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Policy Submission to Pan Canadian Framework on Clean Growth and Climate Change: Renewable Natural Gas for Freight Transportation

June 2016

1.0 Purpose of Submission and Background

The purpose of this submission is to identify initial policy options for moving forward on natural gas and renewable natural gas (RNG) as low carbon transportation fuel sources as part of the Pan-Canadian Strategy for Clean Growth and Climate Change.

This submission draws on data and information collected from leading industry associations including the Canadian Gas Association (CGA) and the Canadian Natural Gas Vehicle Alliance (CNGVA). Further, it builds on findings of a spring 2016, Pollution Probe expert workshop – the *Pathways Initiative Workshop* – that examined developments that are taking place or are being proposed to decarbonize the transportation sector. The workshop brought together 84 international and Canadian transportation experts and stakeholders from a diversity of organizations and backgrounds. One of the priority technology/fuel pathways that was found to have substantial potential to reduce GHG emissions from transportation is through the use of natural gas and RNG.

2.0 Context

Canada and several provinces have set aggressive greenhouse gas emission reduction targets and timelines. A number of municipalities have set similar targets. Leading companies have responded with their own commitments and initiatives, as have some industry associations. Substantive policies, regulations, programs and incentives to attain the targets are being considered or implemented in jurisdictions across Canada.

Transportation presents one of the greatest challenges to achieving deep GHG reductions in Canada. Passenger vehicles and heavy duty trucks in particular are major emission sources. In Ontario for example they represent 28% of Ontario's total emissions, and 18% of Canada's total GHG emissions. Federal GHG emissions standards have helped to reduce GHG emissions from passenger and heavy duty vehicles, and further gains can be made with tighter standards and shifts to newer technologies. While natural gas is well suited for all transportation applications the biggest GHG reduction benefits are seen in the freight and medium-heavy duty transportation sector – representing more than one million on-road vehicles. Freight transportation emissions are increasing rapidly and high horsepower applications such as long haul trucks carrying heavy loads represents one of the highest and fastest growing emitters in the on road transportation sector.

Across North America, current efforts to reduce heavy duty vehicle emissions are focused on improving the efficiency of internal combustion engines, among other measures, and on lowering the carbon content of transportation fuels. The adoption of natural gas engines is the first step to advancing the use of RNG. Natural gas, and blending of RNG can play a significant role in responding to the emissions challenge presented by the transportation sector in particular return to base vehicles (e.g., waste haulers, transit), heavy duty trucking and marine vessels.

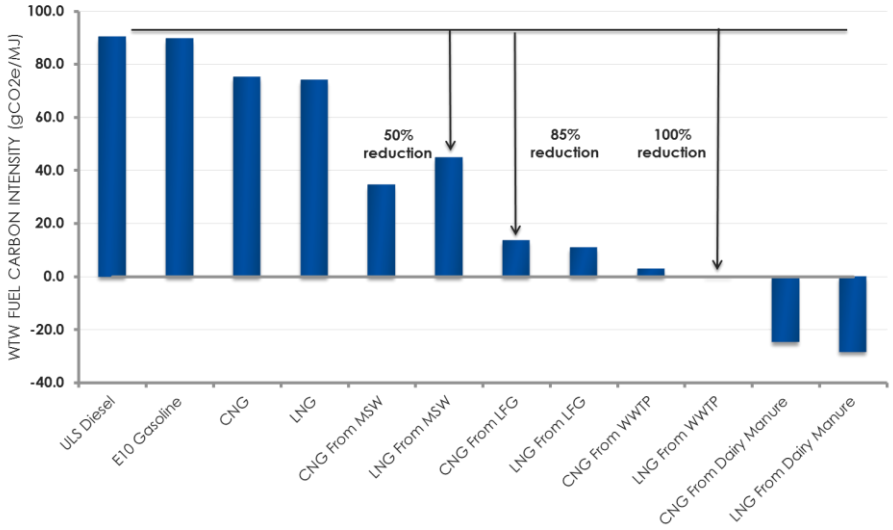
3.0 Why Use Natural Gas and RNG as a Freight Transportation Fuel?

In 2014, natural gas provided more than 30% of Canadian domestic energy needs. Natural gas is the largest source of energy for Canadian homes and industry, it is a growing source of fuel for the generation of electricity. However, natural gas provides less than 0.5% of the energy requirements for the Canadian transportation market. Therefore, the opportunity to harness lower GHG emissions by using natural gas and RNG is significant in Canada. In fact, the combination of natural gas affordability (20-40% cheaper than gasoline and diesel based on 5-year average prices), advances in fuel production and engine technology and absence of ready-made electric solutions for high horse power engines, position natural gas as the fuel of choice for the heavy duty trucking and marine market.

The U.S. Energy Administration's *Annual Energy Outlook 2015* projected that natural gas will be the fastest-growing fuel in the transportation sector, with an average annual demand increase of 10% from 2012-2040. Heavy duty vehicles will lead this expansion, with an average annual growth rate for natural gas vehicles of 14%. In Canada, the waste haul sector, transit buses, and heavy duty fleets have seen the highest rates of natural gas adoption. The use of LNG as a fuel in the marine and ferry sectors are also advancing in Canada with projects underway in British Columbia and Quebec.

Natural gas vehicles offer GHG emission reductions of 15-25% relative to diesel vehicles, and these savings grow with increased RNG blending rates. Depending on the RNG supply and production technique, the GHG emission reduction benefits of RNG use can be in the range 50% to 125% (Figure 1). Further, a full blend of RNG offers a near zero emission transportation solution for the Canadian marketplace. In addition to GHG benefits of natural gas/RNG, the use of methane results in particulate matter reductions in excess of 90%, and nitrous oxide reductions of roughly 50%, relative to diesel use in heavy duty vehicles.

Figure 1: WTW Carbon Intensity of Fuels, Petroleum, Natural Gas and Renewable Natural Gas[1]. Source: Westport.



[1] ULS = Ultra-Low Sulphur; MSW = Municipal Solid Waste; LFG = Landfill Gas; WWTP = Wastewater Treatment Plant

One of the unique Canadian challenges faced by the long-haul heavy duty trucking sector is the lack of a high horsepower natural gas engine. These high horsepower applications were served by Wesport's High Pressure Direct Injection conversion of the Cummins ISX 15 litre engine. The next generation HPDI engine is under development but given the limited global market for these, Original Equipment Manufacturers have not yet indicated any plans to deploy the product in North America. In Canada this is particularly problematic as high horsepower applications are more common, particularly in Western Canada with its mountains, and Long Combination Vehicles. Canada's higher weight allowances and therefore higher productivity per truck, also rely on high horsepower applications in other parts of the Country. Although OEMs have indicated that high horsepower engines will be available as part of the post 2018 compliance options, the risk for the Canadian market is that it will be served by an inferior diesel engine, as high horsepower engines in Canada account for 40% of heavy duty trucks sales. A made in Canada solution to reintroduce a HHP engine is being explored by industry with Canadian governments.

4.0 Renewable Natural Gas Overview

RNG is natural gas produced from organic waste from farms, forests, landfills, and water treatment plants. The gas is captured, cleaned, and injected in pipelines to be used in the same way as natural gas by homes, businesses, institutions, and industry. RNG can be produced in two ways. The first is through a process of anaerobic digestion, whereby organic waste (from landfills, farms or waste water treatment plants) is converted into methane and carbon dioxide in a digester or holding tank. The gas produced is then cleaned or purified to meet utility pipeline specifications. The digesters can be located at waste water treatment plants, landfills, source separated organics waste facilities, or on farms. The second is via a process of gasification, which uses high temperatures to thermally break down biomass into synthesis gas, a mixture of simple gaseous compounds. This syngas is then reformed into methane to produce RNG.

RNG is an attractive fuel because it has the highest energy conversion of feedstock-to-fuel of currently available sources of renewable transportation fuels. It can be mixed or used interchangeably with conventional natural gas. It can reduce GHG emissions (including capturing methane emissions from landfills), reduce air pollutants, eliminate waste products, create new revenue streams via new investments and products, create new jobs, and support green industry development.

Currently, in the provinces of British Columbia, Ontario and Quebec, natural gas distribution utilities are putting RNG into the pipeline distribution system. By the end of 2016, utilities will have brought online eleven RNG projects producing enough renewable fuel for 51,000 homes or equivalent to approximately 132 million litres of renewable fuel for transportation markets.

RNG, while more costly than geologic natural gas supplies, is a cost-effective source of renewable energy for Canada. RNG can be produced, cleaned and put into the natural gas distribution system at a cost of between $10-25 per gigajoule (GJ), or equivalent to between 4-9 cents per kilowatt hour (kWh). For comparison, current renewable electricity contracts for utility scale solar in Ontario have been signed for approximately $19 and $44/GJ or 7-16 cents/kWh.

The supply potential for RNG in Canada has been estimated at 1,210 billion cubic feet (Bcf), which equals 50% of our natural gas consumption in 2014. The potential is greatest in B.C. (300 Bcf), Quebec (282 Bcf), Alberta (169 Bcf), and Ontario (157 Bcf).

The forestry sector has the greatest supply potential at 51%, given its access to waste forestry biomass. However, there is currently no RNG production in this sector and will require technology development on upgrading gasified biomass to RNG.

The agricultural sector could supply 36% of the total RNG potential. This requires access to agricultural and feedlot waste streams. Anaerobic digestion technologies can be used, but they can have high costs due to low-energy densities of feedstocks, small farm sizes with limited feedstock availability, and regulatory barriers that prevent the mixing of off-farm feedstocks.

The municipal sector could supply 13% of the total Canadian RNG potential from landfill waste streams, source-separated organic treatment facilities, and wastewater treatment plants. Solid waste operations are not yet contributing to RNG supply, but raw landfill gas is being produced and is the most cost-effective near-term source of RNG (especially at large landfills located close to natural gas pipelines).

The main drivers for higher costs of RNG include feedstock collection and capital equipment costs to remove impurities. However, the cost of RNG will decline as it gains a larger share of the market and as economies of scale occur, especially if regional differences in Canada related to terminology, regulations, local distribution company operations and practices, and fuel quality management are addressed.

5.0 Policy Support for RNG in the Transportation Sector in Other Jurisdictions

Significant advances on RNG use in transportation have been made in the U.S. and Europe, and Canada can take advantage of this progress. Two key policy measures that have been used to incent RNG development and use in transportation include:

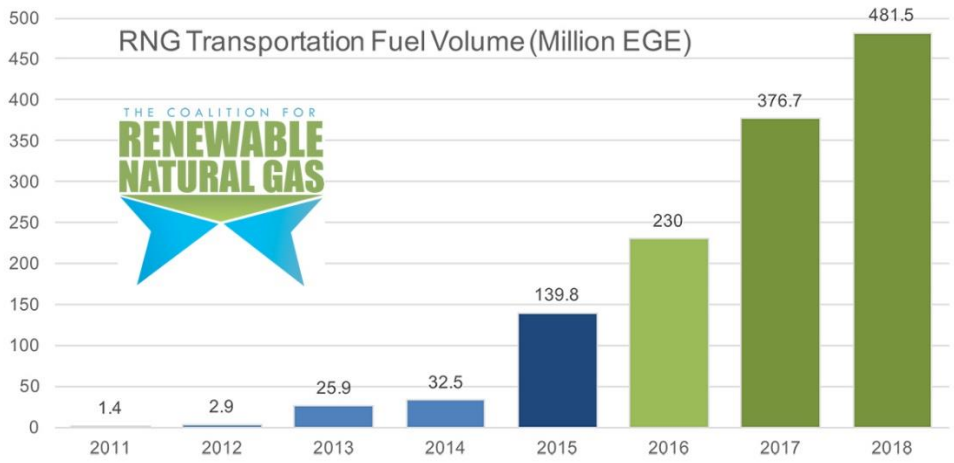
Renewable Fuel Standards (RFS): A policy mechanism used to create a market for renewable fuels in the transportation sector. It requires a minimum percentage of the transportation fuel provided in a given geographic area to be replaced by renewable fuel.

Low Carbon Fuel Standards (LCFS): A policy mechanism that requires a specified reduction in transportation fuel carbon intensity by a given date. Fuel providers must meet reduction targets by selling more low carbon fuels, reducing the carbon intensity of fossil fuels, or purchasing credits from producers who supply low carbon fuels.

The U.S. EPA provides an RNG incentive through its RFS. In 2015, approximately 528 million litres of renewable natural gas were produced for use in U.S. transportation markets. By 2018, it is forecast that the volume of RNG will increase to over 1.8 billion liters (Figure 2). Thirty-five out of fifty state legislatures are providing support for RNG as part of their renewable portfolio standards for electricity

production. Twelve U.S. projects produce RNG for vehicle fuel and 30 or so more are planned (Corporate Knights, 2014).

Figure 2: RNG Transportation Fuel Volume (Million ethanol gallon equivalent (EGE)). Source: Renewable Natural Gas Coalition (Sacramento).



California's LCFS is one of the most advanced programs in the world. It requires a 10% reduction in transportation fuel carbon intensity by 2020. The University of California, Davis, Institute of Transportation Studies is conducting a major study to assess the feasibility of using RNG as a low carbon alternative fuel to meet the LCFS and to evaluate the volume of RNG that could be made available, as well as savings in emissions and cost compared to traditional hydrocarbon-based fuels.

In Europe, the European Commission's Biofuels Directive has helped push RNG adoption as a transportation fuel. By 2020, the EU aims to have 10% of the transport fuel of every EU country come from renewable sources such as biofuels. Fuel suppliers are also required to reduce the greenhouse gas intensity of the EU fuel mix by 6% by 2020 in comparison to 2010.

6.0 Policy Options for Canada

Policy options that could help level the playing field and/or lower barriers to increased natural gas engines and RNG use in the transportation sector include:

- Canadian governments could support the increased adoption of natural gas engines for trucking and marine through the use of program incentives to cover a portion of the incremental cost of a natural gas truck or vessel.

- Canadian governments could support, through cost sharing with industry, the construction of LNG and CNG refueling stations across Canada's major highways systems. An initial investment by the Government of Canada was announced in Budget 2016 to support approximately 6 new natural gas refueling stations. More can be done to build on this initial investment.

- Support the development of a 15L high-horsepower engine to serve the heavy, long-haul trucking market. This segment represents one of the highest and fastest growing emitters in the on-road transportation sector and needs an engine that can use natural gas and consequently RNG.

- Environment and Climate Change Canada could recognize RNG as a compliance option for reducing GHG emissions in the transportation sector by amending the *Canadian Renewable Fuels Regulation* to align with the US EPA Renewable Fuel Standard (RFS).

- Investment tax credits or program support could be provided for RNG projects, and direct program support could be provided to offset higher RNG costs. For example, the Canadian Gas Association is seeking federal matching for provincial RNG programs (e.g., $100 million announced by the Government of Ontario to support RNG projects that inject into the pipeline network and $20 million to support RNG transportation fuel pilot projects).

- RNG research and demonstration to support industry in de-risking biomass to gasification technology solutions that can unlock the 85% of RNG potential from biomass sources.

- Canada could collaborate with U.S. state and federal governments on RNG development. In particular, Canada could partner with the California Energy Commission and University of California, Davis, on the development and implementation of a RNG Technology Roadmap for the transportation sector.

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ABOUT POLLUTION PROBE

Pollution Probe is a national, not-for-profit, charitable organization that exists to improve the health and well-being of Canadians by advancing policy that achieves positive, tangible environmental change. Pollution Probe has a proven track record of working in successful partnership with industry and government to develop practical solutions for shared environmental challenges.