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.
NGVAmerica Members

South Jersey Gas

Clean Energy

Southern Company Gas

American Gas Association

UPS

AGA

BAUER COMPRESSORS

Applied LNG

Kinetrox Energy

DTE Energy

American Public Gas Association

SOUTHWEST GAS

PENSKE

MOMENTUM FUEL TECHNOLOGIES

Energy to do more

SWL Natural

for everyday life!

Sempra Energy

CHART

EDGE

ATA

Dominion Energy

EAGLE LNG PARTNERS

Westport Fuel Systems

TEGO Energy

Vyrten Live Smart

RW Natural

Westport Trucks

LNG Partners

FCA

Waste Management

اغلور

FIAT CHRYSLER AUTOMOBILES

Luxfer Gas Cylinders

HEXAGON LINCOLN

DAIMLER TRUCKS

AGILITY

PSE

PUGET SOUND ENERGY

EPACT

TruStar Energy CNG

NET LEASE CAPITAL ADVISORS

express

MONDOR

Energy CNG

SEAGLASS

NET LEASE CAPITAL ADVISORS

Metropolitan Utilities District

spire

AMERICAS

WORTHINGTON INDUSTRIES

Metropolitan

CenterPoint Energy

Black Hills Energy

Catalina Composites

Net Lease Capital Advisors

Energy to do more

TruStar Energy CNG

Empire

CenterPoint Energy

BH Energy

Trillium CNG

Net Lease Capital Advisors

CNG

Catalina Composites
The Current Emissions Environment
Urban Emissions: Leading Sources

57% of heavy-duty trucks not certified to latest NOx emission standard

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

43% of heavy-duty trucks meet NOx emissions standard

Source: DTF Analysis of 2018-2019 U.S. vehicles in operation data (Class 3-8) provided by IHS Markit, October 2019
Not just a California problem...

- 141.1 million Americans live in areas with air that is unhealthy to breathe (40% of our total population)
- 25 million Americans suffer from asthma (8% of our total population)

Source: American Lung Association, State of the Air Report 2019
Heavy-Duty = Heavy Impact

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

Unlike trucks and buses, passenger vehicles sit idle 95% of the time.
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.
<table>
<thead>
<tr>
<th>Driving condition</th>
<th>Urban</th>
<th>Suburban</th>
<th>Highway</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speed range</td>
<td>0-25 mph</td>
<td>25-50 mph</td>
<td>&gt; 50 mph</td>
</tr>
<tr>
<td>On-road measured NOx emissions, g/bhp-hr</td>
<td>1.41</td>
<td>0.70</td>
<td>0.2</td>
</tr>
</tbody>
</table>
About 30% of transit buses operate on NG. About 60% of all new refuse truck orders are NG. The long & short haul truck market continues transition. The rail industry is piloting LNG locomotives for vessels. Every Medium- & Heavy-Duty and High Horsepower Application ready-right-now technology on and off the road today.
Natural Gas is the #1 Alternative for Heavy-Duty...
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
NGVs Deliver the Largest & Most Cost-Effective NOx Emissions Reductions Across All HD Applications:

- ✔ Heavy-Duty Trucks
- ✔ Refuse Trucks
- ✔ Transit Buses
- ✔ School Buses

Source: Emission comparisons are based on results using Argonne National Laboratory’s HDVEC tool (https://afleet-web.es.anl.gov/hdv-emissions-calculator/) and include modeling of new low-NOx natural gas engines and the diesel in-use emissions option.
Domestic Source

Natural Gas Producer in the World

#1

90+ years

Continual supply by harnessing renewable sources

Supply of recoverable shale natural gas

Natural Gas Fuels America

An American Fuel Sourced by American Labor Using American Technology

50

Renewable natural gas is produced in every U.S. state. 34 states produce geologic natural gas

4.1 million

4.1 million natural gas industry jobs nationwide

#1

America is the world’s leader in natural gas production and technology

$$$$$

Natural gas fueling pays into the federal highway trust fund

Choose American. Choose Natural Gas.

Find out more about clean fleet initiatives at www.ngvamerica.org

NGV America

Natural Gas Vehicles for America
UPS is doubling down on natural gas.
Waste Management is driving change.
Amazon’s Shipment Zero.

Net zero carbon shipments as part of its Climate Pledge include natural gas heavy-duty
The Sobering Reality of Electric Trucks

“Unfortunately, there is no business case today for a sane and sober customer to buy a battery-electric truck.”

Roger Nielsen, CEO
Daimler Truck N.A.

Source: “Availability of Medium-Duty E-Trucks Is Limited as Testing Continues,” July 23, 2019, Transport Topics
Why Wait?

“Waiting for electric vehicles is like seeing the sign at the bar that says, ‘Free beer tomorrow.’”

Scott Phillippi, Senior Director of Maintenance and Engineering

Source: “Availability of Medium-Duty E-Trucks Is Limited as Testing Continues,” July 23, 2019, Transport Topics
Importance of Freight Trucks

- Red line indicates percentage of fuel consumed by freight trucks—greater than 60%
- Green line shows freight vehicle percentage of all vehicle inventory—currently less than 30% but growing over time
AEO 2019 shows growth trend in on-road, non-road and total natural gas use in transportation

Figures from Transportation Table 37 (AEO 2019)

Freight trucks account for about 30% of vehicles but almost 60% of fuel use

Non-road includes marine and rail but not pipeline fuel
**Natural Gas vs. Diesel:**

- CNG priced at about 69 cents less than diesel-gallon equivalent (based on pump prices end of April 2019)
- California CNG about $1.55 less than diesel

**Natural Gas Provides Long-Term Fuel Cost Savings**

**EIA AEO 2019: Projected Fuel-Price Differential**
(prices per $DGE)
Natural Gas in Transit

### Combined Percentages - 2019

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Built in 2018</th>
<th>Ordered</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG Total</td>
<td>10724</td>
<td>778</td>
<td>689</td>
<td>578</td>
</tr>
<tr>
<td>All Bus Total</td>
<td>38778</td>
<td>2104</td>
<td>2500</td>
<td>2122</td>
</tr>
<tr>
<td>NG %</td>
<td>28%</td>
<td>37%</td>
<td>28%</td>
<td>27%</td>
</tr>
</tbody>
</table>

### Demand Response Vehicles - 2019

<table>
<thead>
<tr>
<th></th>
<th>Existing</th>
<th>Built in 2018</th>
<th>Ordered</th>
<th>Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>NG</td>
<td>871</td>
<td>102</td>
<td>73</td>
<td>279</td>
</tr>
<tr>
<td>Total</td>
<td>9899</td>
<td>925</td>
<td>426</td>
<td>592</td>
</tr>
<tr>
<td>NG Percentage</td>
<td>9%</td>
<td>11%</td>
<td>17%</td>
<td>47%</td>
</tr>
</tbody>
</table>
NGVs to Comprise 20% of NA HD Truck Market in 10 Years

Slow and varied technology transition

PACING FACTORS

1. Infrastructure
2. Regulations
3. Technology maturity
4. Economics

Global Commercial Vehicles

Source: Internal projection
- Diesel
- Natural Gas
- xEV

Global Bus

NA HD Truck

Source: Cummins Analyst Day, November 21, 2019. Found at: https://investor.cummins.com/events
Increased Interest in RNG

*Waste to Gas*

- Landfill
- Wastewater
- Food Waste
- Agriculture
Promise of RNG: North America has abundant sources of renewable natural gas that can be harnessed

Source: Coalition for Renewable Natural Gas, 2017
RNG: the most sustainable transportation fuel available today

Electric vs. Diesel vs. RNG: Carbon Intensity of Transportation Fuels

RNG offers significant reductions in carbon intensity

Source: EER Carbon-Intensity values based on CARB LCFS program data under CA-GREET 3.0
RNG Use Here and Abroad is Growing

**2018 NGV Fuel Use**

In 2018, **32%**, of all on-road fuel used in natural gas vehicles was RNG

- Total NGV Fuel Use: 645 Million GGE
- RNG Component: 204 Million GGE

**Bio Champions**

- Iceland: 100%
- Sweden: 75%
- The Netherlands: 55%
- Finland: 50%

Source: European Biogas Association, Statistical Report 2016. NGVA Europe Statistics 2018
Over the last five years, RNG use as a transportation fuel has increased **577%**, displacing **7+ million tons** of carbon dioxide equivalent (CO$_2$e).

Note: GGE = gasoline gallon equivalent, EGE = ethanol gallon equivalent. EGE units are converted to GGE using a 0.67 multiplier (77,000 Btu/115,000 Btu). Total Natural Gas in Transportation Figure derived from U.S. EIA’s Annual Energy Outlook (2019). RNG numbers derived from U.S. EPA RFS Reporting. Total greenhouse gas emissions and associated carbon dioxide equivalent (CO$_2$e) metric tons identified using the California Air Resources Board’s Low Carbon Fuel Standard carbon intensity scores as well as the U.S. DOE's Argonne National Laboratory Heavy-Duty Vehicle Emission Calculator.
### Massive RNG Growth Potential Reported By Multiple Agencies

<table>
<thead>
<tr>
<th>Report</th>
<th>RNG Potential (Billion DGE)*</th>
<th>Percent of 2018 On-road Diesel Consumption**</th>
</tr>
</thead>
<tbody>
<tr>
<td>American Gas Foundation (2019)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>13.8 - 32.5</td>
<td>35%-81%</td>
</tr>
<tr>
<td>American Gas Foundation (2011)&lt;sup&gt;3&lt;/sup&gt;</td>
<td>6.9 - 17.8</td>
<td>17%-45%</td>
</tr>
<tr>
<td>DOE Billion Ton Study (2011)&lt;sup&gt;4&lt;/sup&gt;</td>
<td>9 - 68.5</td>
<td>23%-171%</td>
</tr>
<tr>
<td>National Petroleum Council (2012)&lt;sup&gt;5&lt;/sup&gt;</td>
<td>34.7</td>
<td>87%</td>
</tr>
<tr>
<td>NREL (2014)&lt;sup&gt;6&lt;/sup&gt;</td>
<td>5.6†</td>
<td>14%</td>
</tr>
</tbody>
</table>
Established November 2018, Align Renewable Natural Gas (RNG)℠ is a partnership between Dominion Energy and Smithfield Foods to align the interests of farmers, food processors, neighbors, municipalities, energy consumers, and policymakers to convert biomass into renewable energy.

Phase 1 Proposed Locations

- **Virginia**: 19 farms
- **North Carolina**: 48 farms
- **Utah**: 25 farms

Source: https://www.alignrng.com
RNG produced from swine manure at Valley View Farms located in Greencastle, Missouri is transported and injected into California pipelines through this strategic partnership.

<table>
<thead>
<tr>
<th>Product</th>
<th>Carbon Intensity (gCO₂e/MJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio-CNG</td>
<td>-345.68</td>
</tr>
<tr>
<td>Bio-LNG</td>
<td>-334.41</td>
</tr>
<tr>
<td>Bio-L-CNG</td>
<td>-330.87</td>
</tr>
</tbody>
</table>

RNG Powering Success Across the USA

- **Clean Energy** commits to 100% RNG by 2025
- **UPS** agrees to 2019 purchase agreement for 170 million gallons of RNG (20 – 25 million gallon equivalents per year through 2027)
- **LA Metro** has saved nearly $500,000 in fuel costs with RNG, generated additional revenue from carbon credits, and committed in 2019 to expand use of RNG to 100% in its 2000+ CNG buses
- **NY MTA**, the nation’s largest transit authority, issued 2019 RFP to refuel its 800 natural gas buses on RNG
- **SoCal Gas** commits to selling RNG at 31 of its operated fueling stations in California
- **WM** currently operates more than a third of its fleet on RNG from its own landfill facilities with plans for more in the future
Driving Down Emissions with RNG

Put into Perspective, RNG as a Transportation Fuel is ...

- Lowering greenhouse gas emissions equivalent to removing 1,539,565 gasoline passenger cars from our roads for one year.
- Reducing CO₂ emissions equivalent to 815,950,377 gallons of gasoline or 712,313,458 gallons of diesel consumed.
- That's equal to the total energy used by 868,321 U.S. homes for one year.
- Avoiding greenhouse gas emissions equivalent to running 1,537 wind turbines for one year.
- or replacing 275,434,003 traditional lightbulbs with LEDs.
- Sequestering carbon equal to growing 119,902,624 tree seedlings for ten years.
- or 8,534,274 acres of U.S. forests for one year.

Note: Assumes 7,251,351 metric tons of CO₂e reduced over last five years through increased RNG usage calculated using CARB’s LCFS carbon intensity numbers. GHG equivalency results calculated using the U.S. EPA’s calculator.
NGVs + RNG offer the **cleanest commercially available path** to reduce heavy-duty vehicle emissions (for likely a decade or more).
The Rise of the “Belief-Driven” Buyer

Impacting purchasing decisions on everything: eat, wear, and use...

Consumers believe brands should take a stand on societal issues. Impacting public perception of company, its future sales, and its stock value

Brands now an important way for consumers to express themselves. Consumers want companies to align with their core beliefs

Source: Edelman, 2018
The Rise of the “Belief-Driven” Buyer
Consumers still focused on brand trust, but it means so much more...

MANY REASONS CONSUMERS NEED TO TRUST BRANDS MORE
Reasons why trusting the brands they buy is becoming more important

<table>
<thead>
<tr>
<th>Category</th>
<th>Percentage</th>
<th>Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>GROWING CONCERNS ABOUT PRODUCT EXPERIENCE</td>
<td>62%</td>
<td>Net of product-oriented concerns:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Pace of innovation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Increasing reliance on brands to automate my life</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Can't afford a bad purchase</td>
</tr>
<tr>
<td>GROWING CONCERNS ABOUT CUSTOMER EXPERIENCE</td>
<td>55%</td>
<td>Net of customer-oriented concerns:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Personal data</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Brands can track and target me</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Use of AI for customer service</td>
</tr>
<tr>
<td>GROWING CONCERNS ABOUT BRANDS’ IMPACT ON SOCIETY</td>
<td>69%</td>
<td>Net of societal-oriented concerns:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fake news and misinformation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Brands more involved in societal issues</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• I want brands to express my values</td>
</tr>
</tbody>
</table>

Source: 2019 Edelman Trust Barometer Special Report: In Brands We Trust?
The Rise of the ESG Investor
Focus Not Just on Profit, but on Needs of Customers, Employees, and Planet

*Investors agree that corporations need to have multi-stakeholder commitment*
84% of respondents said maximizing shareholder returns can no longer be the primary goal of corporations and that business leaders need to commit to balancing the needs of shareholders with customers, employees, suppliers and local communities.

*Investors are investing more in ESG-excelling companies*
More than half of investors believe that ESG practices positively impact trust, with 61% having increased their investment allocation to companies that excel when it comes to ESG factors.

*Investors are changing their voting and engagement policy to be more attentive to ESG*
87% of respondents said that their firms have changed their voting and/or engagement policy to be more attentive to ESG risks and 56 percent of investors globally are hiring more ESG-focused staff. 86% of investors would consider investing with a lower rate of return if it meant investing in a company that addresses sustainable or impact investing considerations.

IMO 2020 Compliance

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

Four Ways to Comply:
- Bunker current Heavy Fuel Oil (HFO); add expensive and unproven “scrubbers”
- Blend low sulfur fuels with conventional HFO
- 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
Municipal Diesel Restrictions/Bans

Is U.S. Next?

Paris, Mexico City, Madrid, Athens
- Restrictions increase annually
- Ban all diesel by 2025

Hamburg, Germany
- Partial ban began 2018
As of 10/1/2018, all newly registered trucks servicing ports to be MY 2014 or newer
EU Heavy-Duty CO₂ Standards
New Mandate Passed April 18th

**CO₂ emissions reduction targets:**
- 15% by 2025, and 30% by 2030
- 2019 baseline emission level (period from 1 July 2019 to 30 June 2020)
- 2030 target is subject to revision in 2022

**Fines:**
- 2025-2029, OEMs missing the target will have “excess emissions premium" of 4,250 €/gCO₂/t-km
- 2030-on, 6,800 €/gCO₂/t-km

**Incentives:**
- 2025-on, ZLEV shall represent at least 2% of the new sold fleet
- The ZLEV factor shall reduce the average specific emissions of an OEM by a maximum of 3%.

**Review:**
- First review by end of 2022
- No later than 2023, review of full life-cycle CO₂ emissions
EPA Cleaner Truck Initiative
Stricter New Federal HD Emissions Are Coming

- Advanced Notice Jan. 6, 2020
- Focus primarily on NOx emissions
- Timeframe 2024 – 2027
- 0.02 g/bhp-hr NOx std. looks doubtful
- Potential early credit opportunity

Source: EPA

On-Road HD Diesel NOx contribution to Ambient Ozone in 2025

Source: EPA
Empowering Your Success
## Technology & Development

<table>
<thead>
<tr>
<th>Safety</th>
<th>Sustainability</th>
<th>High Horsepower</th>
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<tbody>
<tr>
<td>Manufacturing Facility Training / Accreditation</td>
<td>Emissions &amp; Environmental Messaging</td>
<td>LNG</td>
</tr>
<tr>
<td>CNG Fuel System Inspection Intervals</td>
<td>Research &amp; Development</td>
<td>Marine &amp; Rail</td>
</tr>
<tr>
<td>Incident Investigations &amp; Root Cause Analysis</td>
<td>Mobile Pipeline</td>
<td>Research &amp; Development</td>
</tr>
<tr>
<td>NGV Maintenance Facility Modifications</td>
<td></td>
<td>Emissions &amp; Environmental Messaging</td>
</tr>
</tbody>
</table>
NGV Industry Promotion

• Interactive Website
• Weekly NGV newsletter
• Targeted online industry promotion
• Policymaker emails
• Webinars
• Social Media
• Digital campaigns
2020 Work Products

- Weight Allowance Flyer
- NREL’s Foothills Transit Study Review
- 2019 Total On-Road RNG Fuel Usage
- NGV Market Dashboard
- Mobile Pipeline White Paper
- NGV Sustainability Report
- Monthly Infrastructure Reports
Run your fleet on natural gas? Work with a partner who does?

NGVAmerica recently secured a three-year extension of the Alternative Fuels Tax Credit for years 2018, 2019, and 2020. Now what?

Join us for a webinar to discuss the particulars of this $0.50/gallon excise credit, how to claim it, and how best to ensure its extension after 2020.

REGISTER NOW  

AFTC Natural Gas Fleet Webinar  
Wednesday, January 15, 2020 at 2:00 p.m. ET

Register at https://ngvamerica_aftc_whatsnext.eventbrite.com

This no-cost webinar is open to all corporate, fleet, and individual participants; NGVAmerica membership is not required, though pre-registration is. Questions? Contact membership@ngvamerica.org.
Driving Down Emissions
with Renewable Natural Gas

Natural Gas is NOW

NGVAmerica.org

Your source for all NGV industry news and information.
Join us as a Member!
Visit: www.ngvamerica.org/sign-up/
Paul Sandsted
Director of Technology and Sustainability
(803) 374-6843
psandsted@ngvamerica.org

Visit: www.ngvamerica.org