4 Key Things to Know About Natural Gas in Transportation
Sustainable Fleet Technology Conference & Expo
August 22, 2018
About NGVAmerica

NGVAmerica is the national organization dedicated to the development of a growing, profitable, and sustainable marketplace for vehicles powered by natural gas and biomethane and for promoting the use of more natural gas in transportation... trucks, trash, transit, and even off-road uses like HHP marine, rail, and construction/mining applications.

NGVAmerica represents 200+ companies, LDCs, fleets, OEMs, environmental and government organizations.
NGV America Members
Port volumes are on the rise.

Nation’s Largest Ports Report Record TEU Volume Levels Ahead of Tariffs

Business is booming at many of the nation’s largest ports, fueled by a strong U.S. economy and, according to experts, a rush to import and export goods before the Trump administration’s tariffs take hold on products from China and other nations.
More and more trucks are on our roads.

12.6 million commercial vehicles in the U.S.

Source: IHS Automotive, 1/16

With rise of online retail, just-in-time shipping, and delivery-on-demand goods and services, trend will only continue.
Growing Goods Movement Industry

Everything we eat, wear, and use...

Total Freight by Weight

<table>
<thead>
<tr>
<th>Year</th>
<th>2012</th>
<th>2015</th>
<th>2045</th>
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<td>16,896</td>
<td>17,978</td>
<td>25,346</td>
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Source: US DOT, Bureau of Transportation Statistics, 11/15/17
The Problem

Urban Emissions & Public Health
Breathing in particle pollution increases the risk of:
• Asthma
• Lung Cancer
• Heart Disease
• Premature Death

Source: American Lung Association, 2018

134 million Americans live in areas with air that is unhealthy to breathe...

4 out of every 10 Americans
25 million Americans suffer from asthma... about 8% of our total population (1 in 12 people)

Every day in the United States, due to asthma:

- 30,000 people have an asthma attack
- 5,000 people visit the emergency room
- 11 people die.

Source: Centers for Disease Control and Prevention
Urban Emissions: Leading Sources

74% of heavy-duty trucks not certified to latest NOx emission standard

#1 Source of Urban Emissions
- Short-Haul
- Refuse
- Long-Haul
- School Buses
- Transit Buses

26% of heavy-duty trucks meet NOx emissions standard

Source: DTF Analysis on IHS Vehicles in Operation Data, December 2015
Our goal at NGVAMERICA

Every American child will awake in a neighborhood with clean air by 2025.

Natural gas gets us there.
Heavy-Duty = Big Impact

1 for 1 = 119
Replacing 1 traditional diesel-burning heavy-duty truck with 1 new Ultra Low-NOx natural gas heavy-duty truck is the emissions equivalent of removing 119 traditional combustion engine cars off our roads.

Source: https://greet.es.anl.gov/afleet_tool
The Solution

Increased Natural Gas Use in Transportation: 4 Key Things to Know
#1: Natural Gas Is Now.
Get Unmatched Emission Reduction Benefits Today.
The cleanest heavy-duty truck engine in the world is powered by natural gas.

- Certified in 2018 by the U.S. Environmental Protection Agency and California Air Resources Board

The Cummins Westport Ultra-Low NOx engine is certified to a 0.02 g/bhp-hr standard, which is:

- 90% cleaner than the EPA’s current NOx standard
- 90% cleaner than the latest available diesel engine
Cummins Westport Optional Near Zero Product Line

**ISB6.7 G**
- 6.7L
- Spark Ignited, SEGR, TWC
- Peak Rating: 260 hp
- 660 lb-ft torque
- 33,000 lb. GVW
- School bus/Shuttle bus/Sweeper/Yard spotter
- 0.1 g/bhp NOx Available Now

**ISL G**
- 8.9L
- Spark Ignited, SEGR, TWC
- Peak Rating: 320 hp
- 1000 lb-ft torque
- 66,000 lb. GVW
- Refuse/Transit/Regional P&D Truck/Mixers
- NZ Available Now

**ISX12 G**
- 11.9L
- Spark Ignited, SEGR, TWC
- Peak Rating: 400 hp
- 1450 lb-ft torque
- 80,000 lb. GVW
- Regional Haul Truck/Tractor/Refuse
- NZ Available Now
In-use testing results of heavy-duty trucks in port applications found:

» **Natural gas vehicles emitted lower NOx:**

The ISL G natural gas engine emitted lower NOx emissions than its EPA certification standard. Emissions decreased as the duty cycles decreased (i.e., slower speeds, idling, stop-and-go traffic).

» **Diesel vehicles emit up to 5x more NOx:**

2010 diesel engines with SCR emitted up to 5 times more NOx emissions than its EPA certification standard. Emissions increased as the duty cycles decreased.
Fueling with natural gas reduces CO₂ and greenhouse gas emissions

Natural Gas Reduces WTW Greenhouse Gas Emissions

Compared to Diesel:
- LNG: 11% reduction
- CNG: 17% reduction

Source: NGVAmerica Emissions Whitepaper based on CARB LCFS
*Numbers compared to diesel emissions (well-to-wheel)
Renewable natural gas (RNG) provides even greater CO\textsubscript{2} and greenhouse gas emission reductions.

Source: [www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm](http://www.arb.ca.gov/fuels/lcfs/fuelpathways/pathwaytable.htm), CARB, February 2017. Adjusted for heavy-duty truck applications.
What does this really mean?

NGVs + RNG offer the **cleanest commercially available path** to reduce heavy-duty vehicle emissions (for likely a decade or more).
#2: NGVs are the Sustainable Choice. Maximize the Impact of Fleet Investment Funding.
NGVs Deliver the Largest & Most Cost-Effective NOx Emissions Reductions

Examples:
- Heavy Duty Trucks
- Refuse Trucks
- Transit Buses
- School Buses

Data Source: Emission comparisons based on ANL - HDVEC tool with low-NOx engines and higher in-use diesel emissions taken into account. Useful life, cost and mileage vary by applications. Additional details available from NGVA upon request.
Heavy-Duty Vehicle Emissions Calculator (HDVEC)

• Simple online tool based on AFLEET to help analyze AFVs for funding opportunities

• Examines medium-duty & heavy-duty vehicle:
  – Vehicle operation NO\textsubscript{x} & PM\textsubscript{2.5}
  – Well-to-Wheel GHGs
  – Emission reduction cost effectiveness

• Contains 4 fuel/vehicle technologies:
  – Diesel
  – Electric vehicle
  – Propane
  – Natural Gas

• HDVEC available at:
  afleet-web.es.anl.gov/hdv-emissions-calculator/
NGVAmerica VW Trust Action Center
(NGVAmerica.org/vw-trust-action-center)

- Consent Decrees
- Presentations
- Fact Sheets
- HDVEC Tool Access
- State Details
  - Lead Agency / Actions
  - Plans & Summaries
  - NGVA Submissions
Depending on range and application, fleets can realize a pay back in as little as 18–24 months due to:

- Lower fuel costs
- Lower maintenance costs
#3: Why Wait? NGVs are Road-Tested & Commercially Available
NGVs are road-tested, proven technologies that are operating worldwide.

160,000+
on U.S. Roads

23 million+
NGVs in Operation Worldwide

Data Source: NGVGlobal, December 2016
In Use in America Today

- Serving more than 40 major airports
- Long & short haul truck market continues transition

- About 30% of transit buses operate on NG
- About 60% all new refuse trucks orders are NG

- Rail industry piloting LNG locomotives
- Major marine companies deploying LNG-powered vessels

NGVAMERICA
Every Medium- & Heavy-Duty and High Horsepower Application

Ready-Right-Now Technology On and Off the Road Today.
Classes 7-8

Port & Freight Needs
Classes 7-8
Freight Movers

Every major HD OEM has a NG option.
• Freightliner
• Volvo
• Mack
• Peterbilt
• Kenworth
Several high-profile fleet operators use NGVs in daily operations.
#4: NGVs Save Money and Support American Workers. Natural Gas is a Low-Cost, Domestically Abundant Fuel
Natural Gas Provides Long-Term Fuel Cost Savings

Natural Gas vs. Oil:
- Historically 8:1 or better price advantage over oil on a Btu basis
- Pump prices today $0.75 to $1 lower than diesel

Source: U.S. Energy Information Administration
Natural Gas Provides Fuel Price Stability

**What makes up the total price at the pump?**

- **Natural Gas:**
  - Decades of affordable domestic reserves
  - Natural gas sourced from North America
  - Commodity cost makes up 23% of sales price

- **Diesel:**
  - History of volatile price swings
  - Crude oil sourced fuel from high-conflict regions
  - Commodity cost makes up 60% of sales price
IMO 2020 Will Not Impact Natural Gas Prices

January 1, 2020: all fuel used to power marine vessels must contain no more than 0.5% sulfur, down from 3.5% sulfur by mass

Three Ways to Comply:
• Bunker current Heavy Fuel Oil (HFO); add expensive and unproven “scrubbers”
• Switch to LNG
• Switch to compliant Marine Gas Oil (MGO)

Compliant MGO fuel:
• Comes from middle distillates, just like diesel
• Oil industry not prepared for increased demand, refineries at capacity
• 3% of global diesel demand in 2015 to 10% in 2021
North America has an abundant domestic supply
North America has abundant sources of renewable natural gas that can be harnessed.

Source: Coalition for Renewable Natural Gas, 2017
Renewable natural gas production is steadily increasing to meet growing demand throughout the U.S.

Source: Coalition for Renewable Natural Gas, 2017
Diverse network of natural gas station developers

- Natural gas retail fuel sellers
- LDCs
- C-Stores
- Truck Stops
- Grocery/Warehouse stores
- Leasing companies
- Gas exploration & production
- Midstream pipeline
Natural gas fuel station infrastructure is continually expanding

- More than doubled past 5 years
- 10-12+ new stations per month

≈2,000 Natural Gas Stations

Source: [https://www.ngvamerica.org/fuel/](https://www.ngvamerica.org/fuel/)