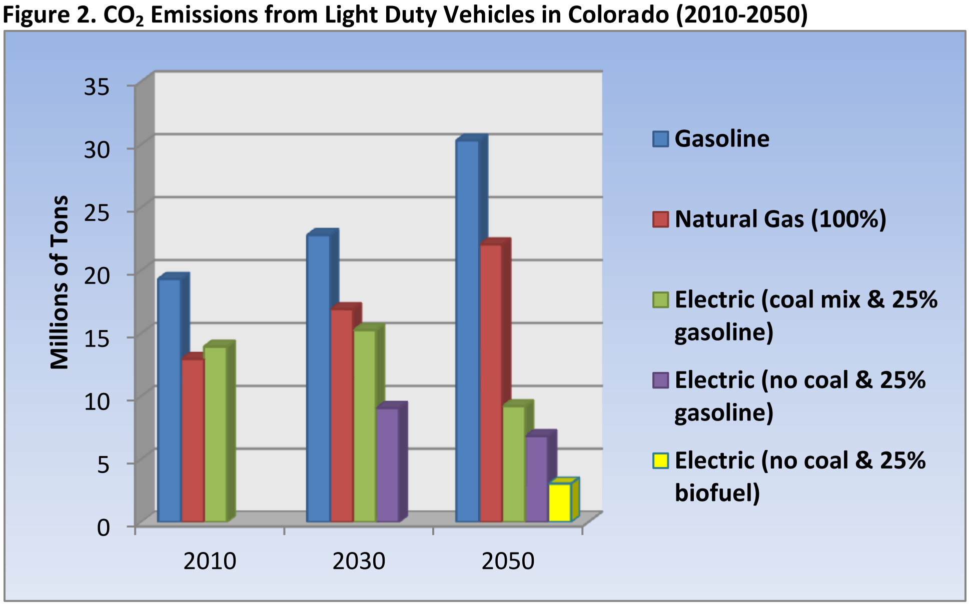
Natural Gas scenario (red bars) – assumes entire light duty fleet converted to natural gas by 2030. CO_2 is reduced 26% compared to gasoline, but after 2030 these reductions are overwhelmed by population growth and increased VMT per capita. CO_2 emissions rise to 2010 levels by 2040, and 14% above 2010 levels by 2050.

Electric vehicle scenario 1 (green bars) -- 75% of VMT is powered by electricity from the grid, with the remaining 25% fueled by gasoline. Compared to 2010 levels, electric generation has reduced its CO_2 emissions by 21% by 2030 and 52% by 2050 with coal being partially displaced by natural gas, wind and solar.

Electric Vehicle scenario 2 (purple bars) – assumes same % VMT powered by electricity as the first electric vehicle scenario, but natural gas replaces all coal in generating electricity for the grid.

Electric Vehicle scenario 3 (yellow bar) -- same as the second electric vehicle scenario except the 25% of VMT fueled by gasoline (fossil carbon) has been replaced by cellulosic biofuels with 80% less fossil carbon content than gasoline.

Figure 2. CO_2 Emissions from Light Duty Vehicles in Colorado (2010-2050)



Converting the light duty fleet to CNG vehicles by 2030 will reduce CO_2 emissions by about 26% compared to gasoline and converting the fleet to electric vehicles will reduce CO_2 emissions by 33% even if electricity is generated using the current coal fuel mix. If coal is replaced by natural gas in electric generating units, CO_2 emissions for electric vehicles would be reduced 60% compared to CO2 emitted from CNG used as a vehicle fuel, and nearly 80% compared to gasoline engines that are as efficient as the federal corporate average fuel efficiency standard. If the electricity used by vehicles is generated from renewable sources such as wind, solar and geothermal energy, then light duty EV emissions can be reduced by more than 80% before 2050.

Comparison of CO_2 Emissions from Individual Vehicles by Technology in 2010 and 2030

	Annual CO_2 Emissions (Tons) 2010 EGU Fuel Mix	% CO_2 Reduction vs New Gasoline Engine	Annual CO_2 Emissions (Tons) 2030 EGU Fuel Mix	% Annual CO_2 Reduction vs New ICE in 2030
Average New Gasoline ICE	5.08		3.70	
Natural Gas ICE	3.36	33%	2.73	26%
PHEV	3.19	37%	2.33	37%
BEV	3.53	30%	1.18	68%

The climate impacts of methane releases from the field production, processing, transmission, storage, distribution to fueling stations, vehicle fueling and incomplete combustion of natural gas are not quantified in this analysis. Methane, constituting more than 90% of unprocessed of natural gas, is a greenhouse gas more than 20 times more potent than CO2 in trapping heat in the Earth's atmosphere. A recent report[6] found that due in part to the leakage of methane, replacing coal with natural gas for electricity production would not provide a reduction in climate impacts because the climate-forcing effects of methane would offset the benefits of CO2 reductions. The EPA has found that 13% of methane leakage from natural gas systems occurs in the natural gas distribution system that delivers natural gas to individual users,[7] which is approximately 4% of all methane emissions in the United State. Adding thousands of additional distribution points in homeowners' garages and at commercial fueling stations will unavoidably increase the amount of leakage in the distribution system, although SWEEP was unable to identify any research on this specific topic of CNG refueling stations. Focusing natural gas delivery to a handful of natural gas-fueled electric generating stations compared to thousands of additional home and commercial CNG distribution stations should result in significantly less leakage. In addition to leaks, natural gas will also be released whenever vehicles are connected and disconnected to fueling hoses, and some gas will be emitted from tailpipes because no internal combustion engine achieves complete combustion of the fuel. Emission factors for each of these sources of release to the atmosphere have not been developed, but if all 4 million vehicles in Colorado were fueled with natural gas, atmospheric releases from natural gas fueling and combustion could double current emissions from the distribution system.

Infrastructure Needs and Costs for Each Fuel Scenario.

A convenient and accessible refueling infrastructure is essential for consumers to invest in owning alternative fueled vehicles. Without the potential for broad consumer demand, manufacturers have no incentive to offer a wide variety of natural gas or electric vehicles.

A significant barrier to the penetration of natural gas and electric vehicles into the light duty market is the lack of public refueling infrastructure. A potential advantage is the ability to refuel while the vehicle is at home and not in use. A majority (55% nationwide) of homes already have some kind of natural gas

[6] Wigley, T. (2011). Coal to gas: the influence of methane leakage. Climatic Change 108: 601-608. Retrieved from http://www.usclimatenetwork.org/resource-database/report-coal-to-gas-the-influence-of-methane-leakage.

[7] U.S. Environmental Protection Agency. (2011, April). 2011 U.S. Greenhouse Gas Inventory Report, Energy. Retrieved from: http://www.epa.gov/climatechange/emissions/usinventoryreport.html.

connection, and virtually all homes have access to the grid. Adding a home refueling station for natural gas is estimated to cost $4,500.

A dedicated public natural gas refueling station with four refueling pumps is estimated to cost between $250,000[8] and $500,000[9] while a fast-charge electric charging station (15 minute charge) with four rechargers would cost between $100,000[10] and $280,000.[11] Supplying a ubiquitous refueling infrastructure (200 stations) for the Denver metropolitan area would cost between 50 and $100 million for natural gas refueling and between $20 million and $56 million for electric refueling. Statewide, at least twice as many stations would be required at double the cost.

The convenience of recharging electric vehicles at home has significant appeal for consumers. Upgrading an existing home electric service (220 V) to allow for reasonable charging times (4-6 hours) is estimated to cost $2,000 to $2,500. The cost is less if a location already has 220V service. With low cost power generated during the night from currently unused generating capacity, the cost of energy for EVs can be half the cost of We urge the PUC to adopt a policy requiring utilities to rebate this cost to vehicle owners, or property owners of rental units, out of the increased revenues that will be received from increased sales of power generated during the off-peak period when existing capacity lies idle.

The availability of a moderate cost residential refueling option is the primary reason why manufacturers are bringing electric vehicles to market. Beginning in 2011, more than 17 manufacturers are planning the introduction of new electric vehicles as shown in Attachment 1. No comparable commitment has been announced by manufacturers to produce natural gas vehicles.

Fuel Supply Issues .

The supply of gasoline may not be reliably available or affordable once global demand exceeds global production. Many energy market analysts expect this shortfall in supply to occur before 2015. Because the U.S. imports over 50% of daily oil consumption, the U.S. economy and travelers dependent on gasoline vehicles are vulnerable to serious price shocks when this occurs.

The complete conversion of the light duty vehicle fleet to a domestically produced fuel source will require at least 20 years from when the alternative vehicles are available to consumers. Domestic supplies of natural gas are expected to remain reliably available through 2050 if the national light duty fleet were converted to natural gas by 2030. But supply may not be sufficient to both fuel the national light duty vehicle fleet and convert a large portion of electric power generation from coal to natural gas. A choice may be necessary between using natural gas to replace coal in power generation or to replace petroleum fuels in the transportation sector. If dedicated to transportation uses, diminishing supply of natural gas after 2050 may require that the national transportation system be converted again to another energy source by 2050.

Electric vehicles operate on a fuel source that will always be available, and generated in Colorado from domestic sources of energy, including wind, solar, geothermal and natural gas. If all light duty vehicles were converted to electricity, and 75% of VMT were driven using battery power from the grid, the increased annual energy demand by 2030 would require about 19,300 GWh, and by 2050 about 25,800 GWh. Statewide power demand in 2005 was 48,353 GWh, and the average capacity use was 46%. This means that new capacity would not be required to power the light duty fleet if the demand can be accommodated during periods (such as 10pm – 6am) when capacity use is low.

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[8] Sustainable St. Louis. (2010, June 21). *Wentzville Planning Natural Gas Refueling Station*. Retrieved from http://sustainstl.org/wentzville-planning-natural-gas-refueling-station/

[9] Loomis, B. (2010, August 24). Station Opens Uinta Basin to Clean Car Enthusiasts. *Salt Lake Tribune*. Retrieved from http://www.sltrib.com/sltrib/home/50160804-76/questar-cng-gas-utah.html.csp

[10] Electrification Coalition. (2009, November). *Electrification Roadmap*. Retrieved from http://www.electrificationcoalition.org/electrification-roadmap.php

[11] Electric Transportation Engineering Corporation. (2010, March). *Electric Vehicle Charging Guidelines for the Central Puget Sound Area.* Retrieved from http://www.psrc.org/assets/3756/eTec_Guidelines_3-24-2010_v2-0.pdf

Biofuels (e.g., ethanol) are currently made from food crops that will be needed before 2020 to meet the food demand of a growing population. Cellulosic biofuels that do not rely on food crops are not expected to be available in commercial quantities before 2020. Once commercially available, the volume of cellulosic biofuels is not expected to be sufficient to displace more than a fraction of current gasoline use, but could be expected to satisfy the remaining demand for liquid fuels if 75% of VMT were powered with electricity.

CONCLUSION.

Using electricity to power light duty vehicles presents an opportunity to achieve major reductions in GHG emissions from the transportation sector that can contribute to meeting the 80% reduction target before 2050. This benefit when combined with regional ozone pollution benefits, the relative ease of installing charging stations, and the reliability and stability of the supply of electric power, provide the nonenergy benefits that support the adoption of policies by the PUC that minimize the costs of EV ownership and use such as those recommended by SWEEP in the comments responding to the questions raised in the Docket Order.

Glossary of Abbreviations

BEV – Battery Electric Vehicle that operates only on electric power
CNG – Compressed Natural Gas
CO_2 – Carbon Dioxide which accounts for over 96% of GHG emissions from the transportation sector.
ICE – Internal Combustion Engine
IPCC – Intergovernmental Panel on Climate Change
MMBTU – Million BTUs
NOx – Nitrogen Dioxide, the pollutant emitted from ICEs that contributes most to atmospheric ozone
PHEV – Plug in Hybrid Electric Vehicle
SO2 – Sulfur Dioxide, the pollutant emitted from burning coal that contributes most to the Brown Cloud
VMT – Vehicle Miles Traveled

Attachment 1. Planned EV and PHEV Releases with Target Dates for Sale in US Market

Make/Model	**EV or PHEV**	**Battery Size (kwh)**	**Electric Range (miles)**	**Target Intro in US**	**Estimated Price**
Audi A1 Sportback	PHEV	20		2011	
BMW ActiveE	EV	125	100	Field trial in 2011	
BYD E6	EV	75-200	Up to 200	2010	
BYD F3DM	PHEV		60	2010	$22,000
Coda Sedan	EV		90-120	2010	$45,000
Daimler Smart ED	EV		90+	2012	
Fisker Karma	PHEV		50	2010	$87,900
Ford Escape	PHEV	10	40	2012	
Ford Focus	EV		100	2011	
Chevy Volt	PHEV	16	40		$41,000
Hyundai Blue Will	PHEV		38	2012	
Hyundai i10	EV		100	2012	
Mitsubishi iMiEV	PHEV	16	50	2010 (limited)	$47,500
Fiat Micro-Vett e500	EV		75	2012	
Nissan Leaf	EV	24	100	2010 (limited)	$32,780
Tesla Model S	EV		150-300	2011	$57,400
Tesla Roadster	EV		220	2010	$109,000
Think City	EV		80	2010	
Toyota Prius	PHEV		10-18	2010- 2012	$27,550
Volkswagen Twin Drive	PHEV		30	2013	
Volvo V70	PHEV		31	2012	