COLUMBIA WILLAMETTE CLEAN CITIES COALITION
4905 SW Scholls Ferry Road
Portland, Oregon 97225

September 27, 2013

Re: Comments on NW Natural Oregon Public Utility Commission Advice No. 13-10

To: Oregon Public Utilities Commission

The Columbia Willamette Clean Cities Coalition (CWCCC) appreciates the oppportunity to comment on NW Natural's Oregon Public Utility Commission Advice No. 13-10. CWCCC's mission is to reduce the consumption of petroleum. Alternative fuels, like natural gas, can have economic and environmental benefits compared to traditional petroleum transportation fuels. CWCCC supports NW Natural's (NWN) filed Advice No. 13-10.

In August 2013, CWCCC released the Oregon Natural Gas Transportation Fuel: Information Paper (Attachment A). The paper provides background and analysis of the current Compressed Natural Gas (CNG) Vehicle market in Oregon. It relies on state and national data, reports and studies, an informal survey of Oregon CNG fleets, and analysis of Oregon transportation fuel policy objectives. It identifies the market potential and barriers to development of a robust CNG, Renewable Natural Gas (RNG) and domestic Liquefied Natural Gas (LNG) transportation fuel market in Oregon. Eight strategies were identified that would accelerate natural gas adoption as a transportation fuel in Oregon:

- Build a minimum of 40 publicly accessible CNG fueling stations for large fleets along inter and intra-state highway corridors by 2022.
- Promote natural gas fuel use to large domestic public and private fleets with high mileage and low fuel economy vehicles which can recover the cost of fueling stations and vehicle incremental cost through fuel cost savings.
- Develop mechanisms to provide existing CNG fleets reliable access to other CNG fueling stations.
- Enhance the existing Oregon Natural Gas Vehicle Work Group to continue to share best practices, provide education, promote development, publish case studies, research market conditions, secure federal funding, and provide market technical, policy or financial support.
- Provide an educated workforce for fueling station installation, vehicle conversions, and vehicle and station maintenance and operation through Oregon community colleges and other trade development organizations.
- Allow natural gas utility investment in CNG, RNG and LNG infrastructure through implementation of regulatory reforms consistent with National Association of Regulated Utility Commissioners (NARUC) Resolution EL-1/ERE-2/GS-1.
- Assure that regulations provide for free market competition.
- Support local jurisdictions' application of codes and standards to expedite fueling station construction.
- The eleven states with some form of regulatory allowance for utility participation in the CNG market accounted for over 253 million gasoline gallon equivalent (GGE) of CNG sales in 2012, or 84 percent of the nationwide total. However no statistically valid cause and effect relationship could be drawn

from this correlation due to the recentness of regulatory actions in those states it is still a telling statistic.

CNG COST SAVINGS

In 2012, Oregonians spent more than $8 billion dollars for on-road transportation fuel. Of this, $6 billion left the state. Using U.S. Census Bureau data, the Oregon Department of Energy estimates that transportation fuel cost the average Oregonian almost seven percent of their disposable income; nearly double the rate ten years ago. Compressed natural gas (CNG) made up less than 0.01 percent of that transportation fuel use but has the potential to represent a much larger percentage in future years. Based on average prices in 2012 CNG is 42 percent less expensive than a gasoline gallon equivalent (GGE), is available in most metropolitan areas of the state and reduces carbon dioxide emissions by more than 20 percent compared to a gasoline gallon equivalent.

Last year the national average CNG retail cost was $1.53 less than a GGE and $1.87 less than a diesel gallon equivalent (DGE). The U.S. Department of Energy Information Administration (EIA) and Alternative Fuels Data Center (AFDC) report that in 2011 Oregon had 1,452 CNG vehicles, served by 14 fueling stations, using 1.2 million GGE of CNG. Oregonians could reduce annual transportation fuel costs by more than $300 million per year if just 10 percent of Oregon on-road transportation fuel (200 million gallons) was provided by natural gas. The addition of 40 to 60 CNG fueling stations, annual capacity between three and five million GGE per station, could meet this demand. With only three publicly accessible CNG fueling stations, the most significant barrier to accelerated use of CNG in Oregon is the lack of fueling stations to provide reliable fuel access.

OREGON TRANSPORTATION POLICIES

Three primary Oregon transportation policies encourage action to increase the use of alternative transportation fuels and reduce transportation emissions. Each relies on or provides some emphasis on CNG to meet emissions reduction goals.[1] The Oregon Clean Fuels Program calls for a 10 percent reduction in roadway fuel CO_2 emissions over a ten year period. The 2012 Governor's 10 Year Energy Action Plan calls for conversion of 20 percent of Oregon's large fleets to alternative fuels in the next 10 years. In the Statewide Transportation Strategy, the Oregon Transportation Commission envisions a 60 percent reduction in transportation greenhouse gas (GHG) emissions by 2050. That strategy includes more effective, efficient and cleaner transportation systems and vehicles or fuel technologies, as well as continued management and optimization of urban land use. For all three policies to be successful in achieving these emissions reduction goals it will require multiple technologies, including numerous strategies for each aspect of the transportation sector.

BUILD OUT TO RENEWABLE NATURAL GAS

Statewide build-out of public CNG fueling infrastructure will support development of renewable natural gas (RNG) as a transportation fuel in addition to CNG. RNG comes at a higher cost than CNG because it requires impurities to be removed but has a lower cost than petroleum fuels. The fueling systems and vehicle technology for CNG and RNG are identical. Pairing these fuels provides an economy of scale that leverages CNG's low cost and RNG's superior CO_2 emissions reductions for an

[1] See Attachment A for full details on Compressed Natural Gas and Oregon Transportation Policies.

affordable lower carbon fuel blend. Nationwide, the use of RNG for transportation fuel has been successful where there is developed demand and infrastructure for CNG. With subsidies and advanced fuel incentives, refuse hauling and fleets serving landfills or dairies demonstrate cost-effective RNG use. Utilization of RNG in projects can use large volumes of recovered, on-site RNG to fuel fleet vehicles that travel a high numbers of miles with high efficiency equipment. Additionally RNG has the added economic value of having the ability to be produced in state. Currently over 94% of Oregon's transportation fuels are imported to the state resulting in excessive amounts of dollars being exported.

Columbia Willamette Clean Cities Coalition supports NW Natural's proposal to offer its customers high pressure gas service. It is a vital step to reducing Oregon's dependence on imported conventional petroleum-based fuels and a step towards the increased benefits of the use of alternative fuels such as CNG RNG and LNG, provide.

ABOUT CWCCC

The Columbia-Willamette Clean Cities Coalition is a non-profit organization which was formed in 1994 as part of the national Clean Cities program. Our goal is to promote domestically-produced alternative transportation fuels. We do this in a variety of ways including community outreach, workshops, information dissemination, and project development. In 2012, CWCCC's stakeholders displaced almost 13 million GGE and reduced greenhouse gas emissions by more than 120,000 tons. We support using a wide range of technologies to reduce gasoline gallon equivalent including biofuels, methanol, compressed natural gas, liquefied natural gas, renewable natural gas, liquefied petroleum gas, hydrogen, and electricity.

Sincerely,

/s/ Michele Crim
President
Columbia-Willamette Clean Cities Coalition

Attachment A

Oregon Natural Gas Transportation Fuel: Information Paper

Prepared for and by:

Columbia Willamette Clean Cities Coalition

and

KENDALL ENERGY CONSULTING, LLC

Funded By:

U.S. Department of Energy

Clean Cities Coalition

Support Funds and Stakeholder Dues

PREFACE

Columbia Willamette Clean Cities Coalition, a public non-profit organized in the State of Oregon, retained KENDALL ENERGY CONSULTING, LLC in March 2013 to conduct secondary research and compile findings on how to accelerate use of compressed natural gas (CNG), liquefied natural gas (LNG), and renewable natural gas (RNG) for use as transportation fuels in Oregon. This paper reviews current natural gas transportation fuel markets, the state and readiness of infrastructure and vehicles, regulatory issues, market barriers, development requirements, best practices and next steps.

Columbia Willamette Clean Cities Coalition members and officers served as editors of this document. Scenario targets, fuel use and cost estimates are based on the Oregon Clean Fuels Program targets for 2022, the Governor's 10 Year Energy Action Plan and the Oregon Statewide Transportation Strategy (March 2013). The data in this report are drawn from state and federal sources. Any analysis or estimations draw on data from those cited sources. Observations and strategies proposed by the authors may not reflect all perspectives and objectives of the Columbia Willamette Clean Cities Coalition stakeholders. Any errors or omissions herein are accepted to be those of the authors and/or editor(s).

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SUMMARY

In 2012, Oregonians spent more than $8 billion dollars for on-road transportation fuel. Of this, $6 billion left the state. Using U.S. Census Bureau data, the Oregon Department of Energy estimates that transportation fuel cost the average Oregonian almost seven percent of disposable income; nearly double the rate ten years ago. Compressed natural gas (CNG) made up less than 0.01 percent of that transportation fuel use but has the potential to represent a much larger percentage in future years. Based on average prices in 2012 CNG is 42 percent less expensive than a gasoline gallon equivalent (GGE), is available in most metropolitan areas of the state and reduces carbon dioxide emissions by more than 20 percent compared to a gasoline gallon equivalent.

In 2012, national average CNG retail cost was $1.53 less than a gasoline gallon equivalent (GGE)[2] and $1.87 less than a diesel gallon equivalent (DGE)[1.] The U.S. Department of Energy Information Administration (EIA) and Alternative Fuels Data Center (AFDC) report that in 2011 Oregon had 1,452 CNG vehicles, served by 14 fueling stations, using 1.2 million GGE of CNG[3,4.] Oregonians could reduce annual transportation fuel costs by more than $300 million per year if just 10 percent of Oregon on-road transportation fuel (200 million gallons) was provided by natural gas[5]. The addition of 40 to 60 CNG fueling stations, with an annual capacity between 3 and 5 million GGE, could meet this demand. By comparison, Oregon has over 900 petroleum fuel stations serving a total of 2 billion gallons of petroleum gasoline and diesel per year. With only three publicly accessible CNG fueling stations, the most significant barrier to accelerated use of CNG in Oregon is the lack of fueling stations to provide reliable fuel access.[6]

Three primary Oregon transportation policies encourage action to increase the use of alternative transportation fuels and reduce transportation emissions. Each relies on or provides some emphasis on CNG to meet emissions reduction goals. The Oregon Clean Fuels Program being deliberated in the Oregon Legislature at the time of this publishing calls for a 10 percent reduction in roadway fuel CO_2 emissions by 2022. The 2012 Governor's 10 Year Energy Action Plan calls for conversion of 20 percent of Oregon's large fleets to alternative fuels in the next 10 years. In the Statewide Transportation Strategy, the Oregon Transportation Commission envisions a 60 percent reduction in transportation greenhouse gas (GHG) emissions by 2050. That strategy includes more effective, efficient and cleaner transportation systems and vehicles or fuel technologies, as well as continued management and optimization of urban land use. For all three policies to be successful in achieving these emissions reduction goals will require multiple technologies, including numerous strategies for each aspect of the transportation sector.

[2] National average retail price for CNG of $2.10 and regular gasoline $3.63. US Energy Information Administration. (2013). Short-Term Energy Outlook. Retrieved from http://www.eia.gov/forecasts/steo/report/prices.cfm
[3] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center. (2013). Compressed Natural Gas Fueling Stations. Retrieved from http://www.afdc.energy.gov/fuels/natural_gas_locations.html
[4] http://www.eia.gov/renewable/afv/users.cfm
[5] Current national average price difference for CNG and gasoline of $1.53.
[6] An informal phone and site visit survey of the fueling station owners cited in the report was conducted in March and April 2013 by KENDALL ENERGY CONSULTING, LLC.

The eleven states with some form of regulatory allowance for utility participation in the CNG market accounted for over 253 million GGE of CNG sales in 2012, or 84 percent of the nationwide total.[7] No statistically valid cause and effect relationship could be drawn from this correlation due to the recentness of regulatory actions in those states.

Statewide build-out of public CNG fueling infrastructure will support development of renewable natural gas (RNG) as a transportation fuel in addition to CNG. RNG comes at a higher cost than CNG because it requires impurities to be removed but has a lower cost than petroleum fuels. The fueling systems and vehicle technology for CNG and RNG are identical. Pairing these fuels provides an economy of scale that leverages CNG's low cost and RNG's superior CO_2 emissions' reductions for an affordable lower carbon fuel blend. Nationwide, the use of RNG for transportation fuel has been successful where there is developed demand and infrastructure for CNG. With subsidies and advanced fuel incentives, refuse hauling and fleets serving landfills or dairies demonstrate cost-effective RNG use.[8,9] RNG projects can use large volumes of RNG recovered on-site to fuel fleet vehicles that travel high numbers of miles at low miles per gallon.

This paper provides background and analysis of the current CNG market in Oregon. It relies on state and national data, reports and studies, an informal survey of Oregon CNG fleets, and analysis of Oregon transportation fuel policy objectives. It identifies the market potential and barriers to development of a robust CNG, RNG and LNG transportation fuel market in Oregon. Eight strategies were identified that would accelerate natural gas (CNG, RNG, LNG) transportation fuel adoption in Oregon:

- Build a minimum of 40 publicly accessible CNG fueling stations for large fleets along inter and intra-state highway corridors by 2022.
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- Enhance the existing Oregon Natural Gas Vehicle Work Group to continue to share best practices, provide education, promote development, publish case studies, research market conditions, secure federal funding, and provide market technical, policy or financial support.
- Provide an educated workforce for fueling station installation, vehicle conversions, and vehicle and station maintenance and operation through Oregon community colleges and other trade development organizations.

[7] US Energy Information Administration, (2013), Natural Gas Consumption by End Use. Retrieved from http://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vdv_mmcf_a.htm

[8] Malone, Billy, Dekalb County Georgia (2012). LFG to RNG & Utilization of CNG Fuel in Solid Waste Vehicles. Retrieved from: http://www.epa.gov/lmop/documents/pdfs/conf/15th/05Malone_Final.pdf

[9] BioCycle: Composting, Renewable Energy and Sustainability, Volume 52, No. 9, pg 32 (2011). Indiana Dairy Fueling Fleet with Renewable Natural Gas. Retrieved from: http://www.biocycle.net/2011/09/indiana-dairy-fueling-fleet-with-renewable-natural-gas/

- Allow natural gas utility investment in CNG, RNG and LNG infrastructure through implementation of regulatory reforms consistent with National Association of Regulated Utility Commissioners (NARUC) Resolution EL-1/ERE-2/GS-1.[10]
- Assure that regulations provide for free market competition.
- Support local jurisdictions' application of codes and standards to expedite fueling station construction.

WHY ALTERNATIVES TO PETROLEUM?

Alternative transportation fuels (biofuels, electricity, liquid petroleum gas, CNG, LNG and RNG) are shown to be available at a lower cost per unit of energy than petroleum while providing reduced emissions. With no petroleum production or refinement facilities Oregon imports all its petroleum fuels. In 2012, Oregonians used nearly 1.5 billion gallons of gasoline[11]. At an average price of $3.81 per gallon[12], Oregonians paid nearly $5.6 billion for gasoline with approximately $4.3 billion of that leaving the state.[13] For the same year, about 583.1 million gallons of on-highway diesel[14] were consumed in the state. With the West Coast average price of diesel reaching $4.17 in 2012, Oregonians spent $2.43 billion for that fuel with $1.7 billion leaving the state from on-highway diesel purchases.[15,16] Combined on-highway gasoline and diesel fuel 2012 expenditures meant $8 billion was spent on transportation fuel with $6 billion of that revenue leaving the state.[17]

It is estimated that in 2000 transportation fuel cost the median Oregon household 3.61 percent of its annual income. By 2011, that rose to 6.64 percent and in 2012 it rose again to 7 percent.[18,23,22] About 92 percent of the transportation sector energy is sourced from petroleum products. In 2010, the transportation sector used 33 percent of all the energy consumed in Oregon. Transportation fuel accounted for 56 percent of all energy expenditures, making it the most expensive energy used in the state.[19,20]

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[10] National Association of Regulated Utility Commissioners (NARUC). (2012). EL-1/ERE-2/GS-1 Resolution on Expanding the Alternative Fuel Vehicle Market. Retrieved from http://www.naruc.org/Resolutions/Resolution percent20on percent20Expanding percent20the percent20Alternative percent20Fuel percent20Vehicle percent20Market.pdf

[11] Oregon Department of Transportation. (2013). Fuels Tax Group. Retrieved from http://www.oregon.gov/ODOT/CS/FTG/Pages/reports.aspx

[12] AAA. (2013). Average Price. Retrieved from http://www.oregon.aaa.com/resources/gasarticles.aspx?zip=97305&stateprov=or&city=salem&devicecd=PC&referer=www.google.com

[13] Assuming the subtraction of $0.484 per gallon for taxes (Federal & State) and 10 percent for distribution and marketing, of which not all stays in state, however it was included within this analysis. (See table 1).

[14] U.S. Energy Information Administration. (2012). Adjusted Distillate Fuel Oil and Kerosene Sales by End Use. Retrieved from http://www.eia.gov/dnav/pet/pet_cons_821usea_dcu_SOR_a.htm

[15] U.S. Energy Information Administration. (2012). Weekly Retail Gasoline and Diesel Prices. Retrieved from http://www.eia.gov/dnav/pet/pet_pri_gnd_dcus_r50_a.htm

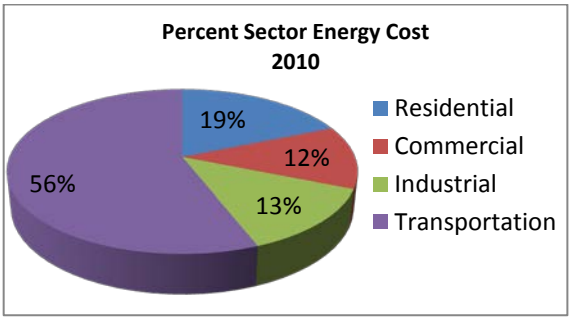
[16] Using the estimation of costs listed in table 2 Oregonians paid about $291 million in State and Federal road tax and distribution and marketing come to about $462 million.

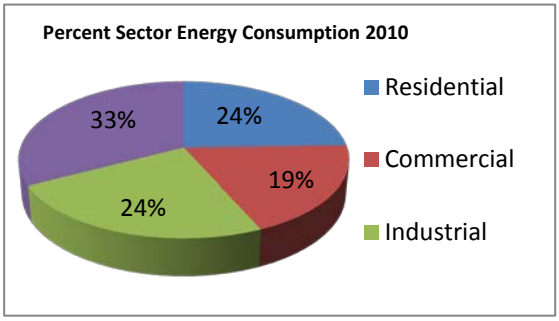
[17] This analysis does not include other petroleum products or uses such as aviation, jet fuel, off-highway use, farming or maritime.

[18] United States Census Bureau. (2013). Oregon State & County QuickFacts. Retrieved from http://quickfacts.census.gov/qfd/states/41000.html

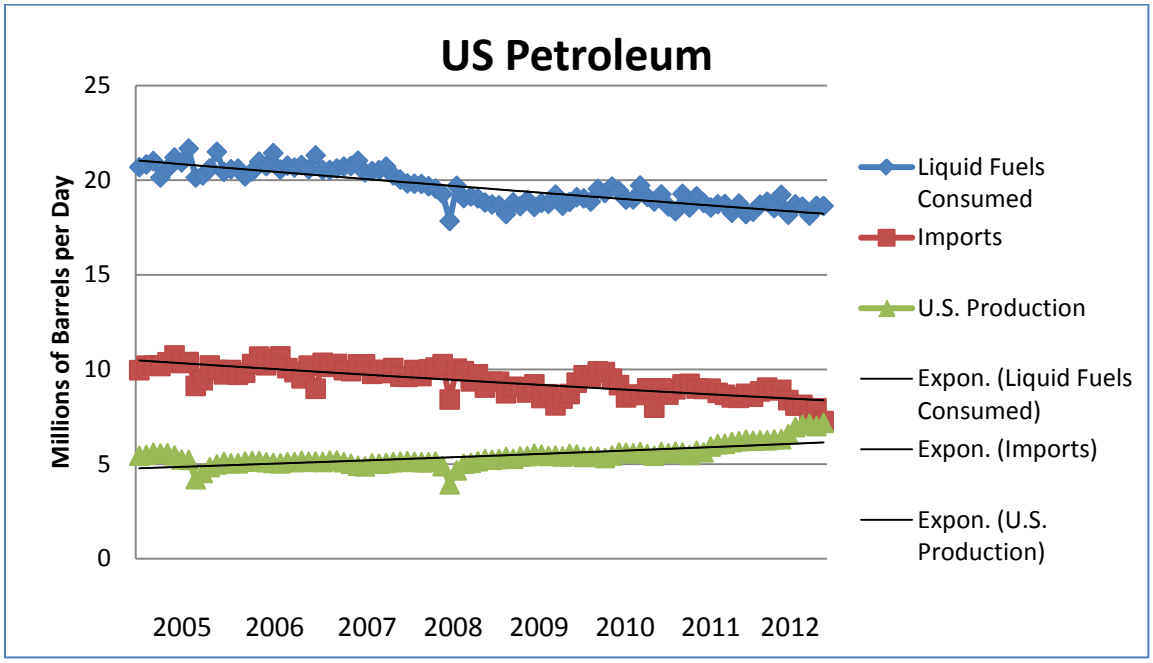
[19] U.S. Energy Information Administration. (2012). State Energy Data System (SEDS): 1960-2010 (Complete). Retrieved from http://www.eia.gov/state/seds/seds-data-complete.cfm?sid=OR

[20] U.S. Energy Information Administration. (2012). State Energy Data System (SEDS): 1960-2010 (Complete). Retrieved from http://www.eia.gov/state/seds/seds-data-complete.cfm?sid=OR





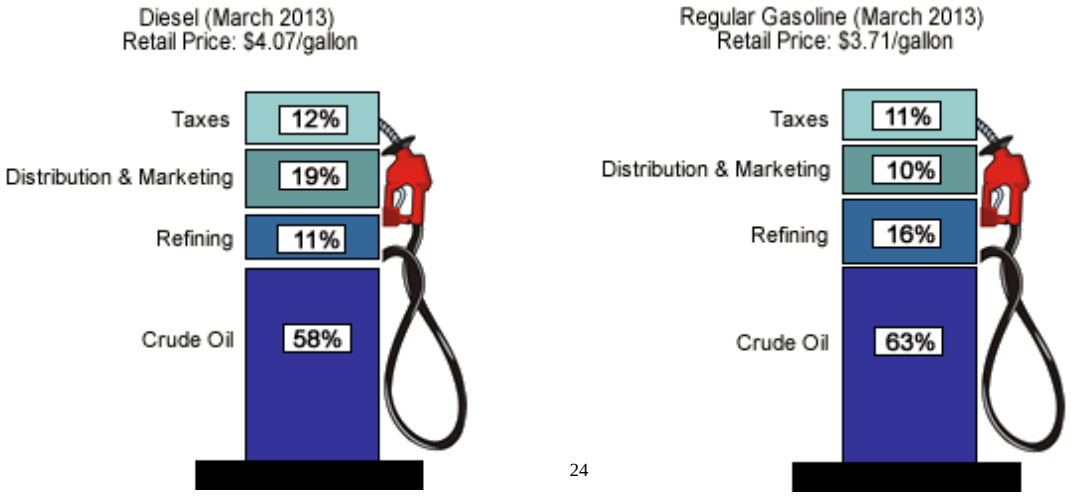
The chart below shows U.S. oil production is at its highest level in 20 years.[21] At the same time U.S. oil demand is at a 17 year low. U.S. consumption has decreased by about 13 percent from 2005 to March of 2013.[22] In this same time period petroleum imports to the U.S. have decreased by about 20 percent.[23]



[21] U.S. Energy Information Administration. (2013). U.S. Field Production of Crude Oil. Retrieved from http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M
[22] U.S. Energy Information Administration. (2013). U.S. Field Production of Crude Oil. Retrieved from http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M
[23] U.S. Energy Information Administration. (2013). U.S. Field Production of Crude Oil. Retrieved from http://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=MCRFPUS2&f=M

U.S. Gasoline and Diesel Price Differential

Between 2005 and 2013 the United States experienced increased prices in diesel and gasoline with the price of diesel increasing by almost 38 percent and gasoline increasing by 36 percent. Crude oil price is the primary driver for increased cost of refined petroleum products. Gasoline and diesel roadway taxes have changed little since 2005. Other underlying components of gasoline and diesel cost, such as marketing, distribution and refining have risen but stayed relatively correlated with inflation. Refinery efficiency and production gains in that time have been for the most part offset by more complex crude oil refining requirements. The following charts identify what portion crude oil price plays in the retail price of gasoline and diesel.



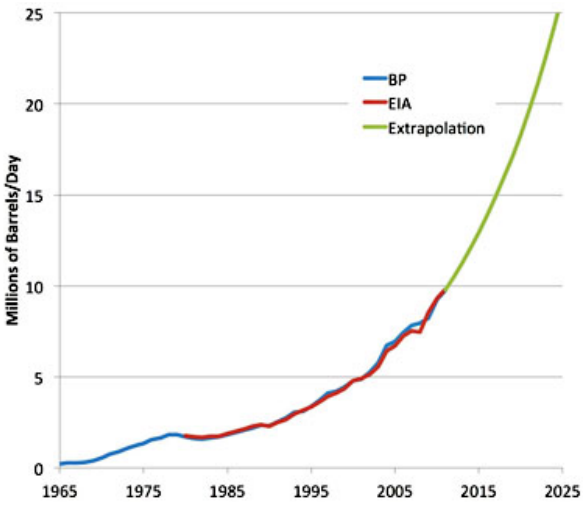
[24]

Why Is Petroleum so Expensive?

The annual average spot price for Europe Brent crude, an international price index, rose from $54 per barrel in 2005 to $112 in 2012. In May 2013, Europe Brent crude was trading at $96. EIA data shows that 60 percent to 76 percent of retail gasoline price is determined by world crude oil prices. Global markets driven primarily by supply and demand set the price refineries pay for crude oil - and world demand, particularly from developing economies, continues to rise. Additional factors affecting crude oil price range from declining output in conventional oil fields and expensive unconventional oil to unstable global politics, natural disasters, infrastructure issues, weakening dollar, speculation, and oil cartel price setting and production quotas,.

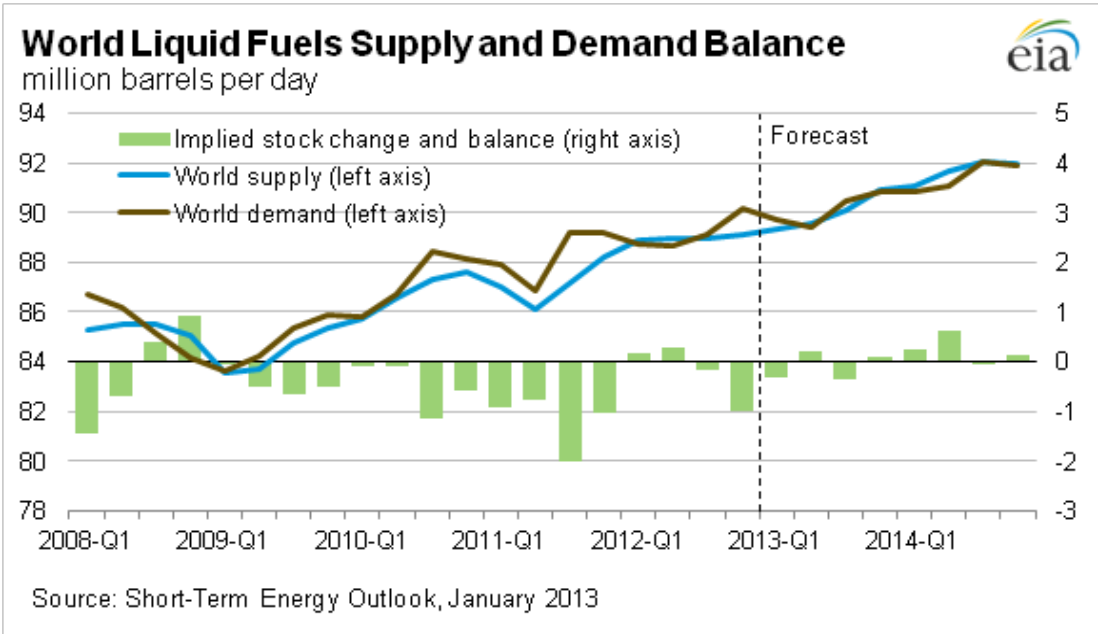
As U.S. oil demand declines or remains flat, worldwide demand is growing. Brazil, Russia, India, and China account for a significant portion of worldwide demand growth. Traditional oil export countries are using more of their own oil due to increased domestic demand resulting from economic development spurred primarily by oil revenues. This creates tight markets.

[24] Energy Information Agency , http://www.eia.gov/petroleum/gasdiesel/



China's growth and estimated future growth in oil consumption

In 16 of the 20 Previous Quarters the World has More Demand than Supply as Evidenced by the Green Bars in the Chart Below



Recently the International Energy Agency (IEA) reported that output from the world's mature conventional oil fields was declining by an average of 6.7 percent and the world reached peak production of conventional oil in 2006. This decline in conventional oil production will be offset with "unconventional" products such as shale oil, tar sands, and deep-water oil. Unconventional products are more expensive than conventional oil and production rates can be limited as in the case of shale oil and tar sands. New production of unconventional oil is just replacing declines in more mature fields that will continue to be depleted.

Oil prices are historically volatile. The Oregon transportation sector is dependent on oil and subject to that price uncertainty. Diversification of Oregon transportation energy supply can be cost effective and can reduce exposure to the price volatility and uncertainty of imported oil.

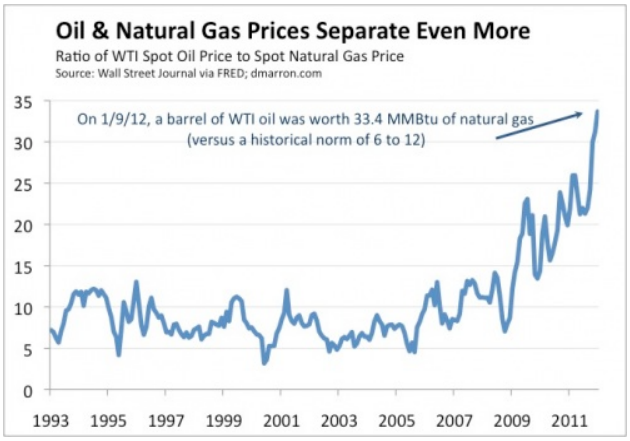
THE ECONOMIC CASE FOR COMPRESSED NATURAL GAS

The growing supply of North American natural gas means that Oregon and the U.S. have the potential to use lower cost domestic energy supplies and to create additional domestic employment to better support a reviving economy.

Technology advancements and widespread adoption of horizontal drilling and hydraulic fracturing have lowered development costs and increased production efficiency, flooding the U.S. market with natural gas and natural gas liquids (NGLs). This has helped to drive renewed competitiveness in several industries such as petrochemical production, refining, and other natural gas-fueled manufacturing sectors that rely on these feedstocks. The EIA estimates that there are 2,203 trillion cubic feet (Tcf) of technically recoverable natural gas in the United States. At the 2011 rate of U.S. natural gas consumption, [25] 2,203 Tcf of natural gas would last about 92 years.

Natural gas has many advantages over petroleum fuels. It has fewer impurities and is less chemically complex so it requires little or no refining. It is distributed throughout Oregon and is transported by pipeline which is more efficient than trucking petroleum fuels. In 2012, the national average retail cost of CNG was $2.10 per GGE compared to an Oregon average of $3.81 per gallon for gasoline. Combustion of CNG results in 20 percent less CO_2 emissions and substantial reduction of other hydrocarbon pollution.

The economics of natural gas demonstrate a compelling case for conversion for some fleets. A barrel of oil has roughly 6 times the energy content of an MMBtu of natural gas (MMBtu are the units in which these commodities are typically traded). If the fuels were perfect substitutes, oil prices would be about 6 times natural gas prices. However, the ease of using oil to make gasoline means that oil is more valuable and is generally traded at a higher price. In the last five years there has been a dramatic change in this energy market.



Before 2005, natural gas and oil prices were traded in tandem, when oil prices rose, gas prices did, too. As of 2012, natural gas and crude oil prices have decoupled in the U.S. market. The result being the price ratio of a barrel of oil to a MMBtu of natural gas has risen to more than 25:1 on a sustained basis. This ratio is well in excess of the 6:1, or the ratio based on pricing energy content at parity.

[25] About 24 Tcf per year

THE ENVIRONMENTAL CASE FOR CNG AND RNG

Using 1.9 million GGE of CNG in lieu of gasoline or diesel in 2012, Oregon realized more than 3,400 tons of CO_2 emissions reductions.[26] That is the equivalent of removing 600 automobiles from the road that travel 12,000 miles per year at 22 miles per gallon.[27] These emissions reductions can be cost-effectively increased.

Natural gas provides full life cycle gallon equivalent carbon dioxide emissions reductions exceeding 20 percent when compared to petroleum fuels (92.3 for gasoline, or 91.53 for diesel, vs. 70.22 CNG in gCO2e/MJ[28]). Using the California Energy Commission (CEC) established full life cycle fuel carbon intensities (CI) for fuel, one gets approximately 19.6 pounds of CO_2 emissions per gallon of gasoline and 22.3 pounds CO_2 for diesel. For CNG the full life cycle CO_2 emissions are 14.1 pounds per GGE and 16.1 pounds per diesel gallon equivalent (DGE). These are emissions reductions of 25 percent and 18 percent respectively.

Renewable natural gas from landfills and anaerobic digesters at wastewater treatment and agricultural or food processing facilities provides carbon dioxide emissions reductions of more than 80 percent compared to gasoline and diesel. Full lifecycle landfill gas CO_2 emissions are set by CEC at 11.26 gCO2e/MJ and dairy digester biogas at 13.45 gCO2e/MJ, resulting in average RNG full lifecycle CO_2 emissions of 3 pounds CO_2 per DGE. Compared to diesel, that is an emissions reduction of over 85 percent.

The Oregon Clean Fuel Program[29] scenario projects an additional 3.8 million GGE of CNG use in 2022 (total 5.7 million). Assuming the transportation sector offsets approximately 3.8 million additional gallons of gasoline with CNG, Oregonians could conservatively save $6 million dollars per year, assuming the 2012 national average gasoline and CNG prices.[30] Additional CO_2 emission reductions of over 11,100 tons per year could result based on an average of 5.85 pounds of CO_2 savings per additional gallon displaced (California Energy Commission, 2013).[31] The following table[32] provides a comparison of CO_2 emissions between various fuels and blends of fuel

[26] 5.5 pounds CO_2 reduction per GGE and 6.3 per DGE.
[27] 3,400 tons per year / 12,000 miles traveled / 22 mpg = 545 gallons per year x 19.6 lbs CO_2 per gallon / 2,000 lbs. per ton= 5.35 tons per vehicle per year
[28] gCO2e/MJ means grams of carbon dioxide equivalent per mega joule.
[29] Low Carbon Fuel Standard Report
[30] Assuming a differential of $1.53 per gallon between gasoline and CNG.
[31] 5.85 pounds CO2 x 3.8 million GGE of CNG / 2,000 pounds per ton.
[32] Source: *California Air Resources Board (2012), Oregon Low Carbon Fuel Standard Report (2011)*

Estimated Relative Carbon Intensity by Fuel Type

Fuel Type	Carbon Intensity Values in gCO2e/MJ	
	Direct	Total[33]
Gasoline – Neat 100 percent petroleum	92.34	92.34
Gasoline E10 – With 10 percent Oregon average ethanol	88.49	91.18
E85 – 85 percent Oregon average ethanol and 15 percent Oregon average petroleum gasoline	59.58	82.46
Ultra Low Sulfur Diesel – 100 percent petroleum diesel	91.53	91.53
Diesel B5 – with 5 percent used cooking oil converted to fatty acid methyl esters	87.74	87.74
Ethanol from cellulose – Farmed softwood trees	15.54	15.54
Biodiesel B100 –100 percent used cooking oil converted to fatty acid methyl esters	15.84	15.84
Biodiesel B100 – 100 percent Midwest soybeans converted to fatty acid methyl esters	21.3	83.25
Liquefied Petroleum Gas (LPG) - Propane	83.13	83.13
Electricity – Oregon statewide mix marginal renewable resources and natural gas	37.80	37.80
Ethanol from corn – Oregon Average; Dry mill, wet distillers grains, natural gas	53.79	80.70
Ethanol from Sugarcane – Brazilian with average production processes	27.40	73.40
Compressed Natural Gas (CNG)_– North American pipeline	70.22	70.22
Liquefied Natural Gas – North American pipeline gas at 80 percent liquefaction efficiency	83.13	83.13
Renewable Biogas – Landfill gas at pipeline grade	11.26	11.26
Renewable Biogas – Dairy Anaerobic Digester gas at pipeline grade	13.45	13.45

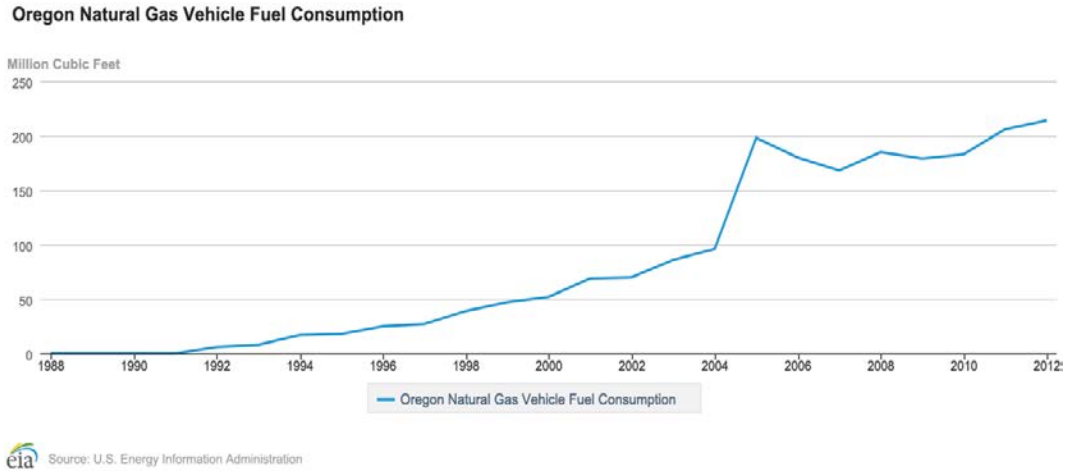
[33] Total carbon intensity includes all land use changes and other indirect effects of the fuel.

OREGON NATURAL GAS TRANSPORTATION FUEL MARKET

In May 2013, the AFDC Alternative Fueling Station Locator identified a network of 385 publicly accessible fueling stations for ethanol, biodiesel and electric vehicles in Oregon[34] indicating that interstate highway corridors for those fuels are well developed.

More than 900 retail petroleum fuel stations provide E10 gasoline and B5 diesel by state mandate. Twenty nine of those petroleum stations provide either E85 gasoline or other blend ratios of biodiesel.[35] AFDC reports Oregon has 311 publicly accessible electric vehicle charging station locations[36] that complete an effective interstate highway corridor while serving the major communities throughout the state. Liquefied petroleum gas (LPG) or propane fueling infrastructure exists at 45 stations in 23 cities across Oregon. However, LPG vehicle-fueling services are not promoted nor are those sites well adapted for vehicle fueling.

A 2013 survey identifies Oregon has 23 operating CNG fueling stations of which 3 are publicly accessible. Oregon initiated use of CNG in response to the federal Energy Policy Act of 1992 (EPACT). EPACT required federal and state governments, and larger utility fleets, to integrate alternative fuels of all types into use. Oregon's CNG fleet size and fuel use have grown slowly since inception.[37] Beginning in 2004, there has been an upswing in the number of fueling stations and vehicles, and increased alternative fuel use. The following chart shows Oregon historical CNG use in million cubic feet.



AFDC and EIA report that in 2011 there were 1,452 CNG vehicles, using 1.176 million GGE of CNG in Oregon. That indicates that in 2011 CNG was less than 0.01 percent of Oregon's nearly 2 billion gallons of roadway gasoline and diesel.

[34] US Department of Energy. (2013). Alternative Fueling Station Locator; Oregon. Retrieved from http://www.afdc.energy.gov/locator/stations/#results?utf8=✓&location=Oregon&filtered=true&fuel=all&owner=all&payment=all&ev_level1=true&ev_level2=true&ev_dc_fast=true&radius_miles=5

[35] In May 2013, AFDC reports 6 fuel stations in Oregon providing gasoline fuel blended with 85 percent ethanol (E85) and 23 stations providing diesel fuel blended with 20 percent or more biodiesel.

[36] There are a total of 850 electric charging stations at these 311 locations.

[37] U.S. Energy Information Administration. (2013). Oregon Natural Gas Vehicle Fuel Consumption. Retrieved from http://www.eia.gov/dnav/ng/hist/na1570_sor_2A.htm

Oregon CNG Fuel Vehicle Count and Thousand Gallons Gasoline Equivalent Use

Year	2003	2004	2005	2006	2007	2008	2009	2010	2011
Total Vehicles	1,385	1,518	1,588	1,452	1,520	1,645	1,675	1,647	1,452
CNG Used[38]	1,297	1,635	1,649	1,496	1,389	1,526	1,468	1,492	1,176

Although AFDC Alternative Fuel Station Locator reports 14 natural gas refueling stations operating in Oregon in 2012 with only three of those offering public access, as mentioned above a 2013 survey indicates 23 operating and two soon to be operating CNG or LNG fueling stations.[39, 40, 41,42] The survey shows that no LNG or RNG is used for vehicle fueling in Oregon at present. Two LNG stations, being built by Clean Energy in 2013, will dispense LNG at Stansfield and Central Point according to the developer's testimony to the Oregon State Legislature.[43] The survey identified that the following Oregon CNG fueling infrastructure includes a wide variety of equipment of which about 20 percent is considered fast-fill and capable of fueling at commercial scale.

EERE AFDC Identified Natural Gas Refueling Infrastructure

Station Name	Street Address	City	Access/Fuel
Northwest Natural Gas - Tualatin Service Center	7100 SW McEwan Rd	Tualatin	Private/CNG
Northwest Natural Gas - South Center	19200 SW Teton Ave	Tualatin	Private/CNG
Northwest Natural Gas - Parkrose Service Center	12120 NE Inverness Dr	Portland	Private/CNG
Northwest Natural Gas - Mt Scott Service Center	9222 SE Knapp St	Portland	Private/CNG
Northwest Natural Gas - Salem Service Center	3123 Broadway St NE	Salem	Private/CNG
Oregon Dept. of Admin. Services Motor Pool	1100 Airport Rd SE	Salem	Public/CNG
Northwest Natural Gas - Sunset Service Center	20605 NW Cornell Rd	Portland	Private/CNG
Jackson County Motorpool	808 W Main St	Medford	Public/CNG
Rogue Valley Transportation District	3200 Crater Lake Ave	Medford	Public /CNG
Port of Portland Airport	7111 NE Alderwood	Portland	Private/CNG
Salem-Keizer Transit	3170 Del Webb Ave NE	Salem	Private/CNG
Avista Klamath Falls Service Center	2825 Dakota Ct	Klamath Falls	Private/CNG
City of Saint Helens	984 Oregon St	Saint	Private/CNG

[38] Thousands gallons gasoline equivalent
[39] EIA reports 14 CNG stations located in Oregon in 2012. This data discrepancy regarding CNG, LNG and RNG fueling infrastructure in Oregon, from the various data sources, indicates a need for additional attention to data continuity.
[40] In March 2013 Kendall Energy conducted a phone survey of listed CNG fueling station operators to verify operation and general pubic access.
[41] These three stations allow some public refueling but are in existence primarily to fuel their own fleet and are open only during limited business hours.
[42] The survey included phone interviews with fueling station operators and a few on-site visits in March and April 2013.
[43] Nationwide infrastructure for long haul vehicle corridors for LNG fueling is being developed (AFDC, 2013). In March 2013, Clean Energy provided testimony to the Oregon Legislature that it has LNG fueling stations in Stanfield and Central Point, Oregon underway.

		Helens	
Waste Management - Portland Hauling	5330 NE Skyport Way	Portland	Private/CNG
Additional CNG/LNG stations Found in Oregon			
Station Name	**Street Address**	**City**	**Access/Fuel**
Pilot Travel Center	2115 Highway 395	Stanfield	Public/LNG[44]
Pilot Travel Center	1600 East Pine St.	Central Point	Public/LNG[25]
American Honda NW Distribution Center	16800 NE Sandy Blvd.	Portland	Private/CNG
Gresham Sanitary Services	2131 NW Birdsdale Ave.	Gresham	Private/CNG
Heiberg Garbage and Recycling	2300 SE Hanna Harvester Dr.	Milwaukie	Private/CNG
Portland Community College	12000 SW 49th	Portland	Private/CNG
Pride Disposal Co.	13980 SW Tualatin	Sherwood	Private/CNG
SMART	28754 Boberg Rd.	Wilsonville	Private/CNG
University Motor Pool	3233 Franklin Boulevard	Eugene	Private/CNG
Avista Utilities	580 Business Park	Medford	Private/CNG
Avista Utilities	1404 Green Siding Rd	Roseburg	Private/CNG

Additional stations to come online soon include: The Linn Benton Community College Advanced Transportation Technology Center CNG station in Albany scheduled to begin public access operation in summer 2013 and Republic Services, the waste hauler for Corvallis and Benton County, will begin construction of a station late summer 2013 with the first trucks running routes by the end of the year. The company plans on replacing 20 trucks this year and a similar number next year. Oregon's retail public access stations currently provide CNG below the national average price of $2.10 per GGE.[45]

Oregon Retail CNG Price in GGE	
Rogue Valley Transit	$1.41
Jackson County Motor Pool	$1.74
State of Oregon Motor Pool - Salem[46]	$1.25
Oregon Un-weighted Average	$1.47
National Average	$2.10

Oregon can build on this existing CNG infrastructure and leverage the existing corridors for other alternative fuels to better serve domestic and interstate CNG consumers. National objectives for a robust

[44] Noted as underway but non-operational by the local provider as of March 2013.

[45] CNGPrices.com., (2013), CNG Stations and Prices Map. Retrieved from http://www.cngprices.com/station_map.php

[46] The state facility is available for public access through 2014, with legislation pending to extend that to 2018 and is required to sell the fuel at their cost which at the time of this writing was $1.25 per GGE.

national alternative fuel corridor system can attract federal resources to Oregon, as it has for electric vehicle charging.

Renewable Natural Gas (RNG) and Liquefied Natural Gas (LNG)

The market for RNG compressed for transportation fuel from biogas sources is not developed in Oregon. Nationwide, use of RNG for transportation fuels is noted as successful where there is developed demand and infrastructure for CNG. That infrastructure and consistent fuel quality and lower price compared to gasoline provides an economy of scale for fuel blending[47]. Some waste management fleets serving landfills or dairies, with gas recovery have demonstrated cost effective RNG dedicated fleets.

Biogas (methane) from landfill recovery, wastewater treatment digesters, and anaerobic digesters at dairies, food processing or waste processing facilities requires filtration with high quality standards. Refining and filtering biogas requires increasing the proportion of methane and decreasing the proportion of carbon dioxide and the removal of contaminants through absorption, adsorption, membrane separation, or cryogenic separation.

In 2011, data show bio-methane filtering costs ranging from $8 to $10 per million BTUs. That would result in a retail price of some $28 per MBTU compared with CNG price in 2012 of $18 and petroleum fuel price of $32. The cost of filtering equipment requires an economy of scale of recoverable biogas to recover the capital cost of that equipment.[48] Transportation from remote sites out of local distribution company (LDC) service areas, compression to 3,500 pounds per square inch, and blending systems for injecting RNG into CNG transportation fuel dispensing systems all increase the RNG variable cost which does not make it competitive with pipeline natural gas price. Renewable Identification Numbers (RINs) are available for RNG and provide cost of production output. In 2012, RINs sold for between $0.80 and $1.00 per GGE and can allow RNG to be competitively blended into CNG markets where there is assured supply for buyers.

Direct injection of filtered RNG into LDC distribution gas lines can reduce the transportation and compression cost. Use of RNG at sites remote from markets or LDC distribution is being developed in some areas where a dedicated fleet is committed to its use (e.g. waste haulers at landfills, haul vehicles at dairies).

Liquefied Natural Gas (LNG) infrastructure is developing across the country with focus on the long-haul trucking market. AFDC identified 32 operating retail access LNG stations across the country in 2011.[49] Two Oregon LNG fueling stations were reported to be in development during legislative testimony in March 2013. This infrastructure alone is not capable of supporting rapid development of LNG fuel use in Oregon in the next 3 to 5 years. Clean Energy is planning private investment and development of a national LNG transportation corridor system with 150 fueling stations nationwide by 2015.[50] Many will be co-located at Pilot-Flying J Travel Centers. Further development in Oregon will depend on LNG demand and favorable price conditions.

[47] In this case fuel blending would be using both RNG and CNG in tandem for fueling.
[48] Kerry Kelley, Waste Management (2011). Landfill Gas to Renewable Energy: A Primer. Retrieved from: http://www.americanbiogascouncil.org/pdf/briefing15may12_wasteManagement.pdf
[49] U.S. Department of Energy, Energy Efficiency & Renewable Energy, Alternative Fuels Data Center, (2013). Compressed Natural Gas Fueling Stations. Retrieved from http://www.afdc.energy.gov/fuels/natural_gas_cng_stations.html#fastfill
[50] Clean Energy, (2013), Clean Energy Fuels, Retrieved from: http://www.cleanenergyfuels.com

CNG Fueling Codes and Standards

Oregon code jurisdictions have little experience siting CNG fueling stations. However, all the relevant codes and standards for electrical, fire and life safety, compressed gas storage, and dispensing exist. Oregon jurisdictions have promulgated those codes and have experience applying them independently of one another but training may be necessary where more than one code must be integrated at one site. The primary organizations publishing codes that affect CNG fueling stations in the U.S. include:

- American National Standards Institute (ANSI)
- American Society of Mechanical Engineers (ASME)
- American Society for Nondestructive Testing (ASNT)
- National Electrical Manufacturers Association (NEMA)
- National Fire Protection Association (NFPA)
- National Electric Code (NEC)
- Occupational Safety and Health Act (OSHA)
- Uniform Building Code, Local Jurisdiction (UBC)
- Uniform Fire Code (UFC)
- Uniform Plumbing Code (UPC)
- National Institute of Standards and Technology (NIST)
- Society of Automotive Engineers (SAE)
- Underwriters Laboratory (UL)

Applicable codes for CNG fueling are summarized in the following table.

Code Agency/Organization	Primary Function
ANSI	Facilitates the development of certain codes and standards that govern the use of CNG and the manufacturing of CNG fueling components, including nozzles, receptacles, dispensers, hoses, breakaway devices, valves, and other related fueling components
ASME • Boiler and Pressure Vessel Code Section 8 • ANSI/ASME B31.3 Chemical Plant and Conventional fuel Refining Piping	Regulates high-pressure CNG storage vessels and piping Section 8 is the manufacturing standard for the pressure vessels used in the CNG station B31.3 establishes the specifications for the piping throughout the CNG station
ASNT	Tests components for safety
NEMA	Establish standards for electrical component manufacturing

NFPA NFPA 52 NFPA 70 NFPA 30A	Regulates the use of natural gas as a vehicle fuel, including stations and vehicles Defines the boundaries of the hazardous areas inside the fueling station Establishes the NEC Governs the use of multiple fuels in one location
OSHA	Regulates occupational safety and health in the work environment
SAE	J1616 establishes the recommended practice for fuel quality and water content
UBC, Local Jurisdiction	Regulates structures that contain CNG fueling equipment
UFC	Some states and/or localities use this code; often contains NFPA 52 within it
UPC	Governs the plumbing components of CNG stations
NIST	Establishes the unit of measurement for custody transfer of CNG from the retailer to the customer
UL	Tests components and publishes lists according to compliance

Facilities certified for maintenance and mechanical support for CNG vehicles must meet certain requirements. These requirements are illustrated in the following table for their application at retrofit or new CNG vehicle maintenance facilities.

Requirement/Recommended Practice	Existing Facility Modification	New Facility Design
Ventilation		
Methane detection	Add methane detection	Specify for new facility

HVAC systems	Could replace existing system but would be costly and unnecessary if supplementary exhaust system is added	Specify to function counter flow to HVAC conventional system to include no open flame heaters
Supplementary exhaust	Add supplementary exhaust fans that are Class 1 Div 2 Group D rated	Would not be necessary
Class 1 Div 2 Group D fans	See above	Specify for new facility
Heating Systems		
Space heaters	Replace with sealed combustion, infrared or catalytic heaters with skin temperature less than 800°F	Would not be necessary

IDENTIFIED MARKET BARRIERS

A survey of Oregon CNG fleets operating fueling stations revealed six primary market barriers to increasing the use of CNG in Oregon.

Lack of Public Infrastructure

As discussed, the lack of distributed fueling infrastructure to allow vehicle range and re-fueling options is a significant challenge for fleets and the first identified barrier. In March 2013, Oregon CNG vehicle operators (SMART, Heiberg Garbage, Pride Disposal) reported that the lack of distributed fueling infrastructure is a barrier to expansion of fleets where vehicle daily range varies or is uncertain. Sole reliance on their own fueling infrastructure poses risks (maintenance, equipment failure) that slow expansion of their CNG fleets.

High Initial Cost

The initial cost of fueling infrastructure and vehicle incremental cost pose a noteworthy barrier. A single commercial CNG fuel dispensing facility costs from $675,000 to $1.7 million per site.[51] CNG vehicle incremental costs range from $6,000 for light duty to as much as $40,000 for heavy-duty vehicles. The economy of scale required to provide market-competitive rates of return often requires conversion of an entire fleet.[52,53] Financiers in Oregon and private fleet operators are not experienced with the risk assessment necessary for financing CNG infrastructure. Reliable and consistent incentives or access to second party developed fueling stations are proven to accelerate consumer investment in the incremental vehicle cost.

[51] Based stations with rapid fueling capacity for up to 15 vehicles per hour.
[52] Honda, (2013), Civic Natural Gas. Retrieved from http://automobiles.honda.com/civic-natural-gas/
[53] U.S. Energy Information Administration, (2013), Alternative Fuel Vehicle Data. Retrieved from http://www.eia.gov/renewable/afv/users.cfm

Codes

CNG fueling station codes and standards follow established electrical, fire and life, safety and compressed gas storage permitting regulations. They are adopted both nationally and at the state level. Oregon building codes address the necessary codes and standards for the construction of CNG fueling systems for residential and commercial buildings and commercial LNG fueling. Some jurisdictions have little experience or training in permitting an entire natural gas fueling station but are familiar with individual codes applied to each of those systems.

No Utility Regulatory Allowances

Oregon lacks clear regulatory treatment of the gas utility role in CNG market development. Oregon Public Utility Commission (OPUC) regulation of CNG for LDC and purchase for resale by independent parties is not developed. The eleven states with utility regulation allowing utility participation in CNG market development account for over 80 percent of national CNG use.[54]

Limited Retrofit Equipment Certification

Original Equipment Manufacturers (OEMs) provide light-duty, medium-duty and heavy-duty vehicles to the market in configurations that meet most fleet user needs. In 2012, demand was high for vehicles manufactured to use CNG as a dedicated fuel. Most Oregon natural gas vehicles (NGVs) are dedicated CNG vehicles, are operated within close proximity to the owner's own fueling station and have fuel capacities suitable to local driving ranges. Some Oregon early adopters interviewed in March 2013 noted that dual or bi-fuel capability is preferred for further expansion of their fleet until additional backup fueling stations are available.

The U.S. Environmental Protection Agency (EPA) and California Air Resources Board (CARB) certify dual fuel, bi-fuel or vehicle fuel conversions for diesel and gasoline in the U.S. The certification cost for allowable vehicle conversions remains a technical and economic hurdle for conversion kit manufacturers. Action may be indicated to address dual and/or bi-fuel conversion equipment certification should public access fueling station construction be delayed.

Low Consumer and Jurisdiction Awareness

Early market adopter familiarity with the reliability, benefits and economics of conversion from liquid petroleum fuels to CNG is lacking in Oregon. The economic benefit of a 40 percent reduction in fuel cost does provide initial market interest. However, potential early adopters are not familiar with the specifics of CNG investment or the risk assessment required. Few have conducted a comprehensive, investment-grade economic feasibility analysis of CNG fleet conversion. Most are unfamiliar with natural gas fueling development plans in Oregon. Those parties are likewise unfamiliar with the benefits and economics of current CNG users in Oregon or the transferability of that experience to their fleet fueling needs.

Oregon has two operating Clean Cities Coalitions (Columbia-Willamette and Rogue Valley) with capacity to provide planning, promotion and education roles to further develop the CNG market, along with other priorities for biofuel, propane and electric vehicle development. Oregon has no natural gas vehicle (NGV) fuel advocacy group acting as an independent third party conducting market

[54] U.S. Energy Information Administration, (2013), Alternative Fuel Vehicle Data. Retrieved from http://www.eia.gov/renewable/afv/users.cfm

development activities.[55] NGV associations or Clean Cities Coalitions in many states provide dedicated NGV infrastructure mapping and real-time pricing, detailed project case studies, training for NGV adopters, fueling station permitting assistance, jurisdiction training and education, utility regulation analysis and/or advocacy, best practices clearinghouse services, support for incentives and financing, and other services.

OREGON ALTERNATIVE FUEL POLICIES

Oregon has clearly developed policy objectives for CNG use. We have a long history of policies favoring alternative fuels in the transportation sector. In 1979, the legislature established the Alternative Energy Development Commission consisting of six separate task forces. The commission completed its report in 1980 and one area of study included gasohol for the transportation sector. In 1989, the Oregon legislature addressed global warming by passing legislation that calls for reduction of GHG emissions to 10 percent below 1988 levels by 2005 through energy efficiency, conservation, new renewable resources, and use of alternative fuels.

In 1991, Oregon established incentives for alternative fuel vehicles and fueling infrastructure within the Business Energy Tax Credit program. The federal government passed the Energy Policy Act of 1992 (EPACT) establishing the Clean Cities program and alternative fuel fleet requirements for federal, state and utility fleets. Additionally, the federal government added tax credits for alternative fuel vehicles and infrastructure. By 2005, alternative fuels represented 1.5 percent of U.S. roadway transportation fuels primarily due to ethanol replacing methyl tertiary butyl ether (MTBE) as the oxygenate in gasoline. In 2005, petroleum dominated at more than 98.5 percent share of highway transportation fuel.

Alternative Fuel Vehicle Infrastructure Working Group[56]

In 2008, as fuel prices rose beyond $4 per gallon and evidence of climate change became more definite, Governor Kulongoski established the Governor's Alternative Fuel Vehicle Infrastructure Working Group by Executive Order 08-24. In January 2010, the working group released its report[57] with a heavy focus on Electric Vehicles (EVs), and a chapter devoted to CNG noting that there was no single technology or alternative fuel that would replace petroleum. Additionally, the work group recognized that CNG worked best in fleet applications where vehicles return to base on a daily basis. For wider use, a network of publicly accessible CNG compressor stations would be required. The barriers section of the CNG chapter noted the following:

> *"Natural gas vehicle technology has been available and used in most regions of the world for decades. Many recognize the economic, environmental and national security benefits of using natural gas technology. However, a lack of refueling infrastructure has caused natural gas vehicle demand to stagnate in many regions. In regions where natural gas vehicles (NGVs) have a strong market share, adoption is predominately due to a combination of inexpensive natural*

[55] The Columbia-Willamette Clean Cities Coalition has started the Natural Gas Vehicle Working Group which could transition into a NGV advocacy group.
[56] Alternative Fuel Vehicle Infrastructure Working Group, (2010), Report of the Alternative Fuel Vehicle Infrastructure Working Group. Retrieved from http://www.psrc.org/assets/3751/W_OregonReport_2010.pdf, p 53
[57] Alternative Fuel Vehicle Infrastructure Working Group. (2010). Report of the Alternative Fuel Vehicle Infrastructure Working Group. Retrieved from http://www.psrc.org/assets/3751/W_OregonReport_2010.pdf

gas, a large number of public accessible refueling stations, favorable government policy and government incentives for vehicles, fuel and infrastructure."[58]

Recommendations for increased adoption of CNG included the following:

- Implement and support a Low Carbon Fuel Standard (LCFS). This will encourage use of CNG technology and further advance biomethane technology.
- Model other states' programs for utility rate based treatment of CNG compression, storage and dispensing of CNG to general public.
- Connect the I-5 corridor with CNG infrastructure accessible to the public. Both Washington and California have substantial numbers of CNG vehicles; we recommend Oregon ensure adequate CNG infrastructure along its section of I-5.
- Open state, public and utility CNG dispensers to the general public for purchase of CNG until adequate private investment is made.
- Establish a statewide CNG advisory committee to assess our current infrastructure and make recommendations for moving forward.[59]

Oregon Clean Fuels Program[60]

In 2009, House Bill 2186 required the Oregon Department of Environmental Quality (DEQ) to create a program that would reduce GHG emissions from transportation fuels. The goal of the program is to reduce the average carbon intensity of conventional gasoline and diesel fuel by 10 percent over a ten year period. DEQ developed the Oregon Clean Fuels program with assistance from a broad base of industry and environmental interests, local, regional and state agencies and experts in the fields of transportation and economic analysis.

Implementation of Oregon's Clean Fuels Program is currently under deliberation by the legislature. If extended it will require the use of lower carbon, alternative fuels such as advanced ethanol and biodiesel as well as electricity, CNG, LNG, LPG and RNG to meet the goal.

CNG's lifecycle carbon footprint was found by DEQ to be 70.22 gCO2e/MJ. This is a 23.3 percent reduction from Ultra Low Sulfur Diesel (ULSD) with a carbon footprint of 91.53 gCO2e/MJ. Several scenarios were modeled to indicate various paths to meet the program's target. A high CNG scenario called for 2,700 vehicles in addition to the 1,647 CNG vehicles found in Oregon in 2010. It was estimated that the total number of CNG vehicles would use about 5.7 million GGE of fuel which would help meet the target along with an assortment of other measures including various biofuel blends, electric vehicles and LPG.

[58] Alternative Fuel Vehicle Infrastructure Working Group. (2010). Report of the Alternative Fuel Vehicle Infrastructure Working Group. Retrieved from http://www.psrc.org/assets/3751/W_OregonReport_2010.pdf, pg 51
[59] Alternative Fuel Vehicle Infrastructure Working Group. (2010). Report of the Alternative Fuel Vehicle Infrastructure Working Group. Retrieved from http://www.psrc.org/assets/3751/W_OregonReport_2010.pdf, pg 53
[60] Formally the Low Carbon Fuel Standard

Oregon Statewide Transportation Strategy[61]

In 2010, the Statewide Transportation Strategy (STS) was initiated by Senate Bill 1059 which called for a plan to reduce Oregon transportation sector GHG emissions by 75 percent by 2050.[62] The Statewide Transportation Strategy: *A 2050 Vision for Greenhouse Gas (GHG) Emissions Reduction* describes how the transportation sector might get as close to the 2050 goal as is plausible. The STS, itself, is neither directive nor regulatory, but rather points to promising approaches for further consideration by policymakers at the national, state, regional, and local levels. Oregon takes three general approaches in this transportation emissions reduction strategy:

- Cleaner vehicle technology,
- Reducing the amount of miles traveled, and
- Decreasing fuel carbon intensity (i.e. GHG emissions)

Vehicle, engine and fuel technology were identified as the major contributors to reaching the strategies' goals. Below is a summary of some of the natural gas related actions called for in the strategy.

- Develop fuel-efficient vehicle technologies and alternative fuels that are compatible with engine technologies.
- Establish financing, tax credit and incentive programs to incentivize the purchase of fuel-efficient vehicles and to encourage more rapid adoption of new technologies (e.g., electric vehicles, hybrid vehicles, alternative fuel vehicles such as natural gas powered vehicles, high efficiency internal combustion engines).
- Transition transit and light and heavy–duty commercial fleets to low or zero-emission powered vehicles, such as CNG, LNG, renewable natural gas (RNG), and electric.
- Use electricity, hydrogen, natural gas and propane and other low emitting fuels in the transportation sector.
- Develop low emission power source infrastructure and alternative fuel networks, such as LNG, CNG, RNG, and hydrogen. Prioritize LNG production for domestic freight movement as opposed to international trade.
- Continue Oregon Clean Fuel Standards.

The Governor's 10-Year Energy Action Plan[63]

The Governor's 10-Year Energy Plan breaks energy into three major categories, with transportation being one class. In the plan the Governor acknowledges that transportation is the single largest contributor to Oregon's carbon dioxide emissions and a significant source of air toxics.

In order to accelerate the market transition to a more efficient, cleaner transportation system the plan proposes a 20 percent conversion of large fleets to alternative fuel vehicles over the next ten years. The plan's action item for fleet conversion stated the following:

[61] Oregon Sustainable Transportation Initiative (OSTI). (2013). Statewide Transportation Strategy (STS), Retrieved from http://www.oregon.gov/ODOT/TD/OSTI/Pages/STS.aspx
[62] (Chapter 85, Oregon Laws 2010, Special Session)
[63] Governor John A. Kitzhaber, M.D. (2012). 10-Year Energy Action Plan. Retrieved from http://www.oregon.gov/energy/Ten_Year/Ten_Year_Energy_Action_Plan_Final.pdf

"Based on successful programs elsewhere, Oregon should develop a comprehensive alternative fuel program that allows utility-ownership of refueling infrastructure and provides incentives, where appropriate, for vehicle conversions. Replacement vehicles include, but are not limited to, biodiesel, electric, CNG, propane, and LNG vehicles for all vehicle types including heavy trucks and school buses. In promoting such conversions, the state will consider how smart grid technologies and practices could increase the value of the converted fleets to the overall energy infrastructure and grid operations. This process will inform the kind of regulatory framework and incentive structure that would be required to further accelerate the market for alternative fuel vehicles."

How Has Adoption of Alternative Fuels Advanced?

The transportation strategies, plans and policies outlined above define Oregon's objectives to lower transportation fuels' GHG emissions. More specifically, they target alternative fuels and particularly electricity, CNG and RNG as strategies.[64] Biofuels (ethanol and biodiesel) have achieved the most market share in recent years due to state and federal Renewable Fuel Standard (RFS, and RFS2) programs that mandate biofuel use. The Oregon RFS requires gasoline to be blended with 10 percent ethanol except for a few special cases and diesel to be blended with 5 percent biodiesel. This program has lowered the petroleum proportion of on-highway transportation fuel to 91.5 percent in 2011 compared to the 98.5 percent in 2005.

Compared with other states for all fuel types, Oregon ranks third with 125 alternative fuel stations per million vehicles registered for roadway use. Boosting Oregon's average are 850 publicly accessible electric charging stations at 311 locations recognized by AFDC in May 2013.

Regardless of ranking by number of stations, only three Oregon CNG fueling stations are open for public use resulting in the state being ranked in the lower half of U.S. states on that specific criterion.

Oregon CNG use rose from 1,613,000 GGE in 2005 to 1,953,600 GGE in 2012 according to EIA.[65] Although in 2011 CNG use was lower than in 2005, this variability is likely due to economic conditions rather than a true market indicator of interest in natural gas. There have been recent notable fleet conversions to CNG in Oregon in the past eighteen months such as Waste Management, SMART, Pride Disposal, Gresham Sanitary Services, and Heiberg Garbage and Recycling.

Natural gas is available in Oregon at a forecasted stable cost that is just over half that of liquid petroleum fuels. Limited RNG and LNG opportunities for transportation fuels exist in Oregon. In the near term (4-6 years) LNG and RNG will play small niche roles in meeting these objectives due to the higher cost of the fuels, the focus of LNG technology on long haul heavy duty fleets and the cost of RNG cleaning treatment, compression and delivery to dispensing locations. CNG fueling technology and light, medium

[64] Biofuels (ethanol and biodiesel) have achieved the most market share in recent years due to state and federal Renewable Fuel Standard (RFS, and RFS2) programs that mandate biofuel use.

[65] US Energy Information Administration, (2012), Alternative Fuel Vehicle Data. Retrieved from http://www.eia.gov/renewable/afv/users.cfm?fs=a&ustate=or&ufueltype=cng&weightclass=ld percent2cmd percent2chd&uvehcat=automobiles percent5fcompact percent2cautomobiles percent5ffullsize percent2cautomobiles percent5fmidsize percent2cautomobiles percent5fsubcompact percent2cbuses percent2clow percent20speed percent20vehicles percent2cmotorcycles percent2cother percent20vehicles percent2cpickups percent2csuvs percent2ctrucks percent2cvans percent5flight percent20duty percent2cvans percent5fmedium percent20duty percent2cvans percent5fminivans&uyear=2011 percent2c2010 percent2c2009 percent2c2008 percent2c2007 percent2c2006 percent2c2005 percent2c2004 percent2c2003

and heavy-duty CNG vehicles are well proven nationwide to be able to meet the natural gas share of Oregon's objectives.

ALTERNATIVE FUELS FINANCE

The primary method for amortizing the cost of fueling stations and NGV incremental cost is fuel cost savings. Simple payback can be calculated by dividing the total incremental cost of the vehicle by the annual fuel cost savings to yield the number of years required to pay back the initial investment. Another way to analyze this is by how many miles the vehicle must travel to re-coup the investment. Heavy-duty vehicles with high annual mileage and lower fuel economy pose the best early adopter target market. Transit systems, refuse hauling and parcel delivery using diesel fuel comprise the largest share of that market.

Following are scenarios of potential fuel cost savings based on three price differentials between diesel and CNG. Diesel is set at $4.00 a gallon. The three examples examine light-duty, medium-duty and heavy-duty vehicles. These are simple payback evaluations and are used here to show various payback scenarios based on incremental cost, vehicle miles driven per year, and fuel cost differential. While fuel economy, annual mileage and incremental cost vary significantly by fleet type and purpose, the scenarios try to develop a median for each class. As a reference, the 2012 differential cost between average U.S. retail CNG and West Coast diesel was $2.07 per DGE based on EIA data and CNG prices.

The first set of scenarios of potential savings uses a large pickup truck (Class 2-3). The diesel version gets 12 mpg and the CNG version gets 10.8 mpg, a 10 percent reduction. Fleets use many parameters for replacement of vehicles, typically mileage and age. The Transportation Energy Data Book Edition 31 reports that light duty trucks have a median lifetime of 15.5 years and 179,954 miles. All of the paybacks are well within this vehicle life, however many organizations will only consider projects with a 3 year or better simple payback, which not all of these scenarios are able to demonstrate.

Estimated Simple Payback of a Large CNG Pickup Truck at $10,000 Incremental Cost						
Miles Per Year	**Price Differential between a DGE of CNG and a Gallon of Diesel**					
	$1.50		**$2.00**		**$2.50**	
	Annual Savings	Payback in Years	Annual Savings	Payback in Years	Annual Savings	Payback in Years
10,000	$ 1,019	9.8	$ 1,481	6.8	$ 2,083	4.8
15,000	$ 1,528	6.5	$ 2,222	4.5	$ 3,125	3.2
20,000	$ 2,037	4.9	$ 2,963	3.4	$ 4,167	2.4
25,000	$ 2,546	3.9	$ 3,704	2.7	$ 5,208	1.9
Miles to simple payback		98,182		67,500		48,000
GGE of CNG to simple payback		9,091		6,250		4,444

The second set of scenarios focuses on medium-duty vehicles. These are typically delivery, school bus, utility and various Class 3-6 vehicles. In these classes there are a variety of uses that will affect fuel efficiency and incremental cost. In the examples below we assume 7 mpg for the diesel-fueled truck and 6.3 mpg for the CNG. These types of vehicles can have a vehicle life of at least 15 years and 200,000 miles. All but one of the examples fall within this vehicle life, however none get below the 3 year simple payback mark.

Estimated Simple Payback of a Class 3-6 CNG Truck at $30,000 Incremental Cost						
Miles Per Year	**Price Differential between a DGE of CNG and a Gallon of Diesel**					
	$1.50		**$2.00**		**$2.50**	
	Annual Savings	Payback in Years	Annual Savings	Payback in Years	Annual Savings	Payback in Years
10,000	$ 1,746	17.2	$ 2,540	11.8	$ 3,333	9.0
15,000	$ 2,619	11.5	$ 3,810	7.9	$ 5,000	6.0
20,000	$ 3,492	8.6	$ 5,079	5.9	$ 6,667	4.5
25,000	$ 4,365	6.9	$ 6,349	4.7	$ 8,333	3.6
Miles to simple payback		171,818		118,125		90,000
GGE of CNG to simple payback		27,273		18,750		14,286

The third set of scenarios looks at heavy-duty vehicles. These are typically transit, refuse and long haul Class 7-8 vehicles. In these classes there are a variety of uses that will affect fuel efficiency and incremental cost. The incremental cost has been increased to $35,000 and mileage scenario range has been changed to reflect this class of vehicle. In the examples below, averaging the lower fuel efficiency of transit and refuse vehicles and the better efficiency of long haul vehicles, we assume 4.5 mpg for the diesel-fueled truck and 4.05 mpg for the CNG. Due to higher fuel consumption, half of the scenarios get below the 3 year simple payback.

Estimated Simple Payback of a Class 7&8 CNG Truck at $35,000 Incremental Cost						
Miles Per Year	**Price Differential between a DGE of CNG and a Gallon of Diesel**					
	$1.50		**$2.00**		**$2.50**	
	Annual Savings	Payback in Years	Annual Savings	Payback in Years	Annual Savings	Payback in Years
20,000	$ 5,432	6.4	$ 7,901	4.4	$ 10,370	3.4
25,000	$ 6,790	5.2	$ 9,877	3.5	$ 12,963	2.7
30,000	$ 8,148	4.3	$ 11,852	3.0	$ 15,556	2.3
35,000	$ 9,506	3.7	$ 13,827	2.5	$ 18,148	1.9
Miles to simple payback		128,864		88,594		67,500
GGE of CNG to simple payback		31,818		21,875		16,667

In the future, new vehicle incremental costs may be lower if demand for NGVs increases and economies of scale take effect; tighter emission standards increase the costs of diesel-fueled engines; and new technologies are developed with an emphasis on reducing costs in fuel storage, the most expensive component of a conversion.

Infrastructure costs can vary widely depending on location, specific fleet requirements, lot characteristics, and whether the station will be open to the public. The availability of offsite fueling from a local gas company, a retail fuel provider or another public or private fleet can make the decision to convert much easier for a fleet.

Meeting the natural gas share of the Oregon carbon dioxide emissions reduction goal in the Clean Fuels Program is estimated to cost between $70 and $90 million dollars. Meeting the Clean Fuels Program target of 5.7 million GGE in CNG sales will mean an additional 2,700 vehicles and an estimated 40 new fueling stations. These new fueling stations will require geographic distribution to promote cost effective sales volumes of some 270,000 GGE per additional station per year (22,500 GGE/month).

To address the uncertainty and risks of natural gas and petroleum price fluctuation and demand growth rates for CNG at individual stations, federal and state incentives have played a role in early market development.

Alternative Fuel Incentives

State and federal tax incentives are available for CNG infrastructure development. The federal government offers a 30 percent tax credit of up to $30,000 to offset the cost of fueling stations. This credit is scheduled to expire at the end of 2013 and is inadequate as a single motivator for large scale natural gas fueling stations as the costs range from $675,000 to $1.7 million. The State of Oregon offers an alternative fuel infrastructure tax credit through the Oregon Department of Energy's Energy Incentive Program for 35 percent of the eligible costs for fueling station equipment and installation. This infrastructure credit shares a capped amount of funds per biennium with transportation services. However, the transportation services funds have been programmed to phase out, thus increasing funds available to infrastructure each biennium. For the current biennium (July 2011-June 2013) $2 million was allocated to alternative fuels infrastructure. For July 2013 to June 2015, $10 million will be allocated and in the final biennium of the program (July 2015- June 2017) infrastructure will be allotted the full $20 million of the transportation category. An additional federal tax incentive is available for alternative fuel that is sold for use or used as a fuel to operate a motor vehicle. A tax credit in the amount of $0.50 per gallon goes to the seller or dispenser of the fuel. This credit is scheduled to expire at the end of 2013.

Currently there are no tax credits available to Oregon businesses for conversions or incremental costs of natural gas vehicles. As of this writing there are two bills in the Oregon Legislature that would help fund vehicles. HB 2894 proposes that alternative fuel vehicle incremental cost or conversion costs for fleets in Oregon be included as a new eligible category alongside the current infrastructure credits, however no additional funds will be added. SB 583, if approved, will establish a revolving loan fund for public and tribal entities for alternative fuel vehicles.

Opportunities for vehicle grants can occur through U.S. DOE, EPA, or Federal Highway programs. However, these are typically limited in scope, are infrequent, and timing for applicants can be difficult due to some organizations' long procurement requirements.

State Small-Scale Energy Loan Program (SELP)

The Oregon SELP program provides low interest, fixed-rate financing for energy efficiency, renewable resource, and alternative fuels projects in Oregon. SELP can lend to individuals, businesses, schools, cities, counties, special districts, state and federal agencies, public corporations, cooperatives, tribes, and non-profits. Projects must be in Oregon.

Typical lending requirements apply: owner equity, collateral and a sound financial condition and business plan are required. SELP can finance alternative fuel infrastructure and vehicle financing. Public bond sales backing the loans may make this financing competitive with commercial lending rates. Financing of up to $2 million for CNG fueling stations is possible with the right applicant financial conditions and project cost savings assurance.

These current state and federal incentives may buy down the cost of infrastructure by 35 percent to 40 percent depending on incentive eligibility. The incentives feasibly account for $14 million of the estimated $40 million investment needed to meet the Clean Fuels Program goals and set Oregon on the path to meeting the 2050 goal of the Statewide Transportation Strategy. However, fuel cost savings will still be the primary means of offsetting the vehicle incremental cost. The limitations of this method of amortization will depend on individual vehicle miles traveled and the related fuel economy.

CNG FUELING INFRASTRUCTURE DEVELOPMENT

There are three primary methods for developing and financing CNG fueling stations demonstrated nationally. These include development through government ownership and incentives, private investment, and utility shareholder or rate-based investments.

Government Ownership and Incentives

Government development of publicly accessible fueling infrastructure has been demonstrated in Oregon at the Oregon State Motor Pool in Salem, Rogue Valley Transit, and two Jackson County motor pool locations.

Most states encouraging CNG market development provide incentives through tax laws, codes or other incentives. Investment tax credits, fuel tax rebates, transportation tax credits, clean air regulations, clean fuel standards, blending requirements, and, in Oregon, low-interest financing through the State Small-Scale Energy Loan Program are the methods most often applied. As aforementioned, Oregon provides tax credits for alternative fuel station development.

These incentives alone have been inadequate to spur private development of the NGV market in Oregon. The current package of federal and Oregon incentives, strategies or mandates to meet the carbon dioxide emissions reduction goals are not much different than they have been in recent years and cannot be expected to change the current market trend alone.

Private Investment

Private equity financing in Oregon has resulted in several waste hauler CNG fueling stations that do not provide retail access. Site security, fuel payment methods, uncertainty of the revenue, administrative cost benefits, and site convenience all limit the private sector's interest in retailing CNG. Public and larger

private fleets have proven that fuel cost savings, which amortize CNG fueling station installation, are adequate where incentives buy down the capital cost and fuel consumption is sufficient to assure cost recovery. With limited interest in retail sales of CNG, private developers have not significantly influenced the market trajectory. The issues of access security, concerns about anti-competitiveness, and retail management requirements will be likely to continue to make that infrastructure inaccessible for public fueling.

Where a business funds its own fueling infrastructure and fleet conversion, the investment must compete with the rate of return of the core business. Often this requires a higher rate of return to compete for internal funding due to risk uncertainty or unfamiliarity. Where the CNG rate of return for fuel savings is based on the incremental cost of the vehicle at the time of replacement or addition to the fleet, the decision hurdle is likely less but fuel availability must be assured.

Where the return on private equity is based on fuel cost savings, the high cost of building and owning a fueling station comes with the additional costs of training and maintenance of infrastructure. The uncertainty of fuel supply in the event of a fueling station failure is often too high a risk. Only large fleets, with multiple motivations, have been shown to overcome all these risks. Private local distribution fleets with high fuel consumption or franchise requirements for low carbon fuel are shown to be the most motivated to invest in CNG fueling stations.

Investment for retail vending of CNG, where the retailer does not benefit from lower fuel cost savings, requires a higher retail price to recover capital cost, overcome default and other forms of risk. Although retail vendors of CNG do not profit from the incremental cost for CNG vehicles, amortizing a $675,000 to $1 million dollar fueling station requires sales of more than 25,000 GGE per month to recover capital and operating costs. This requires guaranteed demand to motivate that investment. However, the current price spread between natural gas delivered to a CNG fueling station,[66] is adequate to provide an investment grade rate of return, provided the CNG sales volume is high and there is assurance of consistent CNG buyers.

For example, a $1 million investment in a CNG fueling station, less any incentives, with 10 year 6 percent financing will have an $11,000 financing payment and another $10,000 in monthly operating cost. With a natural gas price of $1 per therm or $1.20 per GGE and a retail price of $2.10 per GGE of CNG (national average 2012), a site would have to sell a minimum of 23,000 GGE per month (276,000 GGE/year) to cover costs. Under this example, a single investment would have to capture 14 percent of the 2012 Oregon CNG sales to be profitable.

Third-party, bank, or investor financing for CNG is not developed in Oregon due to unfamiliarity with these market risks, technology, rates of return, insecurity, and undemonstrated market demand. Business models where many benefits occur external to the investing organization must charge more in order to recover costs associated with capital, default and other forms of risk.

[66] $1.19 per DGE for CNG versus $3.20 for diesel delivered rack price

Utility Regulation

The sale of CNG or RNG by an Oregon utility for direct use or third party resale as a transportation fuel is likely to be subject to regulation by the Oregon Public Utility Commission (OPUC).[67] To date, no such regulation is in place. Oregon utilities have not sought cost recovery for investments in natural gas transportation fuel distribution infrastructure, nor approval to offer retail rates for CNG or LNG.

The eleven states with some form of regulatory allowance for utility CNG market participation accounted for over 253 million GGE of CNG sales in 2012, or 84 percent of the nationwide total.[68] No statistically valid cause and effect relationship could be drawn from this correlation due to the recentness of regulatory actions in these states, which may or may not have influenced 2012 CNG sales. Further analysis of the relationship between regulatory treatment of CNG markets and CNG use is required.

In November 2012, the National Association of Regulated Utility Commissioners (NARUC) adopted Resolution EL-1/ERE-2/GS-1 on *Expanding the Alternative Fuel Vehicle (AFV) Market Development and Deployment.*[69] With the purpose of enhancing national energy security and reducing transportation GHG emissions, the resolution calls for continued leadership by state and federal policymakers to ensure the goals of the resolution are fulfilled in today's rapidly evolving AFV market (Appendix I, NARUC, 2012).[70]

The following survey of states with regulatory allowances from regulators indicates a range of actions and participant roles (Appendix B). Many of those activities involve active participation by LDCs and include possible regulatory allowances, commensurate with the NARUC Resolution.

NATIONAL NATURAL GAS UTILITY REGULATION REVIEW

A review of states' CNG fueling infrastructure, CNG sales, CNG vehicle count, and utility regulation indicates that no one element, including market forces and/or utility regulatory allowances, is adequate to accelerate CNG use. The following are a sample of states' regulatory approaches to supporting CNG market development and relevant market indicators.

New Jersey

New Jersey's Board of Public Utilities (BPU) approved a New Jersey Natural Gas-sponsored pilot program allowing for regulated business investment of $10 million toward the development of between five and seven new CNG fueling stations. The stations are to be located at hosted private or public fleet locations. The stations will be owned and maintained by New Jersey Natural Gas, and the utility will require that the host-company or governmental fleet make the station open to the public. New Jersey is reported by the EIA to have 27 CNG Fueling stations,, 3,885 CNG vehicles, and to consume 1.5 million GGE of CNG in 2011.

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[67] The OPUC considered similar questions relating to electricity used as a transportation fuel, including utility and non-utility provision of electric vehicle charging services and operation of electric vehicle service equipment, and rate design for utility-provided electricity for the purpose of vehicle charging. *See In the Matter of Public Utility Commission of Oregon Investigation of Matters Related to Electric Vehicle Charging,* Docket No. UM 1461, Order No. 12-013 (January 19, 2012).

[68] US Energy Information Administration, (2013), Natural Gas Consumption by End Use. Retrieved from http://www.eia.gov/dnav/ng/ng_cons_sum_a_EPG0_vdv_mmcf_a.htm

[69] National Association of Regulated Utility Commissioners (NARUC), (2012), EL-1/ERE-2/GS-1 Resolution on Expanding the Alternative Fuel Vehicle Market. Retrieved from http://www.naruc.org/Resolutions/Resolution percent20on percent20Expanding percent20the percent20Alternative percent20Fuel percent20Vehicle percent20Market.pdf

[70] See Appendix A

Oklahoma

The Oklahoma Corporation Commission (OCC) allows Oklahoma Natural Gas (ONG) to provide its customers with rebates covering the cost of purchasing NGVs. OCC Order #598802 under Cause Docket # 201100176 approved on June 29, 2012, provides rebates up to $2,500 for dedicated NGVs and $1,500 for bi-fuel NGVs. Customers can take advantage of up to three rebates per year. Funding is provided by a 25-cent surcharge on CNG sold at the 25 ONG-owned stations. Oklahoma gas utilities may build CNG filling stations for their own use and may allow consumers to fill at the utilities' actual cost of gas. There is no allowance for infrastructure or profit. Oklahoma is reported by the EIA to have 96 CNG Fueling stations, 3,725 CNG vehicles, and to consume 2.7 million GGE of CNG in 2011.

Utah

Utah passed legislation pushing for increased alternative fuel vehicle adoption and offering cost recovery for corporations that help develop natural gas vehicle infrastructure. Senate Bill 275 signed into law March 28, 2013, provides for cost recovery mechanisms for gas companies that pay for NGV fueling stations and related facilities.[71] The statute states:

"*The commission shall find that a gas corporation's expenditures for the construction, operation, and maintenance of natural gas fueling stations and appurtenant natural gas facilities for use by the state, political subdivisions of the state, and the public are in the public interest and are just and reasonable, if:*

(a) the gas corporation's expenditures for the fueling stations and appurtenant facilities:

(i) are prudently incurred; and

(ii) do not exceed $5,000,000 in any calendar year, unless the commission determines after the first year, through the general rate making process, that a higher amount is appropriate and in the best interest of the public;

(b) the gas corporation shows that the estimated annual incremental increase in revenue related to the stations and facilities exceeds 50 percent of the annual revenue requirement of the stations and facilities; and

(c) the stations and facilities are in service and are being used and are useful.

The investing gas company can seek recovery for these expenses allowing the company to collect expenditures between general rate cases. Utah is reported by the EIA to have 88 CNG Fueling stations, 4,272 CNG vehicles, and to consume 1.8 million GGE of CNG in 2011.

Georgia

On November 29, 2011, the Georgia Public Service Commission (GPSC) approved Docket # 32499 allowing Atlanta Gas and Light (AGL) investments in CNG infrastructure and a fuel system lease program.[72] The commission order allows AGL to invest $11.57 million in up to 10 CNG fueling stations throughout the state. AGL is also offering a reduced cost lease on the Fuelmaker "Phill" CNG vehicle refueling systems. The lease is available to residential and commercial customers. It requires a monthly payment of $60 that includes up to $2,000 in installation. On top of the lease charges, customers pay AGL a gasoline gallon-equivalent price for CNG of approximately $1.00. Customers developing commercial CNG fueling sites must demonstrate to AGL that they have real estate for the station, comply with local

[71] Utah State Legislature, (2013), S.B. 275 Substitute Energy Amendments. Retrieved from http://le.utah.gov/~2013/bills/static/SB0275.html
[72] Georgia Public Service Commission, (2010), Docket # 32499. Retrieved from http://www.psc.state.ga.us/factsv2/Docket.aspx?docketNumber=32499

zoning, and have agreements with fleet customers to use approximately 30 percent of the station's capacity. Under the GPSC ruling, AGL can also own and maintain CNG equipment connected to its natural gas distribution system. Georgia is reported by the EIA to have 23 CNG Fueling stations, 2,071 CNG vehicles, and to consume 10.9 million GGE of CNG in 2011.

California

On Thursday December 20, 2012 the California Public Utility Commission (CPUC) issued order 11755 granting Southern California Gas Company's (SCGC) request to establish a Compression Services Tariff.[73] SCGC will build natural gas compression facilities to which customers can add dispensing equipment and sell compressed gas according to the tariff. The ruling provides ratepayer protections and rules for fair market competition. As part of the anti-competition and fair market protections, SCGC will focus on service to natural gas vehicle operators like municipalities, school districts, and private fleets, who might otherwise not be able to afford it. California is reported by the EIA to have 257 CNG Fueling stations, 43,044 CNG vehicles, and to consume 141.7 million GGE of CNG in 2011.

NATURAL GAS MARKET DEVELOPMENT NEXT STEPS

In 2012, the 16 states with more than 5 CNG fueling stations per million vehicles registered for roadway use accounted for 77 percent of national CNG use. Common elements identified in those markets include:

- Collaborative groups of CNG fuel users, Clean Cities Coalitions and/or state NGV associations,
- Participation of gas utilities in infrastructure development,
- Active private fueling station developers, and
- Involvement of state or local government entities

High fuel consumption and high mileage fleets were common early adopters in each of those markets (refuse, transit, utility, school districts and public). Eleven of those states are known to have adopted a regulatory structure to allow utility participation in CNG market development.

The following range of actions were noted:

- Educate fleet owners with vehicles that get low miles per gallon, have high annual mileage and return to central fueling sites of CNG benefits.
- Provide for natural gas utility participation in the development of CNG infrastructure.
- Assure that any allowances or regulations provide for a competitive private market.
- Educate jurisdictions on how to implement applicable codes and standards to expedite fueling station projects,.

[73] Public Utilities Commission of the State of California, (2012), Public Agenda 3306. Retrieved from https://ia.cpuc.ca.gov/agendadocs/3306.pdf

- Develop a natural gas vehicle association or add emphasis to Oregon Clean Cities role as independent third parties for sharing best practices, providing education, promotion, developing case studies and market support for early adopters.
- Implement a CNG fueling station cluster and corridor plan to build infrastructure that provides reliable and widely distributed fueling infrastructure.
- Educate the fueling infrastructure and vehicle providers and service workforce,.
- Work with regional and national equipment and vehicle suppliers to assure timely availability of needed equipment,.
- Support consistent incentives and financing access.

CNG, RNG and LNG Market Development Conclusions and Next Steps

Oregon can meet GHG emissions reduction targets for transportation fuels through assertive market development activities. Further strategic development of CNG, RNG and LNG markets is needed. Those markets can provide economic and environmental benefits while being cost competitive with petroleum fuels. The business as usual trend of the Oregon CNG market will not meet its potential share of these goals without renewed and concerted actions being taken on behalf of fleet owners, state agencies, natural gas utilities, and other interested parties.

This review of current NGV market status, economic conditions and practices in other states indicates eight overarching strategies to accelerate the natural gas (CNG, RNG, LNG) transportation fuel use necessary to meet policy objectives. Those include:

- Build a minimum of 40 publicly accessible CNG fueling stations for large fleets along inter and intra-state highway corridors by 2022.
- Promote CNG, RNG and LNG fuel use to large public and private fleets with high mileage and low fuel economy fleets which can recover the cost of fueling stations and vehicle incremental cost through fuel cost savings.
- Develop mechanisms to provide existing CNG fleets reliable access to other CNG fueling stations to support fuel access reliability.
- Develop a statewide natural gas vehicle association or enhance existing Clean Cities Coalitions to share best practices, provide education, promote development, publish case studies, research market conditions, secure federal funding, and provide market technical, policy or financial support.
- Provide an educated workforce for fueling station and vehicle installation, maintenance and operation through Oregon community colleges and other trade development organizations.
- Allow natural gas utility investment in CNG, RNG and LNG infrastructure through implementation of regulatory reforms consistent with National Association of Regulated Utility Commissioners (NARUC) Resolution EL-1/ERE-2/GS-1.
- Assure that regulations provide for free market competition.
- Support local jurisdictions' application of codes and standards to expedite fueling station construction.

The following specific tactics within these strategies are identified as being applicable in Oregon.

Promotion of CNG, RNG and LNG development and use by an independent third-party association, Oregon's Clean Cities Coalitions or other neutrally interested organizations can best facilitate market development through the following actions:

- Educate fleet operators, infrastructure developers, local jurisdictions.
- Promote benefits and opportunity to strategic market segments.
- Support early adopters and develop case study examples.
- Train developers, operators, codes jurisdictions, policy makers and infrastructure support organizations.
- Attract private fueling station providers to the market.
- Provide a clearinghouse of national best practices for policy, incentives, financing and NGV operations,.
- Educate and promote NGV markets to financiers.
- Strategically market to nationally recognized Key Clean Fleet Works corporate partners including: AT&T, Best Buy, Coca-Cola, Enterprise Holdings, FedEx, Frito-Lay, GE, Johnson Controls, Inc., OSRAM SYLVANIA, Pacific Gas and Electric Company, PepsiCo, Ryder, Schwan's Home Service, Staples, ThyssenKrupp Elevator, UPS, Veolia Environmental Services, and Verizon.

Pursuing utility regulatory allowances may include development of utility regulation that is in conformance with NARUC Resolution EL-1/ERE-2/GS-1, adopted November 14, 2012. That may initially include an OPUC workshop on the market status and policy needs; identifying the Docket requirements for allowing utility investment (regulated or shareholder) in CNG infrastructure; and defining the allowances and anti-competitive market characteristics that allow for other parties to invest in retail CNG.

Workforce development may include re-establishment and elevation of awareness regarding the Portland Community College Alternative Fuels Training Center and Linn Benton Community College Advanced Transportation Technology Center.

Appendices

Appendix A: NARUC Resolution EL-1/ERE-2/GS-1

The following are relevant excerpts from NARUC Resolution EL-1/ERE-2/GS-1.

NARUC recognizes that:

- Utility companies and third-party providers are considering various business models for entering the AFV service market, including providing charging and fueling infrastructure; *and*
- Third-party equipment manufacturers are forging ahead with new technologies to make charging and fueling safe, easy, convenient, and affordable for customers; *and*
- There is a growing convergence of energy and transportation policy at the State level, with many State legislatures and governors considering and adopting policies that impact the role and responsibilities of utilities in the AFV market; *and*
- Utility companies are preparing for the AFV market by deploying advanced metering technologies and control systems, designing innovative rates and incentives, and assessing transmission and distribution systems, to minimize any potential risk to reliability and to maximize consumer savings; *and*
- As AFV penetration increases, a coordinated system to provide utility companies timely notification of AFV purchases and the location of planned public and private charging and fueling infrastructure would facilitate strategic system-wide planning, targeted customer education and outreach and further accelerate the development of the AFV market; *and*
- Continued commitment of utility companies to environmental improvements in the production and delivery of alternative fuels, programs and policies will help realize the full economic, environmental, and societal benefits of AFVs; *and*
- Local and State governments and State commissions are uniquely positioned to further the development of the AFV market by collaborating with utility companies and other stakeholders on educating consumers on the availability, environmental benefits, and cost-effectiveness of AFVs, as well as the proper installation and efficient use of charging and fueling infrastructure.

NARUC resolved to provide direction, support and encouragement on policy-making at the state level and that:

- Third-party providers of fueling and charging services that purchase power or fuel from a regulated public utility or other competitive energy supplier to provide to the public should not be considered public utilities and therefore not regulated as such; *and*
- Utility companies should collaborate with federal, State and local policymakers to address potential consumer protection concerns, safety issues and reliability impacts that could arise from fueling and charging services provided by third-parties; *and*

- A competitive AFV marketplace should be developed, where utility companies, businesses, governments, and third-party service providers are able to participate in the owning, leasing, operating, or maintenance of charging or fueling equipment; *and*
- Utility companies should work with local governments, State agencies, automakers, and other stakeholders to secure timely notification of AFV purchases and proposed charging or fueling infrastructure installations to facilitate strategic system-wide planning and targeted customer outreach; *and*
- Customers should be educated on the benefits of AFVs, including their availability, environmental benefits, and cost effectiveness, and the proper installation and efficient use of charging or fueling infrastructure, as well as the availability of programs and tariffs that maximize savings from AFV use and protect the integrity of the utility system; *and*
- State legislatures and governors should consider consistent, fuel-neutral transportation funding solutions and policies that support the growth, adoption and increased environmental performance of AFVs; *and*
- State and federal regulators should collaborate with other policymakers to remove barriers to AFV deployment, and ensure consistent, fuel-neutral policies to help realize the full economic, environmental and societal benefits of AFVs; *and*
- Utility company programs and policies should allow for the continued development of the AFV market, including addressing any potential upgrades to grid and pipeline infrastructure that may be needed to maintain the integrity of the utility system and design of innovative rate programs or incentives to maximize customer savings.

Appendix B: CNG Market Development Activities and Providers

CNG Market Activities	Typical Provider
Sell distribution service	Local Distribution Company
Sell bundled sales service	Local Distribution Company
Sell Compressed gas to consumer or retailer for dispensing	Local Distribution Company
Sell bundled sales service and fueling service	Local Distribution Company Third party marketers
Sale or lease of residential refueling	Local Distribution Company Third party equipment manufacturers, wholesalers retailers,
Dissemination of CNG, NGV information	Local Distribution Company Third party equipment manufacturers, wholesalers retailers, Clean Cities Coalitions, NGV Associations
Marketing and promotion of CNG and NGVs	Local Distribution Company Third party equipment manufacturers, wholesalers retailers, Clean Cities Coalitions, NGV Associations
Standard promotion and education and training on codes and standards	Local Distribution Company Third party equipment manufacturers, wholesalers retailers, code agencies, Clean Cities Coalitions, NGV Associations
Expansion of infrastructure to meet CNG needs (e.g. geographic distribution, interstate corridors, public access)	Local Distribution Company Third party equipment manufacturers, wholesalers retailers, State transportation and fuels policy implementers
Research, and demonstration pilots	Local Distribution Company Third party equipment manufacturers, wholesalers retailers, Clean Cities Coalitions, NGV Associations State transportation and fuels policy implementers