NC STATE UNIVERSITY

SUSTAINABLE FLEET TECHNOLOGY CONFERENCE & EXPO 2021

Session #3: Natural Gas Transportation Applications and Success Stories

September 16, 2021

NC CLEAN ENERGY TECHNOLOGY CENTER

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

SUSTAINABLE FLEET TECHNOLOGY
WEBINAR SERIES 2021

Sessions through December 09, 2021

SUSTAINABLE FLEET TECHNOLOGY
CONFERENCE & EXPO 2021

Sessions September 09, 2021 – October 19, 2021

https://www.sustainablefleetexpo.com/

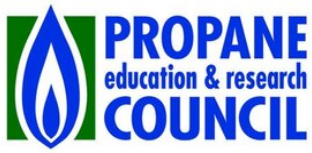
NC CLEAN ENERGY TECHNOLOGY CENTER

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

SFT Conference Series Upcoming Sessions

- 09/21: Working with your Utility and Understanding Fleet Charging Costs
- 09/23: Idle Reduction Simple and Impactful
- 09/30: Innovative Charging Solutions
- 10/05: Total Cost of Ownership--Comparisons of Alternative Fuel Vehicles versus Conventional Fuel Vehicles

2021 SFT Conference Series Sponsors



Format

- Q&A at the end
- Submit questions and comments to “Panelists”
- Scheduled for 2:00p-3:30p
- Handout
- Recording

Natural Gas Transportation Applications and Success Stories September 16, 2021

2:00-2:05 **Rick Sapienza, NCCETC--**Introduction and Welcome

2:05-2:25 **Sherrie Merrow, NGV America**—Achieve Net Zero Now

2:25-2:32 **Patrick Campbell, Cummins-Wesport**—Cummins Natural Gas Engines

2:32-2:45 **Jeff Shefchik, Paper Transport Inc.**—PTI CNG Strategy

2:45-2: 58 **Mark Matheson, Matheson Companies**—The Matheson CNG Story

2:58-3:11 **Jeff Bonnema, Ozinga**—Alternative Fuel for the Ready-Mix Fleet

3:11-3:30 **Q&A**

Driving Clean Air & Renewable Energy
CleanTransportation.org
Supported by the NC Clean Energy Technology Center with funding from the North Carolina Department of Transportation

North Carolina State University
NC Clean Energy Technology Center
Clean Transportation Program
www.cleantransportation.org
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twitter.com/nccleantech

NC CLEAN ENERGY TECHNOLOGY CENTER

STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Sherrie Merrow
SMerrow@ngvamerica.org
202-824-7360

- **Director of State Government Affairs for NGVAmerica**
- **Leads a team of more than 175 people from more than 70 member companies who focus on issues and activities related to the growth of the natural gas vehicle industry, including the VW Settlement**
- **Additional experience as an advisor to the oil & gas industry for natural gas vehicle programs**
- **BS in Computer Science from University of Wyoming and BA in Literature From Wheaton College**

NGVAMERICA

Natural Gas Vehicles for America

Achieve Net Zero Now

Presentation to NC Sustainable Fleet Technology Virtual Conference

Natural Gas Transportation Applications and Success Stories

September 16, 2021

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.

200+

NGVAmerica represents 200+ companies, LDCs, fleets, OEMS, environmental and government organizations.

NGVAmerica Members

Note: Slide not inclusive of all NGVA members

NGVAMERICA
Natural Gas Vehicles for America

We believe:

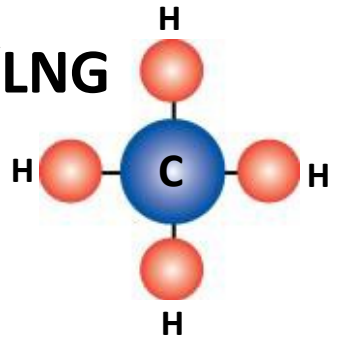
- Climate change is real
- The transportation sector can be cleaner and decarbonized
- Time is of the essence
- Renewable natural gas vehicles are an affordable, scalable, and immediate heavy-duty solution

Why Natural Gas?

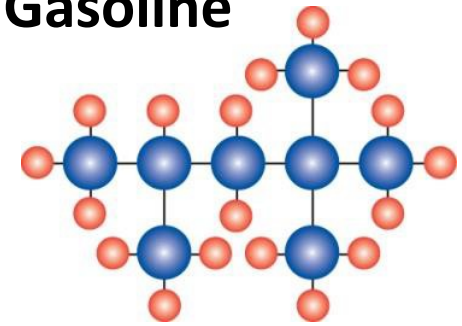
Sustainable, Cost Effective, Available & Domestic

What is Compressed Natural Gas?

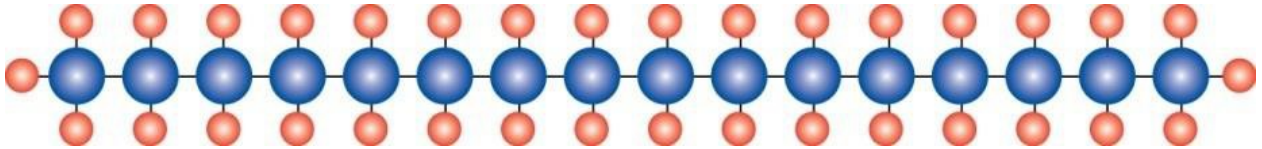
CNG/LNG



Gasoline



Diesel



CNG is NOT a complex hydrocarbon like gasoline or diesel

- CNG is up to 98% methane
- CNG is a low-carbon gaseous fuel
- 75% of combustion energy comes from the hydrogen reaction
- CNG for engines is 130 octane
- CNG is lighter than air (does not pool on ground)
- CNG is not toxic

NGVAMERICA

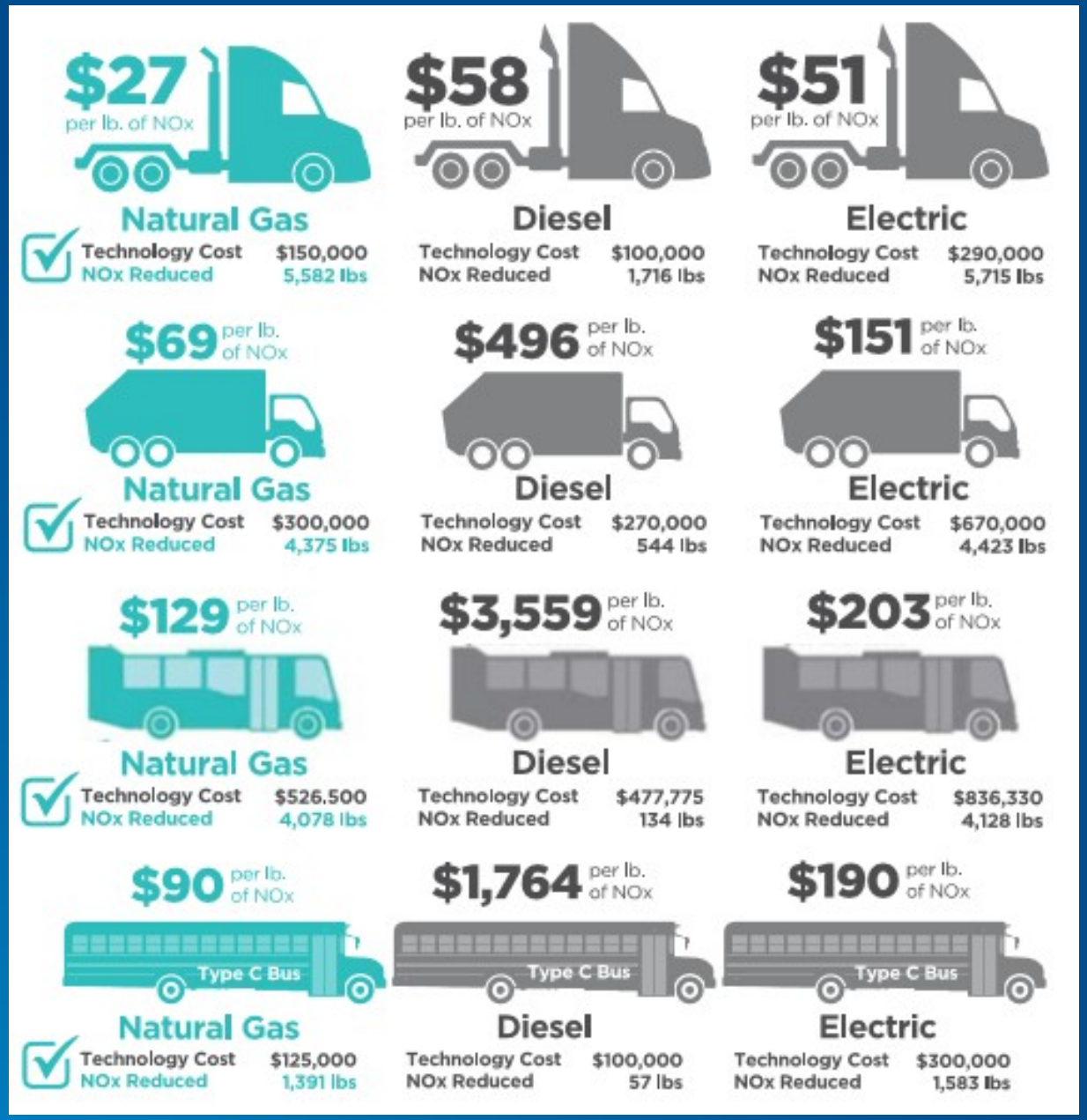
The cleanest heavy-duty truck engine in the world is powered by natural gas

Significant public and private capital invested to get to certified .02

Current generation certified in 2018 by both 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.

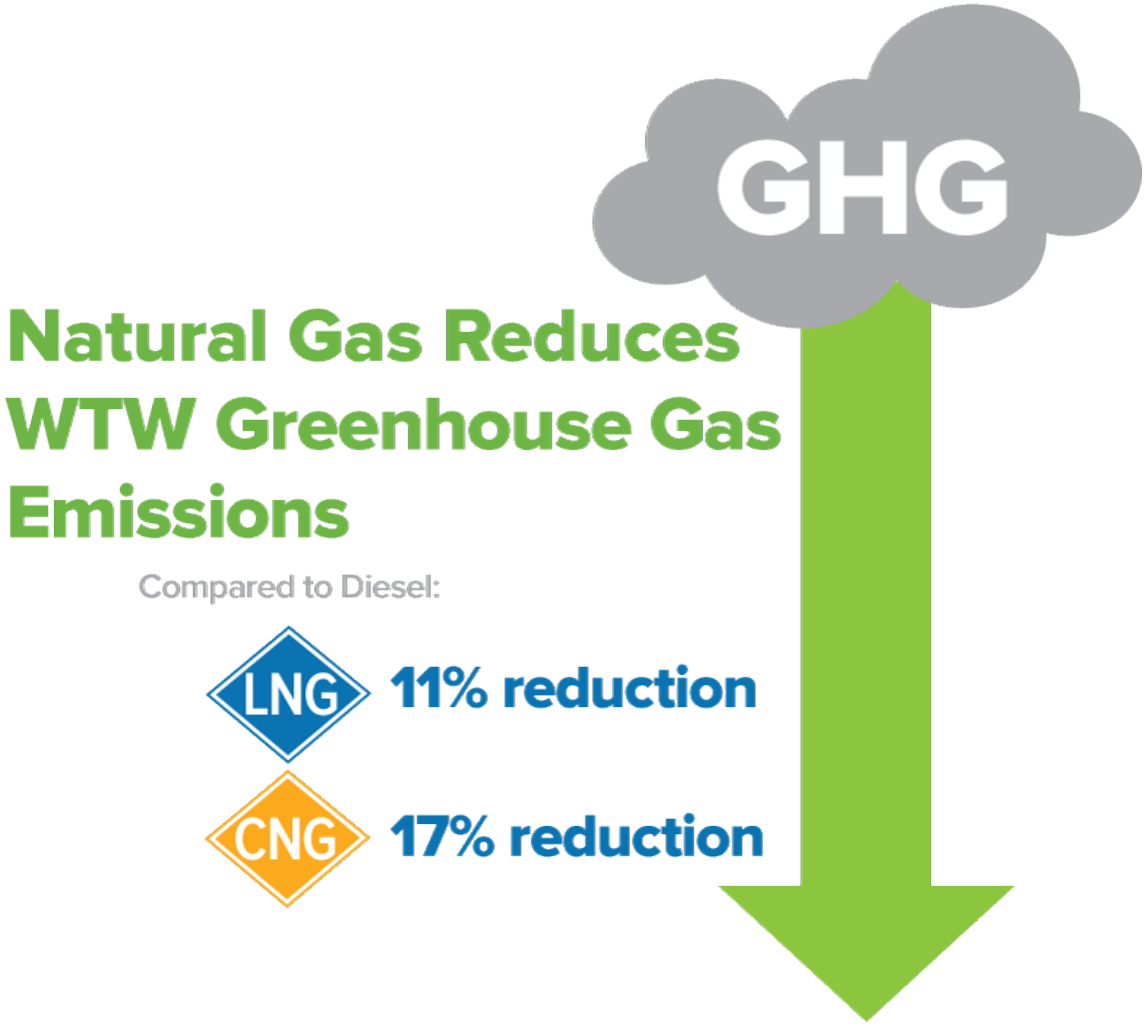
NGVAMERICA

The Alternative Fuels Tax Credit (AFTC)

- 26 USC 6426 and 6427, part of original SAFETE Act of 2005
- $0.50 per gallon credit for CNG, LNG, or RNG sold or used as motor vehicle fuel
- A gallon is defined as the gasoline gallon equivalent (GGE) of compressed natural gas and diesel gallon equivalent (DGE) of liquefied natural gas
- Originally took effect October 1, 2006; regularly extended since that time
- The credit is claimed by the seller of the fuel in retail transactions such as at public fueling stations. In cases where there is no retail transaction such as where a fleet owns it own station the fleet user can claim the credit
- NGVAmerica is working federally to establish a concurrent RNG-specific credit of $1.00 per gallon

NGVAMERICA

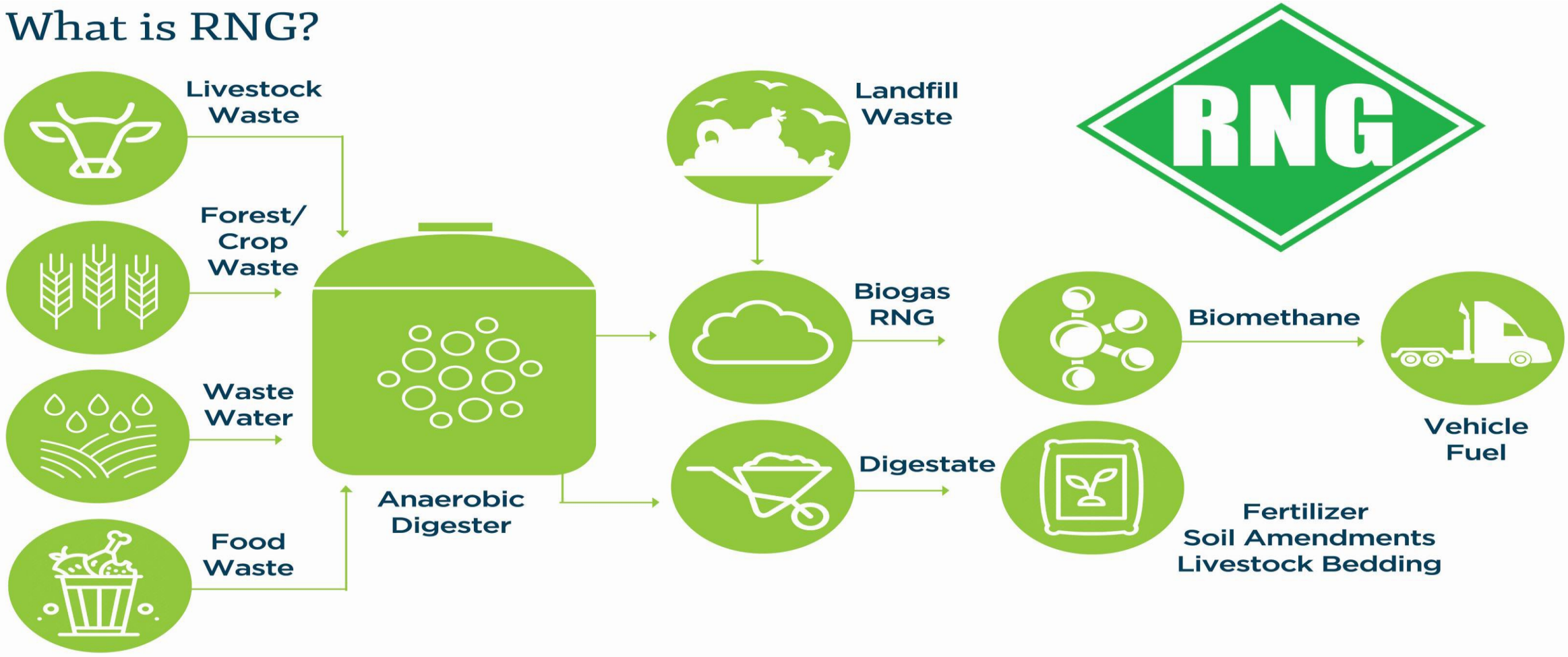
Fueling with natural gas reduces CO_2 and greenhouse gas emissions



Source: NGVAmerica Emissions Whitepaper based on CARB LCFS
**Numbers compared to diesel emissions (well-to-wheel)*

Turn a Waste Liability into a Clean Energy Asset

Recoverable Methane

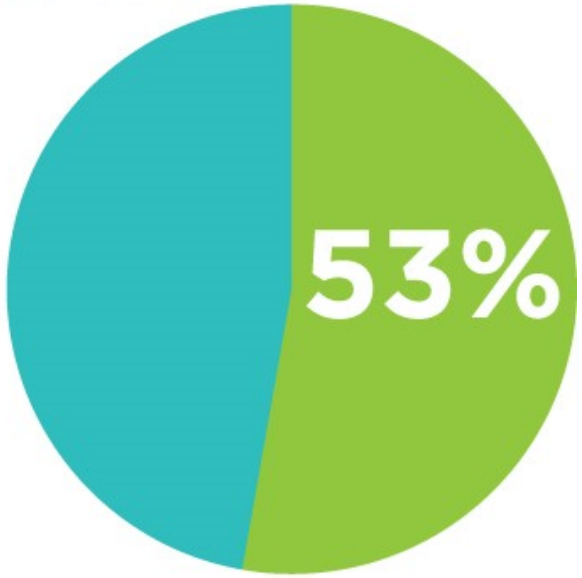


RNG is Now the Majority NGV Fuel in U.S.

2020 NGV Fuel Use

646 Million GGE Total

In 2020, **53%**, of all on-road fuel used in natural gas vehicles was RNG



- Conventional Natural Gas **301 Million GGE**
- Renewable Natural Gas **345 Million GGE**

RNG Growth (2016-2020)

RNG use as a transportation fuel grew **25% over 2019** volumes, increasing **267%** over the last five years and eliminating **3.5 million tons** of carbon dioxide equivalent (CO_2e).

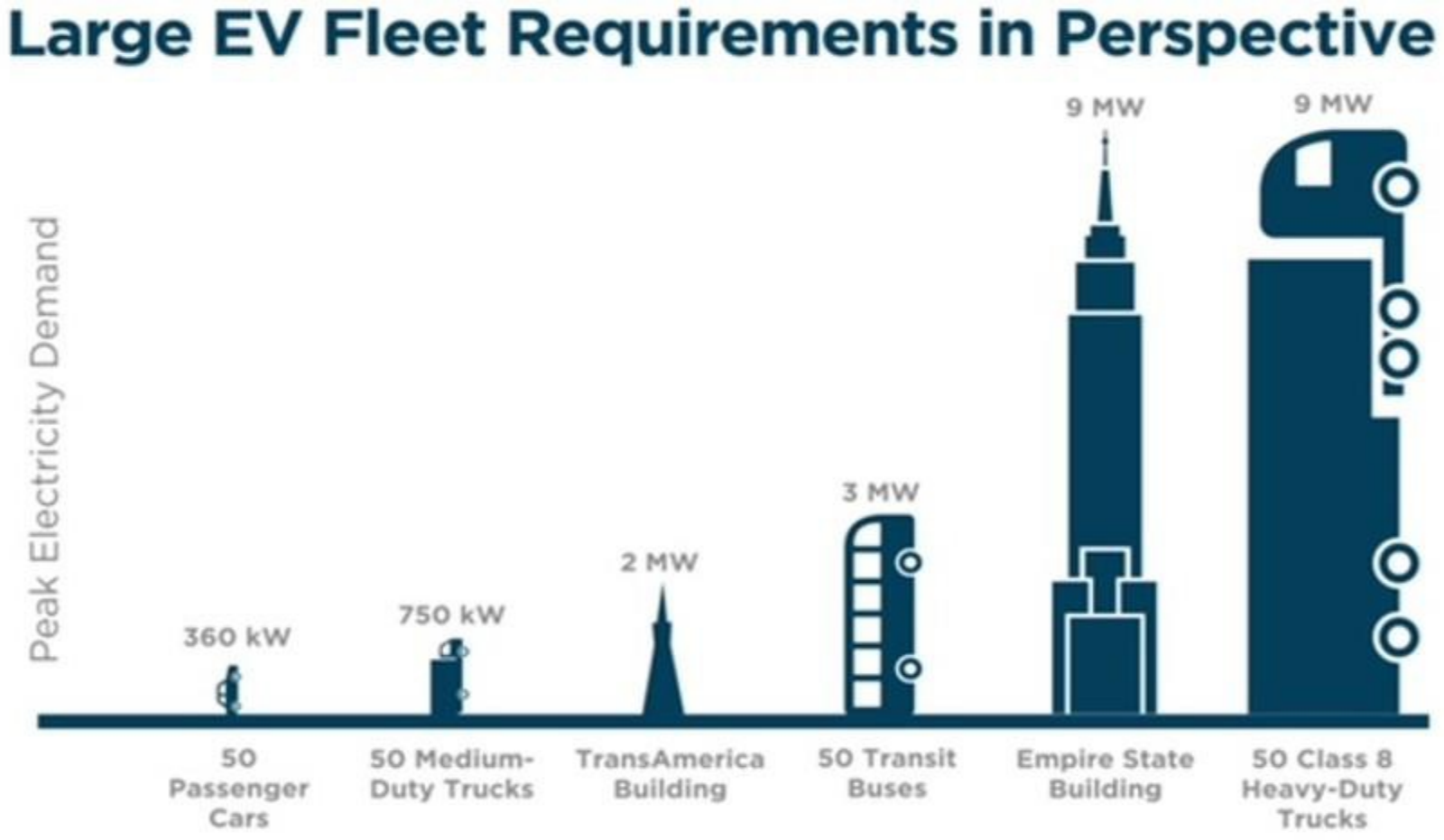
Note: GGE = gasoline gallon equivalent. EGE = ethanol gallon equivalent. EGE units are converted to GGE using a 0.69 multiplier (77,000 Btu/1121,400 Btu). Total Natural Gas in Transportation Figure derived from U.S. EIA's Annual Energy Outlook (2021) and RNG numbers derived from U.S. EPA RFS Reporting with adjustments made based on fueler member reporting. Total greenhouse gas emissions and associated carbon dioxide equivalent (CO_2e) metric tons identified using average carbon intensity (CI) scores of 4.89 g/MJ for Bio-CNG and 54.93 g/MJ for Bio-LNG as reported for the last four quarters under the California LCFS and based on the percentage of RNG reported under the RFS Program – CNG (82%) and LNG (18%).

California is at 92% RNG for 2020!

Fleet Electricity Requirement Comparisons

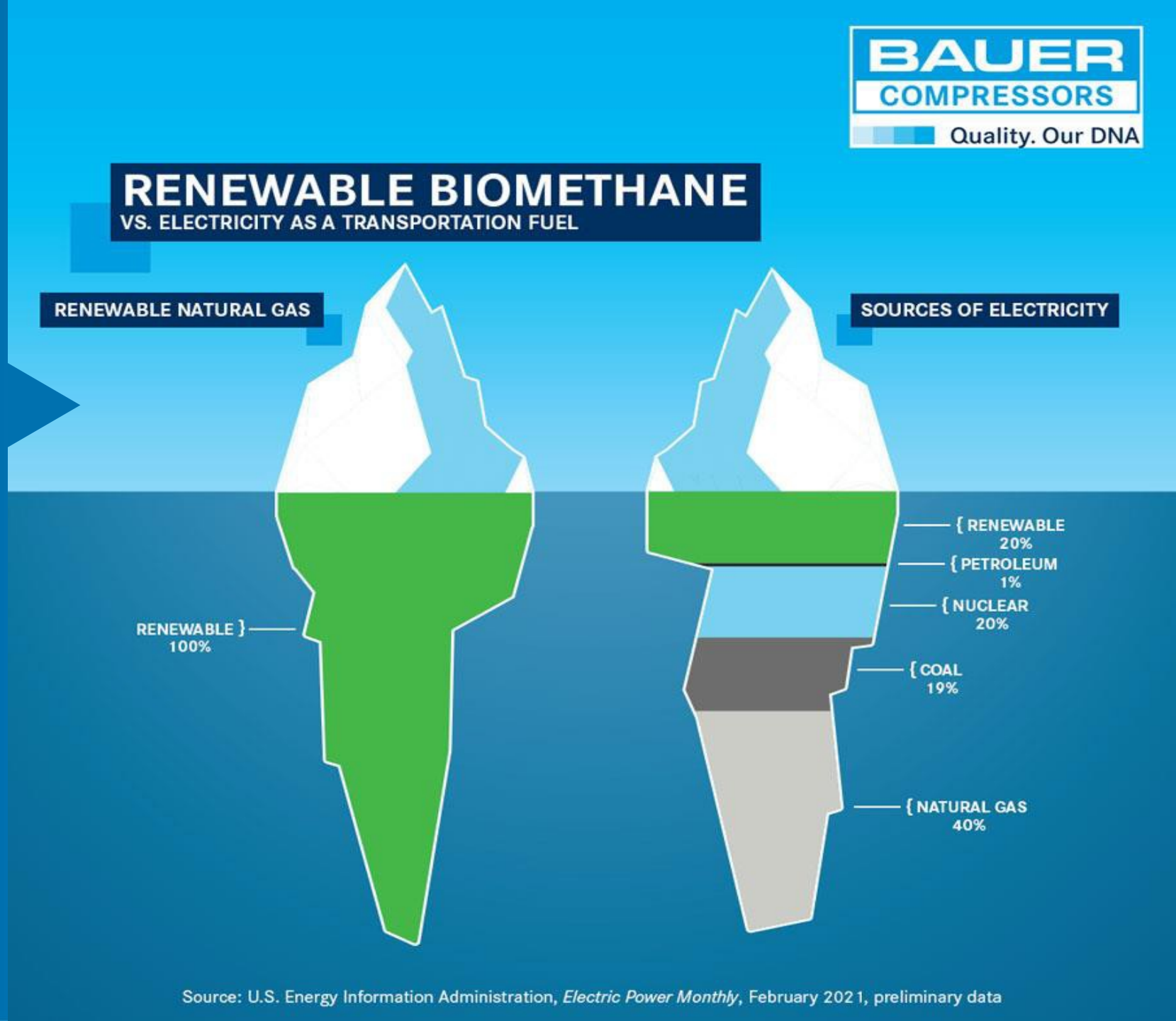
Powering 50 heavy-duty EV trucks = power for the Empire State Building at its peak usage (9 MW)

Not currently possible on a national or state scale!

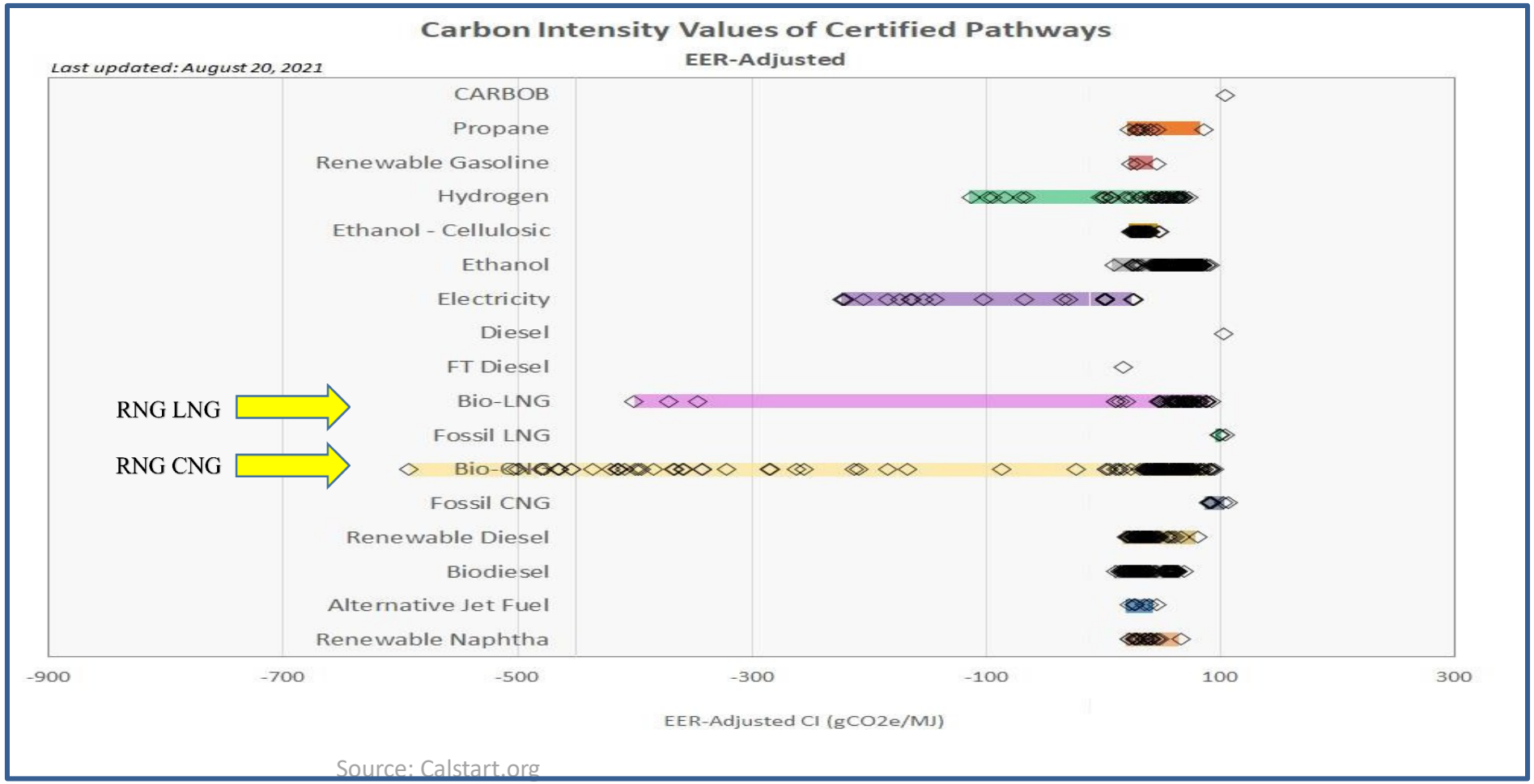


Source: Calstart.org

Why RNG?


BAUER
COMPRESSORS
Quality. Our DNA
RENEWABLE BIOMETHANE
VS. ELECTRICITY AS A TRANSPORTATION FUEL
RENEWABLE NATURAL GAS
SOURCES OF ELECTRICITY
RENEWABLE
100%
RENEWABLE
20%
PETROLEUM
1%
NUCLEAR
20%
COAL
19%
NATURAL GAS
40%
Source: U.S. Energy Information Administration, Electric Power Monthly, February 2021, preliminary data

Achieve Even Greater CO_2 and GHG Emissions Reductions with RNG



Source: Calstart.org

CALIFORNIA AIR RESOURCES BOARD

https://ww2.arb.ca.gov/resources/documents/lcfs-pathway-certified-carbon-intensities

NGVAMERICA

Every Medium- & Heavy-Duty and High Horsepower Application

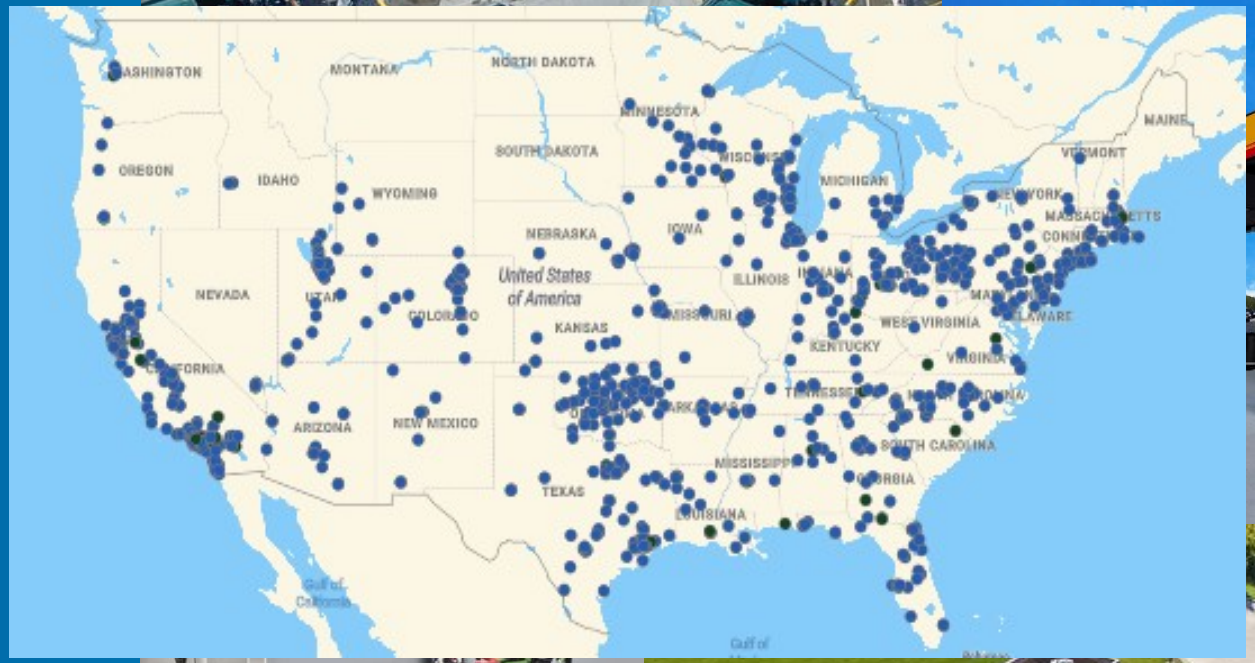
Ready-Right-Now Technology On and Off the Road Today.

NGVAMERICA

Mature network of servicers and suppliers coast to coast

Natural gas refueling infrastructure is expansive

2020 Year End
1,568 CNG Stations
114 LNG Stations



Source: https://www.ngvamerica.org/fuel/

What does this really mean?

+

NGVs + RNG offer the cleanest commercially available path (potentially carbon negative) to reduce heavy-duty vehicle emissions now and for years to come

Who's In?


Prime


Think Green,
Think Clean.
We run on clean burning natural gas


SEED TO SIP
100% POWERED BY
CLEANER-BURNING NATURAL GAS


HYBRID
ELECTRIC
HYLION


UPS

Affordable. Scalable. Ready Right Now.

2021 NGVAMERICA

ANNUAL MEETING AND INDUSTRY SUMMIT

NGV 21

OCTOBER 18 - 21, 2021 | THE WIGWAM RESORT | PHOENIX, ARIZONA

NGVShow.com

Sherrie Merrow

Director, State Government Affairs

smerrow@ngvamerica.org

Visit: www.ngvamerica.org

NGVAMERICA

Natural Gas Vehicles for America

Patrick Campbell
patrick.j.campbell@cummins.com
303.229.7713

- Regional Sales Manager for the Cummins Westport Southern Region On-Highway and Transit
- More than 20 years with Cummins
- Had to opportunity to service customers in territories from coast to coast in the US

Cummins Natural Gas Engines

Patrick Campbell
Regional Sales Manager
On-Highway Natural Gas Business

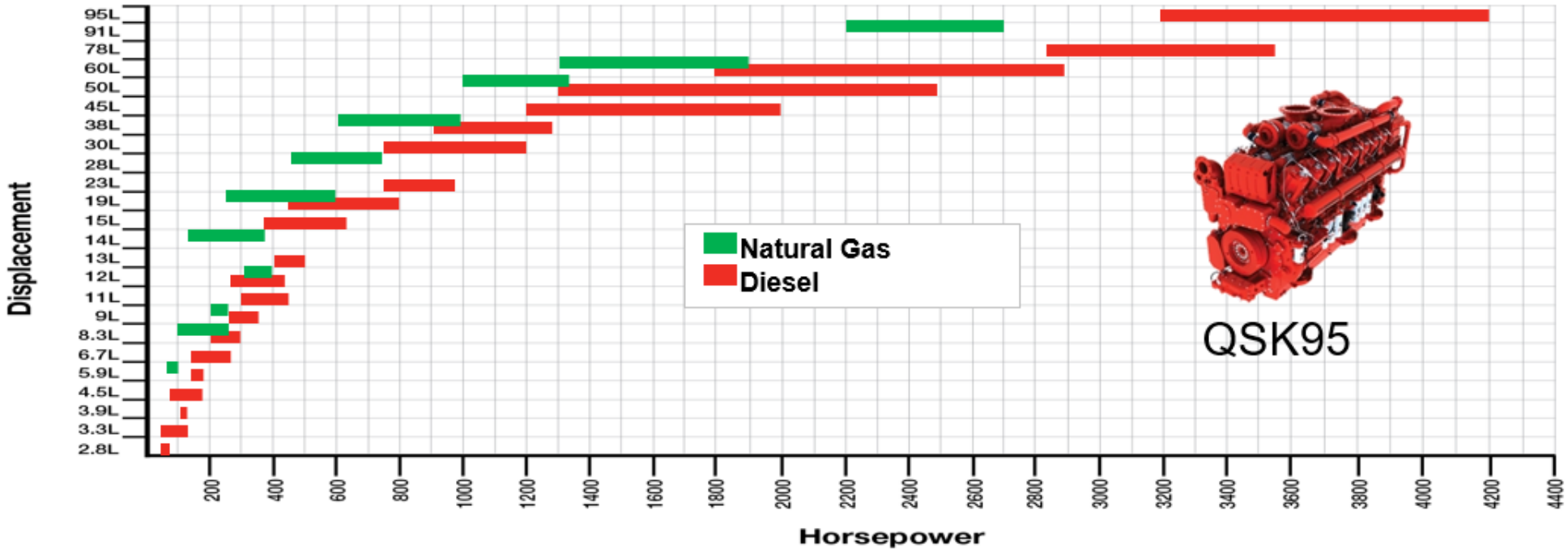
Cummins, Inc
Cell: 303.229.7713
Email: Patrick.J.Campbell@Cummins.com

Cummins Westport JV Update

- Cummins joint venture with Westport Innovations dissolves end of 2021
- Cummins will continue to invest and produce renewable natural gas engines without disruption
- Cummins parts and service locations will continue to support the natural gas engine business as in the past.
- Cummins sales and support will continue to be responsible for natural gas engine sales around the globe
- Cummins spark ignited engineering team is dedicated to continuous product improvement

Cummins Product Range with Commitment to NG

- Sold Over 1 Million Engines in 2019
- Engine HP Range now 49 to 4200 horsepower
- Natural Gas Power Will Span Cummins Entire Engine Portfolio



Natural gas engine offerings for On-highway

ISX12N

L9N

B6.7N

Certified Near Zero Optional Low NOx 0.02g/bhp-hr

ISX12N™

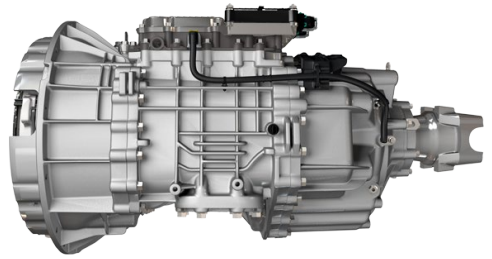
- **Key Product Attributes:**
  - Displacement – 11.9 Liters (762.2 CU IN)
  - Peak rating 400 hp / 1,450 lb-ft torque
  - Recommended use up to 80,000 lb. GVW
  - **Certified** 90% below EPA emission level, CARB certified at 0.02g Near Zero NOx Standard
  - Maintenance and fluid free Exhaust treatment system
  - The 12L platform has been in service since 2013
  - Utilizes Cummins diesel engine block and major part hardware set designed for extended service life

CNG LNG RNG



Endurant HD™ N – New for the Natural Gas Market

- Endurant HD N 12-speed model – EHD-14F112C-N
- Specifically designed to pair with the Cummins Westport X12N natural gas engine
- Powertrain integration delivers improved launch, low speed maneuverability, and smoother shifts
- With 400 hp / 1,450 lb-ft torque, and near-zero emissions, the X12N + Endurant HD N integrated powertrain is well suited for heavy-duty regional-haul trucks looking to improve their sustainability
- Over 100,000 Endurant HD's produced



L9N™

- **Key Product Attributes:**
  - Displacement – 8.9 Liters (540 CU IN)
  - Peak rating 320 hp / 1,000 lb-ft torque
  - Recommended use up to 66,000 lb. GVW
  - **Certified** 90% below EPA emission level, CARB certified at 0.02g Near Zero NOx Standard
  - Maintenance-free exhaust aftertreatment system
  - The L9N platform has been in service since 2007
  - Utilizes Cummins diesel engine block and major part hardware set designed for extended service life

CNG LNG RNG

B6.7N™

- **Key Product Attributes:**
  - Displacement – 6.7 Liters (540 CU IN)
  - Peak rating 240 hp / 560 lb-ft torque
  - Recommended use up to 33,000 lb. GVW
  - **Currently Certified 90**% below EPA emission level at 0.02 g NOx Standard
  - Maintenance-free and fluid free Exhaust Treatment System
  - The B6.7N engine platform has been in service since 2016
  - Utilizes Cummins diesel engine block and major hardware set designed for extended service life

CNG LNG RNG


OEM Availability

ISX12N

KENWORTH

VOLVO

Peterbilt

MACK

FREIGHTLINER

AUTOCAR

MCI

L9N

FREIGHTLINER

MACK

Peterbilt

KENWORTH

AUTOCAR

BLUE BIRD

GILLIG

NEW FLYER

Thomas BUILT BUSES

NOVA BUS

B6.7N

Thomas BUILT BUSES

ARBOC Specialty Vehicles

FREIGHTLINER

Custom Chassis

CAPACITY REV GROUP

TICO

Peterbilt

KENWORTH

New Medium Duty Truck Availability

Natural Gas
Availability (Launch Timing)

Peterbilt	L9N (Dec 2021)	B6.7N (Q1'22)	Transmission	Class
536	X	X	Allison	6
537	X	X	Allison	7
548	X	X	Allison	8

- All new Peterbilt Medium Duty
- First B6.7N Medium Duty truck Application

New Medium Duty Truck Availability

Natural Gas Availability (Launch Timing)				
Kenworth	L9N (Dec 2021)	B6.7N (Q1'22)	Transmission	Class
T280	X	X	Allison	6
T380	X	X	Allison	7
T480	X	X	Allison	8

- All new Kenworth Medium Duty
- First B6.7N Medium Duty truck Application

Natural Gas Success stories:

Success Stories

- **Matheson Postal Services**
- Coast-to-coast for the U.S. Postal Service since 1964
- Matheson operates 95 NZE trucks on its contracted mail routes, hauling 78,000-pound loads through diverse terrains, running more than 16.4 million miles annually
- Matheson's heavy-duty NZE natural gas big rigs runs an average of 185,000 miles per year, or 715 miles per day
- placed an order for another 40 CNG trucks, including Kenworth's CNG-fueled T680 tractors and CNG T680 sleeper-cab tractors

- Waste Management –10,000 CNG in service
- UPS – 6,000 CNG in service
- Republic Services – 3600 CNG in service
- Pepsi – 700 CNG in service
- Waste Industries – 600 CNG in service
- Anheuser Busch – 300 CNG in service

Why Natural Gas?

- **Natural Gas engines help lower emissions and reduce a vehicle's overall environmental impact without sacrificing the performance needed to get the job done**
  - Available today, lowest cost of operation
  - Least disruptive of all alternatives available today
  - Fits current transportation / people & goods movement models
    - No need for radical changes in vehicle technology
  - Fits current community models
    - No need for radical changes in transportation infrastructure
    - No need for radical changes in support infrastructure

Q+A


Cummins

Jeff Shefchik
jshefchik@papertransport.com

- President of Paper Transport Inc.
- Made PTI a national award-winning differentiator that focuses on people, solutions, and safety
- Created a positive atmosphere and culture that has seen an annual growth of 17% per year over the last 10 years

Paper Transport

Jeff Shefchik, President

- Headquarters in Green Bay, WI
- Regional truckload carrier
- Currently operating 825 tractors
- Operations based in Midwest and Southeast

Why we did CNG

- Meet the customers need
- Environmental responsibility
- Fuel diversity

PAPER TRANSPORT

PTI – CNG Accomplishments

- Purchased first CNG tractors in February 2010
- First 12 liter engine in November 2011
- Running trucks locally and regionally

Today

- 60 total CNG truck
- Over 50,000,000 miles

PAPER TRANSPORT

Real World Issues

- Customers
- Drivers
- Truck & engine availability
- Maintenance
- Fuel availability

PTI PAPER TRANSPORT

Operating Cost

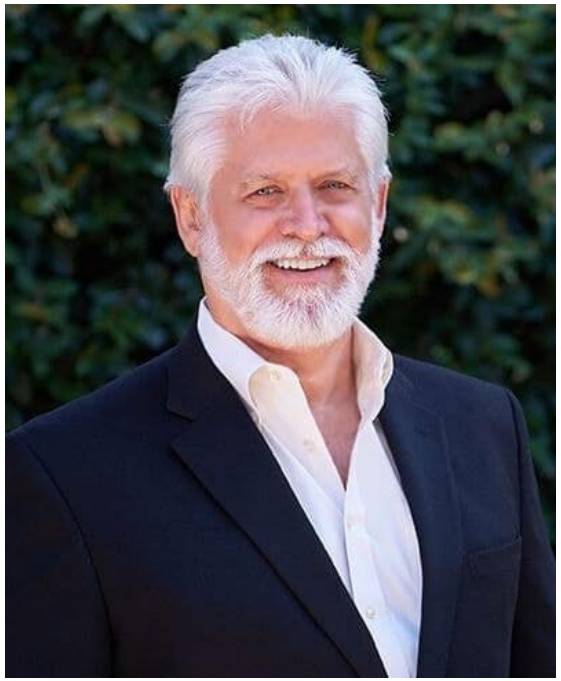
- Capital
- Residual
- Fuel
- Maintenance

PTI PAPER TRANSPORT

Soft Cost to Consider

- Innovative Leadership
- Clean and quiet
- Sustainability – fuel supply & fuel price
- Weight

PTI PAPER TRANSPORT



Mark Matheson
mmatheson@mathesoninc.com

- President & CEO of Matheson Companies
- Company founded in 1962
- Operates nationally with Flight Extenders services and Postal Transport services
- Commitment to efficiency and sustainability, EPA Smartway Partner and USPS Supplier Sustainability Excellence Award

Matheson is proudly growing our CNG Fleet to support a sustainable industry and cleaner environment

Matheson CNG Fleet

Matheson is proudly growing our CNG Fleet to support a sustainable industry and cleaner environment

Jeff Bonnema
JeffBonnema@ozinga.com

- Vice President of Fleet Management at Ozinga
- Provides quality bulk materials and diverse concrete solutions through an extensive network of transportation services including truck, rail, barge and ship terminals
- Conduct business in a manner benefits the earth and its natural resources

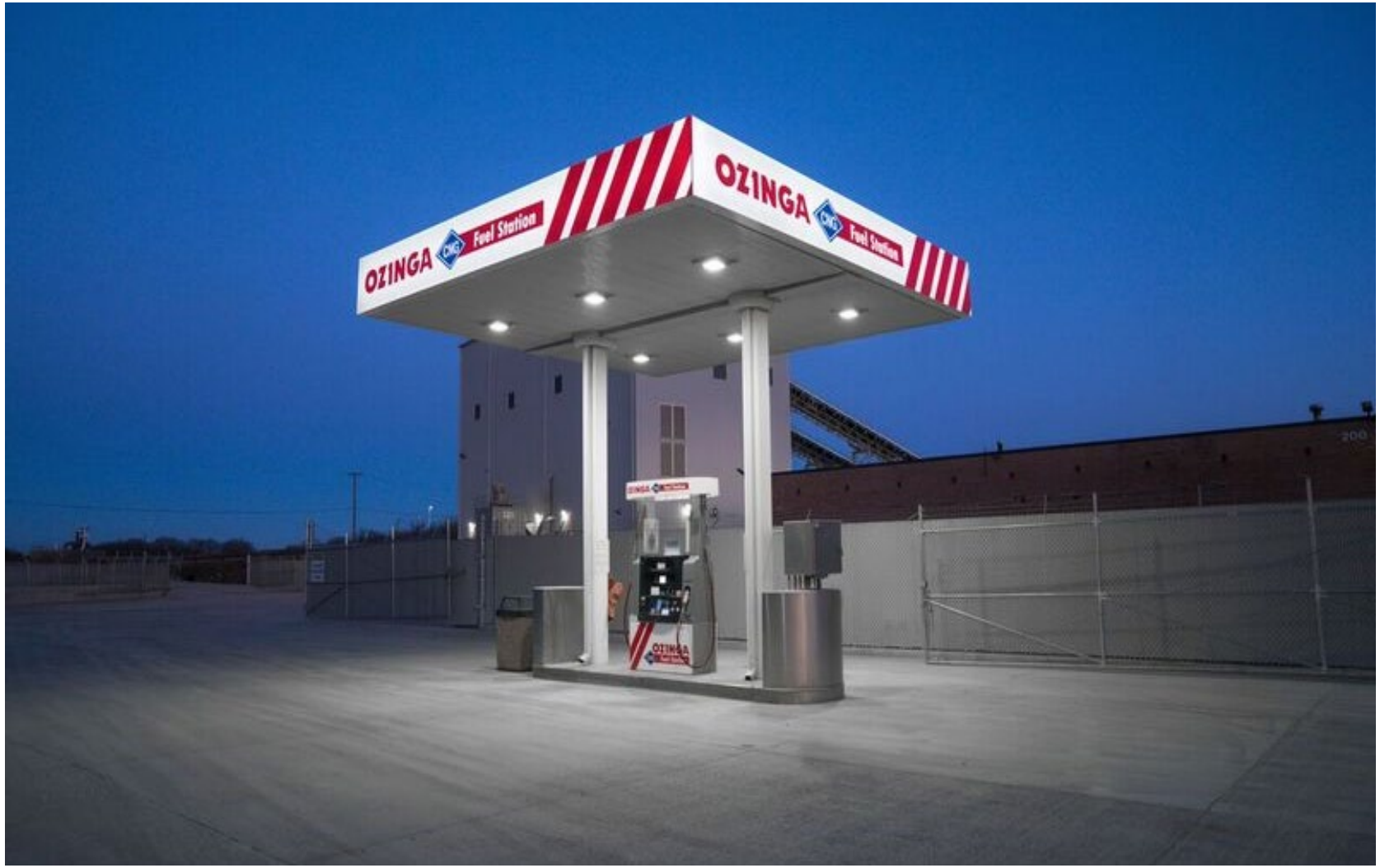
OZINGA®

Alternative Fuel for the Ready-Mix Fleet

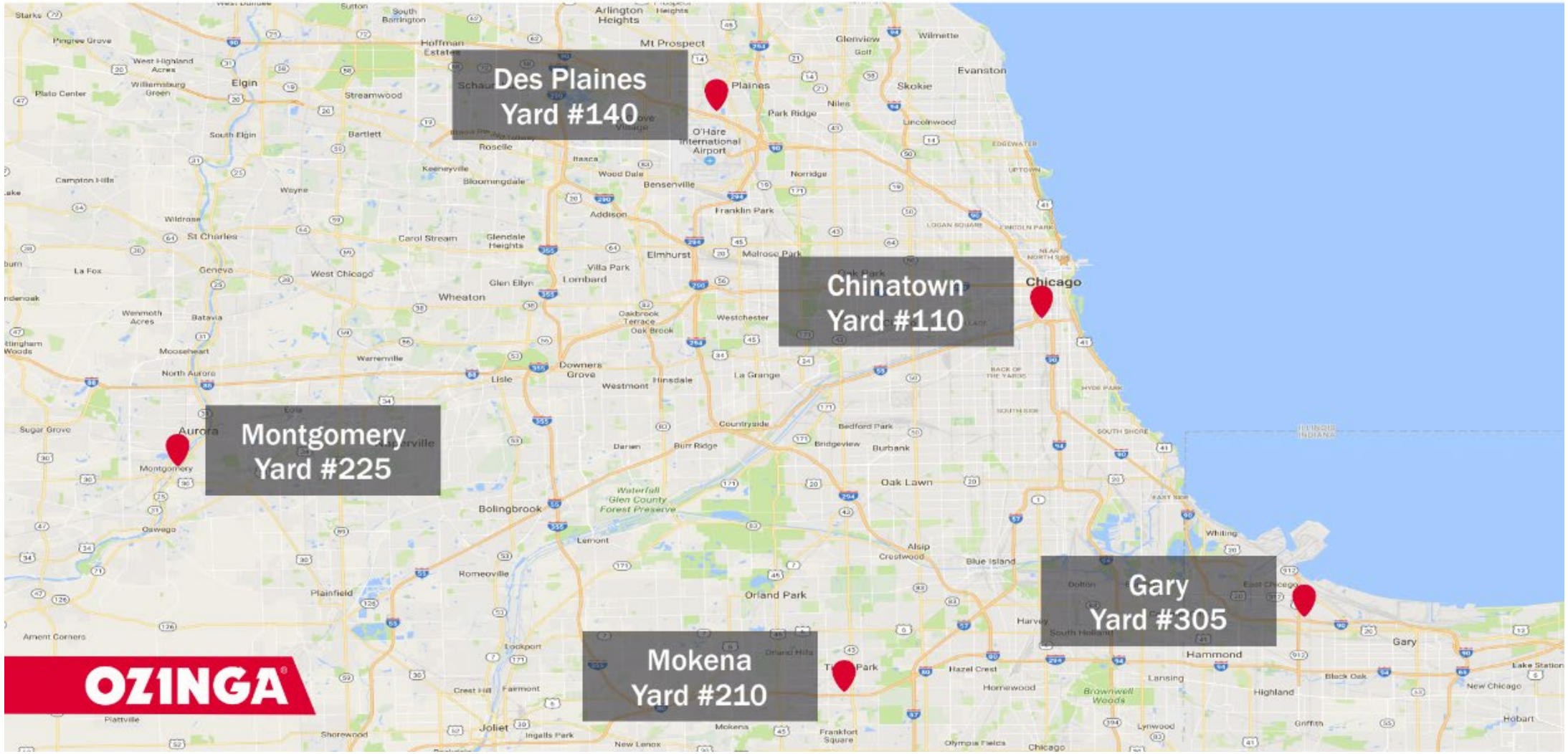
Our Story


90 YEARS
OZINGA
1928-2018
WE ARE OZINGA
BUILDING MATERIALS
M.OZINGA
COAL
PHONE
EVERGREEN PARK
125

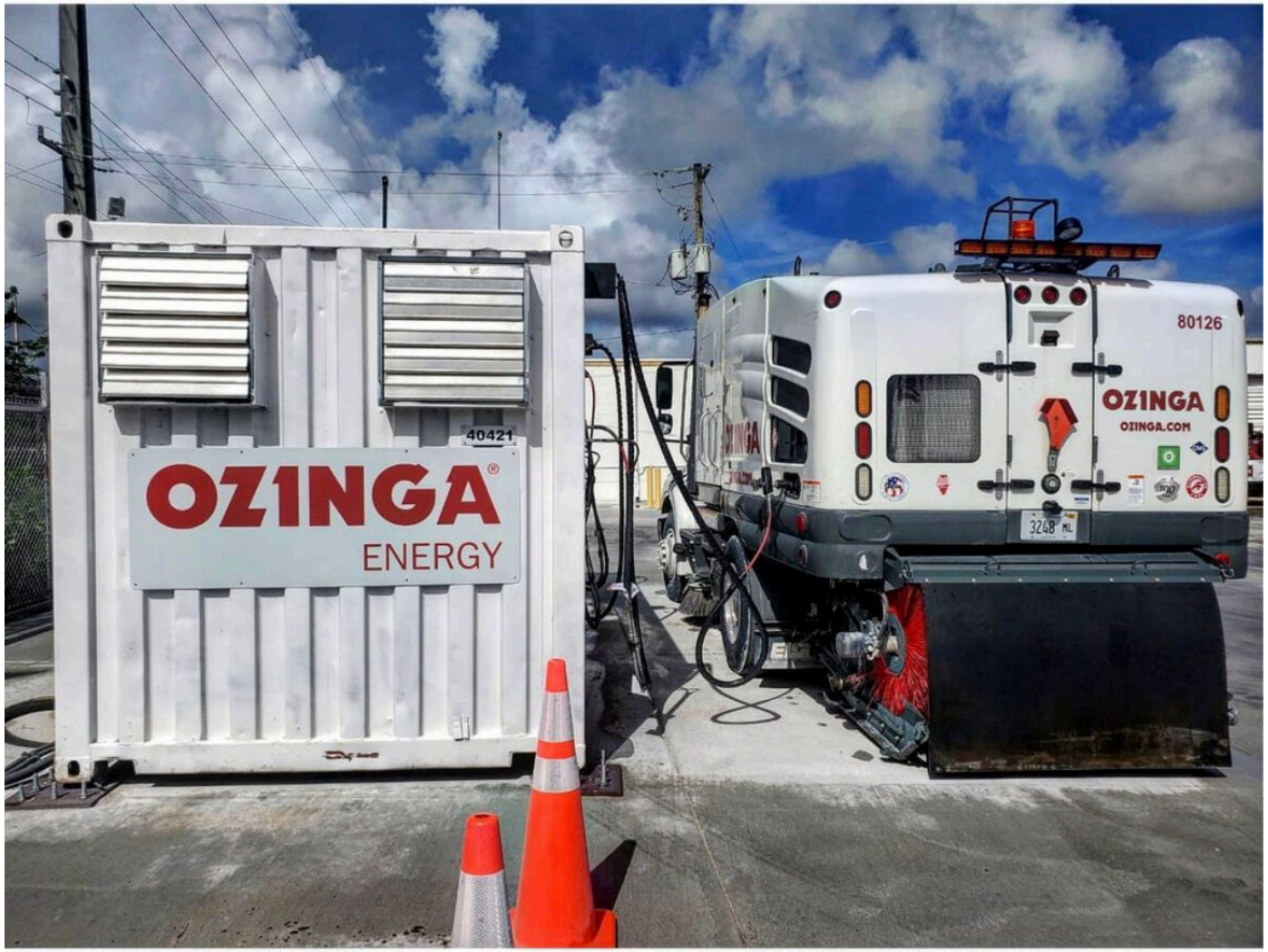
Ozinga Energy



CNG Locations




OZINGA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CNG
Powered by
Natural Gas
Clean Fuel
Clean Air
OZINGA
ENERGY
OzingaEnergy.com


OZINGA
US DOT 1416345 IN


OZINGA
1333
1333 OZINGA 1333


OZINGA


OZINGA
USDOT 753510

B6.7N™

6.7L

Peak Rating: 240 hp
560 lb-ft torque
33,000 lb. GVW
School bus/Shuttle bus
EPA/ARB Low NOx
0.1 g/bhp-hr (50% reduction)

L9N™

8.9L

Peak Rating: 320 hp
1000 lb-ft torque
66,000 lb. GVW
Transit Bus
EPA/ARB Near Zero NOx
0.02 g/bhp-hr (90% Reduction)

ISX12N™

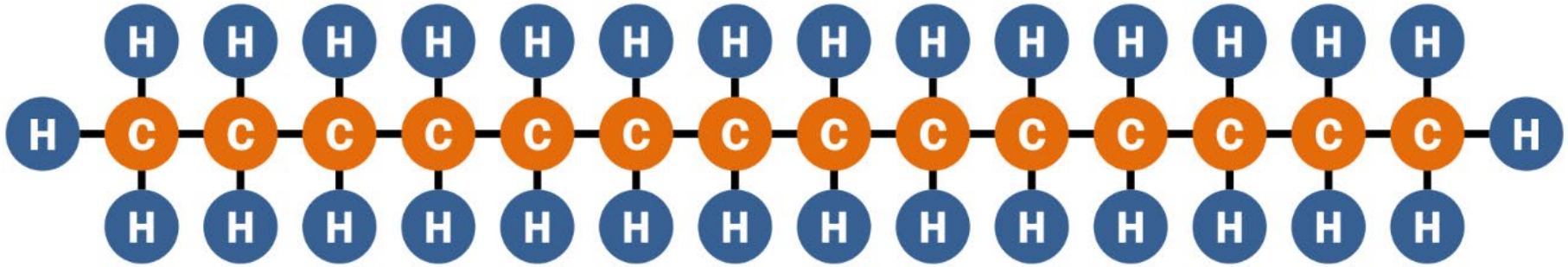
11.9L

Peak Rating: 400 hp
1450 lb-ft torque
80,000 lb. GVW
Coach Bus
EPA/ARB Near Zero NOx – 0.02
g/bhp-hr (90% Reduction)

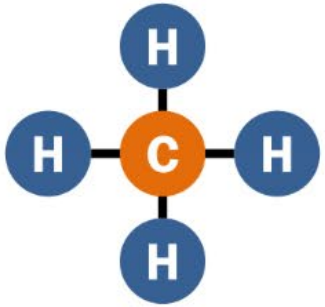
Labor Savings

Why CNG?

Diesel Molecular Structure $C_{14}H_{30}$



Natural Gas Molecular Structure CH_4



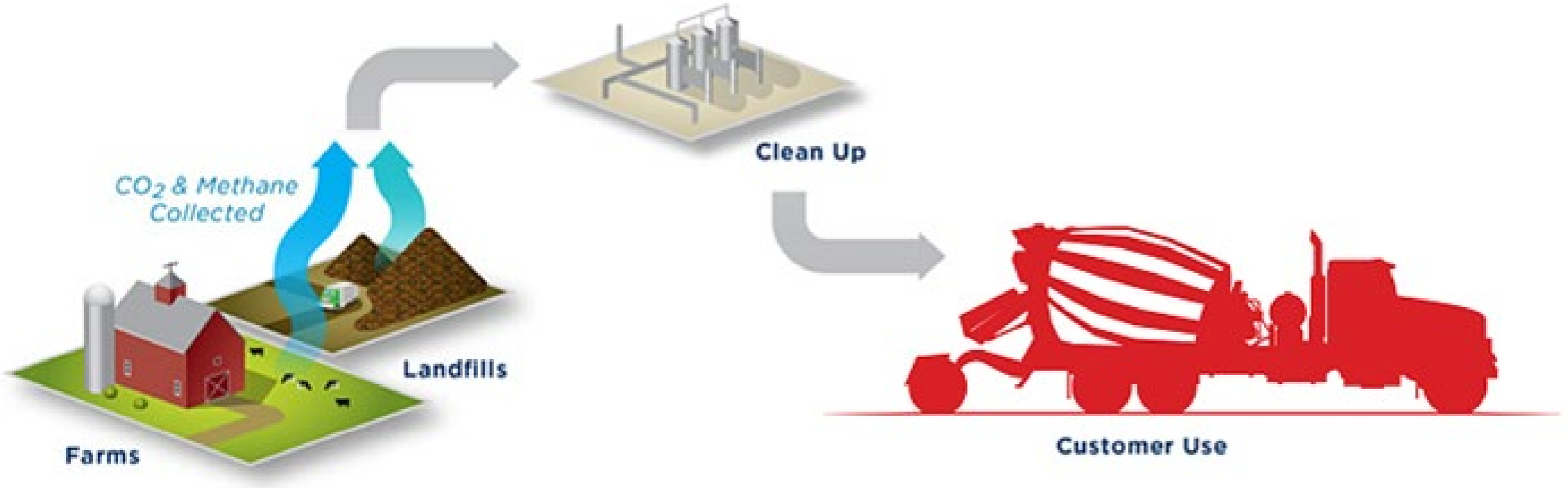
Fuel Displacement

Over

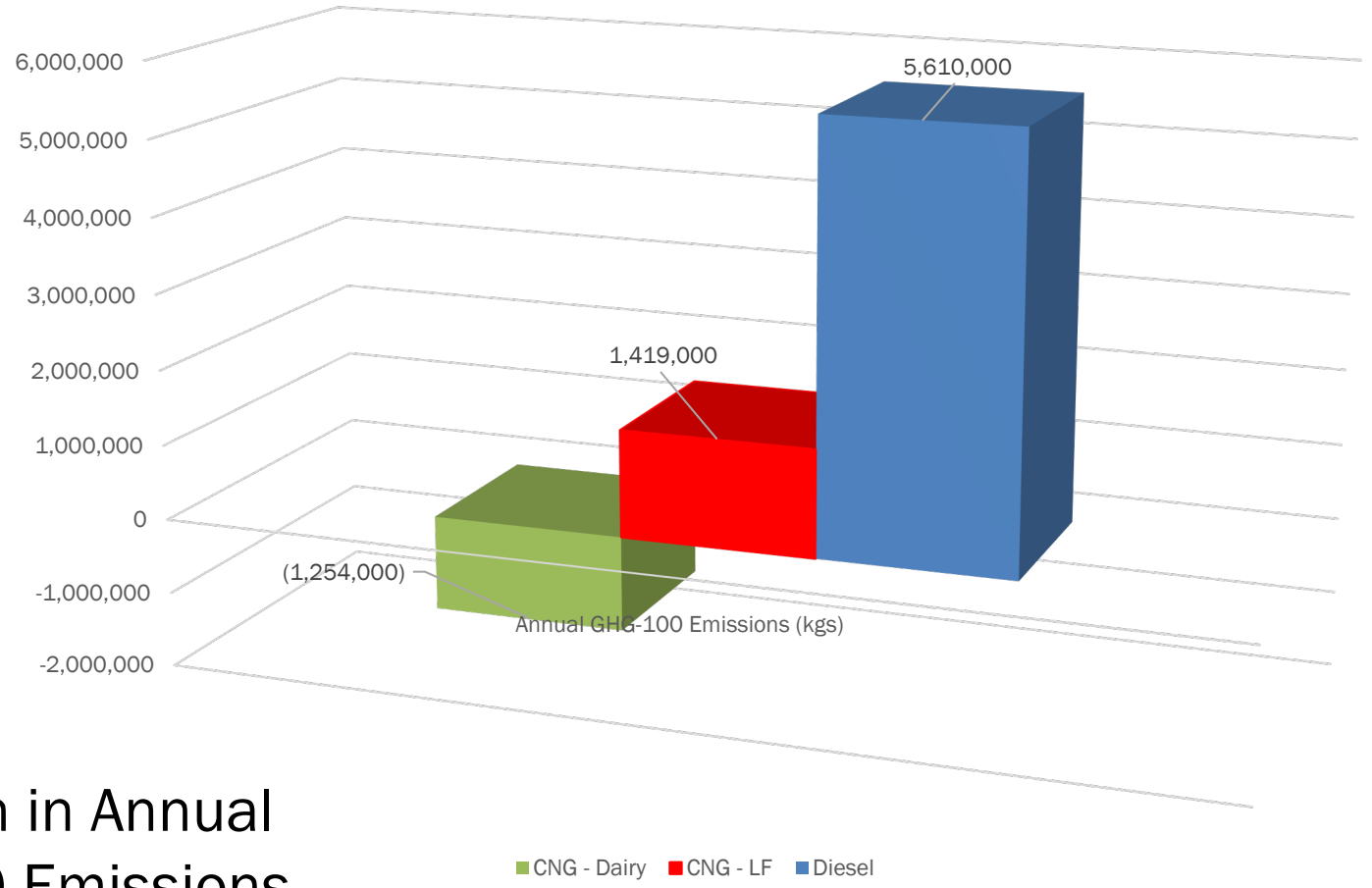
1,000,000

Gallons of Diesel / Year

Why RNG?

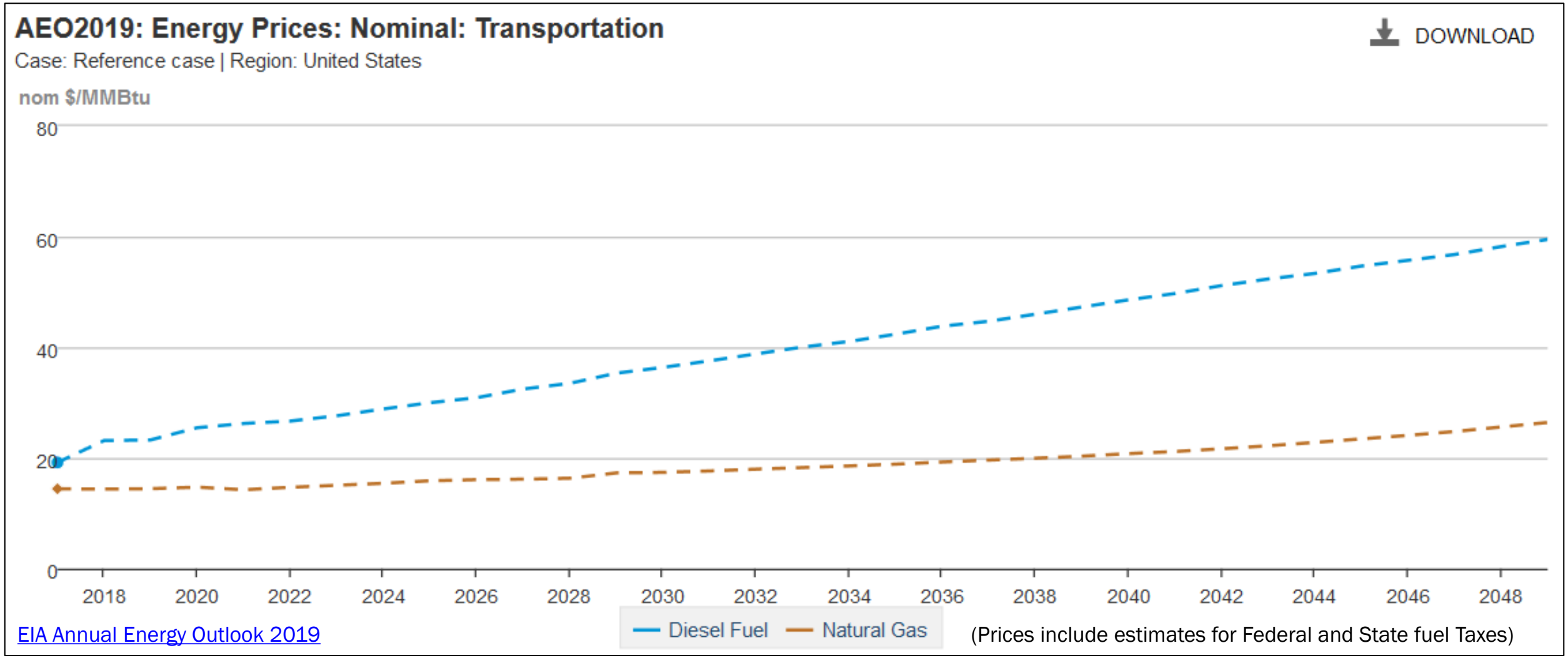

CO_2 & Methane Collected
Landfills
Farms
Clean Up
Customer Use

Ozinga Emissions Savings



75% Reduction in Annual
WTW GHG-100 Emissions

Price Comparison



EIA Annual Energy Outlook 2019

(Prices include estimates for Federal and State fuel Taxes)

Thank you

Questions or Comments:

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