National Transportation in
Indian Country Conference

The Path to Zero Emissions & the Cost Reductions Along the Way

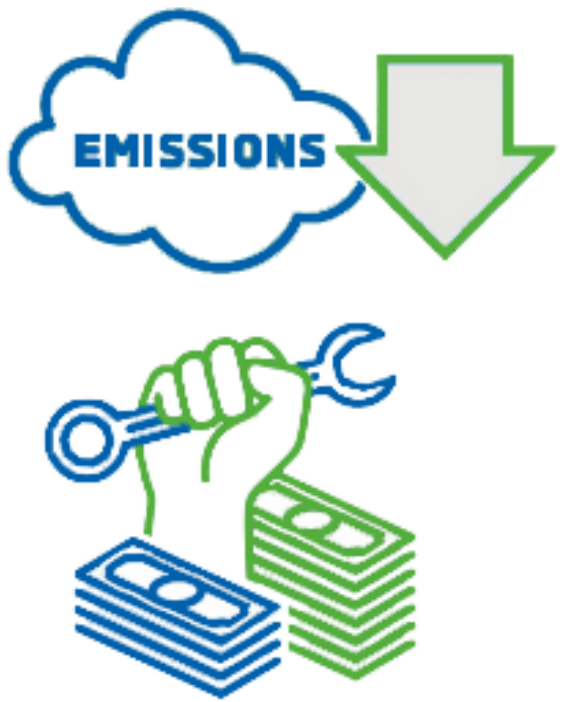
August 23, 2022

Agenda:

- Steve Whaley - Propane Education & Research Council
- Monte McLeod – Thompson Gas
- Jill Drury – Charlevoix County Public Transit

Successful Alternative Energy Adoption

What Makes an Alternative Energy Adoption Successful?

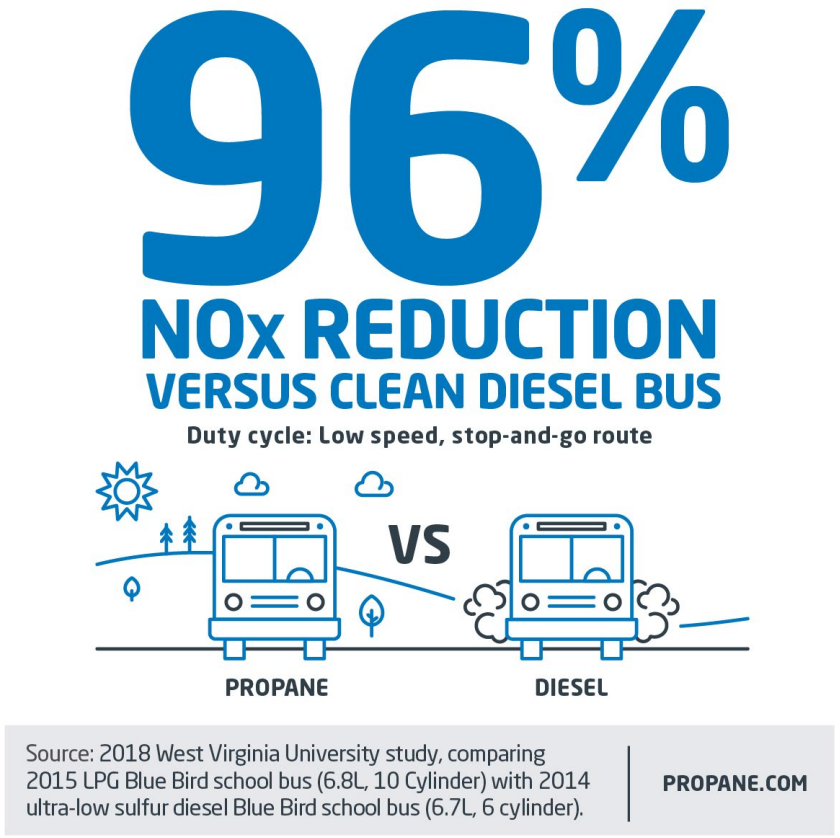


- Reduced emissions without increasing cost or losing efficiency.
- TCO reduction or ROI realized before the end of the lifecycle.
- Similar (or better) performance than the original fuel without compromising range.
- High-volume supply of energy domestically sourced.

Path to Zero Emissions

Path to Zero Emissions

- Particulate Matter
  - Virtually zero
- NOX
  - 96% reduction from best in class diesel
  - Certifying to .02, operating at 0.01, full duty cycle
- GHG
  - Newest technologies have 25% reduction



Propane Autogas Transit Fleets

arch Council

Shuttle Buses

WHAT IS PROPANE?

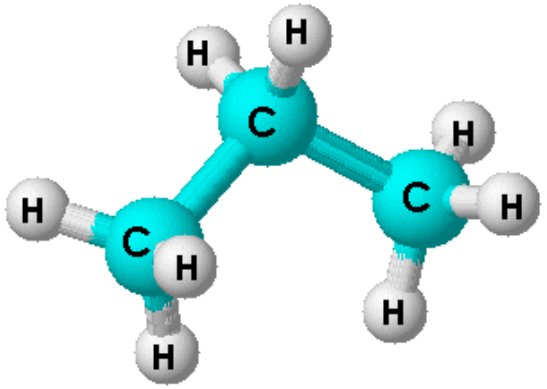
- Affordable, Clean, American-Made Fuel
  - C3H8
  - Byproduct of natural gas processing.
  - 100% Domestic
  - Commonly used for space and water heating, cooking, and as engine fuel.

- Using Propane
  - 48 million Households
  - 900,000 Farms
  - 600,000 Forklifts
  - 25,000 Commercial Mowers

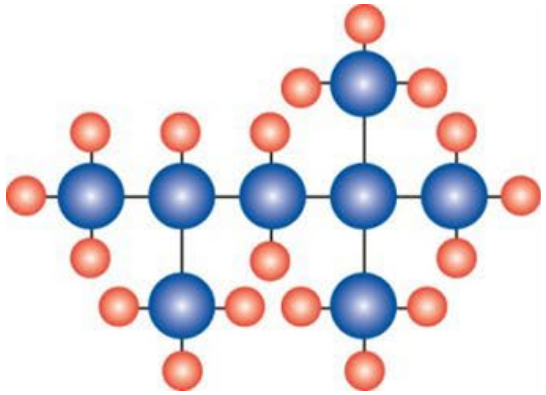
What is Propane?

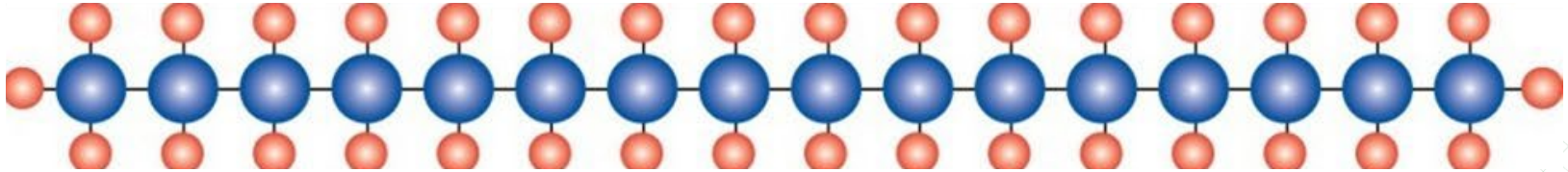
- Liquid state below minus 42 degrees Fahrenheit
- 100 PSI at 60-degree ambient temperature
- Heavier than air
  - No expensive ventilation systems needed for maintenance facilities

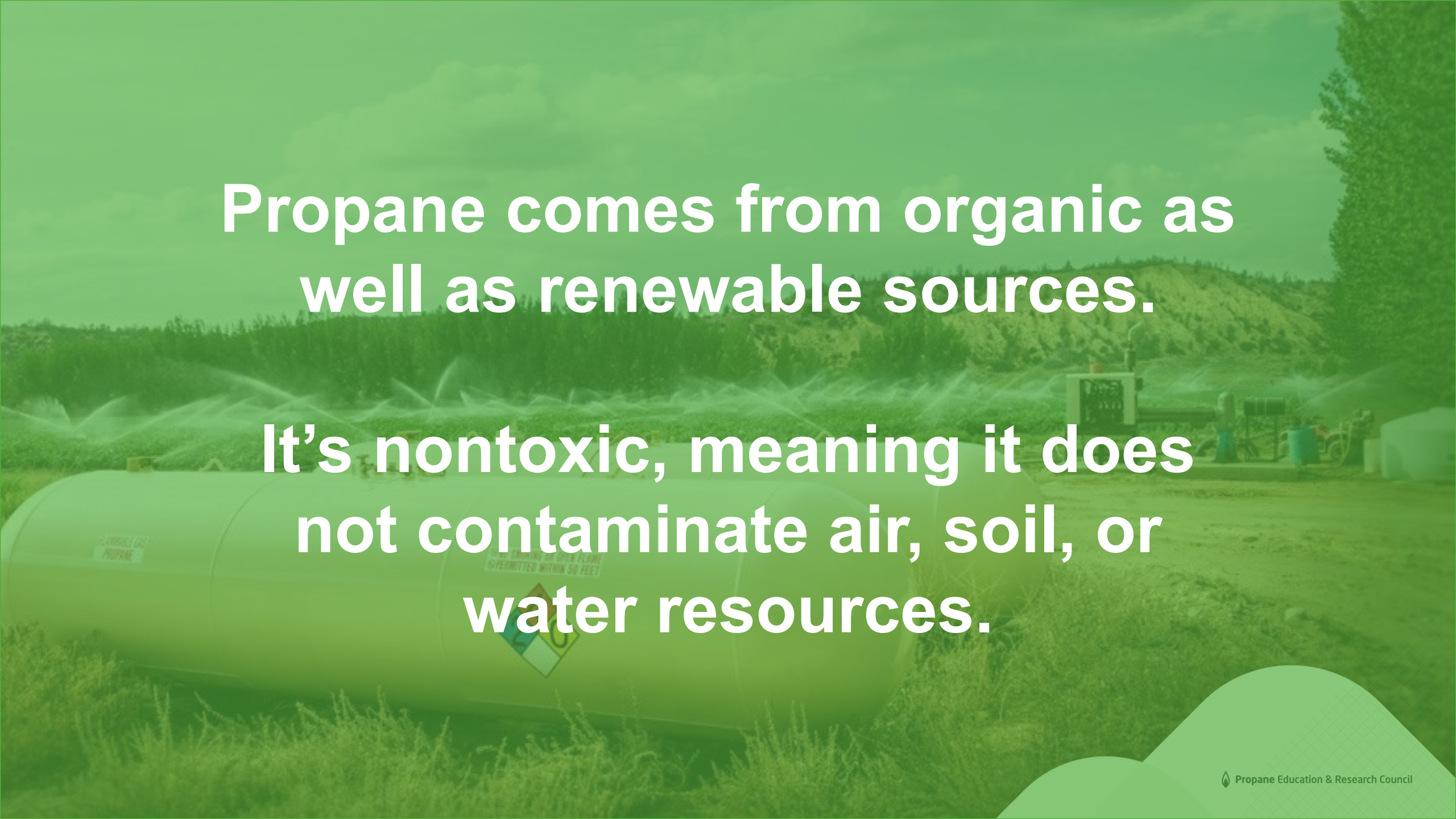
What is Propane?



Low Carbon – Hydrogen Rich Energy





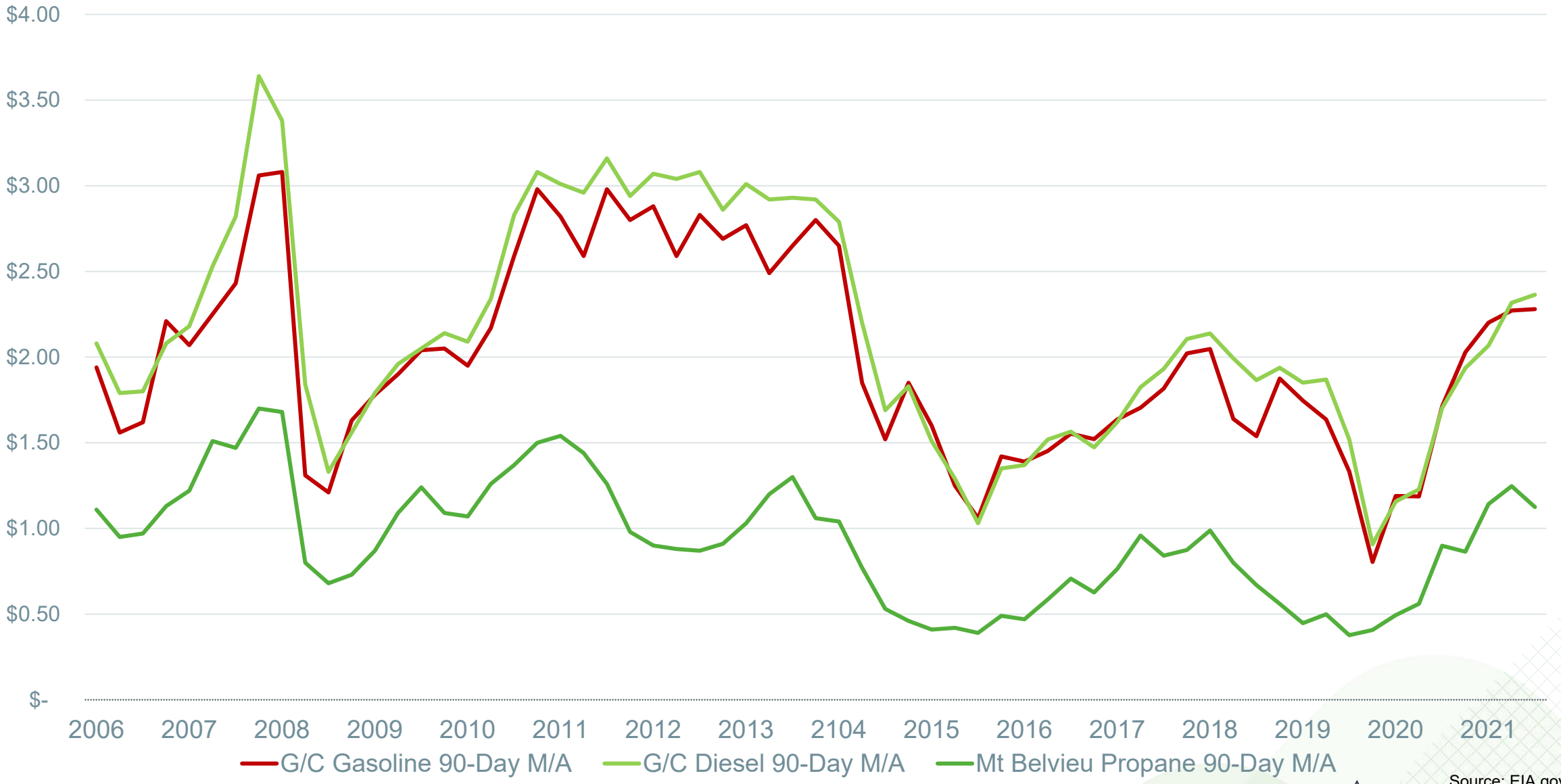


Propane comes from organic as well as renewable sources.

It’s nontoxic, meaning it does not contaminate air, soil, or water resources.

Fuel & Maintenance Cost Reductions

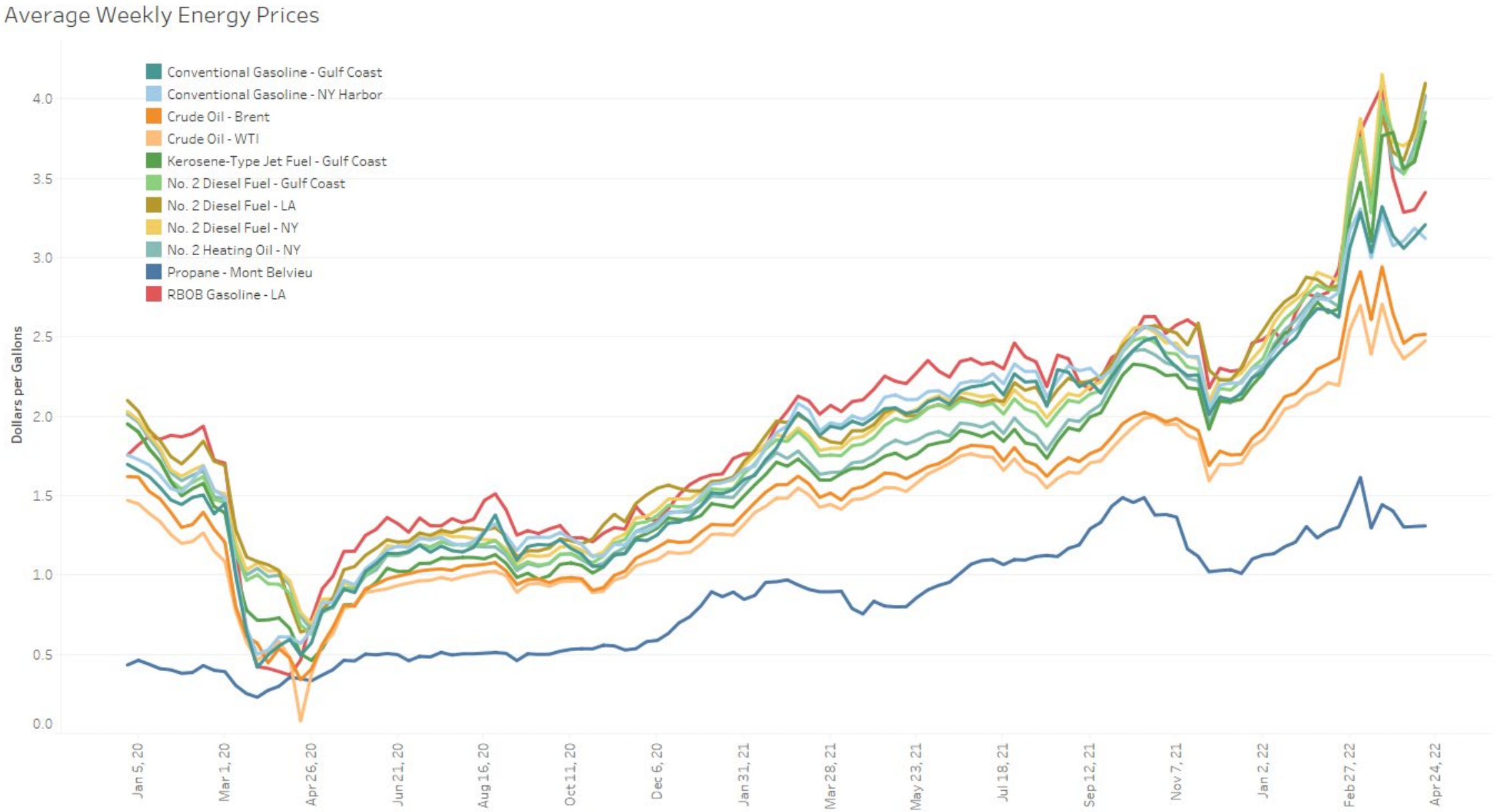
US ENERGY PRICE COMPARISON 2006-2021



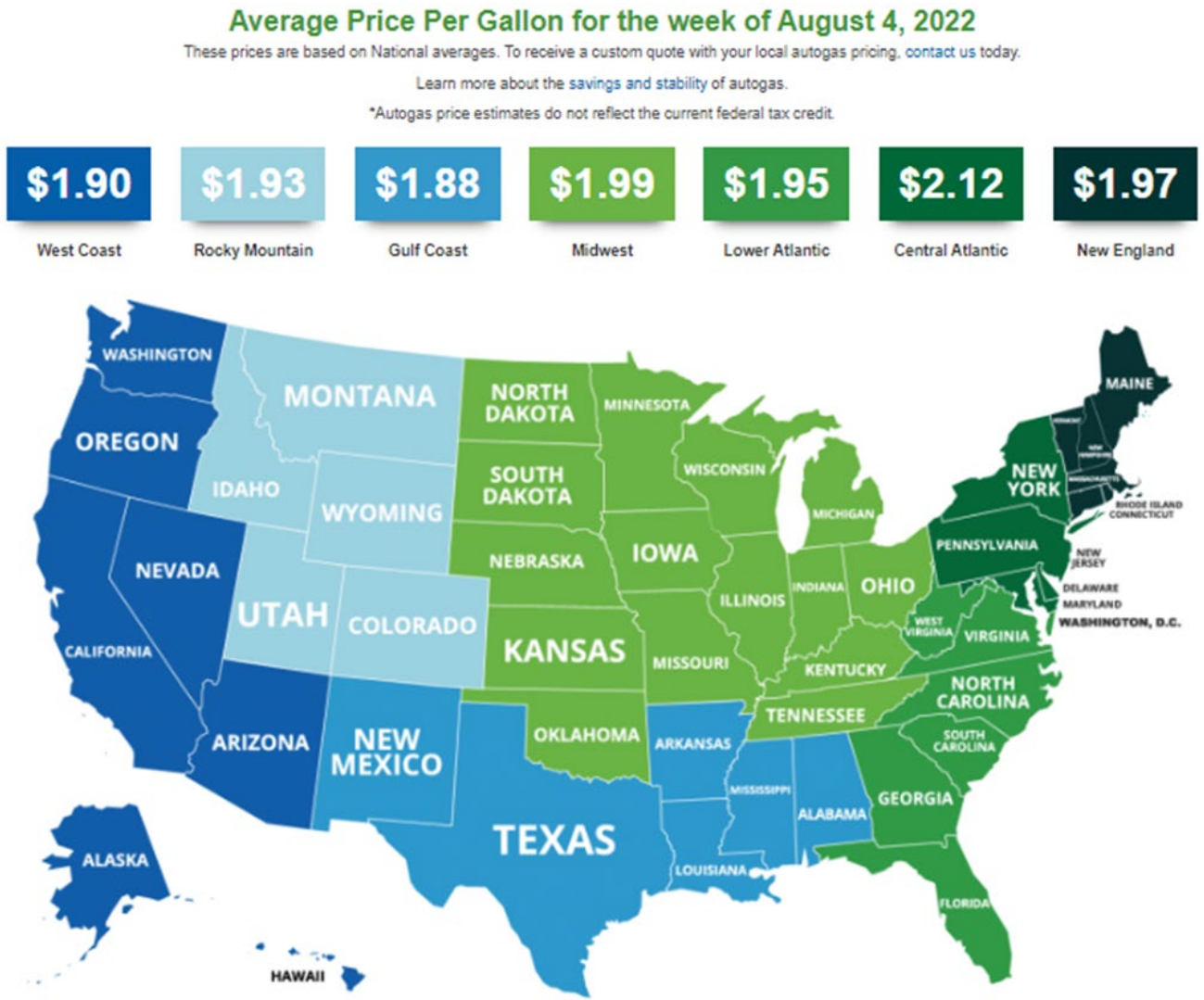
Source: EIA.gov

Propane Education & Research Council

US ENERGY PRICE COMPARISON

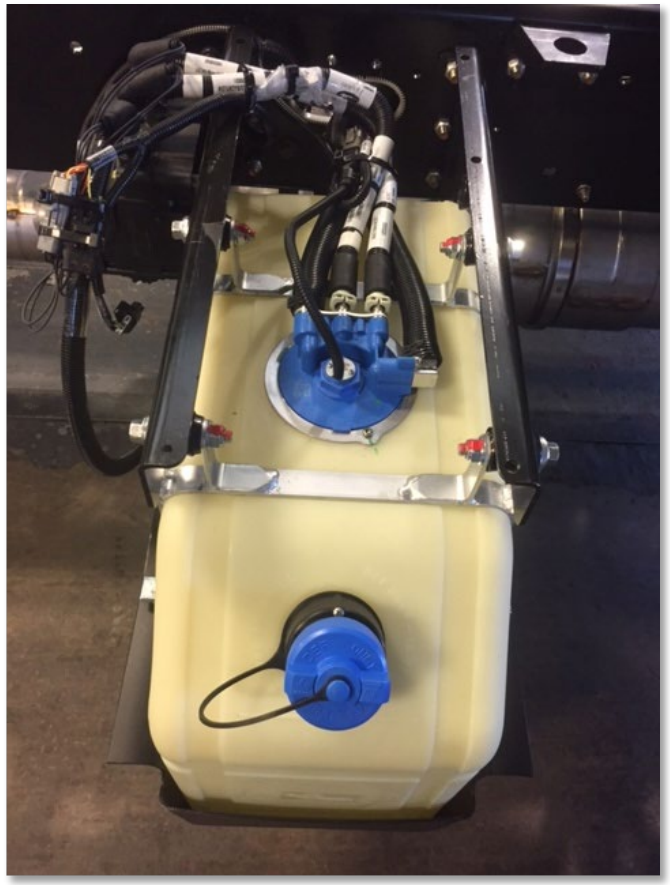


Today’s Propane Autogas

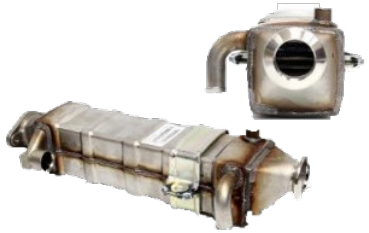


Not On A Propane Autogas Engine

- Propane eliminates the need for DEF and the possibility of putting the wrong fluid in a tank.



Not On A Propane Autogas Engine











The Future of Diesel:

THE NEW PHASE II INTEGRATED SYSTEM CONCEPT

HOW IT WORKS

- The integrated Rotary Turbine Control enables exhaust gases to bypass the turbine stage and enter the Close Coupled Unit after the gas has been injected with urea by the new Cummins UL4 injector.
- When combined with the Single Module™ chassis mounted aftertreatment, the concept integrated System has the potential to improve emissions, particularly for cold start and urban driving operations.

Combining Engineering Expertise to Help Customers Address Future Emissions Control Standards

2010

Figure 1. EPA 2010 aftertreatment system layout.

.2 NOx

2024

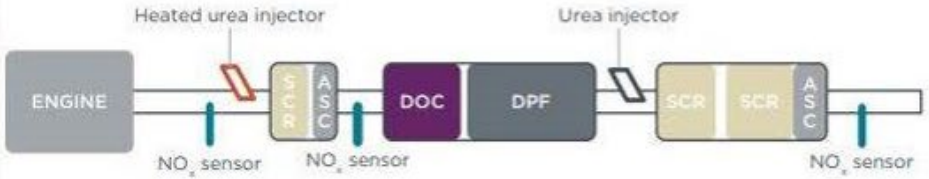


Figure 3. Potential aftertreatment configuration (No. 2) of a CARB 2024 compliant system.

.05 NOx

1

2027

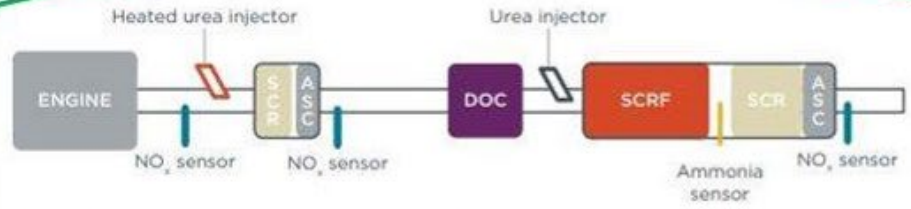


Figure 5. Aftertreatment configuration 2 to meet CARB 2027 standards under FTP and supplemental low-load cycle. Adapted from SwRI (Sharp, 2019).

.02 NOx

1

1

LPG Meets This Today

Source: "ESTIMATED COST OF DIESEL EMISSIONS-CONTROL TECHNOLOGY TO MEET FUTURE CALIFORNIA LOW NOX STANDARDS IN 2024 AND 2027" https://theicct.org/sites/default/files/publications/HDV-emissions-compliance-cost-may2020.pdf

Current Autogas Vehicle Offerings

OEM Propane Options

- Light & medium duty Ford trucks & vans, school bus.
- Factory Ford warranty maintained.
- No loss of HP / torque / towing capacity.
- Serviceable with existing diagnostic equipment.
- EPA & CARB Certified.

ROUSH® CLEANTECH

Ford F-53 / F-59

Ford E-350/450

Ford F-450/550

Ford F-650/750

Blue Bird Vision

Micro Bird G5

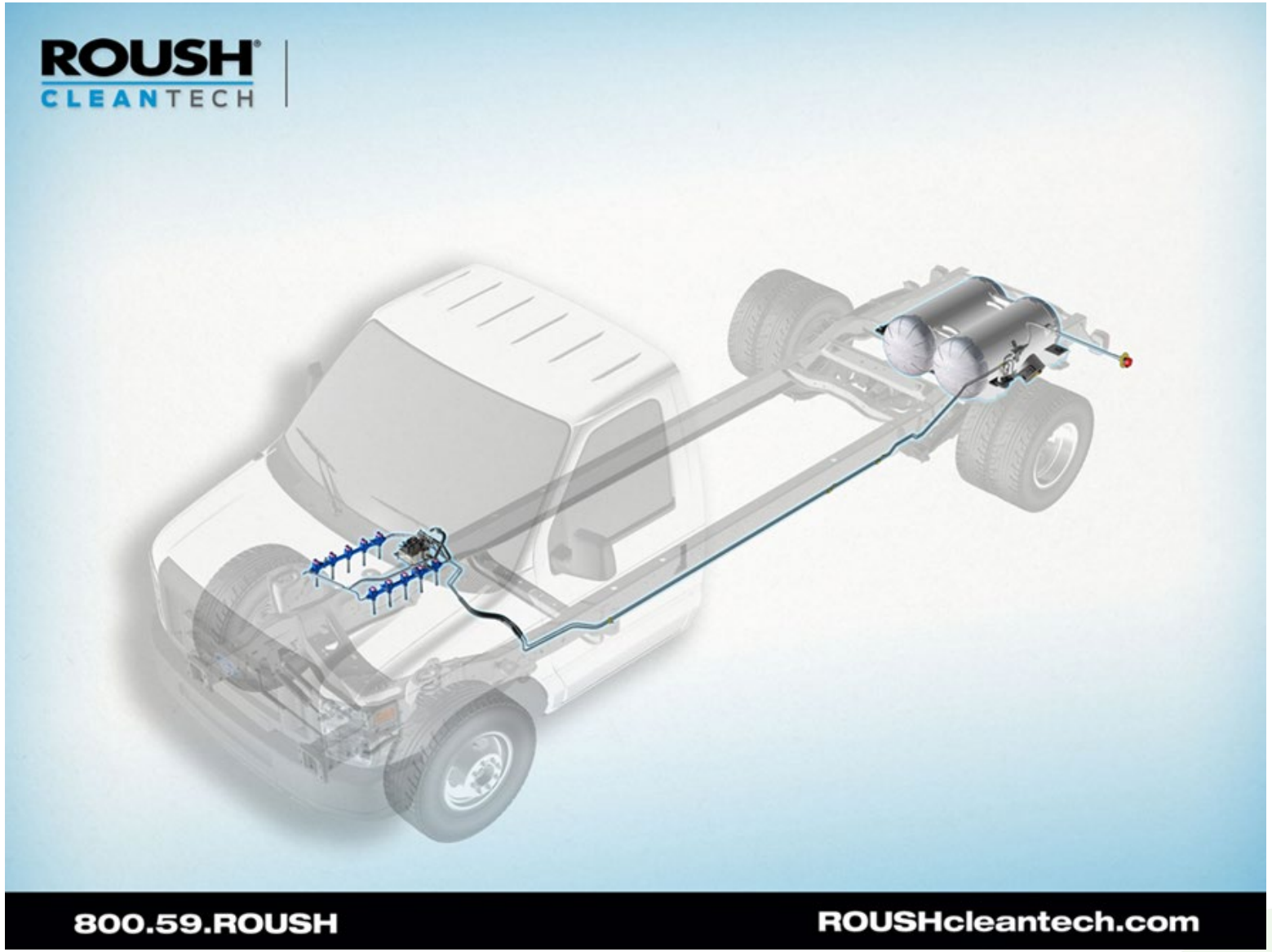
ROUSH CLEANTECH

Ford ROUSH 7.3L V8

Engine RPM	Power
Idle: 680 / Max: 4,050	HP: 350 / Torque: 468 ft-lbs. @ 3,900 RPM
Design	**Compression**
90° V8 / 445 CI / Pushrod 2V	10.5 to 1

7.3

Small Vehicle Footprint



Alliance AutoGas
POWERED BY PROPANE

2021 Model Year Products

Ford

F150
- 3.3 PFDI
- 5.0 PFDI
- 2.7/3.5 PFDI (SUMMER 20)

F250-F350
- 6.2 PFI

F450-F750
- 7.3 PFI (2021 MY)

E450
- 6.2 PFI
- 7.3 PFI (2021 MY)

TRANSIT
- 3.5 PFDI
- 3.5 ECOBOOST (FALL 20)

EXPLORER
- 3.3 PFDI

GM

SILVERADO 1500
- 5.3 DI

SILVERADO 2500/3500
- 6.6 DI

EXPRESS/SAVANA
- 6.0 PFI

FCA

FIAT CHRYSLER AUTOMOBILES

DURANGO
- 5.7 PFI

CHARGER
- 3.6 PFI

RAM
- 5.7 PFI
- 3.6 PFI (SUMMER 20)


SCHOOL BUS
SCHOOL BUS
R415
STOP

SNAPSHOT OF PROPANE AUTOGAS SCHOOL BUS MARKET

1,250,000

STUDENTS TRANSPORTED

DAILY

14

STATES WITH

500+ BUSES

1,000

DISTRICTS & CONTRACTORS

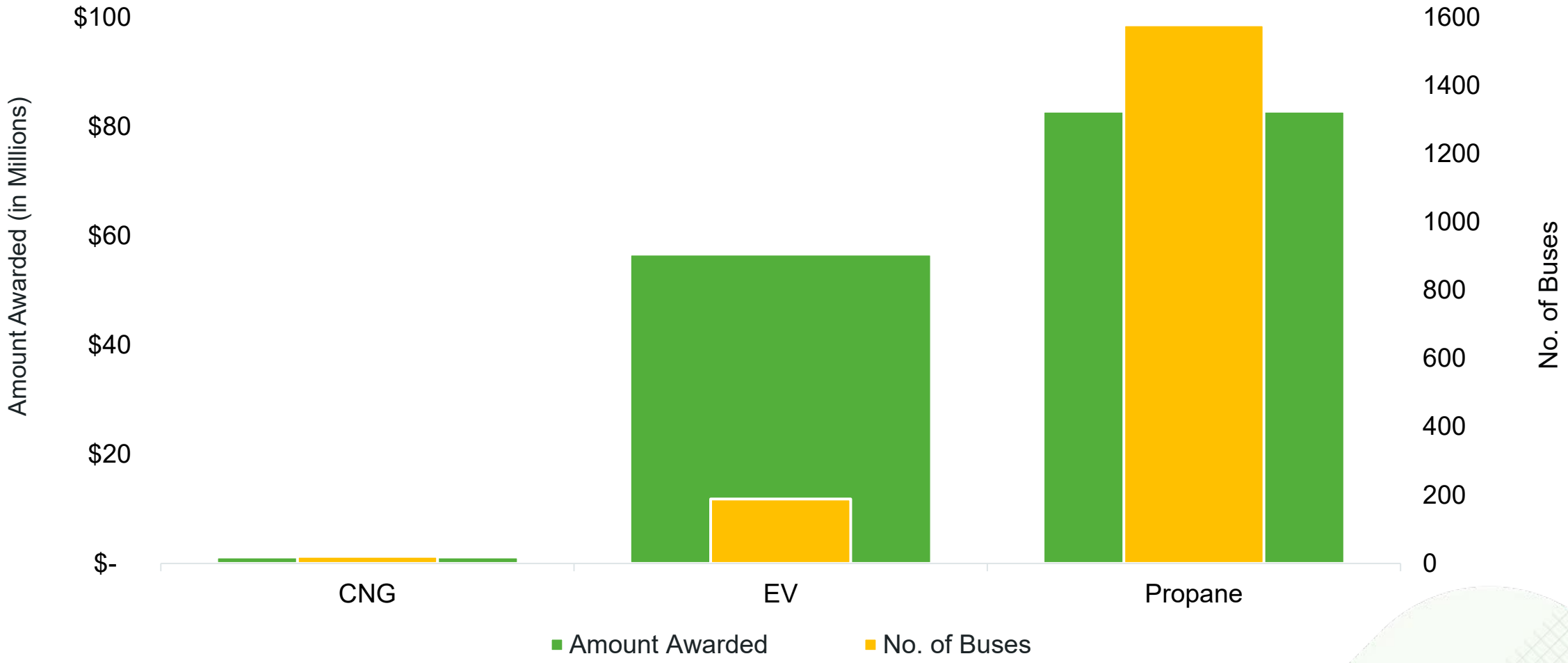
OPERATE PROPANE AUTOGAS BUSES

22,000+

PROPANE AUTOGAS BUSES

ON THE ROAD

VW: School Bus Funding & No. of Buses Through July 31, 2021



Source: Propane Education & Research Council

High Growth Vehicle Markets

Propane Education & Research Council

EMERGING MARKETS

Parcel/Package

- USPS has 92,000 routes for moving mail.
  - **Over 70,000 routes are performed by independent contractors.**
- There are approximately 10,000 class 6-7 straight box trucks operated by USPS contractors.
- Contractors bidding on USPS routes score higher with alternative fuel vehicles.
- 1,000 gallons/month average fuel consumption.

ENERGY FOR EVERYONE
propane

Propane Education & Research Council

EMERGING MARKETS

Food/Beverage

- Major companies have already validated propane autogas in this market.
  - ReadyRefresh by Nestlé Waters.
  - Schwan's Home Delivery.

ENERGY FOR EVERYONE
propane

Propane Education & Research Council

EMERGING MARKETS

Paratransit

- 51,000 paratransit vehicles nationwide.
- 600 gallons per month average fuel consumption.
- ADA requires every county in the U.S. to provide service.

ENERGY FOR EVERYONE
propane

Same Equipped 14 Passenger Shuttle Bus

Gasoline, 7.3L Engine	$71,569.00
Propane 7.3L Engine (300 mi)	$86,784.00
Electric 88kWh Battery (100 mi)	$233,603.00

Autogas Infrastructure


PROPANE EDUCATION & RESEARCH COUNCIL

Fueling Infrastructure – Mobile Refueling

Temporary Refueling Set-up

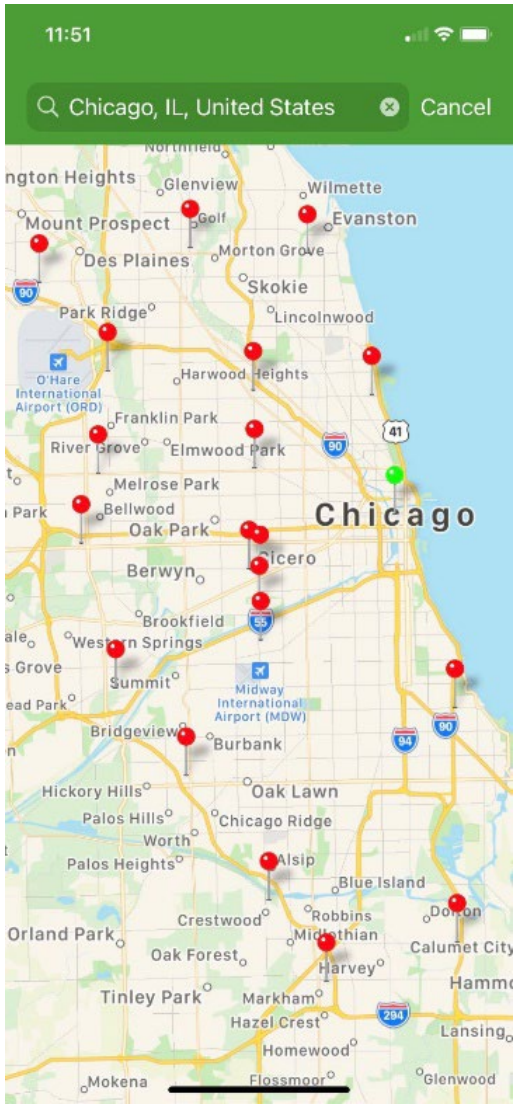
Standard Private Station

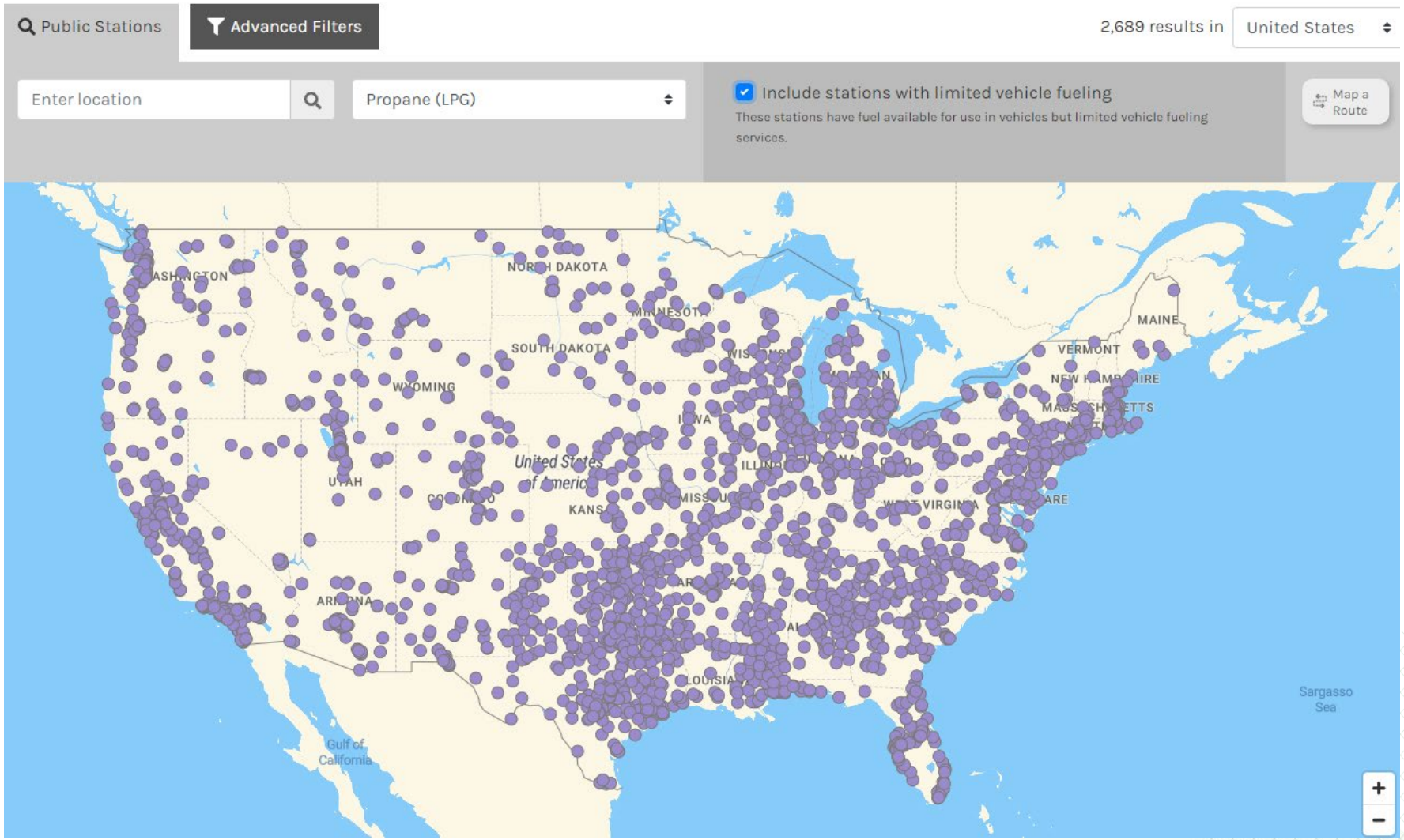
Standard Private Station

Fueling Infrastructure Cost for 10 Shuttles

- Propane = $40k
- CNG = $200k (ten fixed time fill hoses)
- Electric = $360k (ten fixed plug in lines)

Dept of Energy Alt Fuel Station Locator





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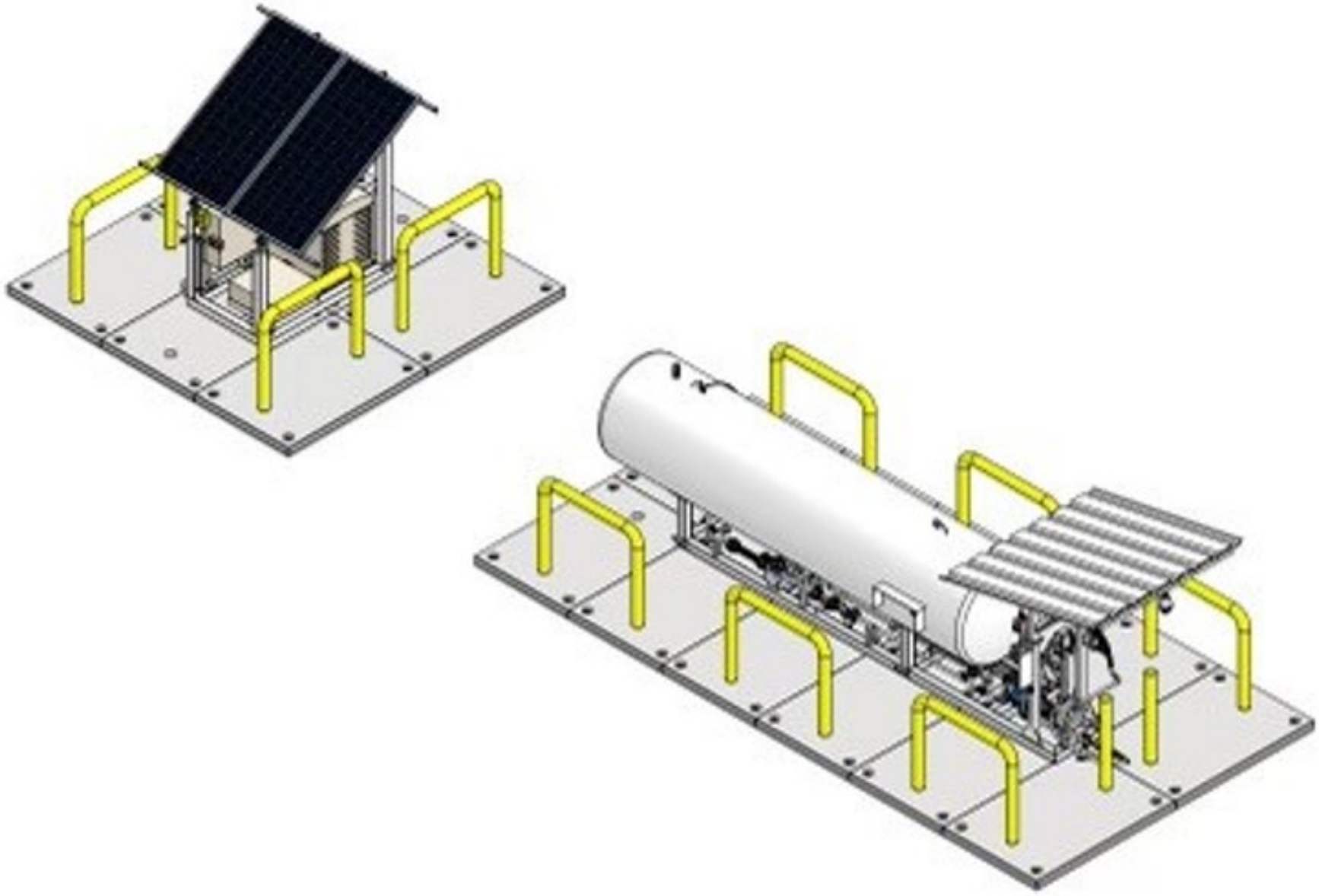
PROPANE
FUELING SOLUTIONS
propane




propane
PROPANE

Resiliency

Resiliency


CLEAN BURNING PROPANE
BROWARD COUNTY Transit
TOPS!


SCHOOL BUS
05/12/2016

Partners in Transit because every trip matters

2-time Recipient of the FTA Administrator's Award for Outstanding Public Service

Why Propane for paratransit?

48% price reduction

Control of fuel costs ✓
Control of fueling process ✓
Consistent with Strategic Planning ✓
Community awareness to Alternative fueling ✓

Kitsap Transit - Bremerton, WA

Dan Sirotzki – Environmental & Social Management Systems Coordinator

Kitsap Transit - Bremerton, WA

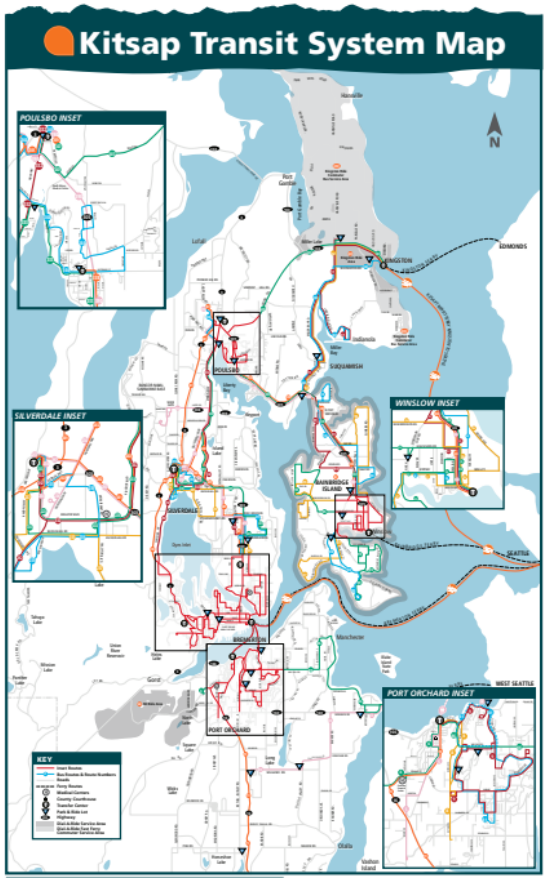
- 3.5 million riders each year
- Started adopting propane autogas 2015

- 47 propane autogas buses
  - 11 remaining diesel buses to be replaced with current order of propane buses

- Fuel Costs per mile
  - Diesel $.48/mile
  - Gasoline $.50/mile
  - Propane $.20/mile

- GHG Emissions for 8-hour route period
  - Diesel bus – 2.4 metric tons
  - Propane bus - .014 metric tons

Kitsap Transit - Bremerton, WA



Kitsap Transit
Connecting Communities

ST LOUIS COUNTY SCHOOLS

We are located in Northern Minnesota and encompass more than 4200 square miles. Our vehicles travel on mostly rural roads in adverse conditions.

OUR FLEET – 31 PROPANE BUSES

Route buses:

95% - Propane – Bluebird (started adopting propane in 2016)

3% - Diesel - International

2% - Gasoline - Microbird

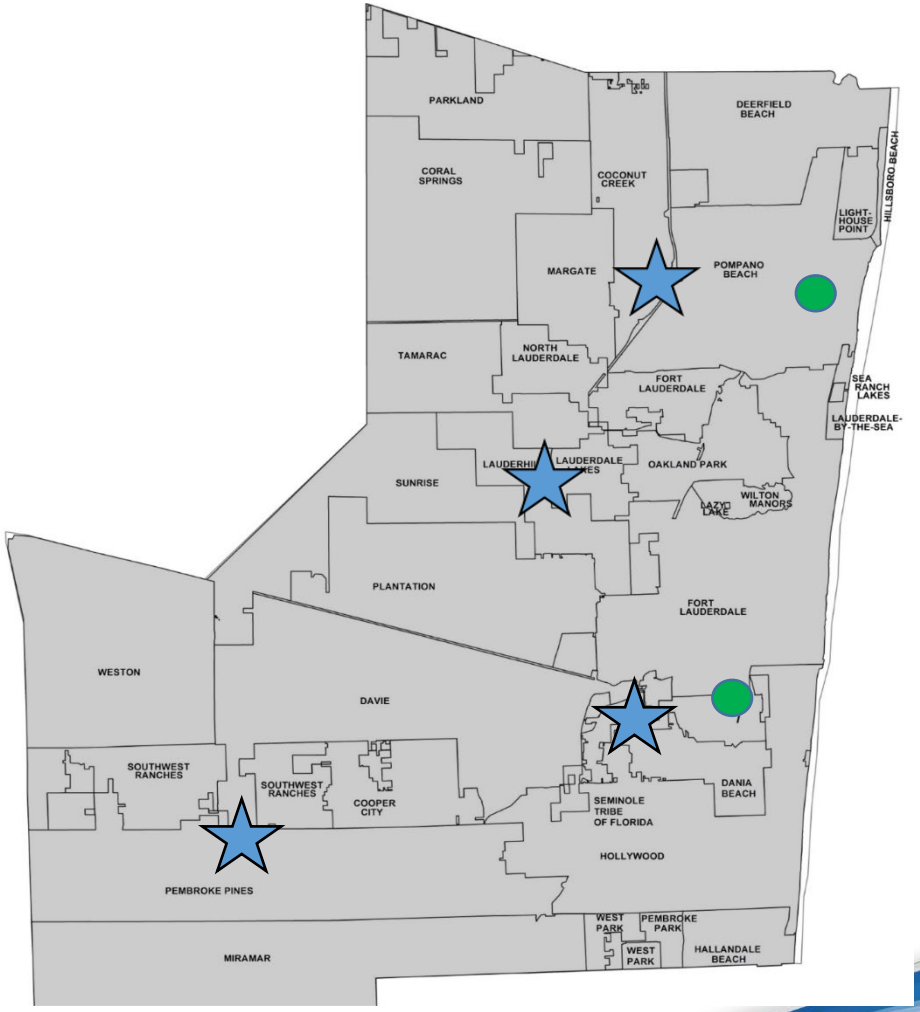
OUR FUELING

FUEL COST ANALYSIS

Propane		Diesel
Price per gallon	$1.52	$4.99 (can not negotiate price)

- ✓ Able to negotiate price per gallon each year
- ✓ Fueling station at the school site
- ✓ Most years – receive Federal Autogas credit (.36 per gallon)
- ✓ Savings in school year 2021-2022 - $150,000 (pumped 125,000 gallons) –calculated before tax credit
- ✓ Projected Autogas usage for 2022-2023 –137,000 gallons

Fueling Infrastructure



Broward County, FL
471 Sq. Miles

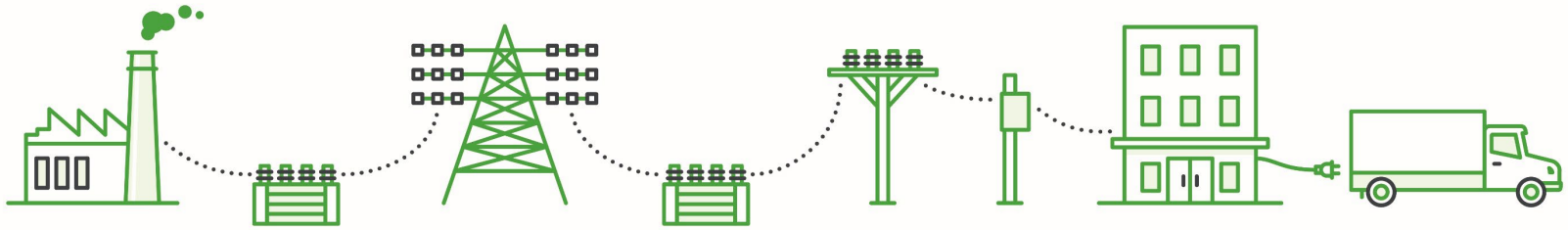
Budget impact

	Propane Gallons	Gasoline Equilalent (85%)	Savings
2015	1,226,048	1,042,141	
2016	1,415,286	1,202,993	
2017	1,474,924	1,253,685	
2018	1,571,064	1,335,404	
2019	1,516,090	1,288,677	
2020	681,890	579,607	
2021	609,929	518,440	
Total Gallons	8,495,231	7,220,946	-1,274,285
Total Cost	$10,888,760.98	$17,241,600.90	$6,352,839.92
Cost per Gallon	$1.28	$2.39	$1.11
Alteranative Fuel Tax Credit	($3,455,750.00)	0	($3,455,750.00)
Total Net Cost	$7,433,010.98	$17,241,600.90	$9,808,589.92
Net Cost per Gallon	$0.87	$2.39	$1.51

GHG LCA
Comparisons between Propane and Electric Medium Duty Vehicles

GHG FOOTPRINT OF ELECTRICITY

CONSIDER EVERY STEP OF THE PROCESS



1 EXTRACTION

Electricity is not naturally occurring, so it must be produced using other resources.

- Gas extraction
- Coal mining
- Nuclear fission
- Wind and solar component manufacturing
- Biomass cultivation and harvesting

approximately 9.9% CO_2 eq emissions

CARBON INTENSITY SCORE:

15.2 g/MJ

2 GENERATION

Power plant generates electricity.

Transformer steps up voltage for transmission.

approximately 75.6% CO_2 eq emissions

CARBON INTENSITY SCORE:

116.5 g/MJ

3 TRANSMISSION & DISTRIBUTION

The transmission lines carry electricity to transformers, which step down voltage. Electricity is delivered to the charging location.

approximately 4.5% CO_2 eq emissions

CARBON INTENSITY SCORE:

7 g/MJ

4 EV CHARGING

Losses occur from charging electric vehicle battery.

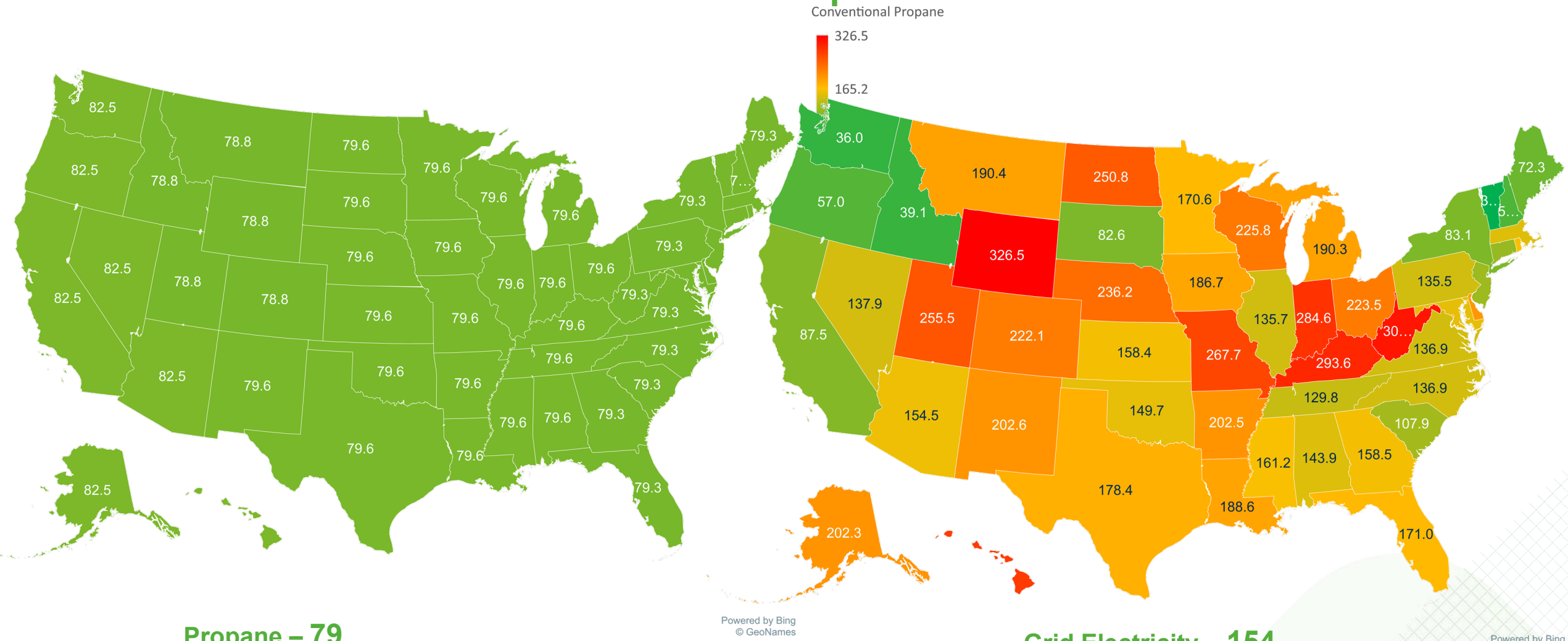
approximately 10% CO_2 eq emissions

CARBON INTENSITY SCORE:

15.4 g/MJ

TOTAL GHG INTENSITY = 154 g/MJ

Well-to-Wheels Carbon Intensity Comparisons of "Fuel" ($gCO2_{eq}/MJ$)

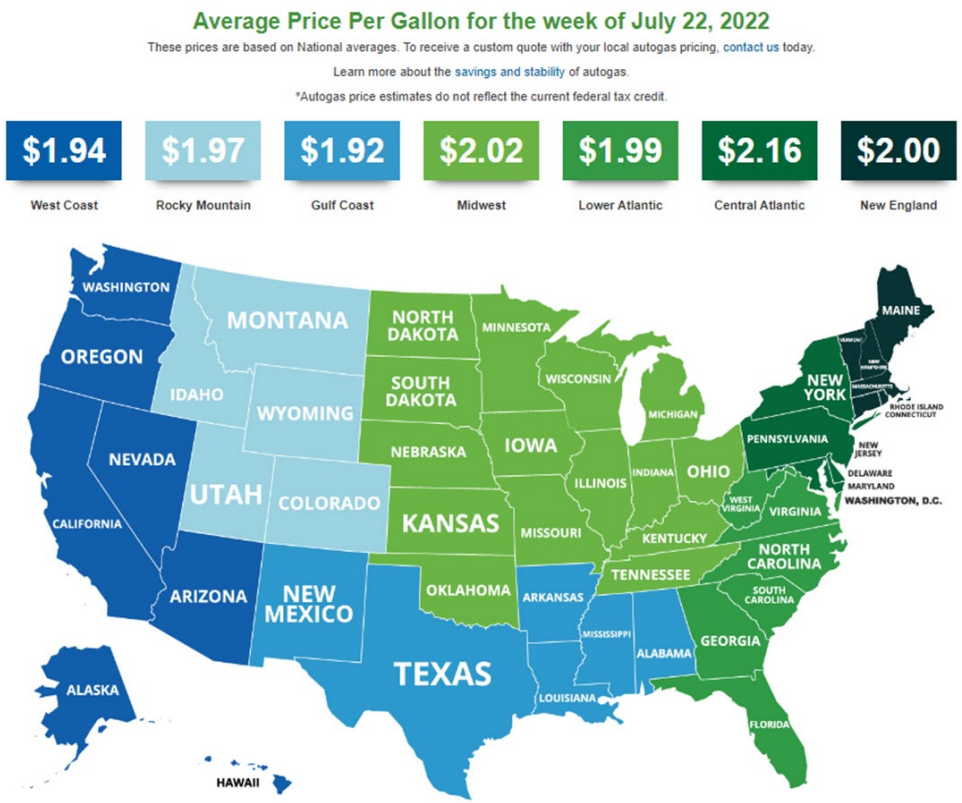


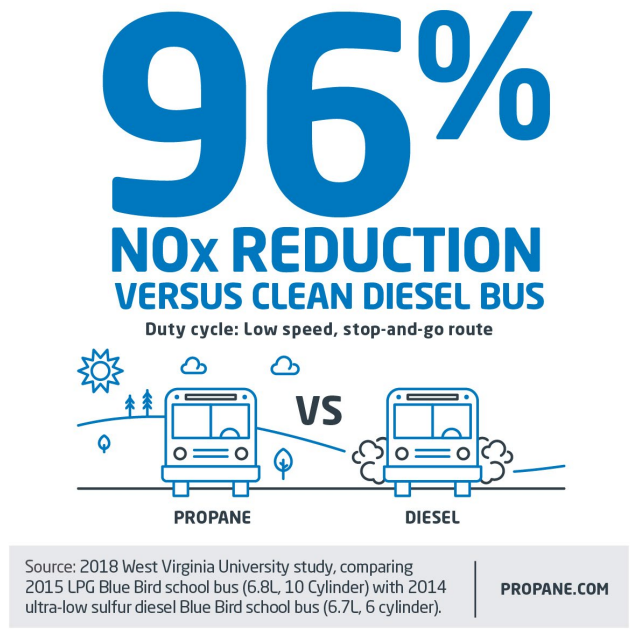
Propane – 79
(National Average)

Grid Electricity – 154
(National Average)

Propane Education & Research Council

Benefits of Propane/Renewable Propane

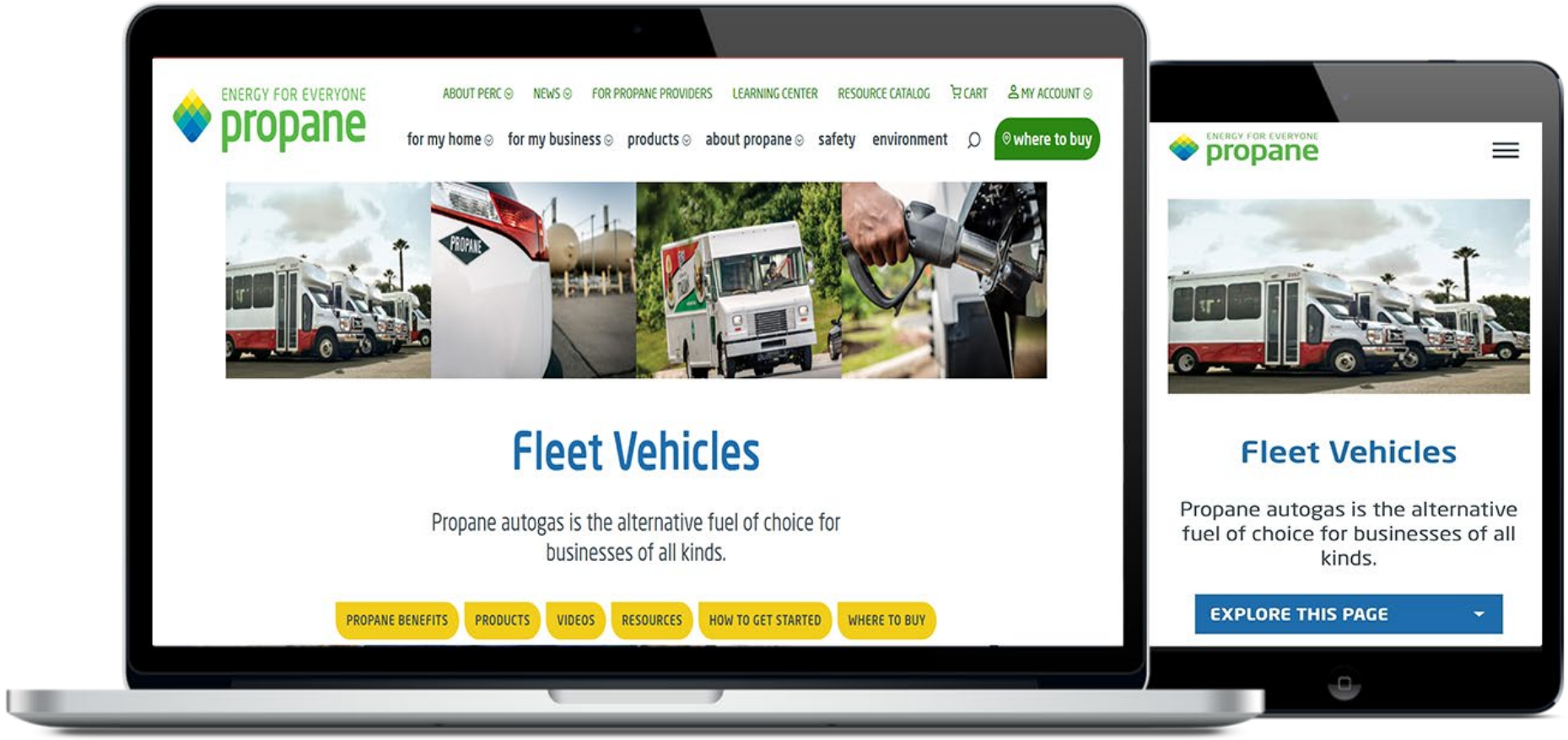




Benefits of Propane/Renewable Propane

- Cost Effectiveness
  - MD Propane averages 15% of vehicle cost
  - MD EV averages 200% of vehicle cost
- Payload/Range
  - MD Propane –no loss of payload/300+ miles in all weather
  - MD EV – heavy battery weight diminishes payload/100 miles weather dependent (no AC or heat)
- Emissions
  - MD Renewable Propane best blend produces less carbon in all states than EV's best grid in 2035
  - MD Propane including upstream NOx emissions = 0.44 g/mile (CA)
  - MD EV including upstream NOx emissions = 0.83 g/mile (CA)

www.propane.com/for-my-business/fleet-vehicles/



Thompson Autogas Program

- Conversion
- Infrastructure
- Supply
- Funding

Conversion

- The “right” vehicles
- Installation
  - Monofuel
  - Bi-Fuel
- Service
- Maintenance
- Training

Supply

- Storage
- Telemetry
- Pricing
- Contract

Infrastructure

- Permits
- Site Prep
- Training
- Maintenance
- Fuel Management

Infrastructure

- On Site
- Turn-Key contracting
- Scalable as fleet grows
- Meets all NFPA 58 and local codes
- Can use “off grid” Power Pack
- Fuel management
- Micron filtered

Funding

- Grants
- Rebates
- Financing
- Media/Marketing
- ROI

Safety

Autogas:

- Is less flammable than gasoline
- Nontoxic
- Burns cleaner – C3H8
- Dissipates into the air unlike liquid fuels
- Tanks are 3/16” steel and 20 times stronger than gasoline tanks
- Powers 30 million vehicles worldwide – 3rd most widely used vehicle fuel in the world

Monte McLeod
mmcleod@thompsongas.com
803-609-1172

About Charlevoix County Transit

- Countywide Public Transit
- Demand-Response Service
- Population: approx. 26,000
- Total Area 1,390 sq mi
  - Land 416 sq mi
  - Water 974 sq mi

22 Active Fleet Vehicles

- 6 Passenger Vans (2 gas, 4 bi-fuel)
- 2 MV-I Vans (gas)
- 14 Cutaway Buses (13 propane, 1 gas)

- 1 Cutaway Bus Ordered (propane)

77% of Charlevoix County Transit is Alternative Fuel

Why Alternative Fuels?

- Cost savings
- Decreased impact on the environment
- Move to a more domestic fuel
- Reduced maintenance costs
- Less wear and tear

The proof is in the numbers…

FY2021 Fleet
5 Gas, 4 Bi-Fuel & 13 Propane

297,167 miles driven

Fuel Type	Gallons Used	Total Cost
Gasoline	2,471	$7,683
Propane	47,693	$74,074
	TOTAL:	$81,757

Will apply for Alternative Fuel Tax Credit

Fleet is 77% Alternative Fuel Vehicles

$36,790 saved in fuel costs alone in FY2021!

What's Next for CCT?

- 1 Cutaway Bus Ordered
- Additional Improvements to Fueling Station Infrastructure
- Oil Sampling
- Additional Savings!

Charlevoix County TRANSIT

WE HAVE THE POWER TO MOVE PEOPLE.

COUNTY OF CHARLEVOIX EST. 1868 Ironton Ferry 1883

A MICHIGAN HISTORICAL SITE

STEVE WHALEY

DIRECTOR OF AUTOGAS BUSINESS DEVELOPMENT

PROPANE EDUCATION & RESEARCH COUNCIL

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