Executive Summary

Natural gas vehicles (NGVs) are a significant untapped opportunity for vehicle operators seeking to lower costs, reduce emissions and play a role in North American energy independence. Utilizing a fuel that is widely available and reliably used by millions of consumers across our continent NGVs have been slow to catch on due to the our region’s limited fueling infrastructure and the up front costs associated with NGV purchases or conversions. This paper identifies key success stories in the Northwest that are overcoming these hurdles while identifying modest and temporary policy incentives that can hasten regional NGV adoption.

In 2011 the average American spent a record $4,000 on gasoline, more than 8 percent of typical take-home pay. This figure was matched by Canadian consumers and does not include the increased costs of goods and services passed along by businesses to offset rising transportation expenses. Beyond dollars and cents, transportation alone accounts for over a third of our region’s greenhouse gas emissions.

Alternative transportation fuels like natural gas will do much to alleviate both of these problems – helping fleet and vehicle owners save money on fuel while reducing impact on the environment. Deploying NGVs in the Pacific Northwest will have numerous economic benefits: stimulating on-going investment and job creation due to new vehicle sales or conversions and the development of infrastructure associated with natural gas fueling stations. Furthermore, the clean burning qualities of natural gas reduce greenhouse gas and smog causing emissions dramatically when compared with conventional transportation fuels.

The convenience of the status quo may be the greatest barrier to broader NGV adoption; however, a number of initiatives exist to overcome market inertia. These include: the development of tax incentives for new vehicle purchases or fueling infrastructure, continued support for programs that promote fleet conversion and allowing regulated utilities the option to invest in this growing market on a voluntary basis.

To accelerate the adoption of NGVs in the region and create a market for new fueling infrastructure our region should first focus on encouraging conversion (or replacement) of fleet vehicles from diesel to compressed natural gas (CNG) or liquefied natural gas (LNG). Fleets can use a central fueling station, enjoy the quickest economic advantage and be anchor tenants that support the development of additional fueling infrastructure. Parallel efforts that focus on public fueling infrastructure along the region’s highways will provide opportunities for public adoption as we
grow toward natural gas powered transportation corridors to, and through, our region.

The Pacific Northwest’s support of NGVs and the accompanying fueling infrastructure – via policies and financial incentives – serves the greater public good by growing jobs, decreasing air pollution, improving public health and keeping dollars in the region.

Introduction

In 2011, the U.S. imported nearly 70 percent of its oil while the average consumer in the U.S. and Canada spent a record $4,000 on gasoline or diesel. Most of the money spent on transportation fuel in the Pacific Northwest leaves our region. At the same time, greenhouse gas and particulate emissions from the transportation sector continue to rise significantly. Alternative transportation fuels such as natural gas, electricity, propane and biodiesel can help address these problems by keeping dollars in the region while mitigating environmental impacts and reliance on foreign oil. Because no single alternative fuel source can meet all transportation demand in the U.S., a portfolio approach is necessary: we must examine each fuel and create policies that are particular to the needs and nature of that fuel. Though this paper focuses on natural gas as a transportation fuel, we recognize there is an important role for each alternative fuel in the transition toward cleaner and more secure fuel sources.

Despite the many benefits of natural gas vehicles (NGVs), they have struggled to gain a meaningful foothold in the U.S. and Pacific Northwest. The goal of this paper is to provide useful information on natural gas as a transportation fuel and inspire a robust conversation about how NGV development can play a critical role in helping us meet energy, economic and environmental goals. To that end, we explore how federal and state/provincial policies – as well as market drivers and barriers – help promote or hinder NGV deployment. We then suggest some useful policy tools that would promote natural gas infrastructure development and fleet adoption in our region, as a first step to more widespread deployment.

Background

Natural gas was used as a transportation fuel during World War II and, since then, vehicle technology has matured and improved significantly. As vehicles improved, so did technology to access the North American natural gas resource base: proven reserves currently measure in excess of 330 trillion cubic feet (Tcf), approxi-

mately a 100-year supply of natural gas at current consumption levels.\(^4\) About 85 percent of the natural gas consumed in the U.S. is produced within U.S. borders and much of the rest comes from Canada, which produces all it needs. Demand from the transportation sector accounts for less than 3 percent of current North American natural gas demand.

NGVs are fueled with liquefied natural gas (LNG) or compressed natural gas (CNG); each treatment is suitable for specific uses. LNG is produced by condensing natural gas to a liquid at temperatures around -260°F, and is vaporized before injection into the cylinders of spark-ignited or diesel engines. It is best used for long-haul trucking fleets because the energy density is higher than CNG, allowing for greater driving range per tank. Due to the liquefaction process, LNG infrastructure requires large amounts of capital. There are currently four liquefaction plants in the Pacific Northwest, all currently operate as utility-scale peak shaving facilities.

CNG is made by compressing natural gas to less than 1 percent of its volume at normal temperature/pressure and is used directly in spark-ignited or diesel engines. It is best suited for light- and medium-duty return-to-base fleets, as well as passenger vehicles.

Economic Benefits

The economic advantage of natural gas over conventional fuels has steadily increased as new technology to extract natural gas has led to vast new recoverable reserves in the U.S. Deploying natural gas as a transportation fuel would have immediate and significant positive economic impacts in the U.S. and our region. Due to its domestic origin, dollars spent to extract the fuel stay in the U.S. and Canada, along with the associated job creation. Additionally, because natural gas is expected to remain cheaper than conventional fuels, using natural gas as a transportation fuel would decrease transportation costs for goods and services, also spurring economic growth. Immediate economic benefits in the region would include on-going investment and job creation associated with fueling stations.\(^5\) From an energy security perspective, relying on North American fuel sources would reduce reliance on foreign oil.

Environmental Benefits

The environmental benefits of NGVs are well documented. On a ‘well-to-wheels’ basis, natural gas is one of the cleanest burning alternative transportation fuels commercially available today.\(^6\) When used as transportation fuel, it can reduce greenhouse
gas emissions by 20 to 29 percent compared with diesel and gasoline, respectively. The natural gas-powered Honda Civic GX is recognized by the U.S. Environmental Protection Agency (EPA) as the cleanest commercially available, internal-combustion vehicle on earth.

Comparative NGV Deployment

Worldwide, there are more than 13 million NGVs on the road, with over 2.8 million vehicles in Pakistan alone. Comparatively, there are only about 112,000 NGVs on U.S. roads today and another 13,000 in Canada, predominantly in fleets: more than 11,000 transit buses, nearly 4,000 refuse trucks, more than 3,000 school buses and 15,000-17,000 medium duty vehicles, and more than 30,000 light-duty vehicles in federal, state, provincial and local government and private fleets. There are about 1,000 NGV fueling stations across the country and approximately half of these stations are open to the public.

Natural Gas Vehicle Emissions Compared to Conventional Vehicle Fuels

- Reduce carbon dioxide (CO2) emissions by 20% to 30%
- Reduce carbon monoxide (CO) emissions up to 75%
- Reduce nitrogen oxide (NOx) emissions by approximately 50%
- Reduce up to 95% of particle matter (PM) emissions
- Reduce volatile organic compound (VOCs) emissions by 55%

North American NGV Manufacturing

In the U.S. and Canada, there are more than 30 different manufacturers that produce over 100 models of light, medium and heavy-duty NGVs, engines or conversion kits, which enable retrofitting vehicles with gasoline or diesel engines. Horsepower, acceleration, and cruise speed of these NGVs/engines are equivalent to conventionally fueled vehicles. However, the driving range of vehicles that run exclusively on natural gas is slightly less than that of comparable gasoline – and diesel-fueled vehicles because of the lower energy content of natural gas. Extra storage tanks can increase range, but the additional weight can displace payload capacity. Bi-fuel vehicles – vehicles that use natural gas and gasoline or diesel as a back-up, and bi-fuel vehicles – vehicles that use natural gas but have gasoline or diesel on board as a back-up – have driving ranges that exceed those of traditional vehicles.

NGV Incentives & Current Deployment in Our Region

Federal Policy Incentives

Federal incentives have helped deploy CNG infrastructure and increase its cost competitiveness across the U.S. and some states have done an excellent job of capitalizing on these benefits. Also, loan and grant programs encourage state and local adoption.
of alternative fuels. For example, Clean Cities – the U.S. Department of Energy’s flagship alternative-transportation deployment initiative – advances the energy, economic and environmental security of the U.S. by supporting local practices that reduce the use of petroleum in the transportation sector. Unfortunately, many federal incentives expired at the end of 2011 and it is unclear whether they will be renewed given the current debate around spending cuts and deficit reduction.

The New Alternative Transportation to Give Americans Solutions Act (Nat Gas Act), proposed in 2011, would provide five-year incentives for the use of natural gas as a vehicle fuel, the purchase of NGVs and the installation of NGV fueling infrastructure. However, the Nat Gas Act has not received much attention in Congress and, though it has bipartisan support, it is uncertain whether it has the necessary momentum and political support to become law.

The uncertainty regarding federal funding for NGV incentives makes state action even more important and many states have excelled in this regard in an effort to improve air quality. A few states – California and Utah in particular – have developed a robust set of initiatives for NGV infrastructure development and vehicle acquisition, and these examples can prove useful for the Pacific Northwest.

In Canada, the federal government continues to offer NGV-users exemptions from the excise tax on fuels (10 cents per liter on gasoline and 4 cents per liter on diesel). Combined with provincial fuel tax exemptions for natural gas, the result is a substantial price advantage for NGV users.

**State Initiative Successes: California & Utah**

California leads the way in NGVs and has several policies to incent infrastructure development and NGV adoption. Programs provide research grants and loans to develop and increase the use of alternative and renewable fuels, as well as innovative technologies in this area. NGV drivers may access High Occupancy Vehicle (HOV) Lanes, which is particularly attractive in a state with high traffic congestion. Alternative Fuel Vehicle (AFV) and Fueling Infrastructure Grants provide funds to projects that develop alternative fueling infrastructure including, in some regions, incentives for NGV home fueling infrastructure. Finally, programs like the state Low Carbon Fuel Standard and Low Emission Vehicle Standard promote adoption of low-carbon fuels and vehicles. As a result of these and other policies, California currently has nearly 600 public-access CNG stations and almost 36,000 fleet and private NGVs on the road.

Though NGVs are most prevalent in California, Utah is catching up fast and could provide a good example of how states and provinces in our region might move forward in this market. Utah has more than 25 fueling stations that are open to the public and the state has used federal tax incentives combined with state credits like the Clean Vehicle Utah State Tax Credit to incent NGV adoption. This incentive allows taxpayers to claim a credit on their tax returns for the purchase or conversion of vehicles that use cleaner burning fuels.

In 2009, Utah’s then-Governor John Huntsman and Questar (Utah’s natural gas utility) announced a partnership for a natural gas corridor along I-15. Additionally, Questar provided matching funds for a Clean Cities grant. Importantly, Utah’s policymakers – including the legislature and public service commission – determined that NGV deployment was in the public’s interests and so permitted and encouraged regulated utility involvement.

**Pacific Northwest Policies and Deployment**

Pacific Northwest states and the province of B.C. are moving toward NGV adoption at varying rates and have some policies in place worth noting.

**Washington**

**Policies** – Washington state focuses more on vehicle incentives than on infrastructure deployment. The AFV Tax Exemption exempts new passenger cars, light-duty trucks, and medium-duty passenger vehicles that are dedicated AFVs from state motor vehicle sales and use taxes; owners of CNG and propane-powered vehicles are instead required to pay an annual license fee. Electric, CNG, and propane vehicles are exempt from state emissions control inspections under the AFV and Hybrid Electric Vehicle (HEV) Emissions Inspection Exemption. Additionally, at least 30 percent of all new vehicles purchased through a state contract must be clean fuel vehicles and state agencies must phase in vehicles that meet specific “ultra-low carbon” fuel standards to achieve fuel economy targets.

---

13 A full list of federal alternative fuel/NGV policies can be found at www.afdc.energy.gov/afdc/laws/laws/US/tech/3253

Deployment highlights – The airport in Seattle (Sea-Tac) has 74 NGVs, including 16 buses used for employee transport and 47 natural gas vans, pickups and sedans and in 2012 opened a CNG station for their vehicles. The Port of Seattle’s alternative fuel program requires Sea-Tac departments to replace vehicles, where practical, with NGVs. In partnership with Clean Energy, the Port also built Washington’s first large-scale public-access natural gas station just south of the airport which allowed Sea-Tac partners, such as its entire taxi fleet, to switch to NGVs.

Pierce Transit runs a fleet of approximately 125 buses on CNG with a station in Tacoma. Sound Transit runs approximately 20 CNG buses. Waste Management in the Puget Sound area has more than 200 CNG trucks, while Allied Waste Services has approximately 90 CNG trucks on the road. CleanScapes operates approximately 40 CNG refuse trucks in Seattle. WorldCNG, an EPA-certified conversion company in Renton, WA, was awarded $15 million by Clean Cities to retrofit local fleets to CNG and recently raised $5 million in private equity for business expansion.

In eastern Washington, NWGA member Avista Utilities has embraced CNG vehicles for its fleet, adding 18 CNG vehicles in 2012 with plans for an additional 35 in 2013. Avista currently operates two private CNG filling stations in its service territory and is engaged in discussions to allow for public fueling at one of its facilities, dependent upon regulatory approval.

Oregon

Policies – Oregon had a Residential Energy Tax Credit (RETC) program that allowed qualified residents to receive tax credits for the purchase of new AFVs or conversion to an AFV prior to Jan. 1, 2012; unfortunately, this portion of the credit was not extended. The RETC continues to apply to the purchase of residential alternative fuel infrastructure such as at-home refueling equipment. Tax credits are also available to businesses for alternative fuel infrastructure and vehicles under certain conditions. Grants and loans exist for AFVs and infrastructure, such as the State Energy Loan Program (SELP) and the Alternative Fuel School Bus Grant and Loan Program. Additionally, dedicated original NGV and electric vehicle equipment are not required to have a certified pollution control system. Oregon and regional communities also have emissions requirements that promote AFVs, like Metro’s Regional Clean Fleet Project, which strives to decrease air pollution by putting filters on diesel garbage trucks.15

Deployment highlights – Like Washington, adoption of NGVs has been spotty throughout Oregon despite incentives. Portland International Airport (PDX) and the Port of Portland have 37 heavy-duty and four light-duty CNG vehicles deployed. All parking lot shuttle buses at PDX currently run on CNG. Additional agencies and companies have NGVs: Salem Transit runs 44 heavy duty buses on natural gas and Oregon Department of Administrative Services (DAS) has 179 light-duty vehicles. NW Natural currently has 80 light-duty NGVs and 15 heavy-duty NGVs, with plans to purchase 125 additional new CNG cargo vans over the next five years. Avista is also planning to add CNG-enabled vehicles to its Oregon fleet.

Idaho

Policies – Idaho allows for state excise taxes paid on special fuels to be refunded for state or federal government-owned or leased vehicles, as long as the tax was originally paid directly to a special fuel vendor. Additionally, a state excise tax applies to special fuels at a rate of $0.25 per gallon on a gasoline gallon equivalent; in lieu of paying this tax, owners of vehicles powered by CNG, propane, or hydrogen may pay an annual fee.

Deployment highlights – Within the next few years, Allied Waste Services plans to deploy more than 50 CNG trucks in the Treasure Valley area of Idaho, and has opened public CNG fueling stations at its Boise and Nampa locations. Valley Regional Transit,
serving Boise and surrounding communities, has been operating CNG buses since 1995 and currently has 39 CNG-powered medium and large buses. They are also adding smaller CNG buses to their fleet. They report that they have saved hundreds of thousands of dollars in fuel costs over this 16-year period. Avista is currently working on upgrading its CNG filling station in its Coeur d’Alene service territory, and plans to add five CNG vehicles to its Idaho fleet in 2013.

**British Columbia**

**Policies** – On May 15, 2012, B.C. announced a Greenhouse Gas Reduction (Clean Energy) regulation which encourages the adoption of natural gas as a transportation fuel. Through a “prescribed undertaking” under Section 18 of the Clean Energy Act, public utility companies are authorized to spend up to $104 million to incent heavy-duty fleets to adopt natural gas as fuel. The regulation permits a utility to spend up to $62 million on vehicle and marine incentives, up to $12 million on CNG fueling stations and up to $30.5 million on LNG stations, for a total of $104.5 million.

FortisBC’s Natural Gas for Transportation (NGT) program initial launch targets promotion of both LNG and CNG for return-to-base heavy duty fleets such as waste haulers, tractor-trailers, and transit buses.

**Existing Refueling Stations**

There are currently 10 publicly available CNG refueling stations along the region’s I-5 corridor, along with two in the Boise area and 7 in the Metro Vancouver region. Many of the stations are not accessible to the public for a variety of reasons: some compressors are located in secured areas that are not convenient or secure for public access and others do not have card access. A state facility in Salem, Oregon, is closed to the public by a statute that sunsets in 2014, at which point public fueling could be permitted; however, rulemaking has not been conducted, so it is unlikely that this station will become accessible to the public. See Table 1 for a list of the region’s CNG fueling stations.

---

**FortisBC Announces Results from Opening Round of NGV Incentive Program**

FortisBC announced the opening round of funding in its $104 million natural gas transportation program in March, 2013. The initial round of funding distributed about $6 million to the following regional operators to help offset the cost of transitioning to natural gas as a transportation fuel:

- BC Transit
- BFI Canada
- City of Vancouver
- Cold Star Freight System Inc.
- Emterra Environmental
- School District No. 23 (Kelowna)
- Smithrite Disposal Ltd.

Under the program, FortisBC provides funding to offset a percentage of the incremental capital cost between a qualifying NGV and the cost of an equivalent diesel vehicle. Depending on the agreement, FortisBC could fund up to 75 percent of the incremental cost. Rounds of funding will continue over the next four years, with the next round beginning April, 2013.

---

**TABLE 1: Location of CNG Stations in the Pacific Northwest**

<table>
<thead>
<tr>
<th>Operator</th>
<th>Address</th>
<th>Town</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chevron</td>
<td>3030 Boundary Road</td>
<td>Burnaby, BC</td>
</tr>
<tr>
<td>Chevron</td>
<td>17790 - 56 Avenue</td>
<td>Cloverdale, BC</td>
</tr>
<tr>
<td>Chevron</td>
<td>1720 Nanaimo Street</td>
<td>Vancouver, BC</td>
</tr>
<tr>
<td>Christie Adams</td>
<td>3373 Norland Avenue</td>
<td>Burnaby, BC</td>
</tr>
<tr>
<td>Farwest Fuels</td>
<td>780 S. Lahakas Boulevard</td>
<td>Kitimat, BC</td>
</tr>
<tr>
<td>Farwest Fuels</td>
<td>225 Second Avenue West</td>
<td>Prince Rupert, BC</td>
</tr>
<tr>
<td>Farwest Fuels</td>
<td>3348 Highway 16 West</td>
<td>Smithers, BC</td>
</tr>
<tr>
<td>Farwest Fuels</td>
<td>4904 Highway 16 West &amp; Eby</td>
<td>Terrace, BC</td>
</tr>
<tr>
<td>Petro Canada</td>
<td>176 Golden Drive &amp; United</td>
<td>Coquitlam, BC</td>
</tr>
<tr>
<td>Petro Canada</td>
<td>5111 Grant McConachie Way</td>
<td>Richmond, BC</td>
</tr>
<tr>
<td>Petro Canada</td>
<td>185 Mountain Highway</td>
<td>North Vancouver, BC</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>3015 E. Comstock Ave.</td>
<td>Nampa, ID</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>11101 W Executive Drive</td>
<td>Boise, ID</td>
</tr>
<tr>
<td>Jackson County Motorpool</td>
<td>808 W Main St.</td>
<td>Medford, OR</td>
</tr>
<tr>
<td>Rogue Valley Trans. District</td>
<td>3200 Crater Lake Ave.</td>
<td>Medford, OR</td>
</tr>
<tr>
<td>Salem Motor Pool</td>
<td>1100 Airport Rd.</td>
<td>Salem, OR</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>3729 Smith Ave</td>
<td>Everett, WA</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>60 S Spokane St.</td>
<td>Seattle, WA</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>13240 SE 32nd St.</td>
<td>Bellevue, WA</td>
</tr>
<tr>
<td>Clean N’Green Fuel</td>
<td>149 SW Kenyon St.</td>
<td>Seattle, WA</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>19425 28th Ave. S</td>
<td>SeaTac, WA</td>
</tr>
<tr>
<td>Fuel Farm-Waste Management</td>
<td>325 C Street</td>
<td>Auburn, WA</td>
</tr>
<tr>
<td>Clean Energy</td>
<td>3898 94th St. SW</td>
<td>Lakewood, WA</td>
</tr>
</tbody>
</table>
Regional Economic Benefits of NGV Deployment

Boosting natural gas consumption in the transportation sector offers considerable economic benefits to the North American and Pacific Northwest economies because most natural gas is produced domestically. This allows the positive economic and employment benefits from production, processing, distribution and sale to be fully captured within the U.S. and Canadian economies. Because the U.S. Pacific Northwest imports 100 percent of its petroleum and has limited gasoline/diesel refining capacity (there is one refinery in Washington), nearly all gasoline and diesel purchased in-region sends dollars out-of-region or out-of-country. Conversely, infrastructure for processing, storing and distributing natural gas already exists throughout our region.

FIGURE 1. Economic Impact Analysis of Oregon’s Low Carbon Fuel Standard


Case Study: Oregon

In Oregon, the gross state product (GSP) impacts of eight fuel portfolio scenarios were modeled for a Low Carbon Fuel Standard (LCFS) Economic Analysis. Overall GSP changes are positive for each one, indicating that the scenarios drive economic growth in the state. Scenario D, represented by the purple line above, focuses more on electricity and natural gas than the others, and produces a larger GSP impact and a different GSP impact pattern.

Deployment Drivers & Challenges

Driver: Centralized CNG Fueling

Natural gas offers significant benefits for vehicle fleets, especially school buses, transit agency vehicles, delivery vehicles and waste hauling vehicles. These types of vehicles tend to “return to base” in the evenings and so can utilize a central fueling station. This makes sense because return-to-base fleets tend to have a limited travel area and consistent daily fuel usage, so they do not need a large network of fueling stations. From a market perspective, serving fleets reduces the risk for CNG providers by ensuring they will have an “anchor tenant.” Depending on the fleet’s location, this model significantly reduces economic risk in offering CNG fueling to the public and is how the two Allied Waste public stations came to fruition in Boise and Nampa, Idaho.

Driver: Cost Savings

The primary driver for NGV fleet adoption exists in the cost differential between natural gas and conventional fuel. NGV fleets enjoy a substantial reduction in fuel expense. The ratio between 1,000 cubic feet (MCF) of natural gas and crude oil barrel prices fluctuates and is currently 1.5. For diesel, this equates to roughly $3.70 a gallon at the pump vs. $2.40 for the equivalent metric of natural gas. This favorable differential is expected to remain wide and even grow as the forecasted price of conventional fuels increases.

Trend to Watch: Natural Gas as a Marine Fuel, a potential driver for LNG fueling infrastructure

New regulation limiting emissions for large ships as far as 200 miles off North American coasts has made LNG a fuel of interest for a number of regional shipping operators. Marine operators would enjoy the same benefits as large on-shore consumers; reduced exposure to volatile diesel prices and greatly reduced emissions.

In the Pacific Northwest the Washington State Ferry System, tanker operators, and regional dry goods shippers have expressed interest in switching some or all of their fleets to LNG. Due to the considerable amount of fuel these ships consume their conversion, and accompanying fueling facilities, could provide the anchor tenant necessary for new or expanded regional LNG infrastructure.
As illustrated in Figure 2, the cost of conventional fuels proves to be extremely variable and quite high compared to the price of natural gas, which is projected to be relatively consistent and comparatively low moving forward. Tariffed natural gas provides additional price stability to fleets; it essentially gives a fuel price for the year, allowing for longer-term planning. (Although only CNG prices are shown in Figure 2, LNG prices are expected to remain stably priced at around $2.50 per gallon, where fueling infrastructure is available).

**FIGURE 2. Average Retail Fuel Prices in the U.S. – Trend of Alternative and Traditional Motor Fuel Prices from 2000-2012**

NGV maintenance costs are also generally lower than those of a diesel fleet. While there are costs associated with retrofitting a maintenance garage – including installing proper ventilation in the roof to adequately vent natural gas as it rises – maintenance intervals for CNG engines are longer. CNG reduces engine deposits and oil changes are required less frequently. Additionally, CNG vehicles are cheaper to maintain than diesel engines retrofitted with scrubbers: new Class 8 vehicles must meet 2010 EPA requirements with special equipment like diesel particulate filters (DPF). As a result, waste haulers anticipate a $5,000 per year per truck increase in cost if they continue using diesel. The emission systems are complicated, maintenance-intensive, and use urea in their operation, which is particularly expensive. This expense also includes the reduced mileage associated with the retrofit.  

**Driver: Environmental Compliance**

Increasingly stringent local, state, provincial and federal emission rules make NGVs a smart investment for many fleets. As stated above, NGVs reduce greenhouse gas and particulate emissions. This makes them an excellent, cost-effective choice for fleets facing compliance requirements. New natural gas fleets see the most significant emission reductions, but vehicles retrofitted to burn natural gas attain significant emission reductions as well.

**Tale of Two Waste Haulers: CNG Conversion vs. Diesel Scrubbers**

Beyond the lower cost of the fuel itself, Allied Waste in Boise, Idaho, has realized significant savings in employee time and maintenance costs following partial conversion of its fleet from diesel to CNG:

- Allied’s diesel trucks are difficult to start in cold weather and typically have to idle for 10 minutes to warm up before they can go to work, despite being hooked up to heaters all night. Allied’s CNG trucks start up immediately in the morning, avoiding the cost of wasted fuel from idling, expenses associated with heaters, and the time drivers spent on the clock waiting for their trucks to operate.
- There is typically a 10 to 15 minute wait to fill up trucks with diesel, as drivers stand by on the clock. Additionally, the diesel trucks sometimes need to return during the workday to refuel. The CNG trucks have enough range to stay out working all day and, when they return, drivers hook up a slow-fill CNG line before leaving for the day. The trucks are ready to go the next day.
- Typically, used diesel oil is black from soot and other by-products but oil from CNG vehicles comes out clean. While this allows longer intervals between oil changes, Allied has maintained its normal maintenance schedule for all trucks, reasoning that it will add to the life of the CNG engines.
- Diesel fuel is transported to the Allied Waste facilities via trucks while natural gas is delivered by Intermountain Gas to the Allied compressor station. This reduces cost and truck traffic.

Meanwhile, in Portland, Oregon waste haulers are required to use a blend of biodiesel fuel and emission control devices in any collection vehicle with a diesel engine used within the city. Fleet owners are working with the Portland-area regional government, Metro, to retrofit their current fleet with special diesel filters that scrub out particulate emissions. However, this technology is fairly immature and has high maintenance costs. Additionally, the filters are expensive and don’t work on older trucks. In this case, NGVs would be an excellent way for fleet managers to mitigate their costs and comply with emissions standards.

---

18. **Heiberg Garbage & Recycling - Garbage Collection, Milwaukie, OR**
**Challenge: Market Confidence**

Past issues with NGVs create barriers to current adoption. For instance, before the large automakers entered the NGV market, some fleets experimented with NGVs by purchasing retrofit kits from smaller companies that eventually went out of business. Maintaining the vehicles then became a problem; finding parts was challenging as was training maintenance personnel. Today, this is not the case. With huge multinational companies like General Motors, Mitsubishi, Toyota and Ford making NGVs, finding parts and people with maintenance knowledge no longer poses a challenge. However, there is also a lack of confidence that long-term fueling infrastructure will be available. Incentives that encourage gas utilities to enter the marketplace can help bridge this important confidence gap. A history of stability and reliability combined with regulatory oversight to ensure fair pricing may be the deciding factor that prompts fleet owners to pursue conversions.

**Challenge: Cost of Infrastructure**

Capital expense for a large-fleet CNG fueling infrastructure system – including compression, storage and card lock dispensers – can cost anywhere between $500,000 to $3 million, depending on necessary fuel capacity and siting. At-home refueling equipment serving individual NGV owners costs approximately $4,000 and is exclusively slow fill. There are additional costs – up to $250,000 – if infrastructure is made publicly accessible. This cost is higher than other alternative fuel infrastructure: electric vehicle charging stations require less capital investment per charging station, so deployment of infrastructure is much cheaper. However, electric vehicles do not provide the same range as NGVs, the technology is not as mature.

**Challenge: Infrastructure Supply/Demand Balance**

Crucially, fleets and fueling infrastructure must go hand-in-hand for each to be successful, and this has been a challenge in the past. Stable infrastructure provides certainty to fleets and large fleets mitigate the financial risk for CNG infrastructure owners. In the past, some NGV fleets depending on CNG infrastructure have been disappointed to learn that the company providing CNG fueling services was closing, leaving them no way to refuel their vehicles. Fleets were then faced with a difficult decision: if they have access, they can use a slow-fill pump that services only a single vehicle overnight, or they can drive out-of-area just to refuel, or they can sell the NGV fleet and purchase new vehicles. None of these choices is appealing.

There are models for NGV infrastructure deployment that mitigate this risk. Because capital expenses for CNG fueling infrastructure are high, the best cost-to-benefit ratio for natural gas infrastructure is currently achieved by serving large fleets that return to base, as noted earlier. This includes buses, waste haulers, taxi cabs, distributors, delivery vehicles and some corporate fleets. And construction may be undertaken by utilities, with regulatory support, or by private companies establishing long-term contracts; either way, the result is refueling infrastructure that can be self-sustaining, and eventually expanded to serve the public.

**NGV Infrastructure: Utility vs. Private Options**

The states that have seen the greatest success deploying NGV fleets – California and Utah among them – both involved utility ownership and rate-basing of CNG fueling stations. In the 1980s and 1990s, California’s Pacific Gas & Electric (PG&E) opened several CNG fueling stations to service their own fleets. In 1991, California’s Public Utility Commission (CPUC) authorized PG&E to establish a ratepayer-funded program designed to achieve “substantial market penetration” of NGVs. In its decision, the CPUC cited growing concern over air quality and increasing energy imports and found it unlikely that an NGV industry could survive without some form of initial public assistance.

Utah followed a slightly different path. Initially, when Questar opened CNG stations in the 1980s and 1990s for its fleet and the few private NGVs on the road, demand for CNG was fairly low. But in 2008, gasoline prices exceeded $4 a gallon and demand for NGVs increased substantially in Utah due to existing CNG infrastructure. Private-sector companies are beginning to enter Utah’s CNG market, but Utah’s regulators continue to support Questar’s involvement.

Beyond the utility model, there are private-sector companies that build and maintain CNG infrastructure with the vision of operating a vast network of publicly accessible CNG stations. Their financial model depends on long-term fueling contracts and partnerships with anchor tenants. Some of these companies provide integrated fueling services such as station engineering and construction along with equipment, service and support. Because the capital costs are fairly high, they tend to enter into contracts with large fleets to mitigate their financial risk and require high returns on their investment. Utilities may also partner with private-sector companies to provide CNG, or operate CNG fueling infrastructure as part of an unregulated business.
Smaller fleets or regions with less population density do not tend to attract interest from such companies, simply because they cannot provide the economies of scale necessary to make the fueling infrastructure worthwhile. Unfortunately, these smaller companies and municipalities are not in a position to invest in and maintain CNG infrastructure themselves. Though they must still comply with emission standards, and though it may make financial sense for them to purchase NGVs for their fleets, smaller businesses and public agencies find CNG infrastructure simply cost-prohibitive. In these instances, a utility-ownership model could make sense.

Challenge: Public Access to Refueling Infrastructure

Not surprisingly, initial investment in CNG refueling infrastructure has taken place in dense areas close to main corridors and arteries. However, as most of these are commercial fleet refueling stations, they are not always optimally placed for eventual public access. Many are also located in a garage or in the back of business property, making public access impractical and a potential liability.

Moving forward, siting of privately owned compressors should consider the ease of public access. For instance, instead of the back of the lot, a compressor could be placed near the front, where an outside-the-fence pump can be easily installed and accessed by the public. Improving public accessibility could also include an awning or roof, and a driveway that allows for cars to easily enter and exit.

Deployment Strategy

Any strategy for CNG deployment must address the symbiotic relationship between vehicles and infrastructure: without viable infrastructure, people and companies will not adopt NGVs. Therefore, the Pacific Northwest states’ Congressional delegation and B.C.’s Parliament and Senate representatives should support federal incentives for both NGV purchases and CNG fueling infrastructure. On the state and provincial level, policies and incentives must do the same – promote NGV adoption and the related economic, environmental, and energy independence benefits of natural gas as an alternative transportation fuel. Continuing these incentives has proven crucial to Utah and California’s success. To this end, we recommend two main strategies to promote full deployment of this beneficial fuel and technology.

Allow a Utility Ownership Model

NGVs and the accompanying CNG fueling infrastructure serve the greater public good by decreasing air pollution, improving public health and bringing dollars into the region. But due to a number of factors, the private sector has not moved to fill this gap in the regional market. Therefore, utilities should be able to rate-base their participation in the CNG infrastructure market if it makes economic sense for their customers and business. In some cases, demand might be too low to warrant such investment while in others, a utility-ownership model could accelerate NGV adoption. Utilities could provide CNG services to fleets in strategic locations and make these pumps accessible to the public following the successful models seen in Utah and California. With this steady and available infrastructure, NGVs would be adopted more widely, which would likely attract private-sector interest. Additionally, a utility-ownership model would allow regulators to regulate and set rates for CNG.

Urban and Rural Deployment

Successful models in Utah, California and other states follow strategic geographic expansion models: they focus on regions and highway intersections where there is an ability to serve 6,000 to 10,000 passenger vehicles per year. However, there are currently only a handful of publicly accessible CNG facilities in or around the region’s most populous areas – primarily Seattle-Tacoma, Washington, and Boise, Idaho.

To effectively deploy CNG in the region, focus must first be on fleet demand. As NGVs become more widely adopted, tanks of LNG can be trucked to and from rural communities to meet demand. At the date of this paper, Intermountain Gas Company has filed with the IPUC for permission to begin selling truckloads of LNG to third-party users.

Additionally, propane can play a very useful role: it is currently used as a transportation fuel on farms for heavy-duty equipment and could easily be used in more rural areas of the state as a transportation fuel for fleets. Eventually, a natural gas pipeline could be installed if a community was able to help meet the capital cost of installing pipeline. For instance, Coos Bay is a fairly rural community but wanted natural gas access and constructed a transmission pipeline using lottery and local bond funds.
Policy Recommendations

In addition to these specific strategies, there are a number of actions the region’s legislatures can take to promote deployment of NGVs.

**Tax Incentives for NGVs and CNG Infrastructure**

1. **Provide alternative fueling infrastructure tax credits for businesses**
   States and provinces should prioritize CNG infrastructure development by creating or bolstering incentives to build new stations. For example, Oregon’s Alternative Fueling Infrastructure Tax Credit for Businesses (HB 3672) provides $20 million in tax credits per biennium for transit services and/or AFV infrastructure projects. Infrastructure projects may receive up to 35 percent of costs in tax credits until Jan. 1, 2018, when the program is set to sunset. However, it should be noted that this program is not exclusively for CNG: it will be shared among all alternative fueling infrastructure, including electric vehicle charging stations, and Oregon’s Department of Energy (ODOE) reports that it will balance its allocations to ensure equitable treatment among all fuel infrastructure types. Splitting $20 million per biennium between all alternative fueling infrastructure as well as transit will not effectively deploy CNG infrastructure in the state. We recommend Oregon’s legislature increase this amount to more effectively deploy alternative fueling infrastructure in the state.

2. **Promote Public Accessibility**
   State and provincial legislatures should structure their alternative fueling infrastructure tax credits in such a way to adequately incent public accessibility. In Oregon, for example, private CNG infrastructure with “outside-the-fence” accessibility was treated separately under the BETC; that is, each piece of infrastructure received a 35 percent tax incentive. While this was sufficient to incent the private portion, it did not adequately encourage public accessibility. Legislatures should consider increasing incentives for the public portion of such infrastructure, or increase the overall tax incentive to companies and fleets that provide public accessibility to make it worth their while.

3. **Create or Strengthen Residential Incentives**
   As CNG infrastructure becomes more widely deployed, the region’s state and provincial legislatures should consider creating or enhancing residential energy tax credits for individual AFV purchases or alternative fuel infrastructure. In 2012, Oregon ended RETCs for AFV purchases, but maintained them for the purchase of alternative fuel infrastructure.

4. **Focus Tax Incentives**
   We recommend that agencies develop unique strategies for deployment of tax dollars for each alternative fuel type. Focusing on creating “outside-the-fence” units at pre-existing CNG stations as well as prioritizing and helping fleets interested in converting to CNG would help move the region’s NGV market forward.

**Multi State/Province Agreements and Joint Purchasing Programs**

The region’s states and provinces should seek out partnership opportunities with neighboring states/provinces to promote the deployment of CNG infrastructure and create transportation corridors with alternative fueling capabilities.

The Memorandum of Understanding (MOU) signed by 23 state governors over the past two years, acknowledging the benefits of CNG use in state fleets, is an example of such cooperative agreements. The document also provides the opportunity for states to utilize their cumulative purchasing power, through participation in joint CNG procurement requests for proposals (RFPs).

Along with state and provincial governments, joint purchasing programs are a useful tool for local governments, schools and special districts. Such agreements allow for volume discounts on NGV purchases and infrastructure. These efforts would also encourage car companies to manufacture more NGVs.

**Tax Abatements & Exemptions**

Tax abatements and exemptions would also promote CNG use by making it even more cost-effective compared with gasoline and diesel. NGV owners and fleets could be exempt from state highway taxes and/or fuel use charges. Additionally, Oregon NGV owners could be exempt from Oregon Department of Environmental Quality (DEQ) emission fees. To recapture some of this revenue, the state could institute an annual “NGV surcharge,” structured like Idaho’s policy.

Any franchise fees for fleet owners that convert to NGVs could also be reduced or waived. Also, any vehicle or company that advertises CNG and its benefits could be given a tax break.
Encourage Land Provisions for CNG Stations

States and provinces can also encourage communities, counties, and municipalities to provide land designated for CNG station sites. This would reduce capital expenses for infrastructure development and send a signal to communities that CNG deployment is a priority. Land along highways or at rest stops, or land co-located with other fueling sources, would be ideal.

Marketing

Methods to promote and effectively advertise the public use of CNG as a transportation fuel warrants substantial attention from governors' offices and the B.C. Ministry of Energy and should be considered a crucial part of effective CNG deployment in the region. The states and provinces should also offer assistance to any community wishing to apply for a federal grant promoting NGVs or CNG. Additionally, utilities should be permitted to promote CNG as a transportation fuel to their customers.

Weight Exemptions

Trucks are limited to a certain Gross Vehicle Weight (GVW) on a given roadway. Any additional weight to the truck (e.g., natural gas fuel tanks) reduces the payload that they can carry. Fleet managers are constantly looking for ways to minimize weight and maximize payload.

A weight credit or “allowance” for the additional weight of natural gas truck fuel tanks would eliminate the concern and financial impact of a diminished payload. A credit for the empty weight of the CNG or LNG tanks would be easiest to determine because weight differential varies greatly depending on the diesel truck that is used for comparison. This would translate to a slight payload benefit for using natural gas because the natural gas itself is lighter (per Btu) than diesel and natural gas trucks do not require diesel after-treatment systems. This would hold no benefit for operations that are not weight-sensitive.

Reduce Barriers Related to Maintenance Shop Upgrades

The high capital cost to upgrade maintenance shops to be safe and compliant remains a financial and operational barrier. There are currently few natural gas compliant shops available to service natural gas vehicles and it is not always practical or cost effective to travel long distances for maintenance. A tax credit for upgrades to natural gas maintenance garages would help mitigate this issue.

In addition, there is general confusion among fleet owners and local fire marshals regarding the specific upgrades required for maintenance shops that service natural gas trucks. Clarity and consistency in the fire codes as well as training for local fire marshals would help remove some of the uncertainty related to the cost of these upgrades.

Conclusion

To effectively deploy NGVs and infrastructure, Pacific Northwest states and provinces must create new incentives or renew and strengthen existing incentive structures to stimulate investment in CNG infrastructure. Because CNG infrastructure is capital intensive and differs from other types of alternative fueling infrastructure, allowing a utility ownership model on a voluntary basis is one way to accelerate CNG deployment. Demand for private NGVs should increase with incentives offered by the state/provincial and federal governments once stations are available for refueling. As NGV ownership increases, the economic risk associated with additional publically accessible CNG stations should decrease, thus effectively deploying CNG infrastructure throughout the region.