



Session #12: Renewable Fuels to Meet Carbon Reduction Goals

December 13, 2023



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Upcoming Webinars

- **01/09/24 Product Feature Webinar: Kempower**
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Format

- Q&A at the end
- Submit questions and comments in the “Chat”
- Scheduled for 2:00p-3:15p
- Handout
- Recording





Sessions through December 13, 2023



Durham Convention Center August 13-15, 2024 Summer

<https://www.sustainablefleetexpo.com/>





North Carolina State University
NC Clean Energy Technology Center
Clean Transportation Program

www.cleantransportation.org

Rick Sapienza

resapienza@ncsu.edu

919-332-4510



www.facebook.com/NCCleanTech



twitter.com/nccleantech



Today's Speakers



Arlene Smithson
US EPA
Manager, Climate Economics
& Modeling Branch
smithson.arlene@epa.gov

Denise Kearns
US EPA
Environmental Professional
Specialist
kearns.denise@epa.gov

Marty Tufte
Waste Management
Corporate Fleet Director
MTufte@wm.com

Gary Lentsch
Eugene Water & Electric Board
Fleet Manager
Gary.Lentsch@eweb.org

Jennifer Weaver
Clean Fuels Alliance America
OEM Market Development
Manager
jennifer_weaver@me.com

Rick Longobart
City of Raleigh
Vehicle Fleet Services
Fleet Manager
rick.longobart@raleighnc.gov



Renewable Fuels to Meet Carbon Reduction Goals December 13, 2023

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

2:05-2:14 **Arlene Smithson, USEPA**—Renewable/Bio-Fuels Regulatory Work and GHG Impact

2:14-2:23 **Denise Kearns, USEPA**—SmartWay Recognizing the Benefits of Alternative Fuels

2:23-2:33 **Marty Tufte, Waste Management**—Renewable Natural Gas

2:33-2:44 **Gary Lentsch**—Renewable Diesel

2:43-2:53 **Jennifer Weaver, Clean Fuels Alliance America**—Biodiesel

2:53-3:03 **Rick Longobart, City of Raleigh**—Renewable Propane

3:03-3:15 **Q&A**



EPA Renewable/Bio-Fuels Regulatory Work and GHG Impact



Arlene Smithson
Environmental Protection Agency
Office of Transportation and Air Quality
Climate Economics and Modeling Branch
Acting Manager

RFS Program Introduction

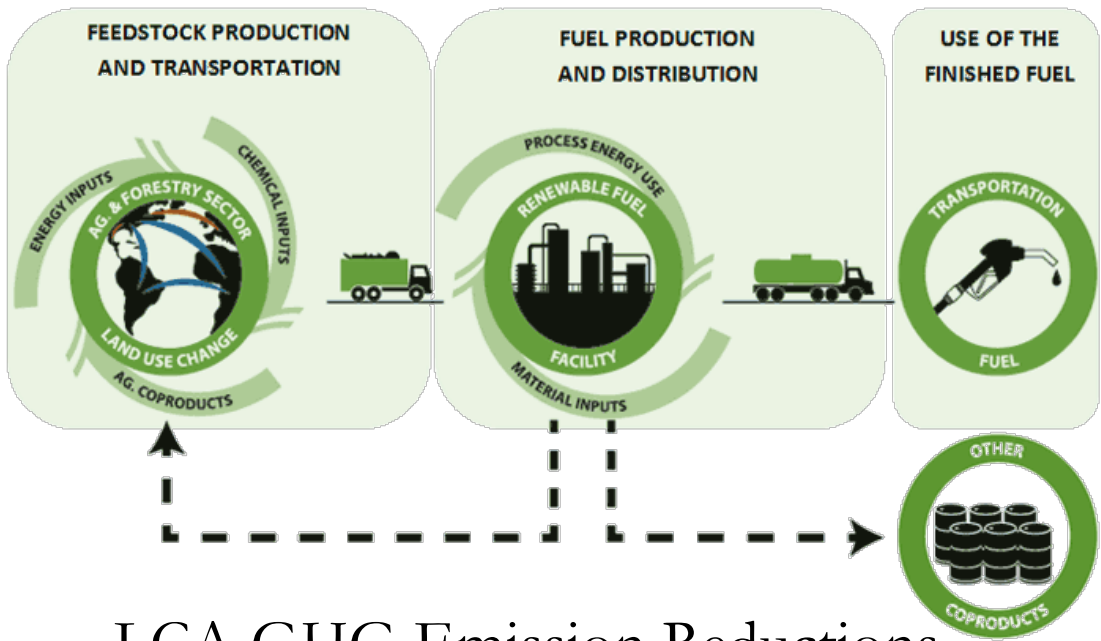
- The Renewable Fuel Standard (RFS) program was created under the Energy Policy Act of 2005 (EPAct) and expanded by the Energy Independence and Security Act of 2007 (EISA).
- EPA implements the program in consultation with U.S. Department of Agriculture and the Department of Energy.
- The RFS program is a national policy that requires the production of renewable fuel to replace or reduce the quantity of petroleum-based transportation fuel, heating oil or jet fuel. The production goal is set to 22.33 billion gallons of renewable fuel annually by 2025.

Renewable Fuels Under RFS

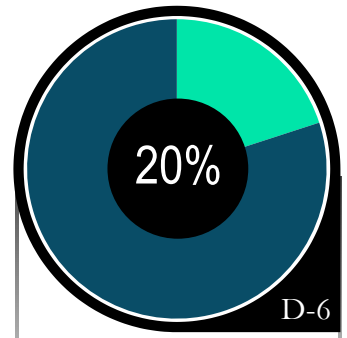
- The four renewable fuel categories under the RFS are:
 - Biomass-based diesel
 - Cellulosic biofuel
 - Advanced biofuel
 - Total renewable fuel → “Conventional” biofuel
- Obligated parties under the RFS program are refiners or importers of gasoline or diesel fuel. Compliance is achieved through the production or blending renewable fuels for transportation, or by obtaining credits (called “Renewable Identification Numbers”, or RINs) to meet the EPA-specified Renewable Volume Obligation (RVO).

Renewable Fuels Qualifications

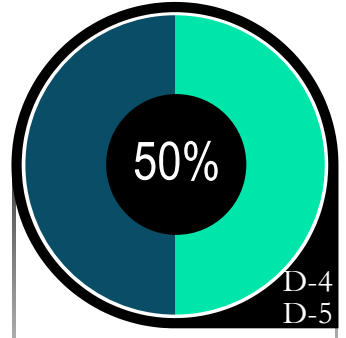
- To qualify as renewable under the RFS program, a fuel must achieve a greenhouse gas (GHG) (CO₂, CH₄, N₂O) emissions reduction (as compared to a 2005 petroleum baseline) of:
 - ❑ Biomass-based diesel \geq 50% lifecycle GHG reduction (D-4)
 - ❑ Cellulosic biofuel (produced from cellulose, hemicellulose, or lignin) \geq 60% lifecycle GHG reduction (D-3, D-7 Cellulosic Diesel)
 - ❑ Advanced biofuel (produced from qualifying renewable biomass) \geq 50% lifecycle GHG reduction (D-5)
 - ❑ Renewable (or “conventional”) fuel (refers mostly to corn starch ethanol) \geq 20% lifecycle GHG reduction (D-6)



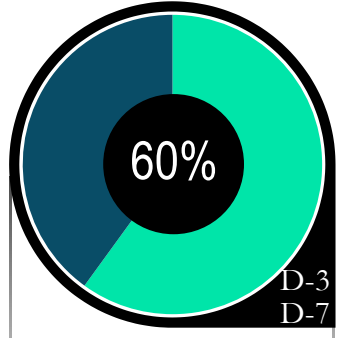
LCA GHG Emission Reductions



Renewable or "Conventional" **Fuels** = Corn Starch Ethanol



Advanced (Renewable Gasoline Blendstock = Naphtha, Renewable LPG, Renewable CNG, Renewable Diesel) **and Biodiesel Fuels**



Cellulosic Fuels (Ethanol, Butanol, Cellulosic Diesel, Naphtha, Renewable LPG, Renewable CNG, Renewable Electricity)

Lifecycle Analysis Assessment

- Lifecycle analysis (LCA), also referred to as fuel cycle or well-to-wheel analysis, assesses the overall greenhouse gas (GHG) impacts of a fuel. It includes:
 - Upstream emissions associated with producing the feedstock and its' transportation to the fuel production facility
 - Process emissions associated with the fuel production
 - Downstream emissions associated with distributing and using the finished fuel
- EPA's lifecycle analysis also includes significant indirect emissions (such as land use change) as required by the Clean Air Act.

Approved RF Pathways

Vegetable Oils,
Covercrops,
Grain Distillers,
Biogenic Waste
Fats/Oils/Greases,
Biogas from Waste
Digester

Cellulosic (Tree/Crop/Grass)
Residue, Cellulosic Food Waste,
Biogenic Separated MSW,
Biogas from Landfills,
Municipal Wastewater/
Agricultural/Separated MSW
Digester, Biogas from Cellulosic
Digester

Trans-Esterification,
Hydrotreating

Catalytic Pyrolysis,
Gasification,
Catalytic Hydrodeoxygenation,
Direct Biological Conversion,
Any Process using Biogas and/or
Biomass

Biodiesel
Renewable Diesel
Naphtha
RLPG
RCNG, RLNG

Cellulosic Diesel
Renewable Diesel
Renewable Gasoline
RNCG, RLNG

50%

60%

- A fuel pathway is a specific combination of three components:
 - ❑ feedstock
 - ❑ production process
 - ❑ fuel type
- See “Table 1 to § 80.1426 - Applicable D Codes for Each Fuel Pathway for Use in Generating RINs” at EPA.gov for full list of pathways.

<https://www.epa.gov/renewable-fuel-standard-program/approved-pathways-renewable-fuel>

Benefits of RFS Program

- Promotes the move away from petroleum-based transportation fuels and creates the availability of renewable/bio-fuels alternatives. (2.1 billion gallons-2010 to 9.6 billion gallons-2023 of advanced/bio-fuels)
- Sets lifecycle GHG emission reductions of renewable/bio-fuels.
- The generation and trading of RIN credits provide accountability and cost incentives to the production of renewable/bio-fuels.
- Renewable/Cellulosic/Bio-Diesel and Renewable Gasoline drop in-fuels allow for relatively seamless integration on fueling systems.
- Renewable Propane, RCNG, RLNG have different vehicle and infrastructure needs, but greater potential of tailpipe GHG emission reductions than Diesel/Gasoline fuels.

Available Tools – GHG Calculator

→ Greenhouse Gas Equivalencies Calculator



Convert emissions or energy data into concrete terms you can understand — such as the annual CO₂ emissions of cars, households, and power plants.

<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator>

→ HEAVY-DUTY VEHICLE EMISSIONS CALCULATOR

<https://afleet.es.anl.gov/hdv-emissions-calculator/>

Available Tools – Fuel Locator

U.S. Department of Energy - Energy Efficiency and Renewable Energy
Alternative Fuels Data Center

Alternative Fueling Station Locator

Download the iPhone app (<https://itunes.apple.com/us/app/alternative-fueling-station/id718577947>) or Android app (<https://play.google.com/store/apps/details?id=gov.energy.afdc.stationlocator>).

Public Stations Advanced Filters Fuel Corridors

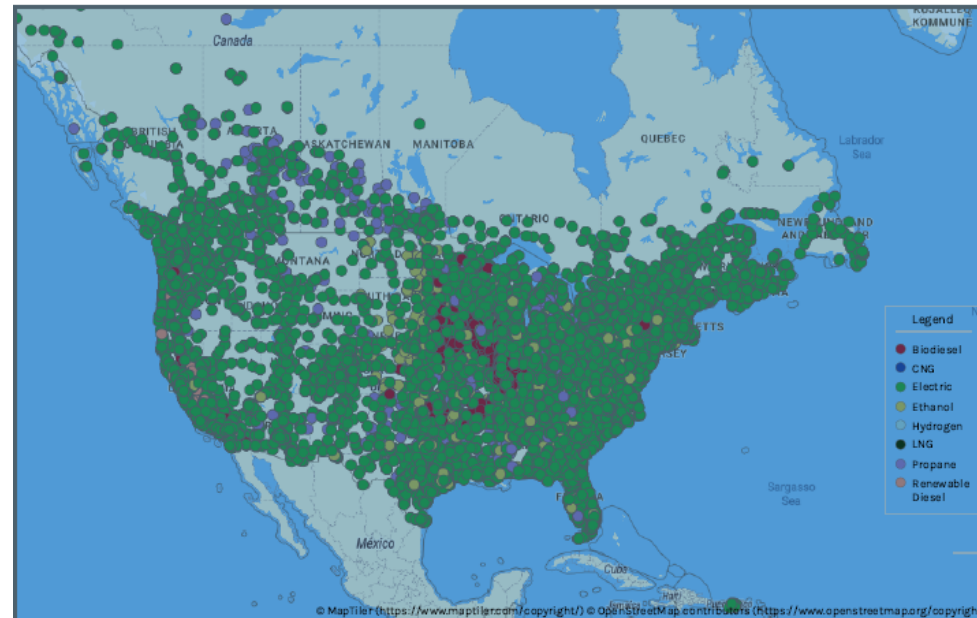
79,485 results in U.S. and Canada

Enter location



All Fuels

[Map](#)
[Route](#)



<https://www.energy.gov/alternative-fueling-station-locator#/find/nearest?country=US>

Available Tools – Local Emissions Calculator

Local Greenhouse Gas Inventory Tool Local Inventory

Developed to help communities across the United States to evaluate their greenhouse gas emissions. Use this tool to compile a greenhouse gas (GHG) inventory for your entire community or for local government operations in particular.



<https://www.epa.gov/statelocalenergy/local-greenhouse-gas-inventory-tool>

Reduction of Local Emissions Program Example

U.S. DEPARTMENT OF
ENERGY

Office of
**ENERGY EFFICIENCY &
RENEWABLE ENERGY**

**Clean Cities
Coalitions:**
Advancing Affordable,
Efficient, and Clean
Transportation Fuels
and Technologies



EPA GHG Reduction Program Examples

- **Clean Ports Program**
 - ❑ The Inflation Reduction Act of 2022 provides EPA \$3 billion to fund zero-emission port equipment and technology and to help ports develop climate action plans to reduce air pollutants at U.S. ports.
- **Clean School Bus Program**
 - ❑ The Bipartisan Infrastructure Law provides EPA \$5 billion over five years (FY 2022-2026) to replace existing school buses with zero-emission and low-emission models. Under the Program's first funding opportunity, the 2022 CSB Rebates, EPA solicited applications for zero-emission and low-emission school buses and awarded up to \$965 million to fund school bus replacements at nearly 400 schools.
- **SmartWay Program**
 - ❑ EPA program to help companies advance supply chain sustainability by measuring, benchmarking, and improving freight transportation efficiency.



USEPA SmartWay

Recognizing the Benefits of Alternative Fuels




Denise Kearns, Chien Sze

December 13, 2023



What we'll cover



-  Introduction to EPA SmartWay, program elements and objective
-  How alternative fuels fit in
-  Featuring the benefits of alternative fuels

SmartWay overview



🌿 **Launched by freight industry leaders in 2004 as a voluntary market-based program aiming to:**

- Improve U.S. freight efficiency, lower emissions impact
- Highlight freight industry's efforts to reduce emissions
- Provide partners with tools for purposes of standardized emissions benchmarking, reporting system
- Clean America's air, reduce dependence on oil



FOR CARRIERS AND ORGANIZATIONS THAT CONTRACT WITH CARRIERS



SmartWay, alternative fuels



Established

 **Compressed Natural Gas**  **LPG (propane)**

 **Liquid Natural Gas**  **Biodiesel, B-5, B-20**

 **Electricity**

 **Hybrid – diesel/electric**

TBD


 **Renewable Diesel**

 **Renewable Natural Gas**


 **Hybrid combinations**



Featuring benefits



Featured Partner



More than
40 %
compressed natural gas
(CNG) vehicles

60
million miles
on CNG

SmartWay and Sustainable Freight

SmartWay High Performer Lists
SmartWay Excellence Awardees

Learn about SmartWay



- [List of New SmartWay Partners](#): View a list of SmartWay partners and affiliates that have joined SmartWay in the last 60 days.
- [SmartWay Carrier Performance Ranking List](#): View rankings and performance indicators for SmartWay Carrier Partners' divisional fleets.
- [SmartWay Truck Carrier Alternative Fuels List](#): View lists of SmartWay truck carrier partners that are using alternative fuels.

Questions?



Denise Kearns

kearns.denise@epa.gov

Chien Sze

sze.chien@epa.gov



Marty Tufte Corporate Fleet Director WM CNG/RNG Program

December 2023



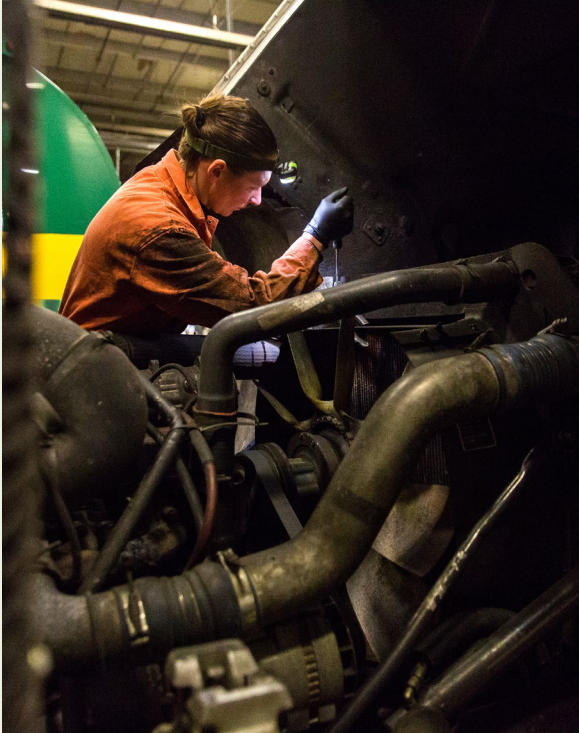
WM's Reason for RNG



Clean Air for Our Customers



Healthier for Our People



Lower Maintenance Cost



Lowest Fuel Cost



WM'S RNG STRATEGY PROVIDES SIGNIFICANT SCALE WHILE SUPPORTING ACHIEVEMENT OF SUSTAINABILITY GOALS

	End of 2022	2026
RNG plants in service, #	6	21
MMBTU production, M	3.7M	24M
Landfill Gas Beneficially Used, % of total	53%	65%
WM CNG fleet utilization, % fueled on RNG	75%	100%

Importance of CNG in WM Fleet

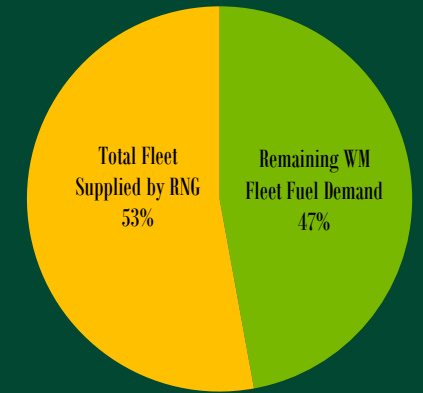
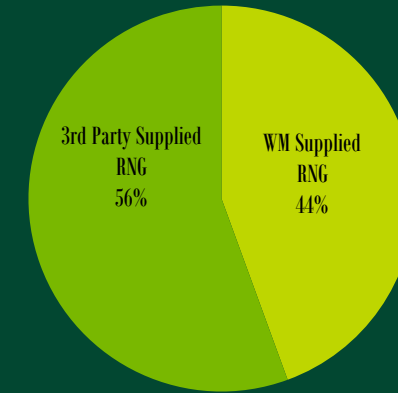
Why CNG?

- Lower fuel costs
 - Commodity prices
 - Incentives (LCFS and RFS/RINs)
 - Tax credits distributed at BU level
- Reduce labor costs
 - CNG trucks can be fueled overnight > drivers spend less time waiting in line to fuel
- Reduced maintenance
 - Fewer filters to maintain and clean than diesel trucks
- Improved operational efficiencies
- Quieter than diesel
- Federal grants
 - Offset truck costs and infrastructure costs
- Environmental benefits
 - CNG already meets EPA/CARB phase II GHG emissions requirements through 2027
 - CNG trucks emit nearly zero particulate emissions

Total RNG Supplied

WM Fleet Supply & Demand

As of August 2022



Why not electrify collection fleet?

- Technology was the most like diesel trucks
- Weight limitations for heavy duty trucks — batteries add too much
- Technology not yet there for heavy duty trucks
- Charging time vs running time of trucks — trucks cannot run daily with only one charging session

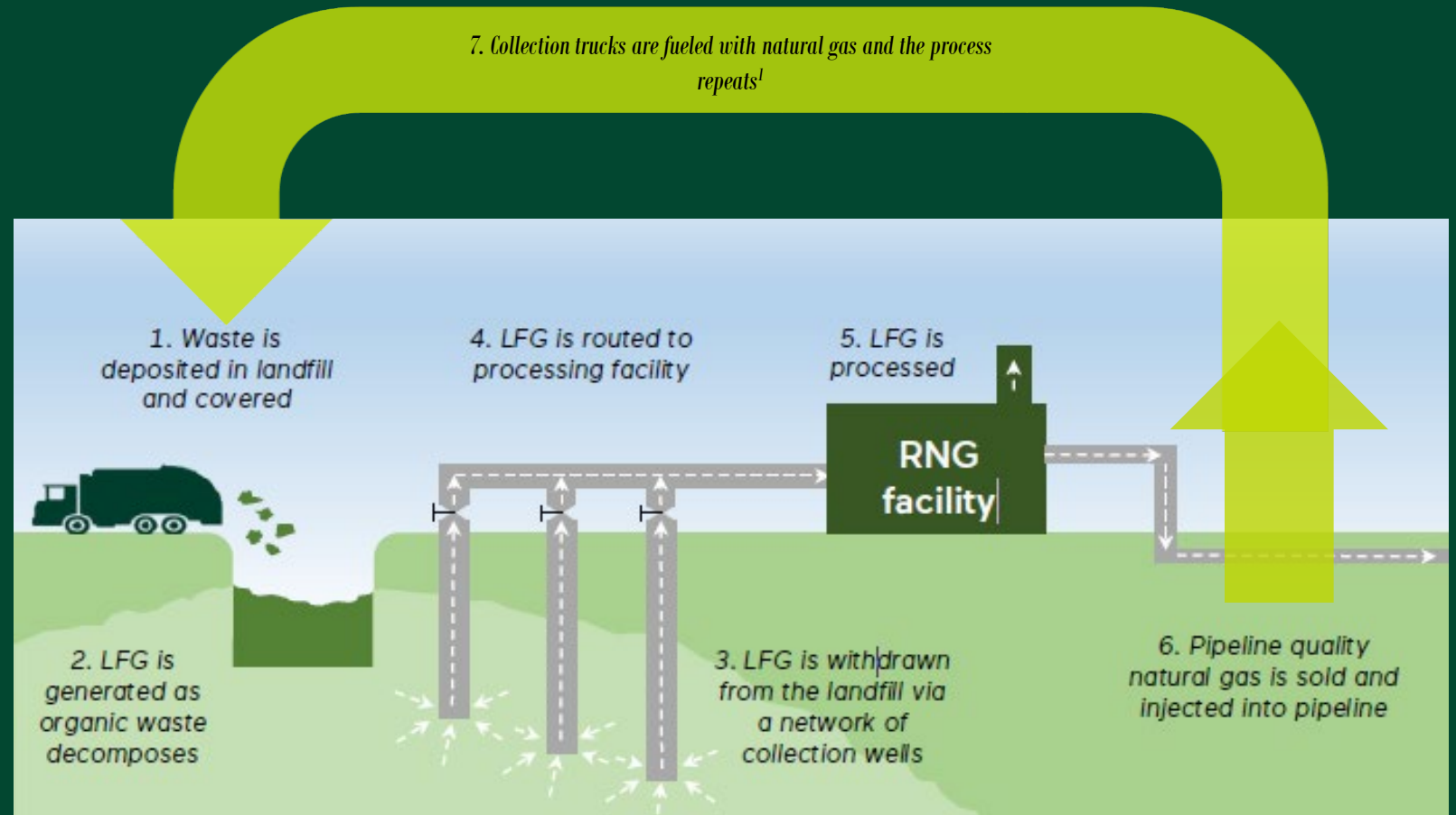
WM currently owns and operates a few electric delivery vehicles and has plans to add more, including automated side loaders and tractors.



Renewable Natural Gas (RNG) to Compressed Natural Gas (CNG)

Closing the Loop

- ❖ RNG is pipeline-quality natural gas
- ❖ Offers a cost-effective, drop-in, low-carbon replacement for conventional fossil natural gas
- ❖ Can be transported via existing natural gas infrastructure



1. Environmental attributes (EAs), RINs, etc. are generated through allocation of gas to trucks

Environmental Impact

Invested over \$100 million in new recycling infrastructure technology for our materials recovery facilities (MRFs) across the U.S. — more than any other entity — **but we do more than recycle...**



3X

Our service avoids 3X more greenhouse gas (GHG) emissions than our operations generate.



53%

of our compressed natural gas (CNG) fleet has transitioned to fuel with renewable natural gas (RNG)



15M

15M Tons of recycled plastics used to make WM uniforms with REPREVE fiber



177

Natural gas fueling stations in operations across North America



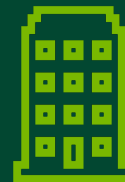
46%

Reduced fleet emissions 46% against a 2010 baseline



17

Currently building 17 more facilities to capture and process landfill gas into energy



1st

WM's headquarters is the 1st LEED v4 Platinum Core and Shell-certified project in U.S.



100%

Working with vendors to purchase 100% renewable electricity by 2025.

WM's History with Natural Gas

1995 - The first 14 CNG trucks launched in Palm Desert, CA.

1997 - 8 LNG trucks deployed in Lancaster, PA.

2000 - 120 LNG truck project in partnership with PGE in San Diego.

2001-2006 - 405 natural gas trucks deployed in SoCal South Coast Air district.

2007 - WM CEO David Steiner commits to increasing fuel efficiency and reducing emissions by 15% by year 2020.

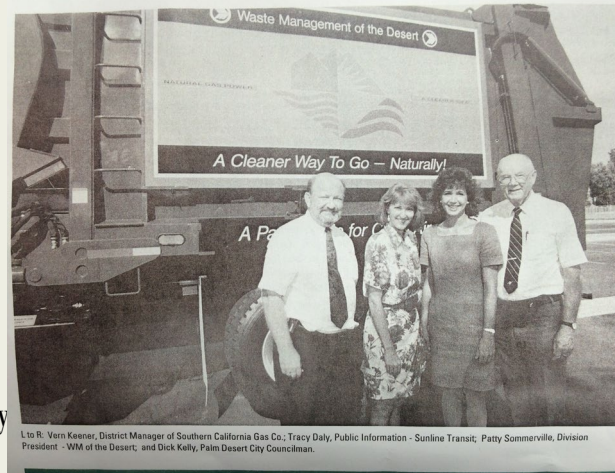
2009 - 122 natural gas trucks deployed in the City of Seattle, the largest single municipal refuse launch in US history. Trademarked "Clean N' Green".

2011 - 1,000 CNG trucks in operation, Formalization of the WM CNG Team, commitment to build \$250MM in Stations over the next 5 years.

2012 - Our 2020 efficiency and emission goal accomplished.

2017 - 100 stations completed and 6,000 NGV's in operation.

2020 - 10,000+ CNG trucks in operation and achieved our 2025 emissions goal.



L to R: Vern Keener, District Manager of Southern California Gas Co.; Tracy Daly, Public Information - Sunline Transit; Patty Sommerville, Division President - WM of the Desert; and Dick Kelly, Palm Desert City Councilman.



WM's CNG 2023 Fleet Stats

- Natural Gas Vehicles: 11,134 (55% of Fleet)
- NGV's at year end: 12,000+
- NG fueling stations: 194
- Stations open to Public: 28
- New CNG Stations in 2022: 25
- Over 90 MM gals of Diesel displaced in 2022.
- Over \$4 Billion invested in NGVs and infrastructure.
- With the ADS acquisition completed, WM is now the largest class 8 US DOT fleet.

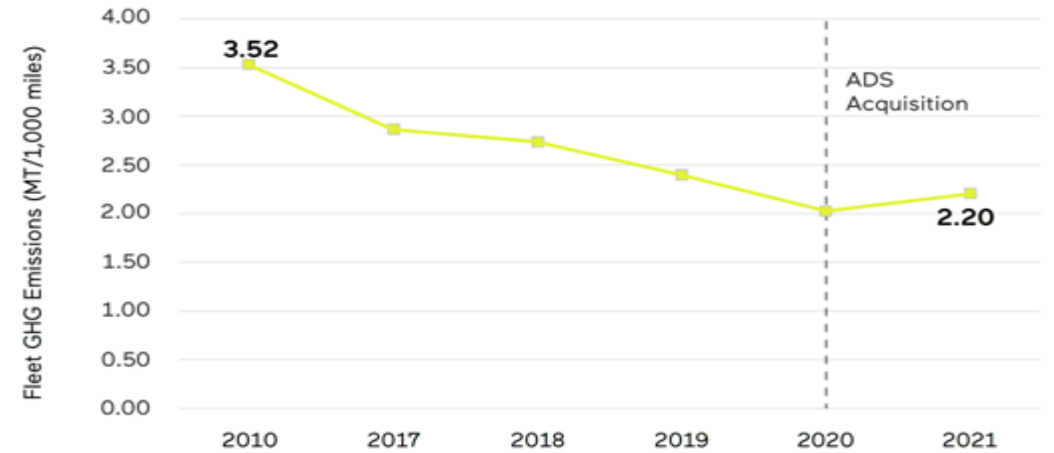


WM's RNG Usage

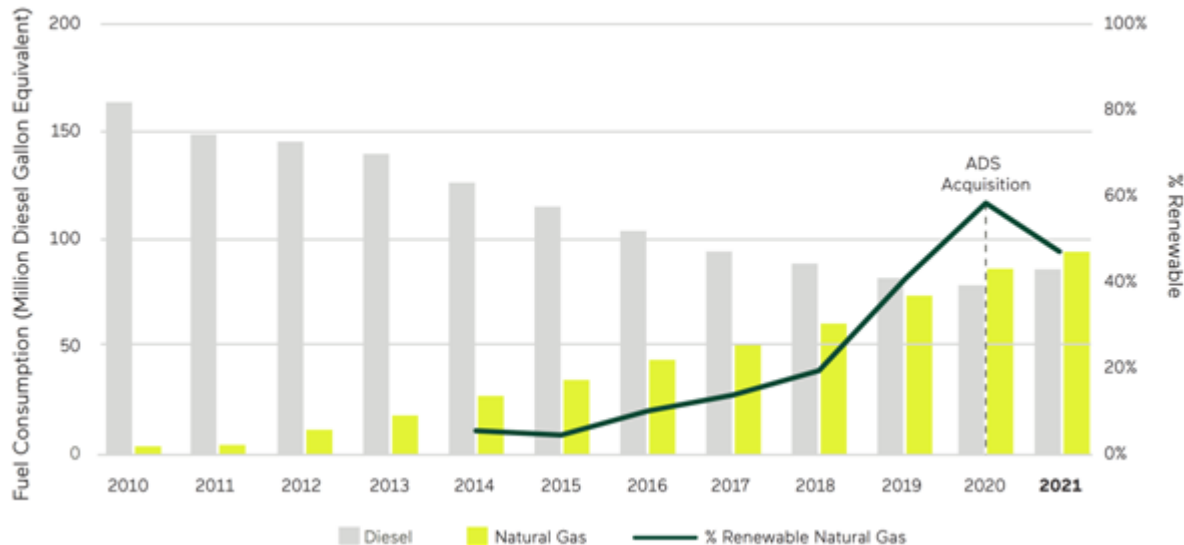
* ADS acquisition fleet had a high %

- RNG fuels **53%** of WM's CNG Fleet
- RNG fuels **100%** of WM's CNG Fleet in CA, OR, and WA
- **44 MM DGE** of RNG used in 2021, **94MM DGE Total of Natural Gas**
- **16** Renewable Natural Gas (RNG) production projects.
- Reduced Fleet emissions by **43%** against our 2010 baseline

CARBON INTENSITY-EMISSIONS PER 1,000 MILES DRIVEN



COLLECTION FLEET FUEL CONSUMPTION BY FUEL TYPE



WM's Growth

- We are transitioning large districts with over 75 trucks first 10 trucks. and then the balance of the 425 sites that are capable.
- We have worked with our suppliers to develop cost effective fueling capabilities for our smaller sites down to as few as



WM's Future

- Expand collection fleet to 18,000 CNG trucks.
- Expand fueling infrastructure to 300+ stations.
- Increase internal RNG production to **100%** of collection CNG fleet usage.
- Reduce collection fleet emissions **45%** by 2038 (versus 2010 baseline).
- The above goals are moving WM closer to a near-zero emissions collection fleet.



Thank you.



Renewable Diesel

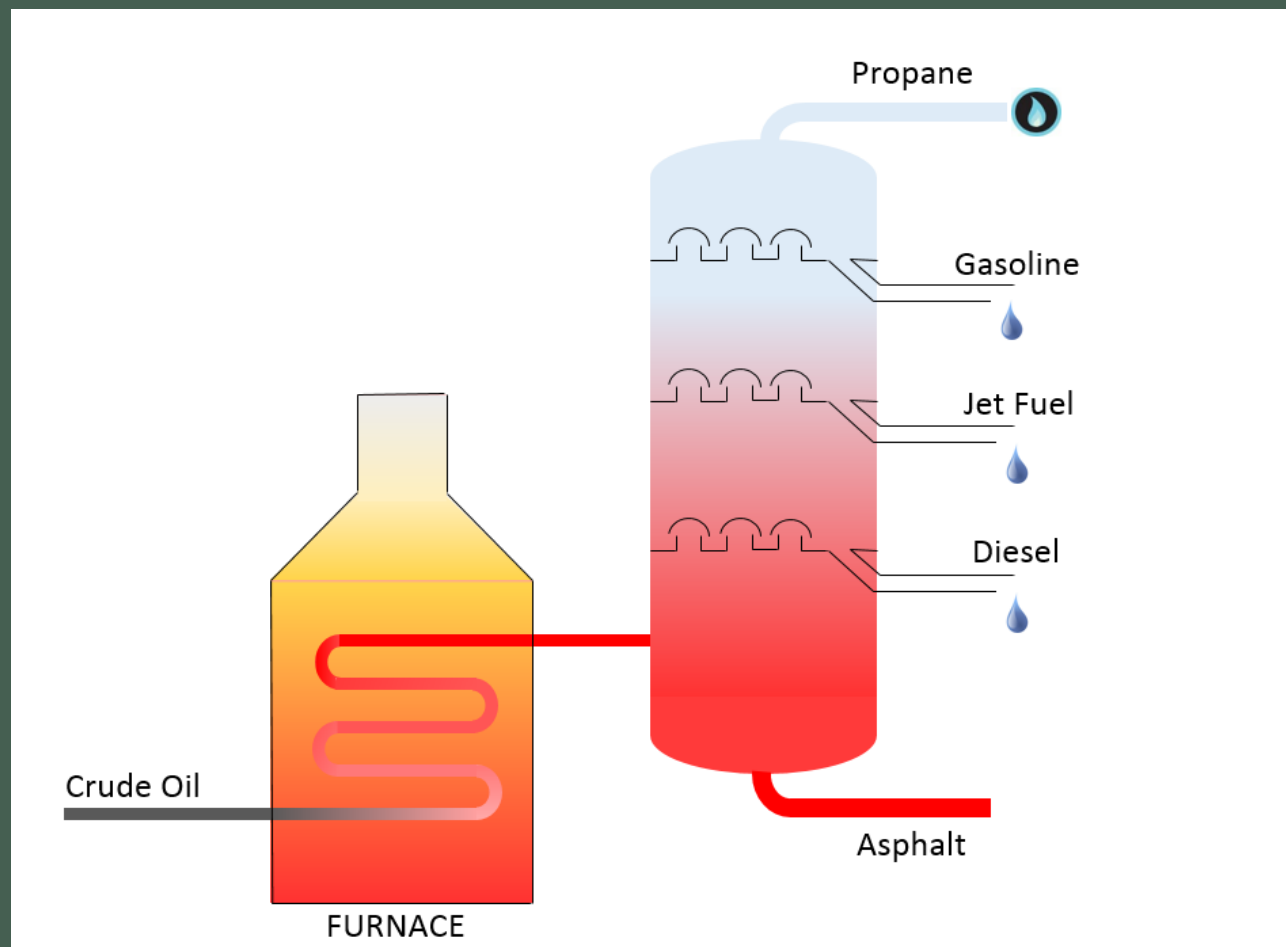
Gary Lentsch CAFM

Eugene Water & Electric Board

Eugene, Oregon

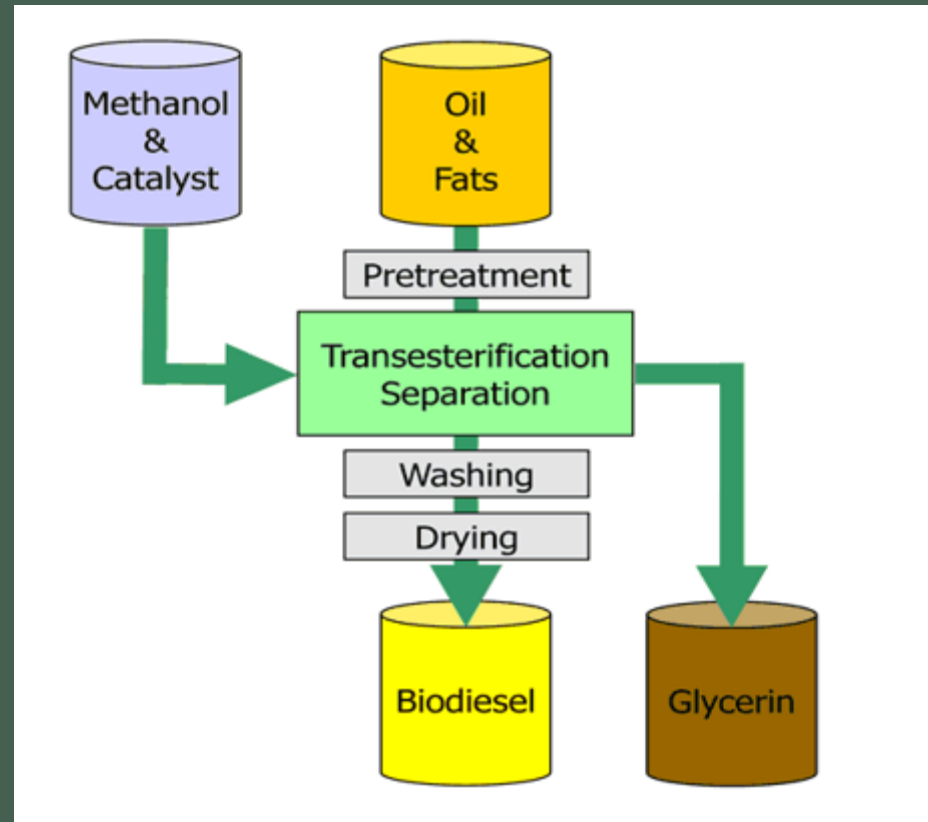
Petroleum Fuels

(the fractional distillation process)



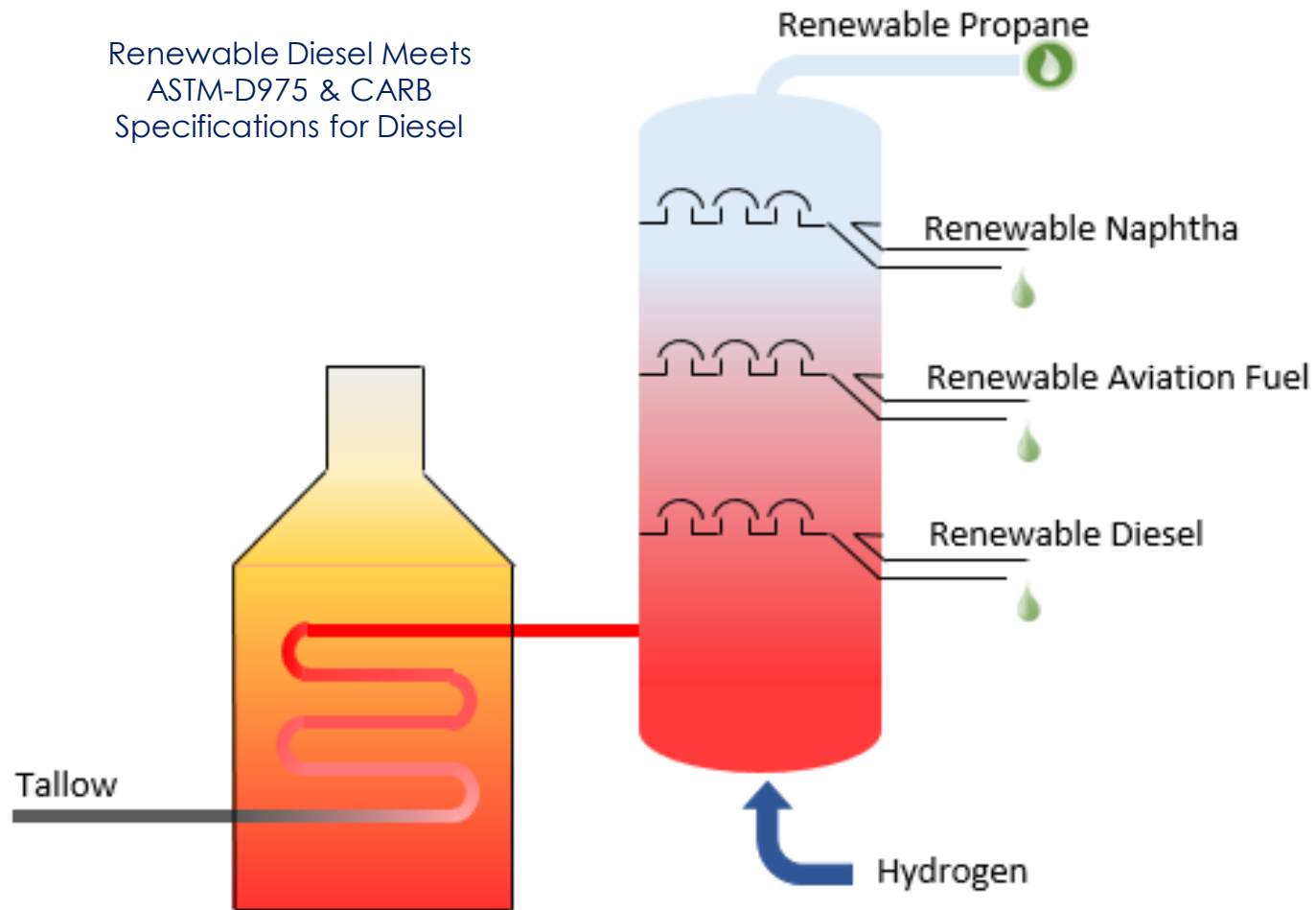
Bio-Diesel

(utilizes a transesterification process)



Renewable Diesel — Refined by a Hydrotreating Process

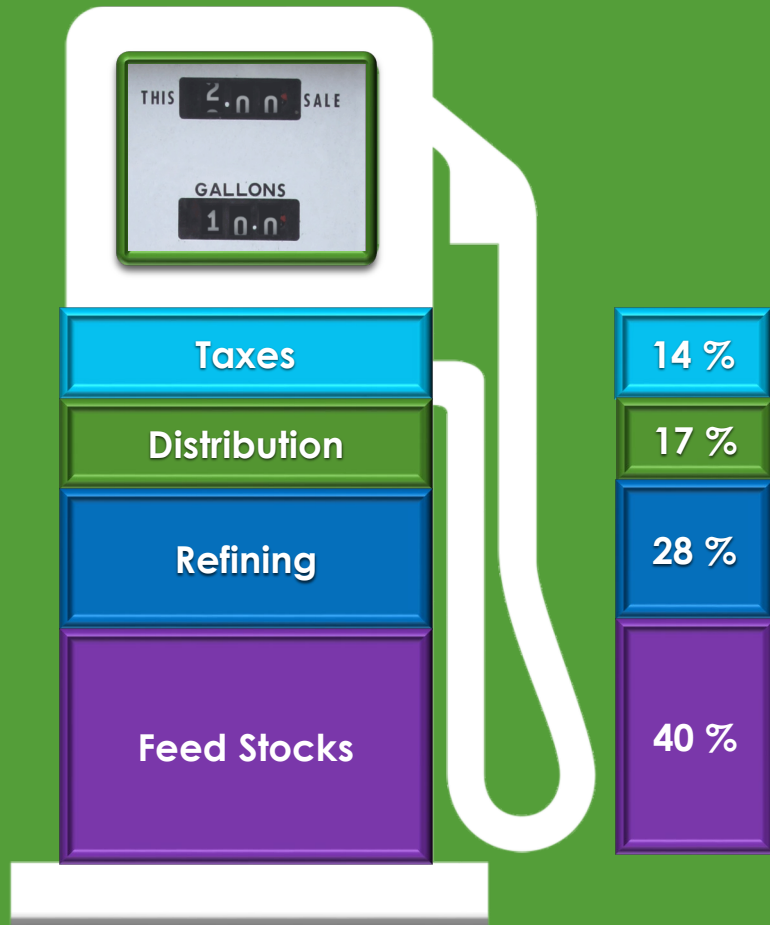
Renewable Diesel Meets
ASTM-D975 & CARB
Specifications for Diesel



It's Made by Using Organic Materials

- Waste Animal Fat
- Wasted Fish products
- Vegetable Oil Residues
- Used Cooking Oil
- Technical Corn Oil
- Tall Oil Pitch
- Crude Palm Oil
- Camelina Oil
- Jatropha Oil
- Rapeseed Oil
- Soybean Oil

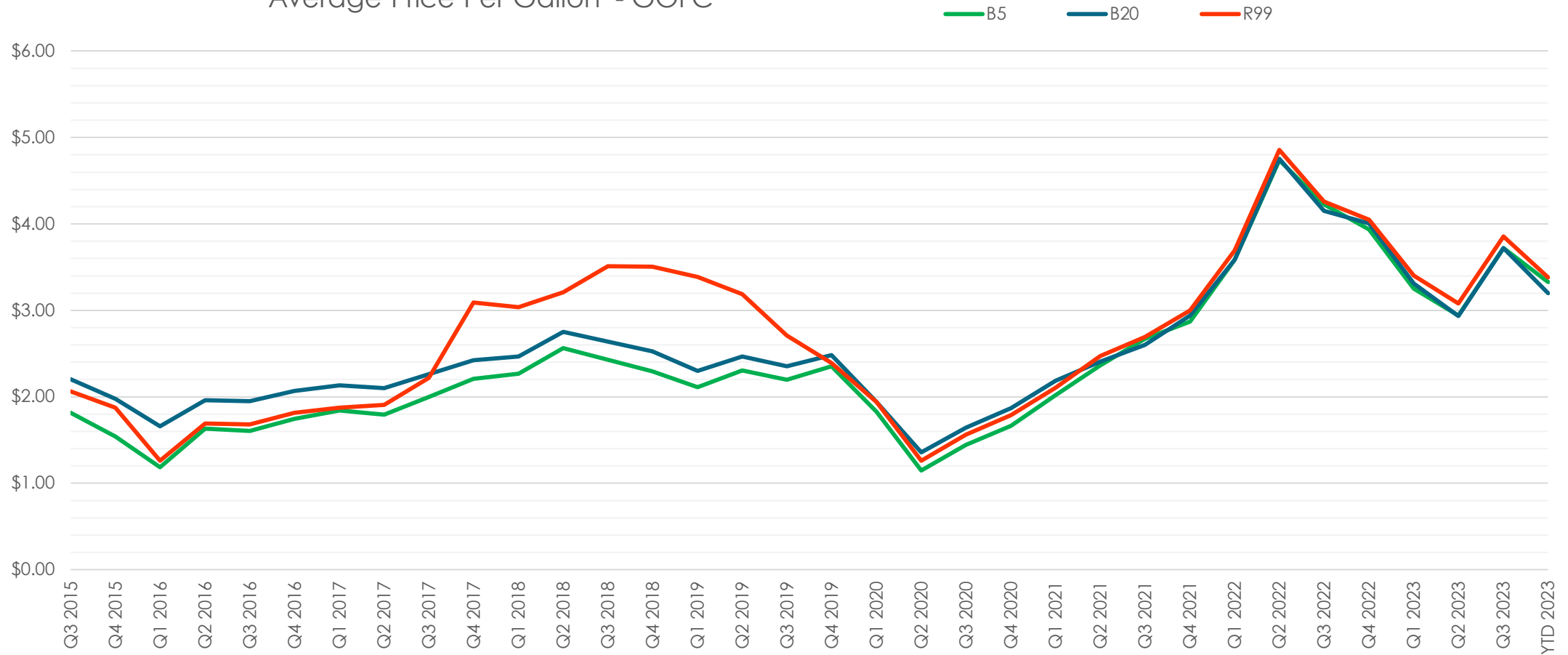
What's in a gallon of Alternative Fuel



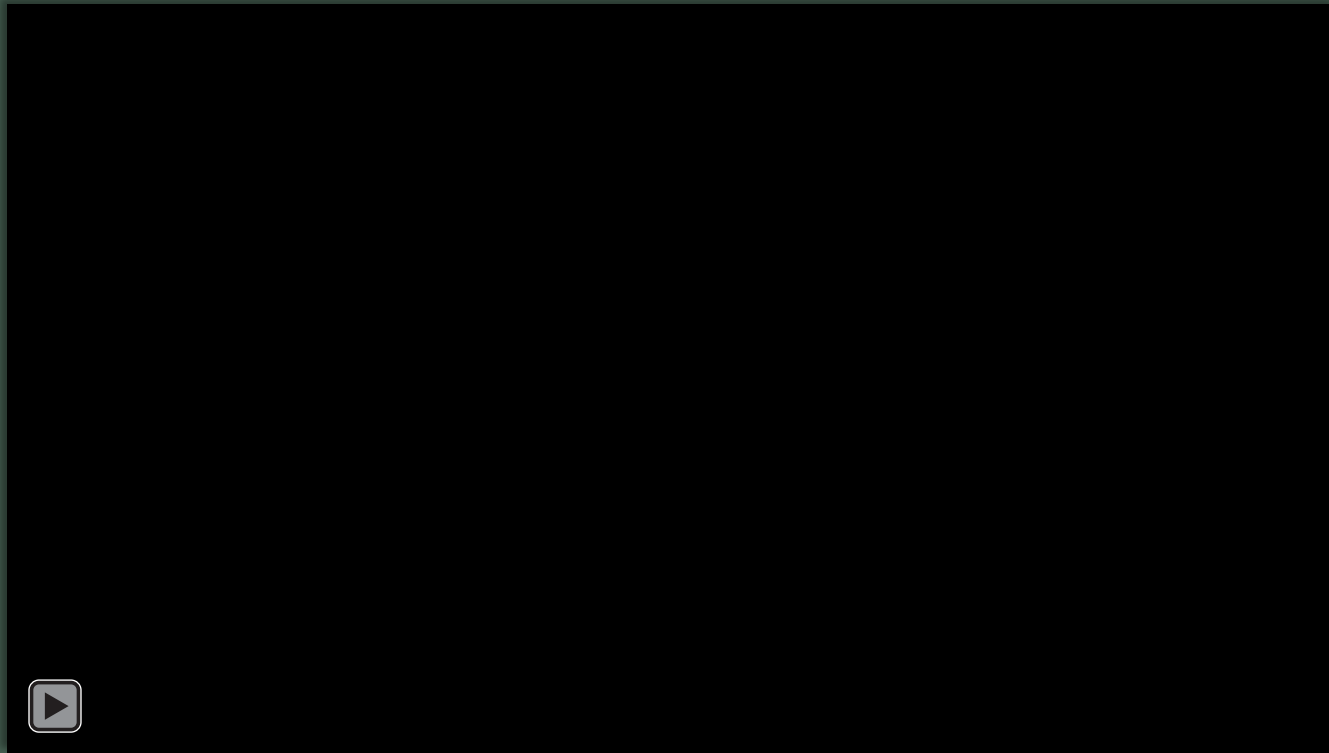
- Taxes will fluctuate from State to State.
- Distribution cost tend to be higher because the refineries are father away.
- Refining cost tend to be higher because of new infrastructure cost.
- When we compare Base Stocks of Oil, Gasoline 61%, and Diesel 50%.
- In a competitive free market, an increased supply of alternative fuels reduces the demand for conventional fuels, and thus lowers overall fuel prices.

8+ Years of Historical Cost

Average Price Per Gallon - GOFB



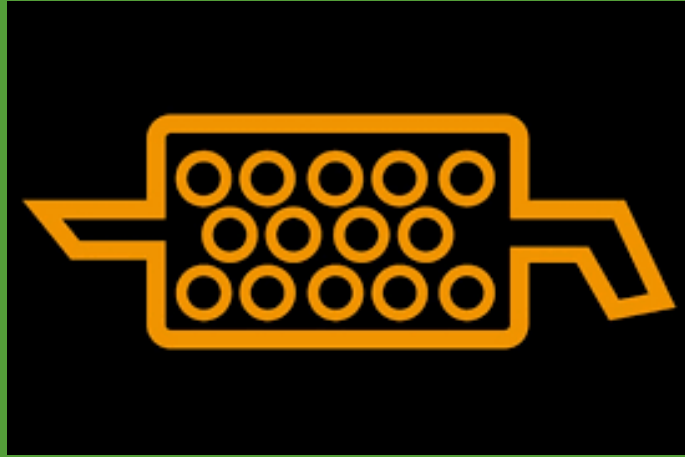
Why Maintenance Is This Important



- Renewable Diesel is on the left-side
- Fossil-Diesel is on the right-side
- The black soot are the particulates that are going in your exhaust systems

Reduced Maintenance

- Less Regens
- Less DEF Usage
- Less DPF Cleaning
- Less Fuel System Maintenance
- Extended Oil Drops



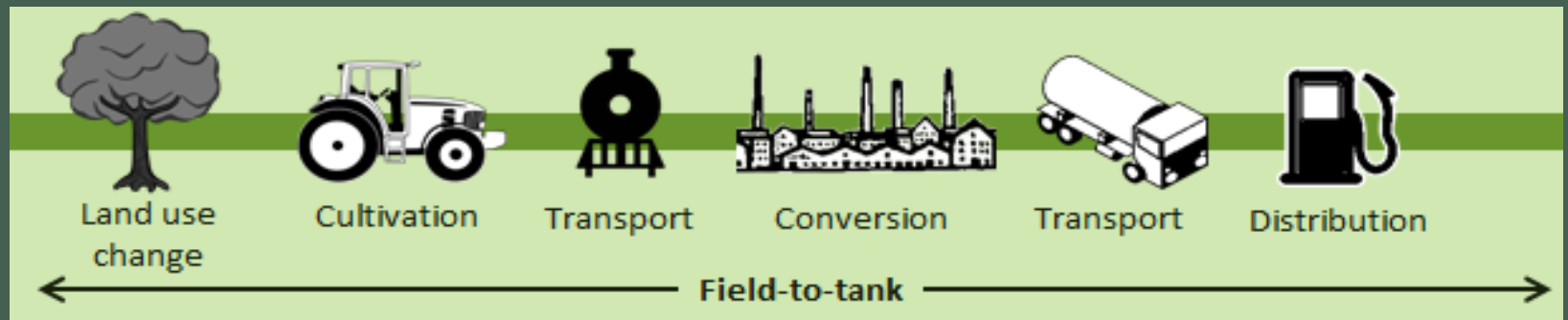
Lubricant Analysis Report
North America +1 877-608-3755

Account Information		Component Information		Sample Information	
Account Number: DEH004-9999-0206	Company Name: The On-Shore Drilling Company	Component ID: R206 #1 GEN ENGINE	Secondary ID: 14-517109	Tracking Number: V-046866	Lab Number: V-046866
Contact: jtm The On-Shore Drilling Company	Address: 123 The On-Shore Drilling Company Street	Component Type: DIESEL ENGINE	Manufacturer: CATPAC/FLAN	Lab Location: Houston	Data Analyst: AC
Phone Number: 555-555-5555		Model: 3512	Application: On-Site Drilling	Sampled: 28 Dec 2016	Received: 28 Dec 2016
		Sump Capacity:		Completed: 31 Dec 2016	
Filter Information		Miscellaneous Information		Product Information	
Filter Type: FULLFLOW	Filter Rating: 15			Product Manufacturer: UNKNOWN	Product Name: Information Requested
				Viscosity Grade: SAE 15W-85	
Comments: (Trapped data does not indicate an immediate need for maintenance action. Continue to observe the trend and monitor equipment and fluid conditions. Copper is at a MINOR LEVEL. Please provide COMPONENT MODEL number to compare data to the correct standards for this component. Please provide missing lubricant information: Manufacturer, product name, and viscosity grade are needed to properly evaluate lubricant properties. Unit and/or Lubricant TYPE missing.					
Component					
Wear Metals (ppm)		Metals (ppm)		Multi-Source Metals (ppm)	
Sample #	Unit	Iron	Copper	Iron	Copper
1	0	0	0	0	0
2	0	0	0	0	0
3	0	0	0	0	0
4	0	0	0	0	0
5	0	0	0	0	0
6	0	0	0	0	0
7	0	0	0	0	0
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73	0	0	0	0	0
74	0	0	0	0	0
75	0	0	0	0	0
76	0	0	0	0	0
77	0	0	0	0	0
78	0	0	0	0	0
79	0	0	0	0	0
80	0	0	0	0	0
81	0	0	0	0	0
82	0	0	0	0	0
83	0	0	0	0	0
84	0	0	0	0	0
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86	0	0	0	0	0
87	0	0	0	0	0
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91	0	0	0	0	0
92	0	0	0	0	0
93	0	0	0	0	0
94	0	0	0	0	0
95	0	0	0	0	0
96	0	0	0	0	0
97	0	0	0	0	0
98	0	0	0	0	0
99	0	0	0	0	0
100	0	0	0	0	0

Reducing Emissions

By using Diesel as the Baseline

- Using B5, reduces emissions 3.1%
- Using B20, reduces emissions 12.4%
- Using RD50, reduces emissions 31.5%
- Using RD99, reduces emissions 62.3%



So, What Does it Take to Reduce One (1) Metric Tons of Emissions?

Let's take a Scenario of:

- Class 2-6 vehicle, diesel engine
- Annual utilization 14,000 miles per year
- Estimated useful life cycle is 10 years
- Average Diesel Fuel Cost \$ 3.80 a gallon



Base Unit A gets 15.2 MPG

- Uses 921 gallons annually, or 9,210 gallons over the anticipated 10-year life cycle
- At \$3.80 a gallon, the annual fuel cost \$3,500, or \$35,000 (10-years)
- The annual CO² Emissions will be 12.48 M/tons, or 124.78 M/tons (10-years)

Hybrid Option / that gets 25% better MPG

- The Hybrid Option cost \$18,000 more
- Uses 737 gallons annually (19 MPG)
- Annual fuel cost \$2,800 (\$3.80 gallon)
- Annual emissions will be 9.68 M/tons
- The annual cost to reduce to reduce one (1) M/ton of CO² emissions

\$ 440.78

Using R99 (Renewable Diesel)

- Uses 921 gallons annually (15.2 MPG)
- Annual Fuel Cost \$4,053 (\$4.40 gallon)
- Annual emissions will be 4.71 M/tons
- The annual cost to reduce to reduce one (1) M/ton of CO² emissions

\$ 71.10

When it comes to reducing Fossil fuel and CO² Emissions, what is the Best Bang for your Buck?

- We need to change our mindset on what's the best value on meeting our fossil fuel and emissions reductions.
 - We don't think twice about purchasing a vehicle that cost \$18,000 more.
 - But when it comes to using available alternative fuels, we bock at spending a nickel.
- More than ever, we need to look at what does it cost to reduce one (1) M/ton on CO² Emissions.
- Alternative Fuels can be the best bank for our overall reductions when it comes to obtaining your goals.



EWEB's Summary – YTD 2023

	Carbon Intensity Value of the Fuel being Used	CO ² Emissions Metric/tons	Fossil Fuel (gallons)	Alternative Fuel (gallons)	Average Cost Per Gallon	2023 Fuel Cost
This is our baseline to measure fuel cost and emissions						
99,963	Gasoline related fuels (E10)	25.3201 lbCO ₂ e/gge	1,148.08	89,967	9,996	\$ 3.3345 \$ 333,326.62
89,570	Diesel related fuels (B5)	28.9423 lbCO ₂ e/dge	1,175.88	85,092	4,479	\$ 3.2949 \$ 295,124.19
189,533	Total (gallons)		2,323.95	175,058	14,475	\$ 3.3158 \$ 628,450.82

Gasoline Related Fuels

10,533	E10 Ethanol Blended Gasoline	25.3201 lbCO ₂ e/gge	120.97	9,480	1,053	\$ 3.3345 \$ 35,122.29
48,376	E20 Ethanol Blended Gasoline	23.6002 lbCO ₂ e/gge	517.86	38,701	9,675	\$ 3.3063 \$ 159,945.57
41,054	E85 Ethanol Blended Gasoline	15.4208 lbCO ₂ e/gge	287.16	6,158	34,896	\$ 3.1227 \$ 128,199.33
99,963	Gallons		925.99	54,339	45,624	\$ 323,267.18

Diesel Related Fuels

796	B5 Bio-Diesel	28.9423 lbCO ₂ e/dge	10.45	756	40	\$ 3.2949 \$ 2,622.74
-	B20 Bio-Diesel	26.1676 lbCO ₂ e/dge	0.00	-	-	\$ 3.3034 \$ -
88,774	R99 Renewable Diesel	11.2626 lbCO ₂ e/dge	453.51	888	87,886	\$ 3.4464 \$ 305,950.71
89,570	Gallons		463.96	1,644	87,926	\$ 308,573.45
189,533	Total Gallons		1,389.96	55,983	133,550	\$ 3.3337 \$ 631,840.64

933.99 Reduction in metric/tons of CO² Emissions

40.2% Percent of reduction in CO² Emissions

62.8% Percent of Alternative Fuel use

\$ 3,389.82 Difference in YTD cost to use various blends of alternative fuels

\$ 0.0179 Difference in cost per gallon to use various blends of alternative fuels

0.54% Increase/(Decrease) of cost to use alternative blend fuels on percentage

\$ 3.63 Cost associated to reducing one (1) Metric/ton of CO² Emissions

What Else am I Missing ?

As a drop-In biofuel Renewable diesel behaves exactly like fossil diesel –

- Can be used straight or blended
- No need for infrastructure change
- It meets the ASTM-D975 and CARB standards for Diesel Fuel
- Very stable – it can be stored over long periods of time with no deterioration in quality
- Year-around performance, various grades can be produced to reach cloud points $-34\text{ }^{\circ}\text{C}$ (-29°F)

More environmental benefits -

- Feedstock flexibility from various sources
- 100% renewable and sustainable
- Smaller environmental footprint
- Easy to use
- Lower operating costs than other alternative fuels
- Less regeneration cycles
- No blending limit
- Odorless



Clean Fuels
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SUSTAINABLE
FLEET
TECHNOLOGY

WEBINAR SERIES 2023

USING BIODIESEL & RENEWABLE DIESEL TO MEET CARBON REDUCTION GOALS

Jennifer Weaver

OEM Market Development Manager

December 13, 2023

THE TIME VALUE OF CARBON

The Time Value of Carbon is key,
and the next decade is critical.

When evaluating emission reduction strategies, there are 2 essential elements to consider: the **amount** of the reduction, and **when** it happens.

- Carbon emissions are persistent and accumulate
- Increased levels of carbon dioxide (CO₂) in the atmosphere contribute to global warming now, and for decades to come
- A reduction in CO₂ emissions now can avoid decades of associated heating, thus having significantly more value than carbon reductions made later

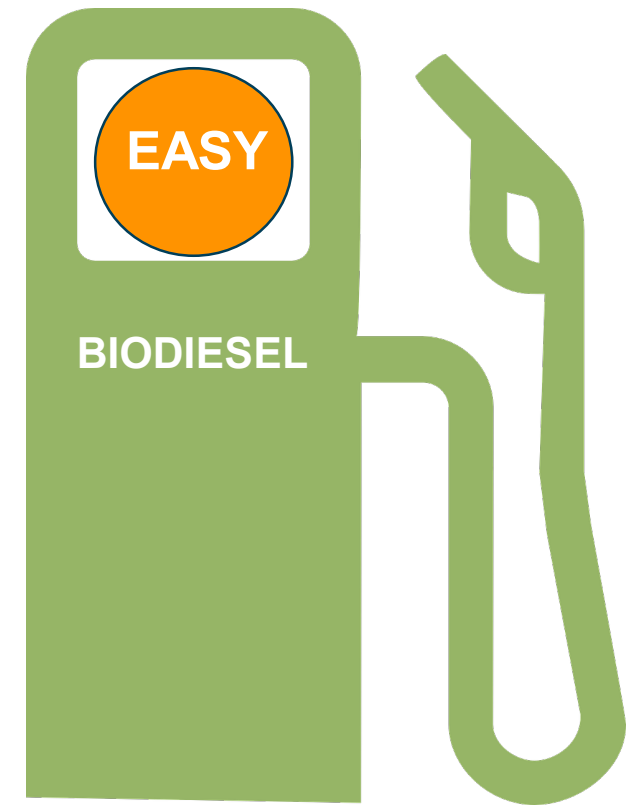




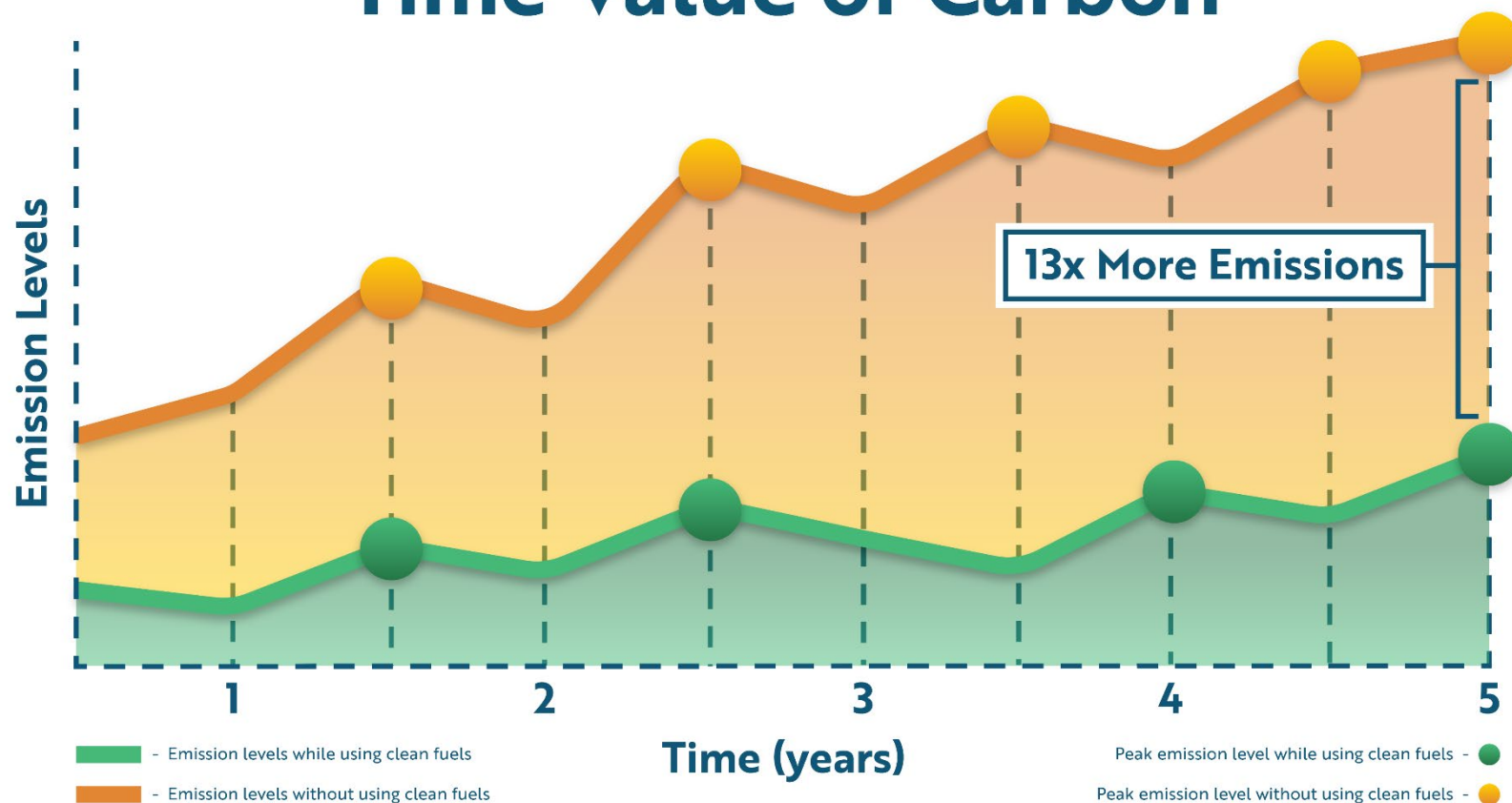
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DECARBONIZATION DOESN'T HAVE TO BE DAUNTING... ADVANCED BIOFUELS ARE HERE TODAY

- OEMs and Fleets are taking a fresh look at biodiesel and renewable diesel as **better, cleaner, advanced biofuels that are available now** for use in their existing diesel engines, allowing them to make immediate reductions in their carbon emissions, easily and affordably
- EPA defines **Advanced Biofuels** as renewable fuels that have **lifecycle greenhouse gas emissions** that are at least **50 percent less** than baseline lifecycle greenhouse gas emissions from diesel fuel
- **B100 reduces GHG emissions by more than 70%** on average compared to ULSD



Time Value of Carbon



For every 5 years' delay, we will have to reduce emissions 13x more to have the same climate impact.

Reducing CO₂ emissions now can avoid decades, even centuries, of associated heating.



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BIODIESEL + RENEWABLE DIESEL

Better Together



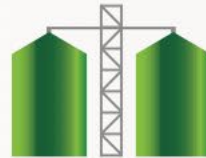
BIODIESEL & RENEWABLE DIESEL

are low-carbon diesel-replacement fuels produced from renewable feedstocks such as used cooking oil, animal fats, inedible corn oil, soybean oil and canola oil.



BIODIESEL IS...

Produced through esterification or transesterification, a simple process that reacts a fat or oil with a small amount of alcohol (typically methanol) to produce a finished fuel.



A "drop-in" fuel that can be used in all engines and equipment up to 20% and many up to 100%.



Non-toxic, biodegradable, ultra-low sulfur and 0% aromatics.



Better for engines due to higher cetane and improved lubricity.



Made to meet the requirements of ASTM D975 (B5), D7467 (B6-B20), and D6751 (B100).



RENEWABLE DIESEL IS...

Produced through hydrotreating, a process similar to a traditional refinery operation. This high-heat, high-pressure process produces a fuel that is chemically indistinguishable from conventional diesel.

A "drop-in" fuel that can be used in all engines and equipment up to 100%.

Ultra-low sulfur and 0% aromatics.

Better for engines due to higher cetane.

Made to meet the requirements of ASTM D975 (all blends).



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EMISSIONS REDUCTION BENEFITS OF BD + RD



THE BEST FUEL IS...

A combination of biodiesel and renewable diesel produces a cost-effective full replacement option for petroleum diesel. As a paired fuel, biodiesel and renewable diesel optimize petroleum displacement and cost, as well as particulate matter, carbon and nitrogen oxide reductions.



Up to 79% less carbon emissions.



Up to 79% less carbon emissions.

29% particulate matter reduction.



56% particulate matter reduction.

39% fewer aromatic compounds.



53% fewer aromatic compounds.

23% less carbon monoxide.



30% less carbon monoxide.

9% NOx reduction.



6% NOx reduction.



ABOUT BIODIESEL AND RENEWABLE DIESEL

Made from plant-based oils, used cooking oils, and animal fats

Clean-burning ultra-low carbon

Can be used in any diesel engine without modification

Commercially available nationwide

Today's solution for heavy-duty trucking, emergency vehicles, bus fleets, and farm equipment

Sources: Impact of biodiesel and renewable diesel on emissions of regulated pollutants and greenhouse gases on a 2000 heavy duty diesel truck, California Air Resources Board, 2015; Effects of biodiesel blends on emissions, National Renewable Energy Laboratory, 2006.



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MAJOR DIESEL FUEL INDUSTRY CHANGES

- Carbon reduction is now driving the market
- B20 is simply not enough for many policy targets and corporate ESG goals

Industry Is Telling Us:

- B20 minimum in On/Off road Engines, moving toward B30/B50/B100
- B50/B100 in Home Heating Oil
- Marine Fuels Want B50/B100
- Railroads Want Over B20
- Interest in Low Carbon Electrical Generation

- cleanfuels.org -



nytimes

Following



In a First, Nearly 200 Nations Agree to Move Away From Fossil Fuels

For the first time since nations began meeting three decades ago to confront climate change, diplomats at COP28 on Wednesday approved a milestone plan to ramp up renewable energy and transition away from coal, oil and gas.

Dec. 13, 2023



OEM BIODIESEL SUPPORT



- Biodiesel is registered as a legal fuel and fuel additive at any concentration
- The vast majority of new diesel engines in the on-road and off-road markets now have full OEM support for B20 or higher biodiesel blends meeting ASTM standards (ASTM D6751 / ASTM D7467)
- Many OEMs also recommend that biodiesel be sourced from a BQ-9000 certified supplier
- See Toolkit at www.cleanfuels.org for a summary of OEM Support Positions on Biodiesel and Renewable Diesel

CONFIDENCE IN HIGHER BIODIESEL BLENDS

- Increasingly stringent ASTM specs and robust BQ-9000 quality program have led to extremely high-quality biodiesel today and eliminated issues formerly attributed to B20
- Today's biodiesel has ultra-low metals, high oxidation reserve (stability), very low minor components (No.1-B low metals grade)
- Tips for Success:
 - Require ASTM grade fuels
 - Buy from high quality BQ-9000 Certified suppliers
 - Be proactive with cold flow management in winter months or use Optimus system



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FLEETS ARE MOVING BEYOND B20

Forward-looking fleets are using higher biodiesel blends to maximize the reduction in their carbon footprint using their new and existing diesel vehicles



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QUESTIONS?

Jennifer Weaver

OEM Market Development Manager

For Clean Fuels Alliance America

E: Jennifer_Weaver@me.com

T: (734) 904-3822

www.CleanFuels.org

www.CleanFuelsConference.org



CleanFuelsConference.org

FORT WORTH, TEXAS 2024

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CONFERENCE



F E B R U A R Y 5 - 8





City of Raleigh

Vehicle Fleet Services

Carbon Reduction Goals Webinar

December 13, 2023



Who is Vehicle Fleet Services?

- We provide high quality, cost-effective fleet and fuel management services for all City vehicles and motorized, through the highest standards of safety & equipment efficiency for over 4,600 assets.
- Promote an environmentally friendly and reliable fleet, with the emphasis of transitioning the fleet to electrification.
- We are a division within the Engineering Services Department. We have 78 full time positions that consists of technicians, service writers, parts staff, supervisors/managers, fiscal/accounting staff, and more!





Vehicle Fleet Services Sites



Central Operations
Facility



Northeast Remote
Operations
Facility (NEROF)

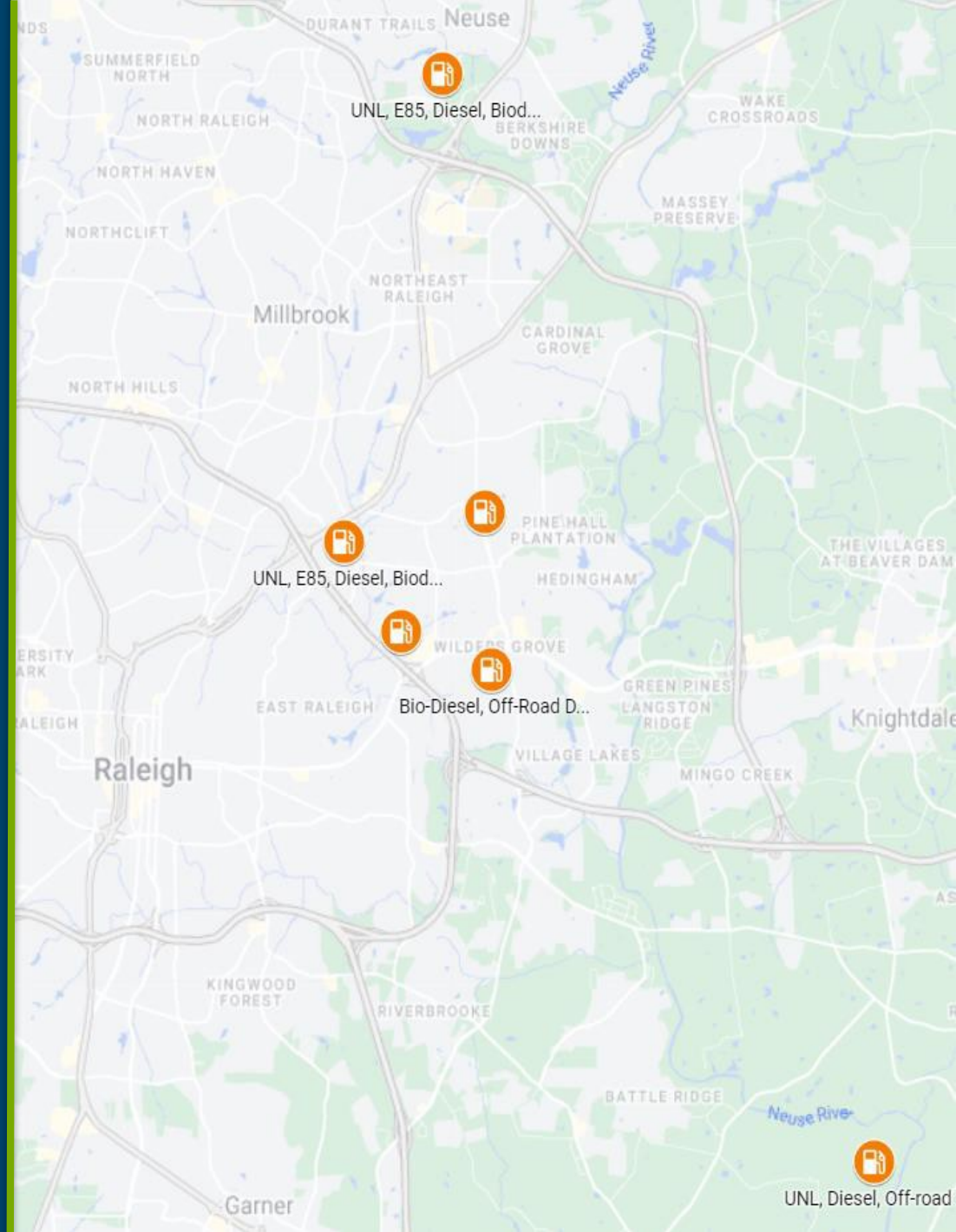


Heavy Equipment
Shop



Fuel Sites

VFS maintains all 7 of the City's fuel sites that consist of gasoline, diesel, bi-fuel fuel, E85, propane, CNG and propane.





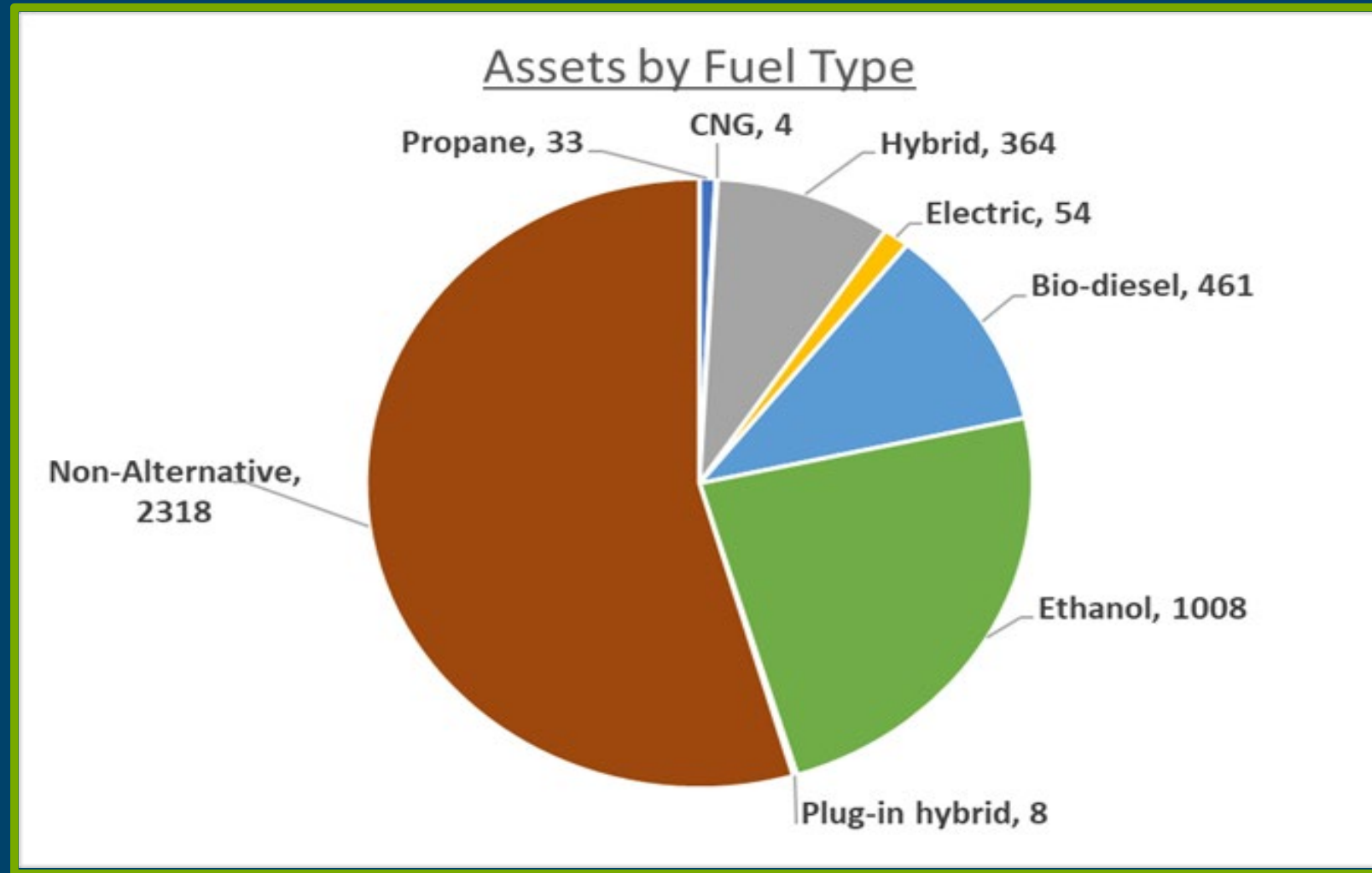
Fuel Sites and Goals

Raleigh aims to reduce greenhouse gas emissions by 80% by 2050

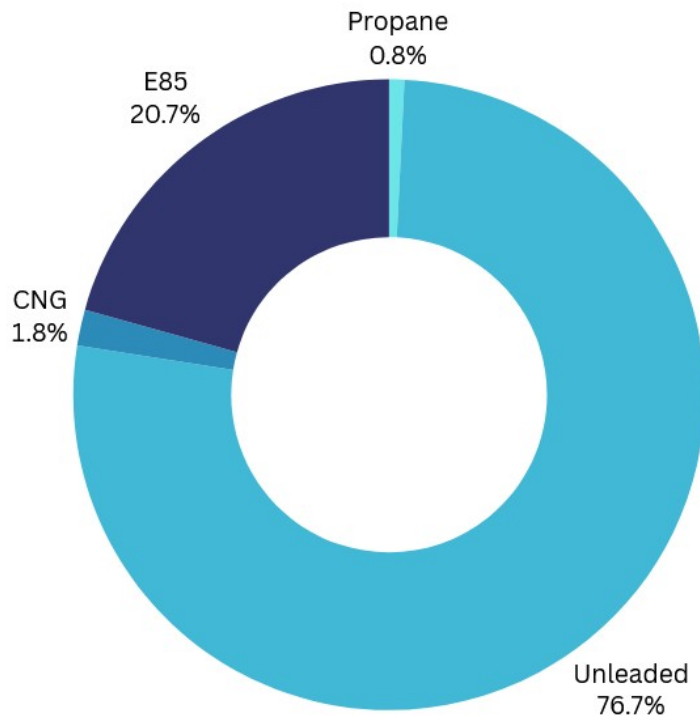




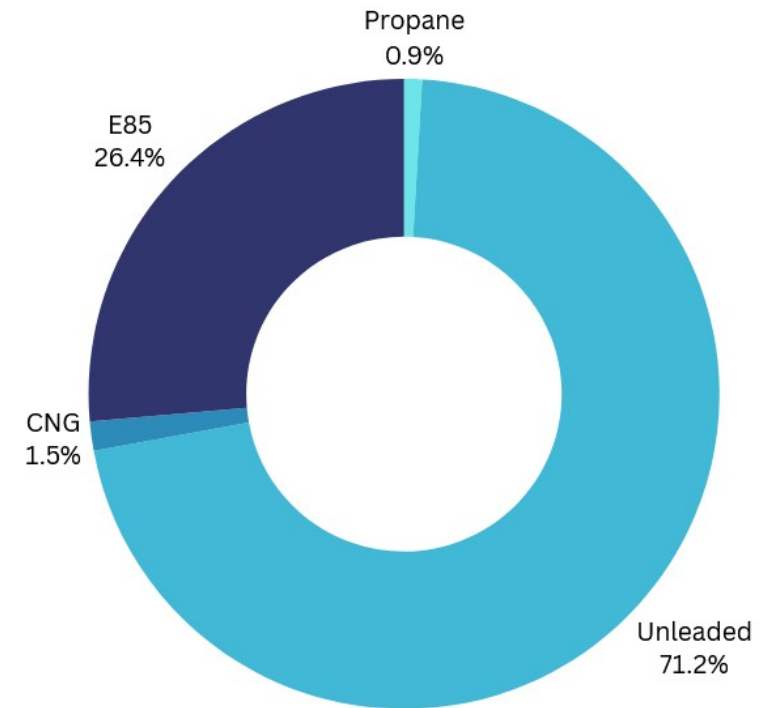
Assets by Fuel Type



Alternative Fuel Usage (2019)

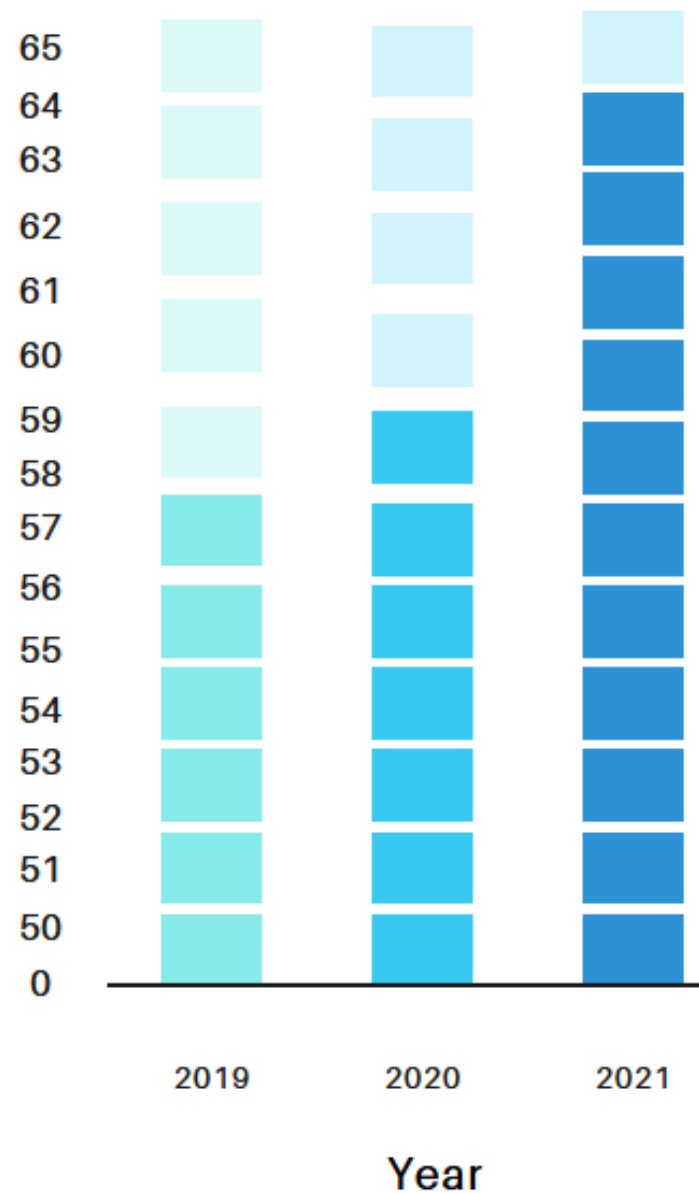


Alternative Fuel Usage (2021)





Metric tons reduced compared to regular unleaded fuel







In **2019**, the COR replaced just over **10,000 lbs.** or **31.7628 metric tons of CO2** in our fleet use via the use of **propane over unleaded gasoline**. For perspective.

That is the equivalency of:

- Charging 3,863,711 smart phones
- Powering 6.2 homes for one year
- Driving 79,470 miles in an average gasoline powered vehicle
- Saving 3,000 gallons of oil use

It also equivalents to carbon sequestered by:

- 525 tree seedlings grown for 10 years.
- 37.9 acres of U.S. in one year

In 2021, we increased our propane usage by 12% (37 metric tons of CO2)

- Charge an additional 515,424 phones, totaling 4,379,135 phones charged.
- Enough electricity to now power 8 homes, nearly 2 additional homes.
- 92,288 miles driven by an average gasoline powered vehicle.
- Saving 3,700 gallons of oil use

It also equivalents to carbon sequestered by:

- 595 tree seedlings grown for 10 years.
- 42.9 acres of U.S Forest in one year



Propane
Fuel Tank

Propane Tank Installation





Grants that we are pursuing

- VW Settlement Grants
- CFAT Funding Clean Fuel Alternative Transportation
- ARPA Funding
- Energy Efficiency and Conservation Block Grant
- Federal Highway Grant Funds
- US Federal Highway Grant
- NEVI National Electric Vehicle Infrastructure
- DERA Diesel Emission Reduction Act



Raleigh

City of Raleigh was named the **#1 Large and Overall, #1 Fleet** in the Nation out of 38,000 government fleets in Northern America.





Thank you~



Rick Longobart



Rick.longobart@raleighnc.gov

rick@longobart-ross.com



Cell: 919 903-6106

Cell: 949 943-0334

Renewable Gasoline

- A.K.A. green gasoline or drop-in gasoline
- Chemically identical to petroleum gasoline and meets ASTM D4814
- Drop-in no modification or special measures for vehicles or infrastructure
- Variety of feedstocks using a biological, thermal & chemical process
- California Energy Commission states that it can reduce carbon dioxide emissions by 61% to 83% depending on the feedstock
- Chevron road-trip April 2023: renewable gasoline blend (>50%) can reduce lifecycle CO₂ emissions by more than 40% compared to traditional gasoline
- Sources/Producers: gevo, Chevron, ExxonMobile, Novozymes

<https://www.energy.ca.gov/programs-and-topics/programs/clean-transportation-program/clean-transportation-funding-areas-2-2>
<https://www.chevron.com/newsroom/2023/q2/renewable-gasoline-blend-hits-the-road>





Sessions through December 13, 2023



Durham Convention Center August 13-15, 2024 Summer

<https://www.sustainablefleetexpo.com/>

