NGVAMERICA
Natural Gas Vehicles for America

400 North Capitol Street, N.W.
Washington, D.C. 20001
ngvamerica.org

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Mr. Michael Berube
Deputy Assistant Secretary for Transportation
Office of Energy Efficiency & Renewable Energy
U.S. Department of Energy
1000 Independence Avenue SW
Washington, DC 20585

RE: Natural Gas as a Transportation Fuel – A Strategic Opportunity for U.S. Energy Security Enabled by Innovation and Advanced Technology

Dear Mr. Berube:

NGVAmerica and the Office of Energy Efficiency and Renewable Energy (EERE) enjoy a long history of collaboration. Your office has supported NGVs over the years through the Clean Cities program, research and development initiatives related to engine development and natural gas storage, the ARPA-E MOVE program, deployment incentives, and national laboratory funding for NGV analysis and codes and standards support. Clean transportation initiatives that involve natural gas vehicles have benefited from these efforts, and we are eager to continue and grow our partnership.

Further, we appreciate EERE's outreach as it prepares the Department of Energy's (DOE) response to Fiscal Year 2019 Energy and Water Appropriations Senate report language directing DOE to undertake a comprehensive study on existing barriers to increased natural gas vehicle (NGV) deployment in on- and off-road transportation.

In addition to EERE information shared at our November 2018 Industry Summit and subsequent webinar in January 2019, NGVAmerica solicited feedback from members through various conversations and working group exchanges. This document seeks to consolidate NGVAmerica members' shared data, comments and concerns related to DOE's presentation and its findings.

NGVAmerica's comments are aggregated in three categories – technical, policy/regulatory, and market considerations – and echo DOE's shared focus on reducing the higher NGV costs of onboard fuel storage, engine efficiency, and vehicle production.

Technical Investments

Improve Engine Efficiency. The highest development priority with existing engine technology is improving fuel economy. Natural gas engine manufacturers have been spending vast resources to lower NOx emissions and meet expanding OBD requirements, but a need remains to improve natural gas engine efficiency. While one engine company has made significant improvements in efficiency, a gap remains between natural gas engines and their diesel counterparts. To remain competitive with diesel, additional improvements in fuel efficiency must be achieved. Pursuing combustion efficiency improvements can bring natural gas engine on par with their diesel counterparts. Reducing main engine idle time with renewable

technologies would also reduce the use of fuel for air conditioning, heating and radio use while drivers are waiting to pick up or drop off loads. DOE should endorse these efforts by continuing to fund advancements in natural gas engine and vehicle fuel efficiency, such as but not limited to:

- ***Variable Valve Timing.*** Evaluate opportunities for improving heavy-duty natural gas engine efficiency through the implementation of variable valve timing. This technology has the potential to significantly reduce fuel consumption and therefore, operating costs and greenhouse gases.

- ***Homogeneous Charge Compression Ignition.*** Evaluate opportunities for improving heavy duty natural gas engine efficiency through the implementation of homogeneous charge compression ignition (HCCI) during cruise. This technology may significantly reduce fuel consumption and therefore, lower operating costs and reduce greenhouse gas emissions.

- ***High Pressure Common Rail Fuel System***. Evaluate opportunities related to using high pressure common rail fuel systems that deliver improved fuel economy.

Develop a Larger Engine. Growth of the NGV industry depends on growth of fueling volumes. The most immediate way to impact that outcome is to support the development and certification of larger natural gas engines to market. By increasing the deployment of existing 0.02 g/bhp-hr NOx certified engines, DOE and the NGV industry can help to accelerate the development and deployment of the cleanest medium- and heavy-duty engines in the world. This effort will accelerate the reductions of emissions that contribute to ozone formation and support NGV industry's effort to improve air quality and public health. This step is critical as conventionally-fueled vehicles are not expected to focus on lower-NOx emissions in the foreseeable future. To broaden the use of this novel technology, the industry must have a full platform of Near-Zero NOx engines. There is currently a 9L Near-Zero NOx engine which is being used in refuse and transit markets, a 12L Near-Zero NOx engine available for dedicated return-to-base or urban applications, and a 6.7L engine. New technology advancements need to continue to be encouraged.

To have a full portfolio of product offerings required by truck operators, a larger, efficient natural gas engine is also required (450-500 hp / 1650 to 1750 ft-lbs or greater). Natural gas has proven a reliable fuel for long-haul trucking, and a larger low-NOx engine will improve the value proposition for the heaviest of heavy-duty trucking fleets. ACT Research's *NA On-Highway CV Engine Outlook* indicate that large engines, i.e., greater than 14 liter, continue to make up a significant percentage of new Class 8 tractor orders, accounting for 50 percent or more of such orders in recent years. ACT Research's forecast indicates that larger size engines will continue to have a similar share of the overall market for new tractors. For these reasons, it is important that there also be competitive natural gas engines in this market segment. However, the combustion technology for a natural gas engine of this size remains undetermined with technological hurdles to achieving the Near Zero 0.02 g/bhp-hr standard while still retaining competitive fuel economy. A technology development program is needed to support expanded development and adoption.

Simplify Engine Certification. Several global OEMs have medium and heavy-duty natural gas engine offerings in the EU and throughout the world, but these products have not been brought over to the U.S. because of the high cost of certifying such products and the current limited demand. While market conditions are the main constraint, efforts to lower certification costs may reduce the risk of entering the U.S. market. DOE should identify and develop incremental "Cross-Over" tests capable of proving that U.S.-certified engine systems are compliant with European certification requirements and European-certified engine systems are compliant with U.S. certification requirements.

Engine sales volumes greatly affect unit costs and therefore prices of engines. The ability to offer engines for sale in other markets could reduce production prices. Reducing the cost of certification for off-shore engines can increase competition within the U.S., stimulating innovation and reducing costs through

competition. The largest impediment today for fleets looking to switch to clean burning natural gas is the higher capital cost of the vehicles. Economies of scale will certainly help reduce engine and fuel system costs.

Advance Natural Gas Storage. DOE has invested in CNG-conformable tank technology with the ARPA-E MOVE program. The MOVE projects made headway in conformable CNG tank technology, but there is still more to offer. A commercially-viable conformable CNG tank offers an opportunity to awaken the light-duty natural gas vehicle segment. Liquefied natural gas storage can also be improved. Basic challenges of providing accurate fuel reserve levels and remaining range still exist. Cold LNG storage offers lower LNG tank pressure, which in turn provides increased range and longer hold times. There has been prior activity in cold LNG storage, but additional R&D in cost effective cryogenic small pumps, vaporizers and related equipment can make this technology more acceptable. DOE should carry on the work that was started with the MOVE program for conformable CNG tanks and support LNG tank improvements.

Policy/Regulatory Corrections

Provide Tax Parity. Federal tax policy often provides preferential treatment for certain fuel and vehicle types at the expense of others. Several policy changes could provide alternative fuel vehicle parity for natural gas vehicles and system technology:

- ***Extend the AFTC.*** The Alternative Fuels Excise Tax Credit (AFTC) is one mechanism used to encourage further natural gas vehicle deployment. As this credit has not been prospectively extended and its fate perpetually hangs in the balance, it fails to provide the Return on Investment (ROI) certainty needed for fleets to make long-term business investment decisions, thereby disincentivizing conversion to natural gas. Consequently, without longevity, adoption of natural gas vehicles is greatly inhibited.

- ***Eliminate the Federal Excise Tax on the Incremental Cost of New NGV Purchases.*** U.S. tax code currently imposes a 12 percent Federal Excise Tax (FET) on the sale of all heavy-duty trucks, trailers and tractors. While it applies to all trucks regardless of fuel source, this tax serves as a further disincentive for the purchase natural gas trucks by adding additional costs on top of already higher technology costs. Eliminating the 12 percent FET on the incremental cost of the new natural gas truck over like diesel-powered models would discontinue the disincentive to purchase cleaner natural gas technology, lowering conversion costs and reducing the required payback period for these trucks. Fundamentally, by eliminating the FET on the incremental cost of a natural gas truck, the total collection of FET remains the same as if the fleet were to purchase a diesel truck. The elimination of this incremental FET thereby encourages increased adoption. Some states already exempt portions of the vehicle cost from taxes (SC: 30 percent; NM: 18 percent). The federal government ought to do the same.

- ***Re-enact a Natural Gas Vehicle Tax Credit.*** Federal tax code currently provides a tax credit of up to $7,500 for the purchase of an electric vehicle. (See 26 USC 30D). This incentive is available on the first 200,000 electric vehicles sold by a manufacturer, worth more than $1.5 billion per manufacturer. The tax code does not provide a similar incentive for the purchase of NGVs while also encouraging the OEMs to produce NGVs in America as they do around the world. Proposed 2018 legislation provided structure for incentivizing light, medium and heavy-duty vehicles which can be shared. The addition of such a vehicle purchase credit could further reduce the added cost of this clean technology investment, speeding up ROI, and increase adoption.

- ***Amend the LNG in Inland Waterways Tax.*** In 2015, Congress recognized the unfairness of taxing LNG by the by the gallon since it takes about 1.7 gallons of LNG to provide the same energy as a

gallon of diesel fuel. The on-road tax is now based on a diesel gallon equivalent (DGE) unit using mass and is defined as 6.06 pounds of LNG per DGE. Taxing LNG based on volumetric gallons for purposes of the Inland Waterways tax results in LNG paying 50 cent per diesel gallon equivalent (DGE) compared to the 29 cent paid for an equivalent gallon of diesel. Amending the Inland Waterways Financing rate on LNG so that the tax is imposed on the energy content or on a DGE basis rather than per gallon would ensure that LNG is taxed fairly, and that this tax is no longer a barrier to further NGV deployment. LNG has huge potential as a cheaper, cleaner, domestic energy source, and the financing mechanism for the inland waterways system should not disadvantage its use.

Equalize Federal Funding Programs. A variety of federal programs provide significant advantages for competing alternative fuel technologies over NGVs. These proposals should be evaluated:

- ***Reform FTA Low- or No-Emission Bus Funding.*** Because it prioritizes reductions of tailpipe greenhouse emissions while ignoring upstream emissions and reductions of other important pollutants such as nitrogen oxides (NOx), the Federal Transit Administration (FTA) Low- or No-Emission Bus Program provides millions of dollars exclusively for electric buses at the expense of Ultra Low-NOx natural gas transit buses. This program should be expanded to encourage natural gas buses which operate on extremely low pollution engines and offer a cost-effective solution to reducing greenhouse gas (GHG) emissions using renewable natural gas (RNG). It should place both criteria pollutant reductions on equal footing as GHGs while recognizing RNGs important benefits. As currently structured, this program does not allow grant providers to consider the advantages of NGVs, and prioritizes electric vehicle purchases even when they are not the best available solution for the transit applications and route.

- ***Amend FTA Bus procurement guidelines recognizing contributions of Low NOx natural gas engines to a 90% funding threshold***. Natural gas transit buses available today are certified to levels for nitrogen oxide (NOx) that are 90 percent below federal emission levels. However, the current increased funding levels permitted for cleaner buses do not differentiate between natural gas and available diesel buses. The funding guidelines provide an increase from 80 to 85 percent federal share for all buses purchased for Clean Air Act compliance regardless of the actual emission benefit of a new bus. To truly encourage cleaner buses, the funding percentage for new, natural gas buses powered by "Near-Zero" low NOx engines should be increased from 85 to 90 percent to encourage manufacturers to offer these cleaner buses and to further encourage local transit agencies to buy these cleaner buses.

- ***Amend Diesel Emissions Reduction Act Funding to Increase Opportunities for NGVs.*** The U.S. Environmental Protection Agency (EPA) Diesel Emission Reduction Act (DERA) Program provides preferential treatment for electric vehicles by providing an offset of up to 45 percent of the cost of new electric trucks or buses but only funding 25 percent of the cost of a new natural gas truck or bus (35 percent if the engine is a low-NOx engine). The 45 percent level was arbitrarily set based on the higher cost of electric vehicles and is not based on emission benefits. The DERA Program should be amended to require no less than 20% of funds shall be for natural gas vehicle related projects. The amendment should also eliminate funding for diesel and continue to provide 50% of the cost to replace a diesel drayage truck with a new Low-NOx natural gas truck, which will further support adoption typically in disadvantaged communities.

Include Upstream Emissions in Corporate Average Fuel Economy Standards. Current light-duty fuel economy and greenhouse gas regulations include regulatory incentives for electric vehicles that far exceed those provided for natural gas vehicles. Current rules ignore electric vehicle upstream emissions and treat them as if they produce 0 grams per mile of pollution, effectively providing a significant greenhouse gas

emission credit not extended to any other clean technology like natural gas. For example, the standard in 2016 was 263 grams per mile, meaning that each zero-emission vehicle produced by a manufacturer in that year was treated as offsetting 263 grams of greenhouse gas emissions. These credits have been in place for many years and currently are not set to expire for many more years. Credit calculations should be revised to reflect the full cycle emissions of electric and natural gas vehicles and account for the beneficial use of renewable natural gas.

NGV Market Influencers

Grow Renewable Natural Gas as a Transportation Fuel. The EPA's Renewable Fuel Standard (RFS) Program is encouraging the development of renewable natural gas projects across the country. When this biogas is captured from agricultural, food, landfill or wastewater and used as a transportation fuel, even greater CO_2 and greenhouse gas emissions reductions are achieved – up to 125 percent lower than the cleanest diesel. The reporting provisions for testing are burdensome and imped the market and can be simply enhanced by actions such as allowing for random testing. In addition, the program's Renewable Information Numbers (RINs) deliver operating cost advantages between $0.10 and $0.60 per gasoline gallon equivalent (GGE) depending on the source and availability. The additional savings is likely to impact economic payback assumptions used by DOE since it appears to be using retail fuel prices and not contracted prices. Large fleets typically pay a discount for natural gas and diesel when contracting for fuel supplies. To the extent that natural gas fleets can contract for steeper discounts based on Low-Carbon Fuel Standard (LCFS), RFS or other credit values, the economic savings associated with using natural gas should be even greater than expected based on the retail price differences.

Support Virtual Pipelining. DOE should investigate technological areas around hydraulic compression trailers and ionic compressors. Advancements in this area could provide ready access to low-cost stranded natural gas that could be brought to market to facilitate new projects in remote locations and serve markets that currently do not have access to natural gas thus creating new opportunities for natural gas transportation projects.

Consider Adsorption Technologies. Adsorbed natural gas (ANG) can reduce cost barriers by reducing compression equipment cost. The cost of compressors and compression can be reduced by using ANG because fueling infrastructure built to support such applications can use lower cost compressors. Research and development to reduce the overall weight and cost of this onboard storage may lead to better shaped tanks, increased adoption, as well as the safety benefits of utilizing a lower pressure.

The benefits of conformable tanks and low-pressure systems could be particularly attractive in the light-duty vehicle segment where space for required fueling tanks is limited. NGVAmerica is supportive of efforts to expand opportunities for NGVs in the light-duty segment, particularly with respect to light trucks and sport utility vehicles which dominant the segment and often are not good candidate for electrification. Natural gas is well suited for addressing the needs of this market segment including the significant number of light trucks purchased by fleets.

Support Natural Gas Use in Rail Applications. Evaluate opportunities for overcoming barriers to use of natural gas as a fuel for rail operations. Rail projects have the potential to use significant amounts of natural gas and support large-scale infrastructure investments that could benefit other markets such as marine or truck transport where these different industries intersect. The key is identifying projects and applications that use sufficiently large amounts of fuel to justify the initial investments in infrastructure projects that can then serve other applications and markets.

Rail consumed 3.7 billion gallons of diesel in 2011. That represents 12 percent of the diesel fuel consumption by transportation. (Chase, 2013). Two engine technology opportunities are available in the rail transportation sector; prime movers and switchers. Prime movers generate the electricity that

provides traction motors with power for locomotives to travel distances. Switchers are locomotives that move cars around yards, switch, sort and order various loads, and operate in localized areas. Several engine options already exist to serve this market. More work needs to be done to understand what technology and regulatory barriers continue to exist in this market.

Apart from the obvious greenhouse gas and emissions reduction benefits of using natural gas engine technologies during general goods movement, when applied to local switchers in rail yards, cargo storage and switching areas, the resulting emissions reduction can substantially improve air quality in EPA and ARB Non-Attainment Zones.

Therefore, direct the Department of Transportation (DOT) to allocate Research, Development and Deployment (RD&D) funding for high horsepower natural gas engine technology within the Federal Railroad Administration's Research, Development, and Technology department.

Support Natural Gas Use in Marine Applications. DOE should evaluate opportunities for overcoming barriers to the use of natural gas as a fuel for marine operations. Like rail, the marine segment consumes significant amounts of fuel and successful introduction of natural gas fueling infrastructure for marine applications could benefit other markets like trucking. Marine annually consumed an average of 415 million gallons of diesel in inland waterways between 2005 and 2014 (NGVA estimate, based on marine fuel taxes paid (GAO, 2016), pg.11).

Marine vessels, looking to reduce emissions per the International Maritime Organization's 2020 Rule and meet sustainability targets, have begun transitioning away from heavy fuel oil to LNG. Large shipping and cruise lines such as Tote, Crowley, Carnival Cruise Lines, and Disney Cruise Lines have launched, and will be launching additional LNG-powered vessels. Ports looking to clean up their air have begun to require cleaner burning vehicles, such as those powered by natural gas. One issue with launching these clean burning vehicles at ports is the permitting required for LNG refueling. The Department could support permitting LNG fueling stations for marine vessels.

A significant barrier, particularly for natural gas adoption in inland waterways, is the significant lifetime of marine vessels (e.g. tugs and transporters) and the difficulty of converting or retrofitting these vessels to operate on natural gas. To impact this market, there needs to be a practical solution to retrofitting the fleet of existing vessels. Establishing retrofit requirements is important which may be available by leveraging International standards. One of the complications of converting diesel powered vessels to operate on natural gas is the requirement that operators install expensive SCR systems in case the engine is operated in diesel-only mode. This requirement further complicates conversions and adds to the cost. Reducing engine power or derating of engines if they operate in diesel only mode may be a beneficial regulatory alternative to requiring SCR systems. RD&D funds should be directed to supporting retrofit applications in marine engines.

Apart from the obvious greenhouse gas and emissions reduction benefits of using natural gas engine technologies during general goods movement, when applied to local marinas, cargo storage and transfer areas, the resulting emissions reduction can substantially improve air quality in EPA and ARB Non-Attainment Zones.

Other Regulatory/Legislative Actions with the potential to foster sustained attention supporting the transition to utilizing natural gas as a transportation fuel:

- Direct federal agencies utilizing third party fleets for goods movement, etc., to provide additional priority (higher point scoring for RFPs) and incentives, such as an extended term, for fleets that operate natural gas trucks in the application.

- Encourage federally-funded infrastructure projects to utilize domestically-produced natural gas by directing states receiving new funds for infrastructure projects to provide preferential treatment for businesses that operate NGVs in their fleet.
- Require, when possible, that new construction projects receiving federal funds use natural gas-powered machinery and equipment wherever possible.
- Support legislation encouraging natural gas for transportation.
- Modernize the SmartWay Program to ensure additional promotional opportunity and program benefits are provided to fleets utilizing natural gas.
- Simplify dual-fuel certification for non-road engines by removing testing requirements for diesel mode, as it imposes unnecessary costs and controls that are required for diesel only engines.
- Identify and remove barriers that impede government fleet purchases of NGVs to further encourage OEM US NGV production similar to products provided globally.

Thank you for consideration of these comments for inclusion in your report to Congress.

Sincerely,

Timothy Standke
Director, Technology & Development

Endnotes

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