NC STATE UNIVERSITY

SUSTAINABLE FLEET TECHNOLOGY CONFERENCE & EXPO 2021

Session #2: Alternative and Renewable Fuels for MD/HD Fleet Decarbonization

September 14, 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
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Sessions September 09, 2021 – October 19, 2021

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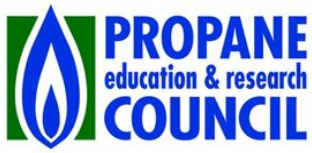
SFT Conference Series Upcoming Sessions

- 09/16: Natural Gas Transportation Applications and Success Stories
- 09/21: Working with your Utility and Understanding Fleet Charging Costs
- 09/23: Idle Reduction Simple and Impactful
- 09/30: Innovative Charging Solutions

2021 SFT Conference Series Sponsors

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Format

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

EVSE Planning & Best Practices for Today & the Future
September 09, 2021

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

2:05-2:25 **Jon Scharingson, REG**—Bio-Based Diesel: Today's Most Impactful Low Carbon Option

2:25-2:30 **Monte McLeod, Thompson Autogas**—Autogas as a Solution & Infrastucture Deployment

2:30-2:45 **Steve Whaley, PERC**—Propane's Role in Decarbonizing Transportation

2:45-3:00 **Michael Vittese, Clean Energy**—Renewable Natural Gas for Transportation

America's Best Kept Secret

3:00-3:15 **Chelsea Jenkins, Roush CleanTech**—Path to Electrification

3:15-3:30 **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

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STATE OF NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

Jon Scharingson
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- Executive Director of Sales & Marketing at Renewable Energy Group
- Oversees the company's marketing activities and responsible for business development within the sales organization
- Previous experience several senior management roles in business strategy, business development and marketing in the seeds, crop protection and the agriculture biotechnology industries with Imperial Chemical Industries, AstraZeneca and Syngenta
- BBA in Management and an MBA in Marketing from Iowa State University

REG RENEWABLE ENERGY GROUP

9/14/2021

Bio-Based Diesel: Today's Most Impactful Low Carbon Option

Jon Scharingson

Executive Director, Strategic Initiatives

REG RENEWABLE ENERGY GROUP

Safe Harbor Statement

This presentation contains certain forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995 as amended, including statements regarding: our expectations regarding our future financial condition and results of operations; future pricing and availability of inputs and products, including our sourcing thereof; the success of our strategic investments and/or partnerships, including our partnership with Manchester United our customer's continued usage of our products; estimated demand for petroleum distillates; developments regarding the COVID-19 pandemic and its impact on our markets; the strength of our business model; market demand for our products and related government actions and market forces that may affect demand; our production plans; improvements expected regarding our operations, outputs and costs; overall market conditions; changes in governmental programs, policymaking and requirements or encouraged use of biofuels, including Canada's Clean Fuel Standard, Washington's clean fuel standard and cap and trade, and the European Union's Fit for 55 package; our outlook for 2021 market forces; the success of our risk management program on minimizing economic volatility; our outlook for 32 2021 for gallons sold and Adjusted EBITDA and our outlook for full year 2021 gallons sold and produced.

These forward-looking statements are based on current expectations, estimates, assumptions and projections that are subject to change, and actual results may differ materially from the forward-looking statements. Factors that could cause actual results to differ materially include, but are not limited to: the ability to obtain the capital needed to complete the announced expansion project at our Geismar, Louisiana biorefinery; cost overruns and construction delays; the inability to obtain governmental permits and third party easements required or necessary to initiate or complete the expansion project; the impact of COVID-19 on our business and operations, financial performance, including revenues, cost of revenues and operating expenses; changes in governmental programs and policies requiring or encouraging the use of biofuels, including RFS2 on the federal level, and on the state level, programs such as California's Low Carbon Fuel Standard; availability of federal and state governmental tax incentives and incentives for biomass-based diesel production; changes in the spread between biomass-based diesel prices and feedstock costs; the availability, future price, and volatility of feedstocks; the availability, future price and volatility of petroleum and products derived from petroleum; risks associated with fire, explosions, leaks, weather related events and other natural disasters at our facilities; any disruption of operations at the Geismar renewable diesel refinery (which would have a disproportionately adverse effect on our profitability, including our proposed capacity expansion thereto); the effect of excess capacity in the biomass-based diesel industry and announced large plant expansions and potential co-processing of renewable diesel by petroleum refiners; unanticipated changes in the biomass-based diesel market; potential failure to comply with government regulations; competition in the markets in which we operate; technological advances or new methods of biomass-based diesel production or the development of energy alternatives to biomass-based diesel; our indebtedness and compliance, or failure to comply, with restrictive and financial covenants in our various debt agreements; risks associated with customer negotiations; the risk that measures intended to remediate weaknesses in internal controls will prove to be inadequate; the potential for our risk management program to fail to minimize volatility; and other risks and uncertainties described in our annual report Form 10-K for the year ended December 31, 2020 and subsequent periodic filings with the Securities and Exchange Commission.

All forward-looking statements are made as of the date of this presentation and REG does not undertake to update any forward-looking statements based on new developments or changes in our expectations.

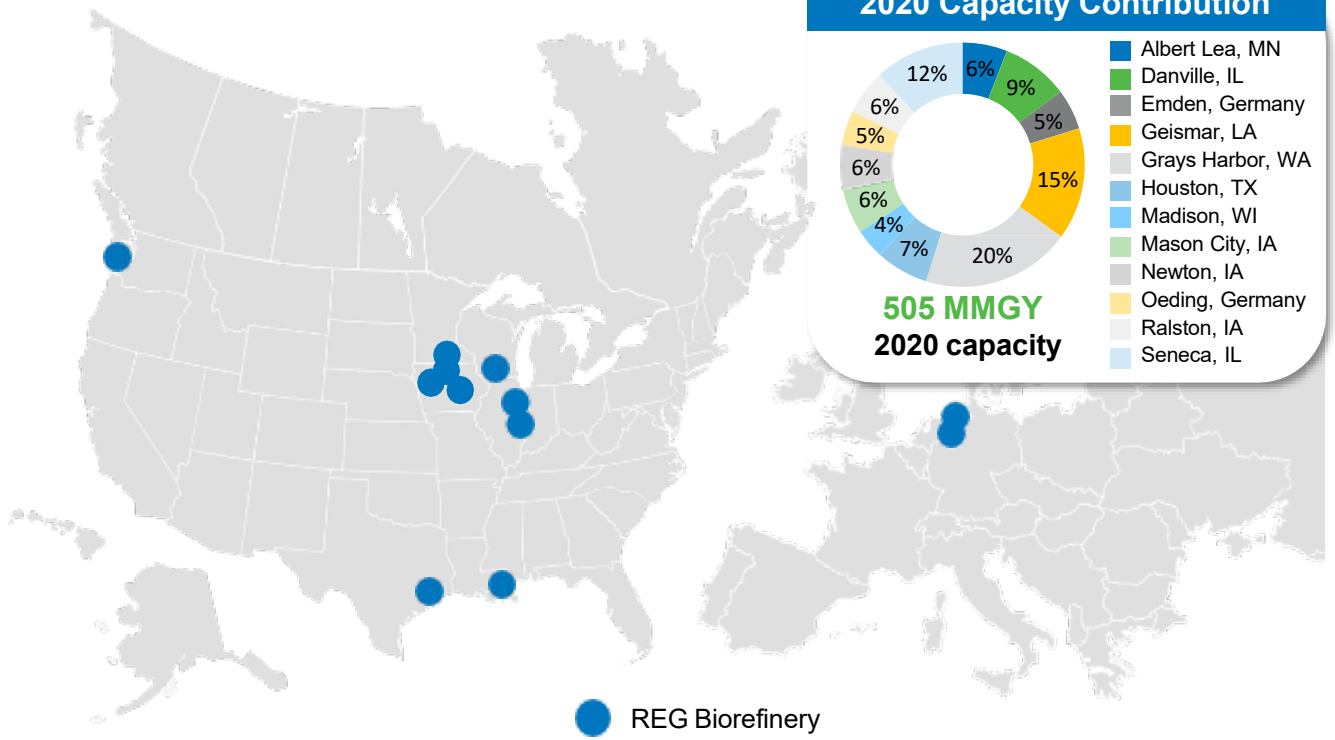
Agenda

- REG Introduction
- Carbon Reduction Timing
- Deciding How to Make a Difference
- Bio-Based Diesel in the Real World
- Technical Overview of Bio-Based Diesel

Diversified footprint of biorefineries enables optimization

12 Bio-Based Diesel Plants | **651**[(1)] Million Gallons Sold in 2020 | REG 2020 Sales were made in: **41** U.S. States, **7** Canadian Provinces, **14** Countries

- **Global reach with diversified end-market exposure**
- **Integrated model with optimized feedstock and distribution networks**
- **Flexibility and sales optimization to incentivized markets**
- **Proven access to diversified feedstocks**



2020 Capacity Contribution

505 MMGY
2020 capacity

Source: Company
(1) Includes self-produced and third-party bio-based diesel and petroleum-based diesel.

Reducing carbon at scale

4.2 MILLION METRIC TONS

OF CARBON REDUCTION[1]

FROM 519 MILLION GALLONS OF BIOFUELS PRODUCED IN 2020

EQUIVALENT TO

GHG EMISSIONS FROM
10.4 BILLION MILES
DRIVEN BY AN AVERAGE PASSENGER VEHICLE[2]

CO_2 EMISSIONS FROM
4.6 BILLION POUNDS
OF COAL BURNED[2]

CO_2 SEQUESTERED BY
5.5 MILLION ACRES
OF U.S. FORESTS IN ONE YEAR[2]

CO_2 EMISSION REDUCTION FROM
1.7 MILLION
PASSENGER ELECTRIC VEHICLES ON THE ROAD IN ONE YEAR[3]

(1) Carbon reduction based on life cycle analysis of REG-produced fuels versus petroleum diesel.
(2) epa.gov/energy/greenhouse-gas-equivalencies-calculator
(3) Assuming annual travel of 11,484 miles/year and national grid average electricity versus gasoline using CA-GREET

Carbon Reduction Timing

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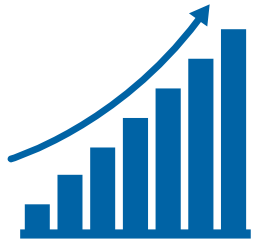
Assessing The Impact Of GHG Emissions

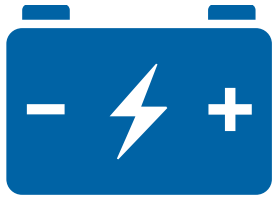
- Many environmental scientists consider 2030 to be a critical year for climate change mitigation
  - Experts often discuss 2030 as a deadline, but some organizations still treat it like a starting line
  - We don't typically apply a climate action deadline to the beneficial impacts of reducing GHG emissions sooner, but we should…

A Simple Step Today For A Better Tomorrow

Transportation is a top contributor to GHG emissions



Emissions accumulate in the atmosphere



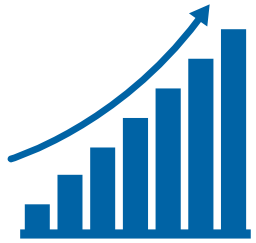
Waiting for future technology is doing harm

Bio-based diesel: A simple step to reduce GHG emissions today

REG

A Simple Step Today For A Better Tomorrow

Transportation is a top contributor to GHG emissions



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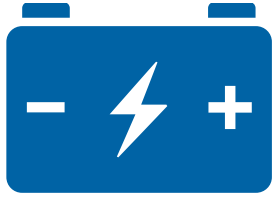

Waiting for future technology is doing harm

Bio-based diesel: A simple step to reduce GHG emissions today

While we plan for the long-term, we must also ask: "What can we do now?"

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Years of Successful Use of Higher BD Blends

- Many travel centers sell B20 to all customers
  - All major travel centers in Texas, Iowa, & Illinois from March – November
  - Large majority of travel centers in California and Oregon year ‘round
- All diesel in Minnesota and most diesel in Iowa has been B20 for the last two years (April – September +)
- Higher blends (> B20) have been used by many on-road fleets
  - REG has supplied hundreds of PNW vehicles with B50/R50 for two years
  - REG has multiple fleet customers in the Midwest and Texas using B35 – B50 this year
- Underground mining sector has used B50 – B100 in larger engines for years
  - 15 years of successful experience
- Indonesia is in their 2nd year of a B30 mandate (after 2 years of mandatory B20)
  - Considering a B40 mandate next

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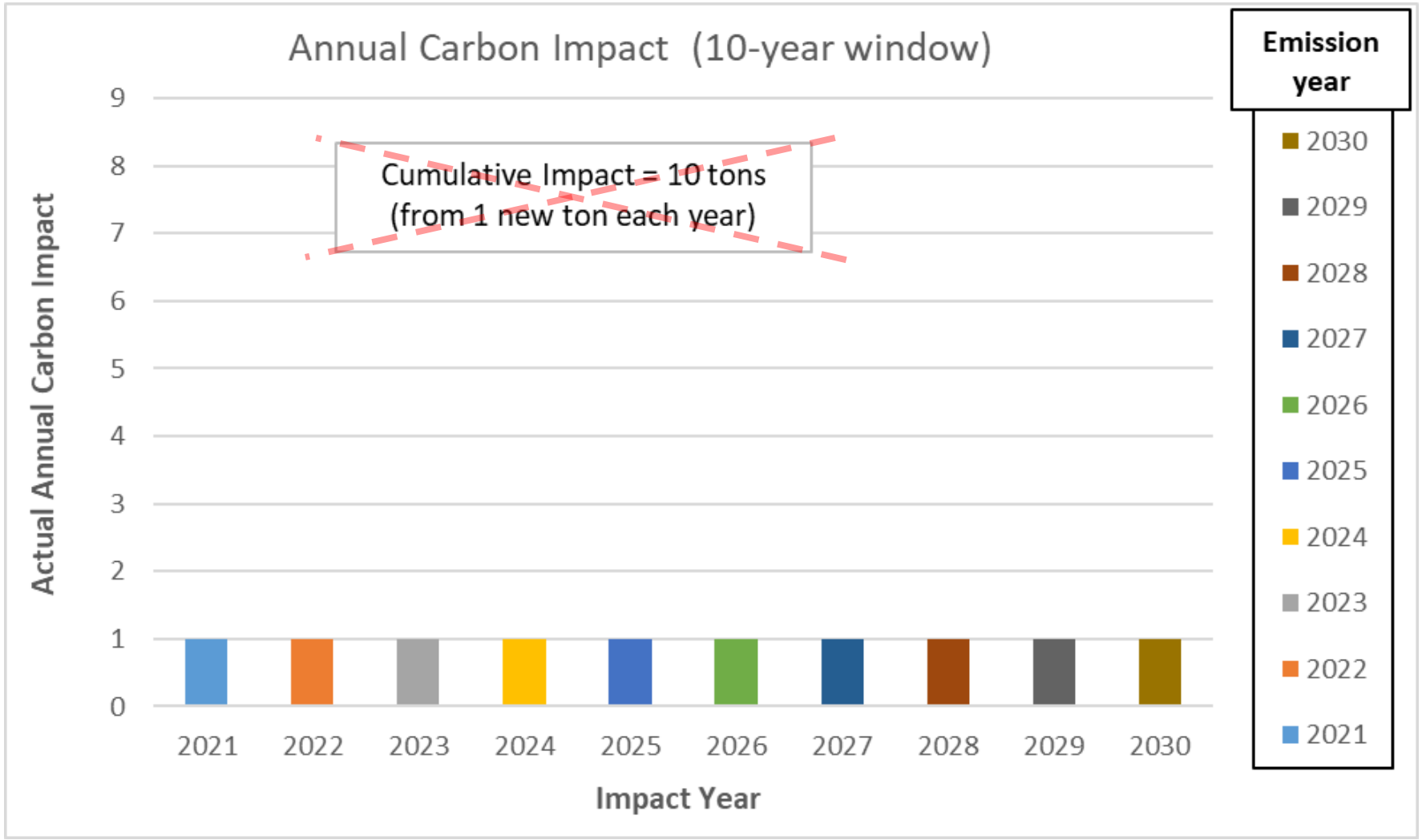
Cumulative Impact vs. Annual Accounting

What Is Cumulative Carbon Impact?

- Cumulative Carbon Impact can be estimated for any activity that generates fossil carbon emissions
  - Analogous to how we save for retirement
  - Except emission reductions are the currency (not deposits)

- The Cumulative Carbon Impact for fossil carbon emissions is determined by both the size of the emissions AND when they occur
  - Like retirement investing because the earlier an emissions behavior is changed, the more years that change has to make a difference
    - → Similar to annual deposits in a retirement account
  - But also because greenhouse gases persist in the atmosphere
    - → Similar to compounded interest on annual deposits
    - → Each year's emissions continue to have a negative impact for many years, which means emissions reductions have a multi-year benefit

Annual Carbon Accounting Is Wrong



TAKEAWAYS

- **FALSE**: New carbon affects the atmosphere only in the year it was emitted
- **FALSE**: Total of annual emissions reflects their actual impact on the environment

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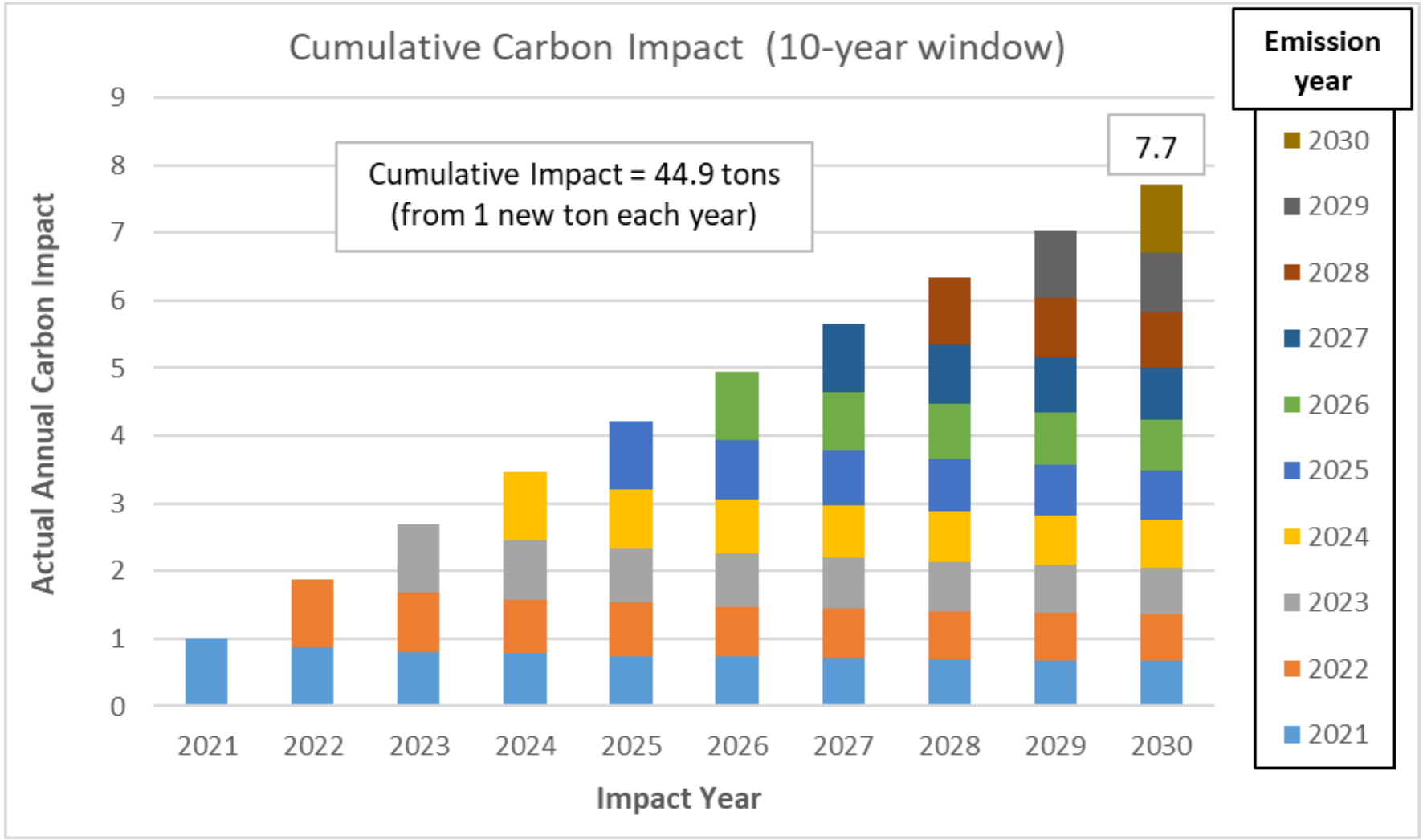
Cumulative Carbon Impact Accounting Is Correct



TAKEAWAYS

- New carbon impacts the atmosphere each year for many years (new carbon = fossil carbon)
- 7.7 tons of new (fossil) carbon in the atmosphere in 2030 (as CO_2)

* Using the Bern Carbon Cycle model provided in Ch. 10 of the 4th Assessment Report of the IPCC (2007) from Joos et al., 2001.

Deciding How to Make a Difference

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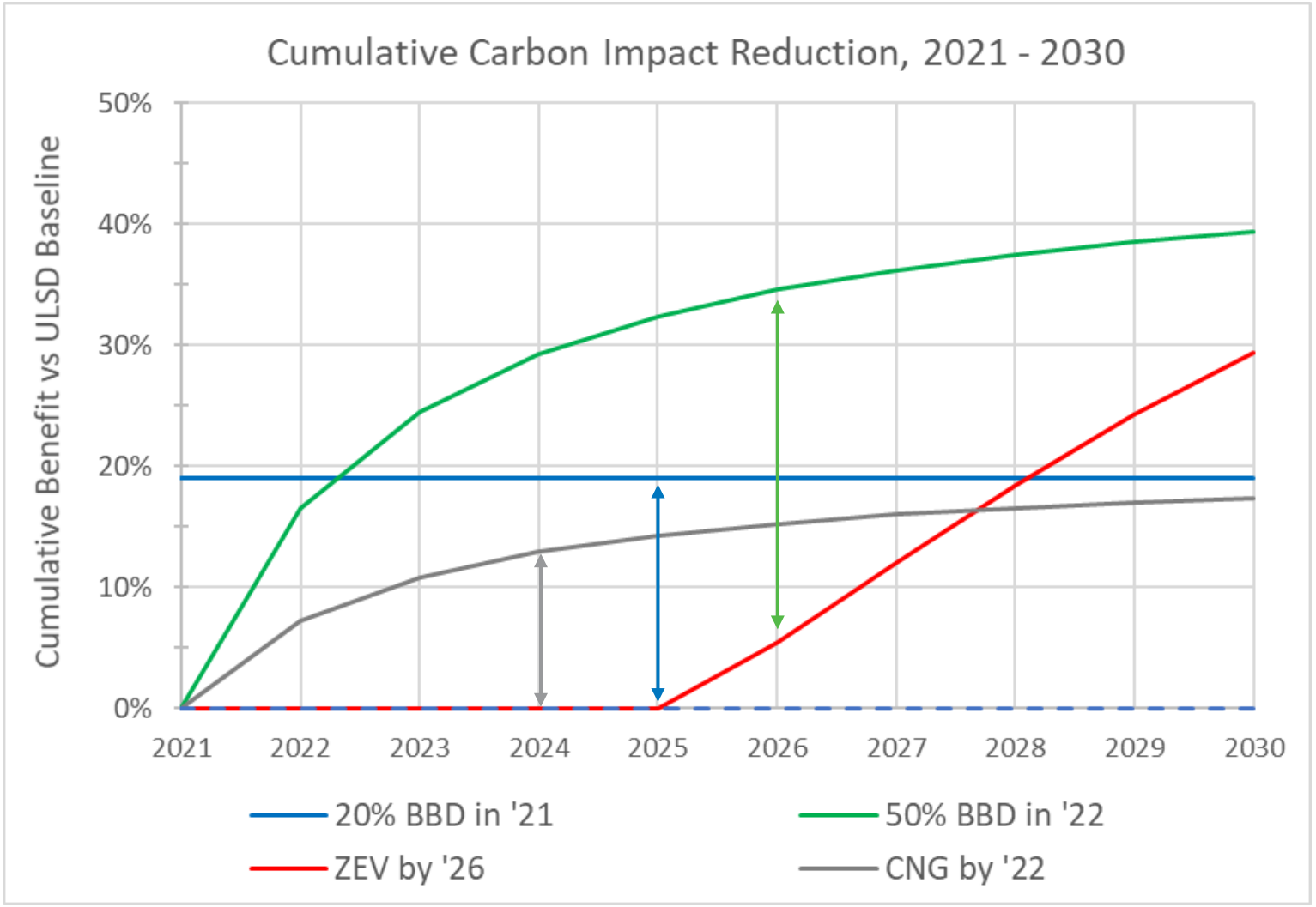
1. Compare Cumulative CO2 Reduction Benefits

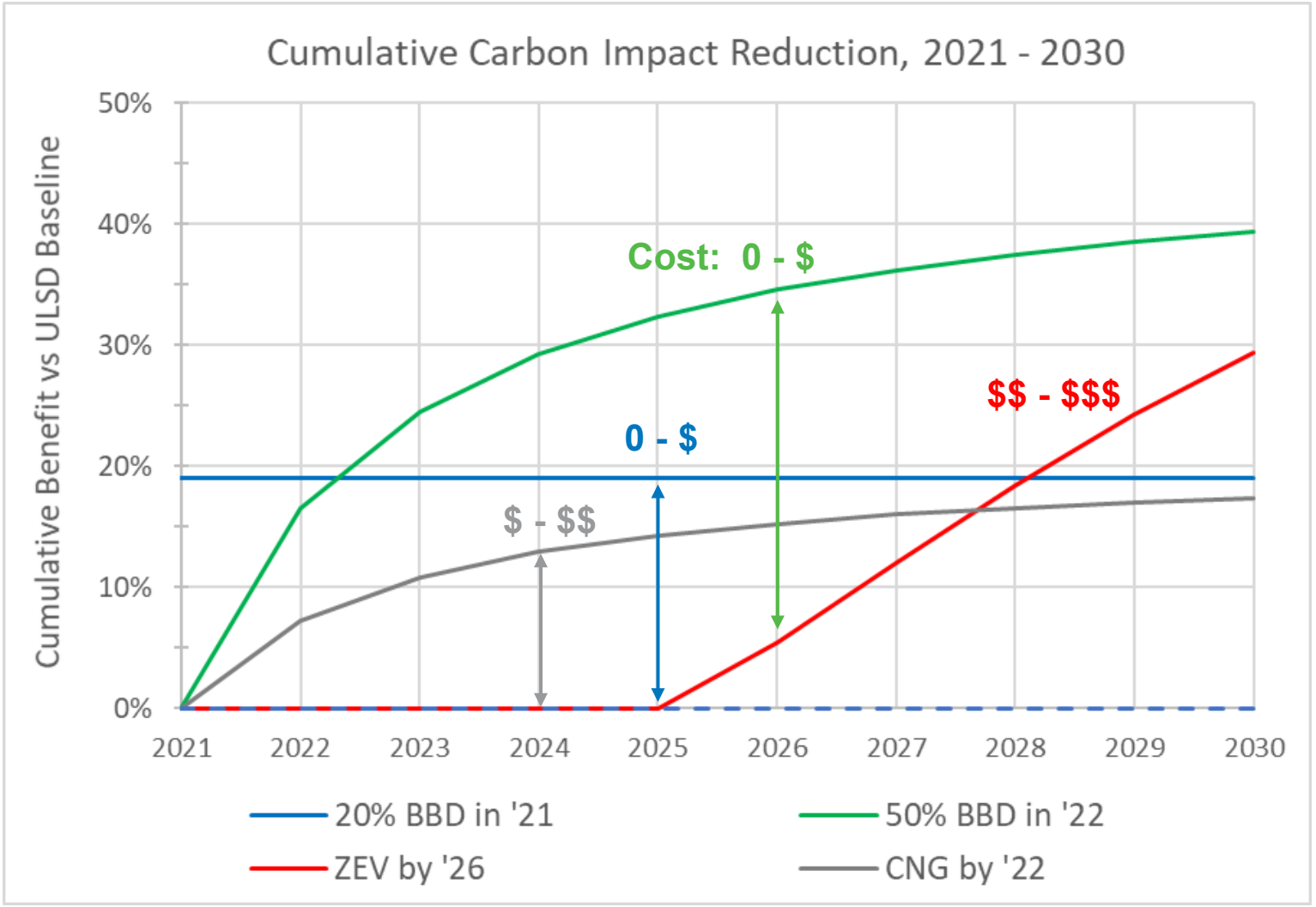


TAKEAWAYS

- BBD can reduce our Cumulative Carbon Impact the most over the next 10 years

Source: Chart assumes 95% fossil carbon reduction for BBD, 21% reduction for CNG, and 100% reduction for the ZEV

2. Compare Costs



Source: Chart assumes 95% fossil carbon reduction for BBD, 21% reduction for CNG, and 100% reduction for the ZEV

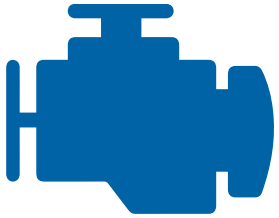
TAKEAWAYS

- BBD can reduce our Cumulative Carbon Impact the most over the next 10 years
- BBD can also have the lowest cost per ton of fossil carbon reduced

REG

3. Choose Bio-Based Diesel and DON'T WAIT

> 94% lower direct fossil carbon emissions than petro diesel *



Drop-in solutions for today's engines

Reduce fossil carbon emissions **today** with bio-based diesel

** GHG Protocol Scope 1 fossil carbon emissions reduction for biodiesel and renewable diesel; https://www.epa.gov/climateleadership/scope-1-and-scope-2-inventory-guidance*

Bio-Based Diesel in the Market

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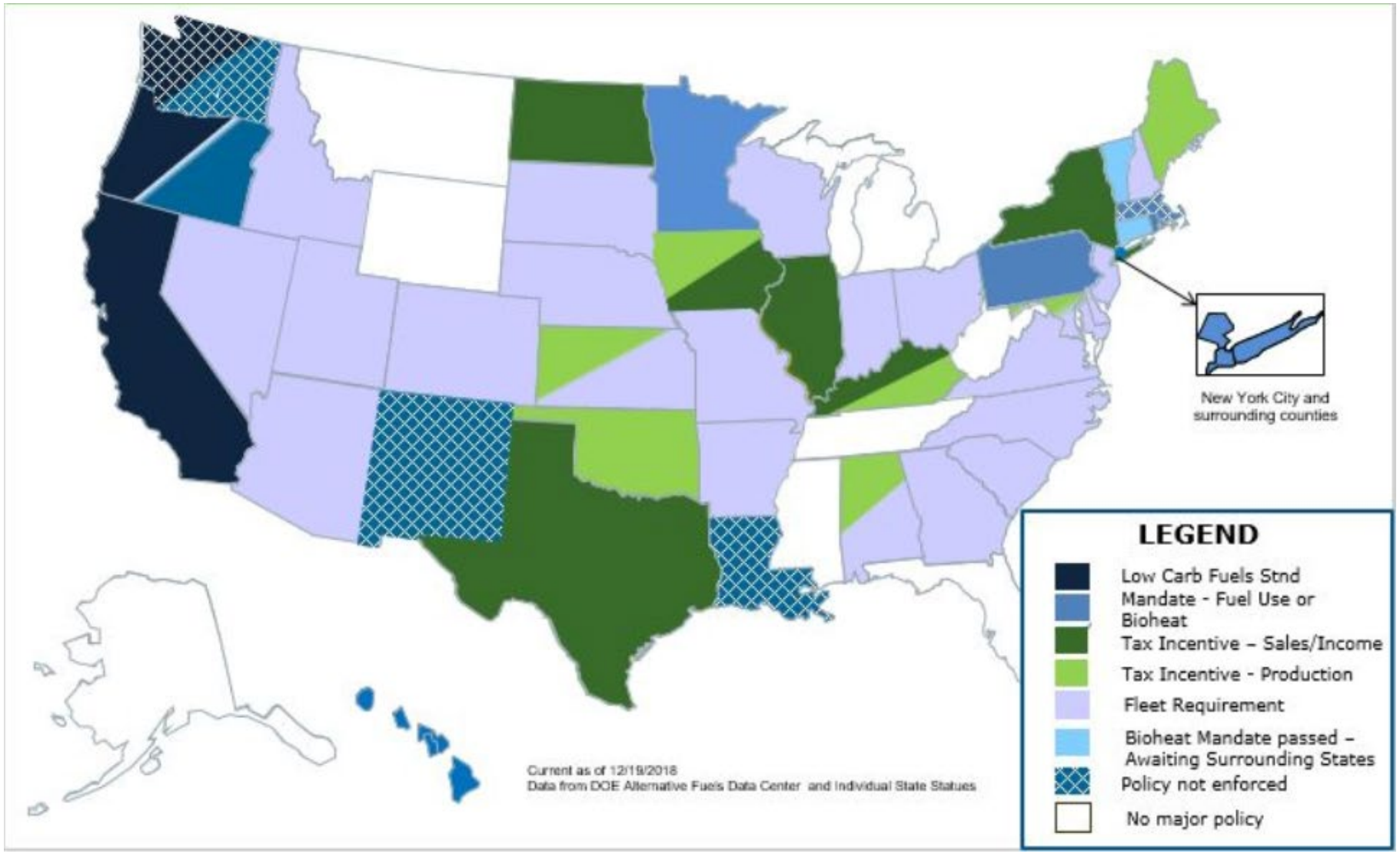
Two Common BBDs Offer Synergistic Benefits

- Biodiesel (BD) is an oxygenated fuel with:
  - Reduced engine emissions (Particulate Matter and Hydrocarbons, in particular)
  - Exceptional lubricity
- Renewable Diesel (RD) is a paraffinic fuel with:
  - Reduced engine emissions (NOx, in particular)
  - Exceptional Cetane Number
- Blends have superior properties to either fuel alone (i.e., complementary benefits)
  - BD provides PM reduction, density, elastomer swell, and lubricity
  - RD provides NOx reduction & Cetane
- A 50:50 blend of BD and RD is most similar to petroleum diesel in fluid properties
  - And has the lowest overall engine emissions

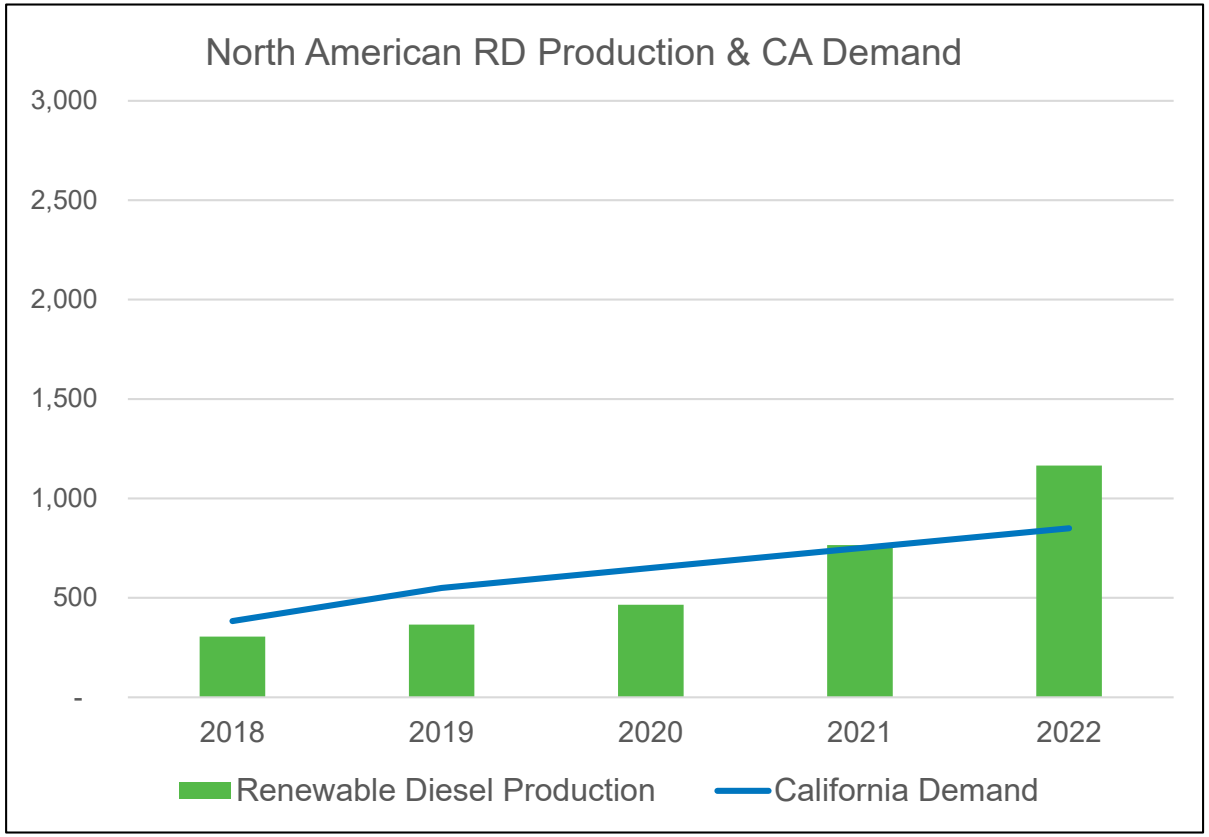
Different Jurisdictions, Different Incentives

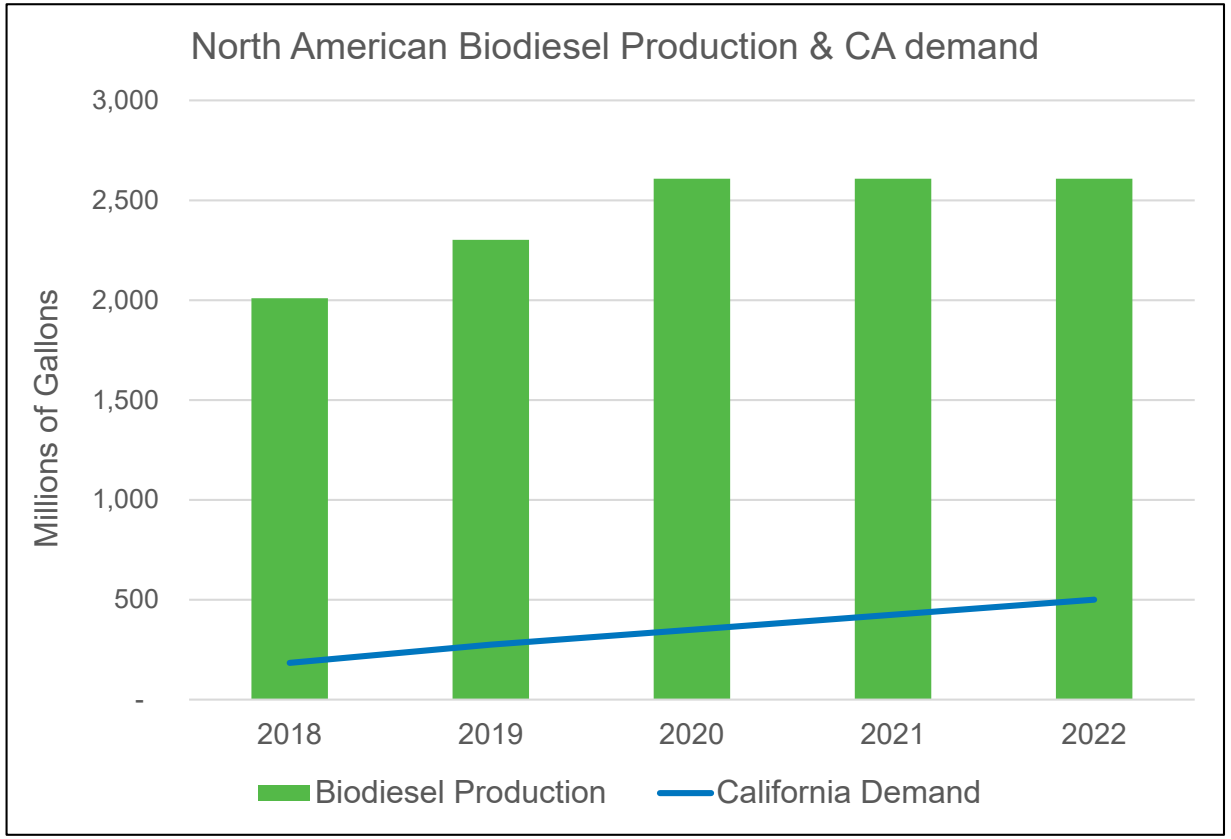


Consumer Choice Is Critical To Success

- Success is: reducing fossil carbon emissions as much as possible as quickly as possible
  - This requires an “all of the above” mindset from everyone who is willing to help
  - Customers need as much flexibility as possible
- Fuel users will perpetuate the status quo if they don’t believe they are able to utilize the option that’s available in their market
  - OEM failure to support biodiesel (a readily-available lower-carbon alternative) has delayed our collective effort to reduce fossil carbon emissions
- Providing clear support for higher BD blends enables consumer choice, which allows market forces to successfully reduce fossil carbon emissions sooner and more thoroughly

California Can Take All U.S. RD Today





* California demand values from CARB data and projections; RD and BD production values from multiple public sources with REG estimates

Biodiesel Can Reduce Fossil Carbon Now

- Fleet leadership is needed to enable the world to realize the full decarbonization potential of biodiesel
- Concerns about biodiesel based on early quality issues have been refuted by years of successful usage in a wide variety of engine types throughout N. America
  - Billions of gallons per year for many years
- Biodiesel is currently available in much larger quantities than RD (or any other low-CI option) and in many more jurisdictions
  - Approximately four billion gallons per year of biodiesel production capacity in the U.S. has been under-utilized for years

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Consumer Choice → Maximum GHG Reductions

CUSTOMER

WANTS:

100% renewable; lower Cloud Point

SOLUTION:

R80
B20

CUSTOMER

WANTS:

100% renewable; better economics & larger supply

SOLUTION:

R50
B50

CUSTOMER

WANTS:

40% renewable; good economics; lowest Cloud Point

SOLUTION:

P60
R20
B20

CUSTOMER

WANTS:

100% renewable; good economics & larger supply

SOLUTION:

B100

CUSTOMER

WANTS:

≥ 20% renewable; good economics & largest supply

SOLUTION:

B20+

REG

Thank you.

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Monte McLeod
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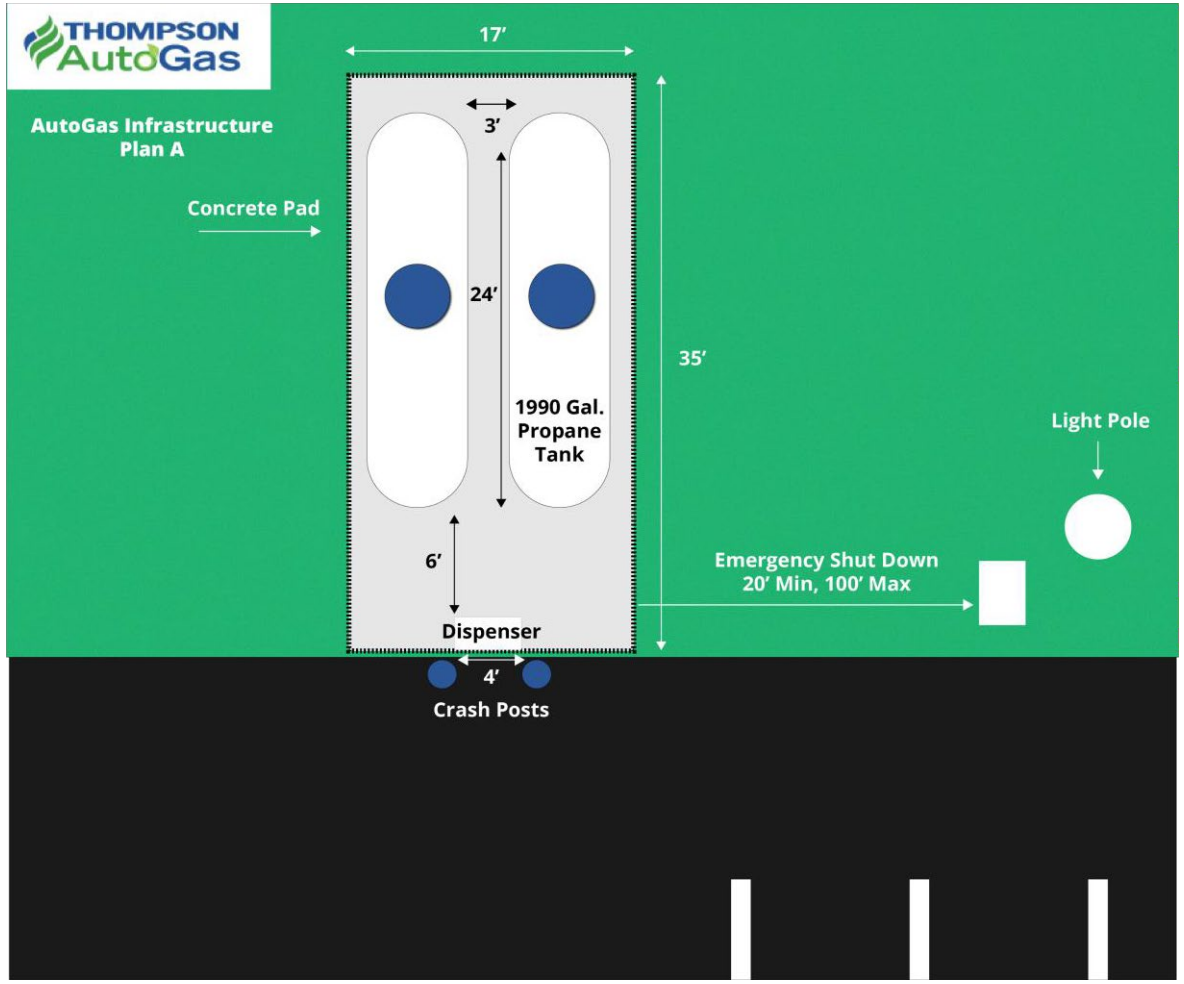
803-609-1172

- Director of Autogas for Thompson Autogas
- 20 years experience in the propane industry with a 12 year focus on Autogas
- Developed, implemented and managed Autogas programs including Grant procurement, Infrastructure building, and Growing gallons through Fleet management practices
- Frequent expert contributor at industry forums for Clean Cities and PERC

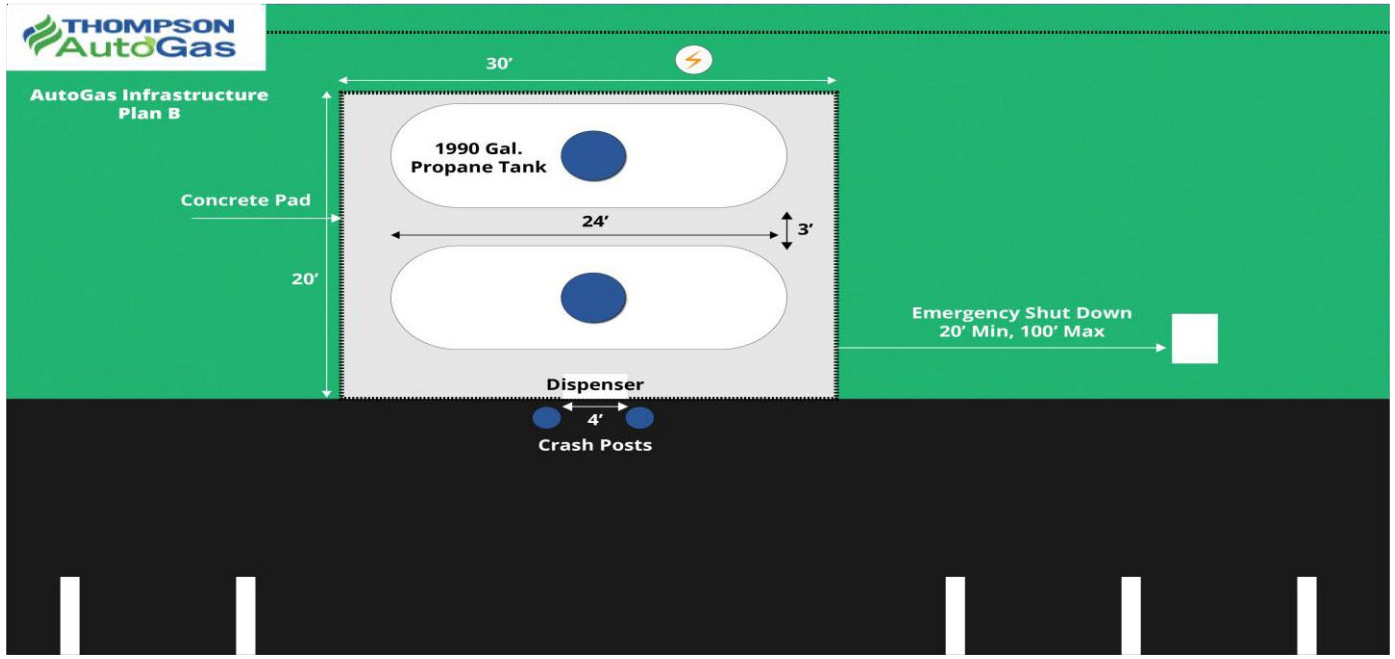
Autogas Program Implementation

Putting the puzzle together

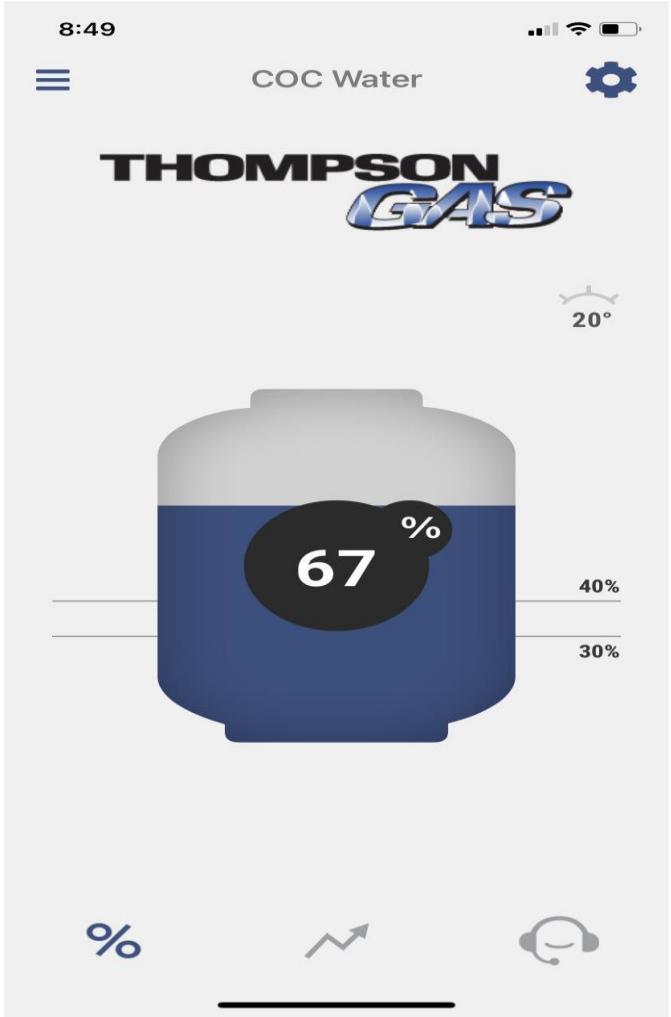
Autogas Infrastructure

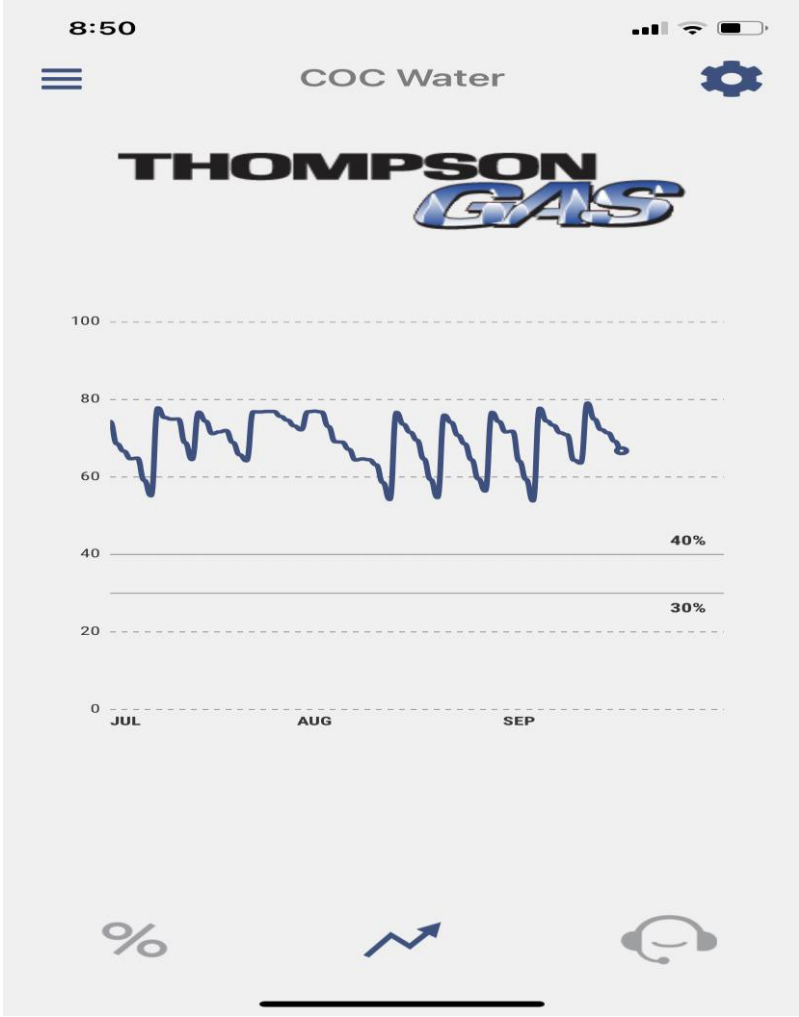


Autogas Infrastructure



Tank Monitoring





Training

Fleet Conversion

Questions?

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Steve Whaley
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864-606-2290

- Director of Autogas Business Development for the Propane Education & Research Council
- More 25 years experience working with both natural gas and propane solutions for public and private fleets
- Previous experience with Whaley Clean Transportations Consulting, Agility Fuel Systems, Roush Clean Tech and Blossman Propane

Propane Education & Research Council

Propane's Role in Decarbonizing Transportation

Steve Whaley

Propane Education & Research Council

Sustainable Fleet Technology Conference
9.14/2021

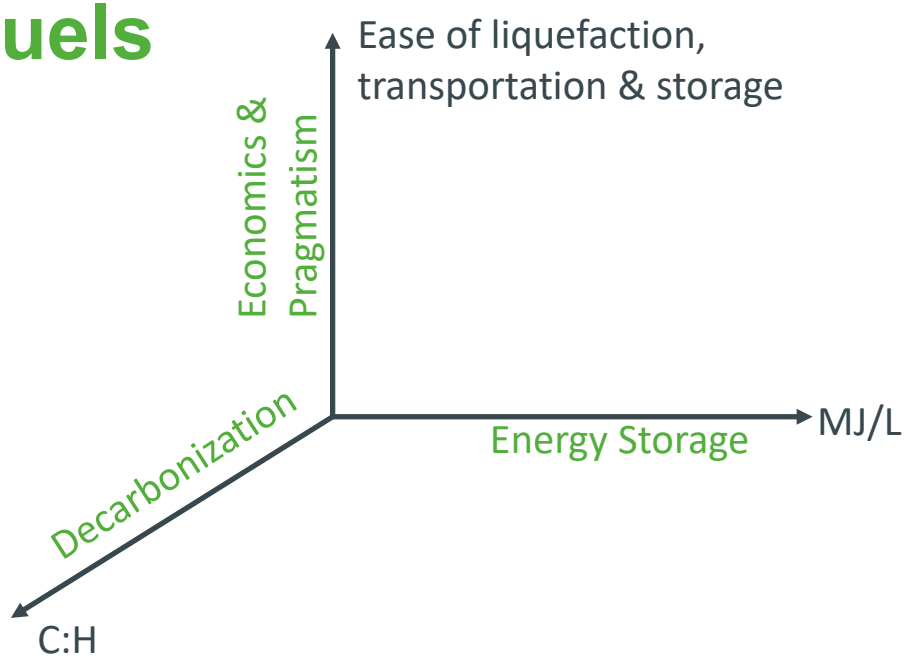
ENERGY FOR EVERYONE
propane

What Makes an Alternative Energy Adoption Successful?

- There is reduction in emissions over the lifecycle of the energy used in the vehicle without increasing cost or losing efficiency.
- Total cost-of-ownership reduction or a return on investment long before the end of the vehicle lifecycle.
- The vehicle performs as well or better than the original fuel without compromising range.
- There must be a high-volume supply of energy domestically sourced.

Conventional Propane Relative to Other Fuels

Fuel	Liquid volumetric energy density (MJ/l)	C:H	Ease of liquefaction, transportation and storage
Hydrogen	8.5	0	X
Ammonia	11.5	0	✓
Liquefied natural gas[5]	22.2	0.25	X
Propane or LPG	25.3	0.375	✓
Gasoline	34.2	0.5	✓
Diesel	38.6	0.55	✓



- Propane offers the “sweet-spot” in terms of liquid volumetric energy density (determines storage volume), C:H ratio (decarbonization metric) and ease of liquefaction (cost-effective and level of complexity of storage and transport).
- Hydrogen and Ammonia are inherently zero carbon but >95% of hydrogen in the US comes from steam-methane-reforming of fossil natural gas. Ammonia is currently produced with hydrogen using Haber-Bosch process.

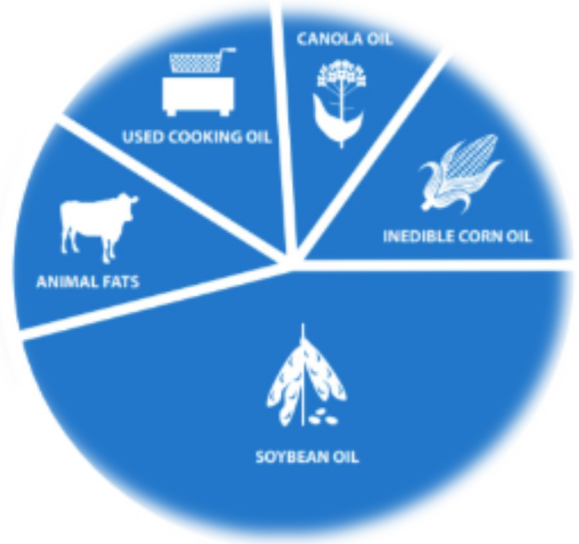
Renewable Propane

- Renewable propane is a byproduct of renewable diesel and sustainable aviation fuel. Predominantly sourced by Hydrotreated Vegetable Oil (HVO) process.
- HVO – large scale commercial process.

Feedstock	Process	Outputs	Developer
Vegetable oil/ animal fat	HVO	Biodiesel, biopropane (5-8%)	Neste Oil (NExBTL); UOP/Eni Dynamic Fuels, ConocoPhillips, Diamond Green
Cellulosic biomass (wood)/sugar/ starch (crops)	MTG gasification	Gasoline, biopropane (10-30%)	ExxonMobil (MTG); Haldor Topsoe (TIGAS)
	Gasification/direct synthesis	DME, gasoline or biopropane (significant %)	Japan Synthesis Gas Co
	Fischer-Tropsch gasification	Diesel, naphtha, lubes, biopropane (small volumes)	Shell (GTL); UPM Maverick Fuels
	Pyrolysis/hydrogenation	Gasoline, diesel, kerosene, biopropane (up to 15%)	Ensyn (RTP); GTI (IH2)
Glycerine	Dehydration/hydrogenation	Bioethane or biopropane	Bio-fuel Solution
	Methanol gasification	Methanol, DME, biopropane (small volumes)	BioMCN
	Aqueous Phase Reforming	Various fuels, including biopropane	VES (BioForming)
Sugar/starch (crops)	Supercritical fermentation	Various fuels, including biopropane	C3 Bioenergy (US)

Source: Menecon Consulting/Atlantic Consulting

Renewable Propane



DME+ PROPANE

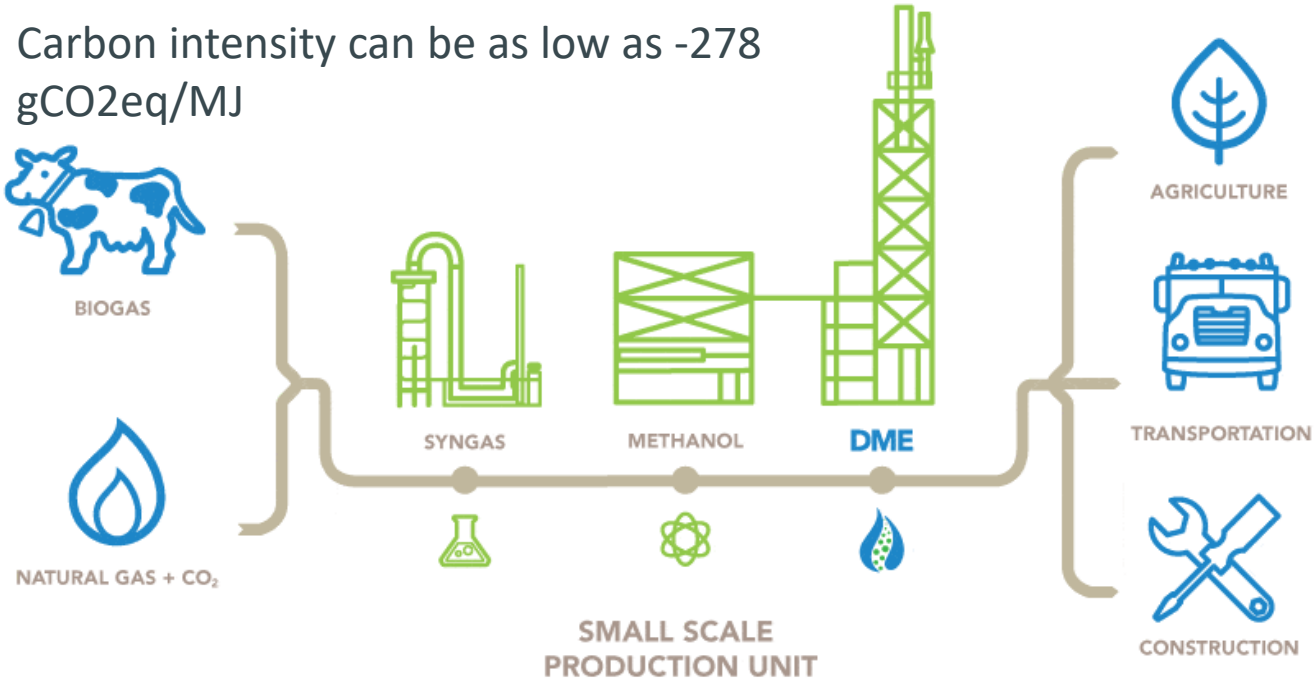
Source: Menecon Consulting/Atlantic Consulting

Renewable Dimethyl Ether (DME)

- DME vs. Propane
  - Similar thermophysical properties
  - Disparate chemical/combustion properties (high cetane vs. high octane)
  - Ideal for blending

- Conventional and renewable propane can be blended with renewable DME to drastically reduce the fuel's carbon intensity

Carbon intensity can be as low as -278 gCO2eq/MJ



Source: Oberon Fuels

Renewable Propane

Producer	Location	Renewable propane capacity (Millions Gallons)	Status 2020
BP	Blaine, WA	2.7	Operating
Diamond Green Diesel	Norco, LA	5.4	Operating
Diamond Green Diesel	Port Arthur, TX	48.2	Start-up 2024
Global Clean Energy Holdings	Bakersfield, CA	18.8	Onstream late 2021
HollyFrontier	Cheyenne, WY	10.7	Start-up early 2022
HollyFrontier	Artesia, NM	13.4	Start Q1 2022
Kern Oil & Refining	Bakersfield, CA	NA	Unknown
Tesoro Marathon	Dickinson, ND	0.8	Operating
Marathon	Martinez, CA	36.8	
Next Renewable Fuels	Portland, OR	80	Unknown
Philips 66	Rodeo, CA	34	
Renewable Energy Group	Geismar, LA	10.1	Operating
Seaboard Energy		8.9	Q4 2021
Sinclair	Sinclair, WY	14.8	Operating
World Energy	Paramount, CA	3.8	Operating
	Potential Capacity Sum	288.4	

ALL models are wrong, but some are useful
– British Statistician George E.P. Box

Major Assumptions

Parameter	Value
Vehicle	Class 5-7 Truck
State-level Electricity CI (lb/MWh)	• 2019 EIA (Combustion) + 2019 production emissions. Adopted CARB methodology for each state's energy-mix • Decarbonized electric grid scenario - 95% reduction from above CI
Propane WTW CI ($gCO2_e/MJ$)	CARB for PADD5 (83.19) and adopted CARB method for each state in a PADD, Renewable Propane (45 for HVO), Renewable DME (-278 – CARB approved)
T&D Losses	5% for all states (Based on EIA National Average)
Miles Driven Per Day	200
Miles Driven Per Year	60,000
Life (miles)	300,000 (5 years)
MDEV Charging, power conversion and battery roundtrip Losses	10%
Net vehicle energy Efficiency (kWh/mile) and Battery Size (kWh)	2.08 and 520
Life of Li-ion Battery (cycles)	• 1000 • 5000 (million-mile battery)

Petroleum Administration for Defense Districts (PADD).

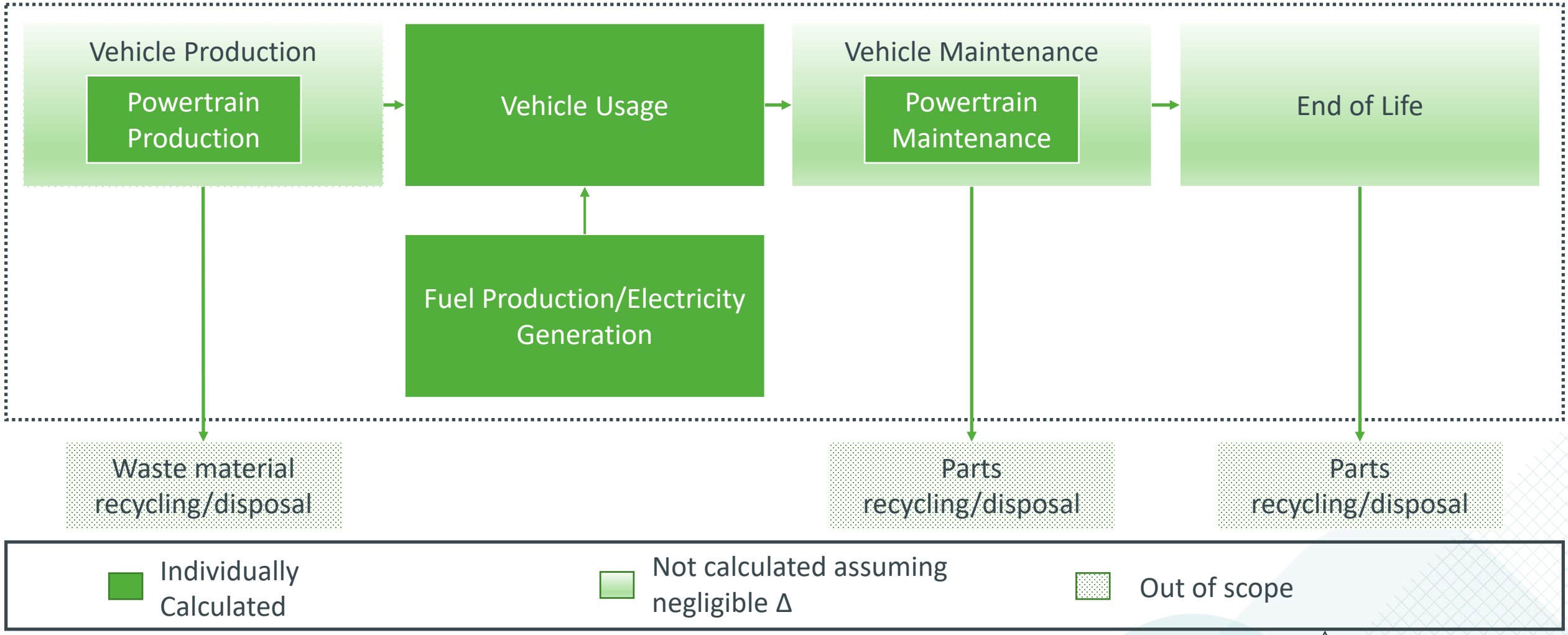
Major Assumptions

Parameter	Value
Battery Manufacturing $CO2_{eq}$ Emissions ($kgCO2_{eq}$/kWh)	• 140 • 61 (Decarbonized electric grid scenario)
Regenerative Braking Energy Savings	20%
Propane Vehicle MPG	• 5.5 for propane and renewable propane • 5.3 when blended with DME due to its 3% lower energy content
Engine Peak Power (kW)	260

Accounted for:

- GHG footprint of engine, after-treatment and transmission production
- GHG footprint of fluids for MDEV and Propane vehicle and their replacement
- GHG footprint of MDEV motor, inverter, controller, transmission and cooling system
- MDEV service interval – 40,000 miles. Propane vehicle service interval (oil - 5,000 miles, radiator coolant – 15,000 miles and all others – 40,000 miles)

Boundary of LCA

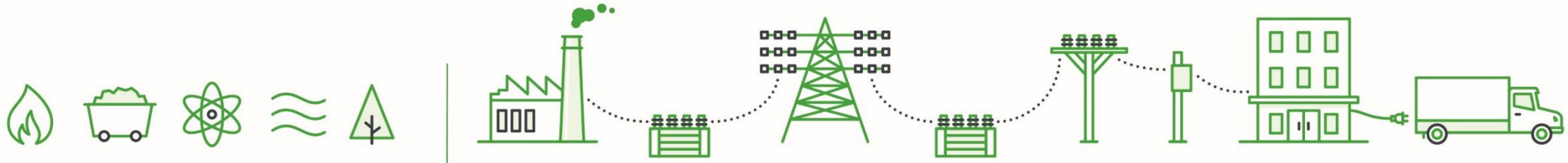


Adapted from Kawamoto et al. (2020). Estimation of CO2eq Emissions of Internal Combustion Engine Vehicle and Battery Electric Vehicle Using LCA, Sustainability, 2019

U.S. Average

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

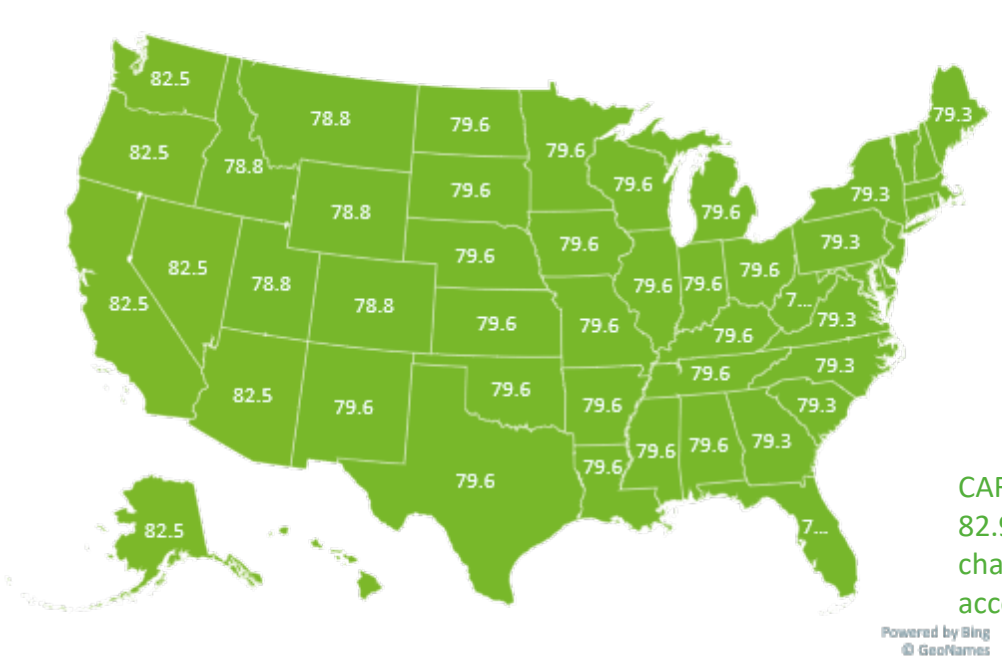
CARBON INTENSITY SCORE:

15.4 g/MJ

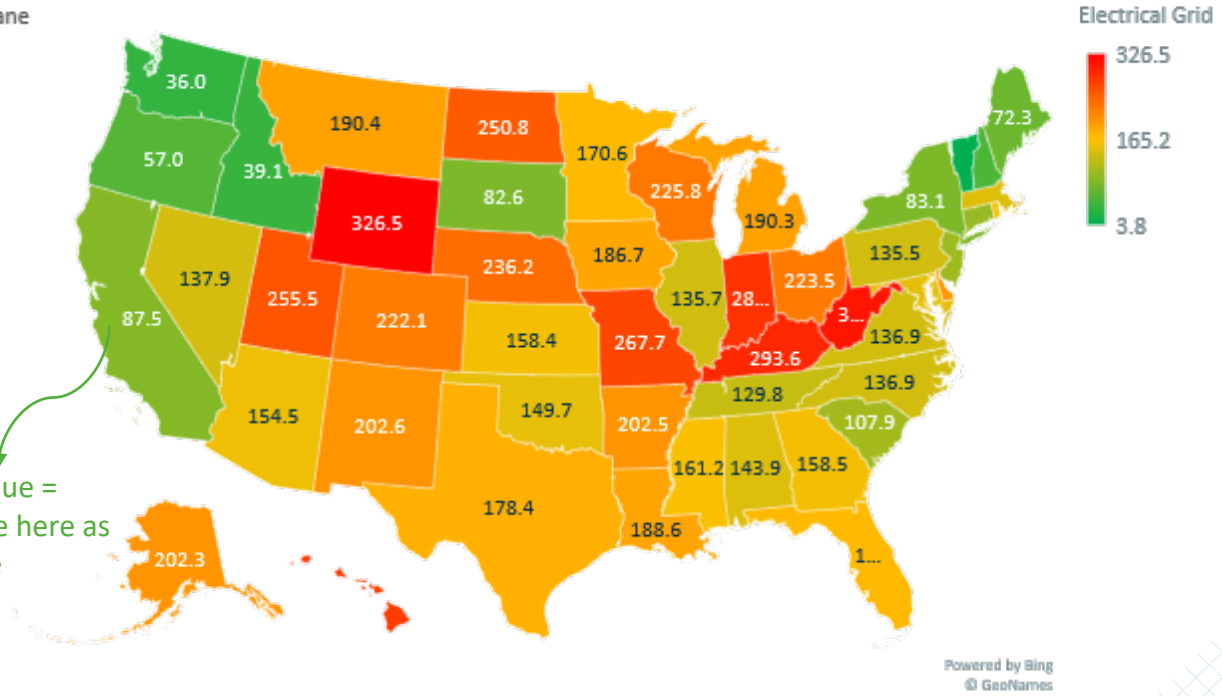
TOTAL GHG INTENSITY = 154 g/MJ

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

Note: They are compared on the same scale



CARB approved value = 82.92. Higher value here as charging losses are accounted for

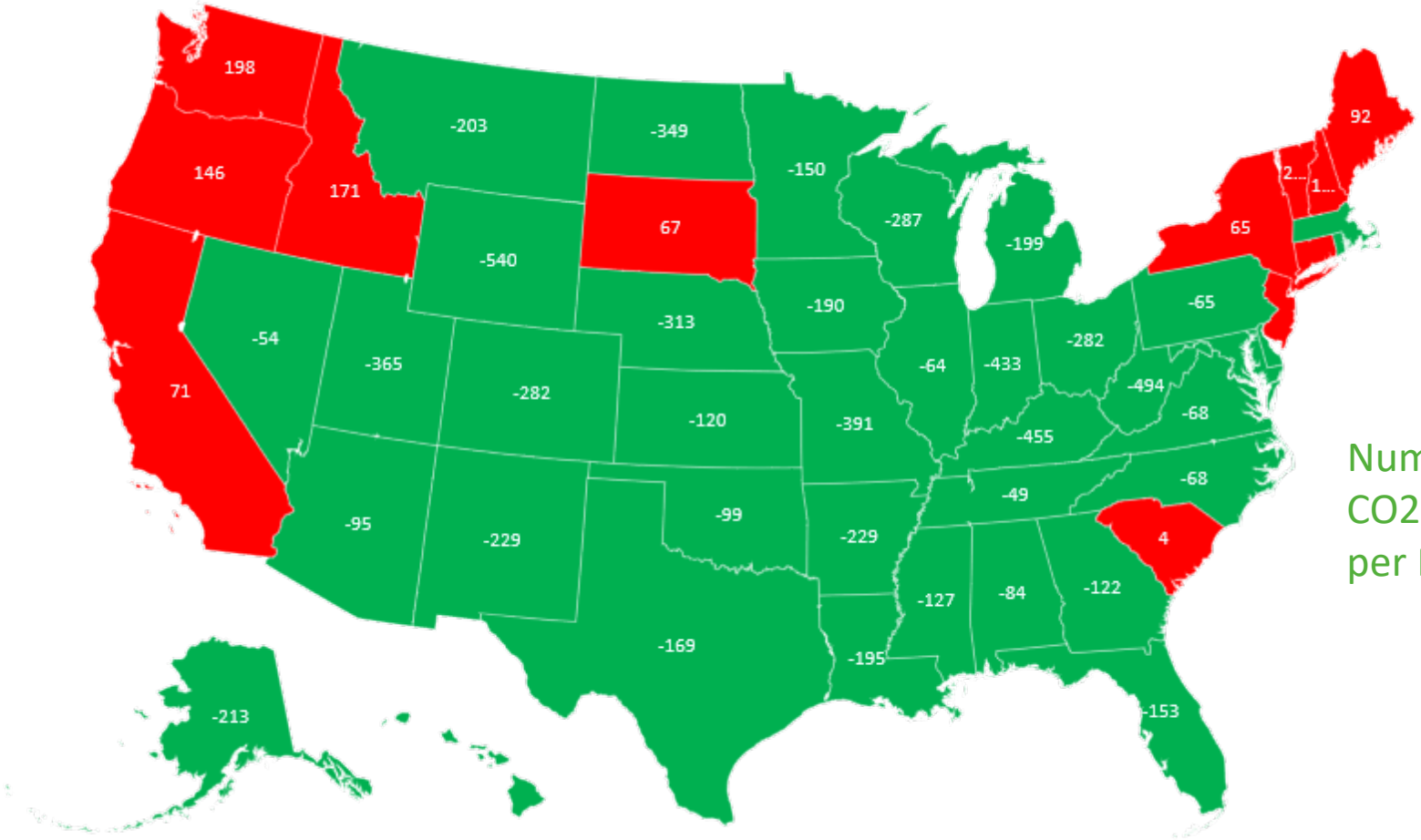


Propane = 79

Today's Grid Electricity = 154

White paper can be downloaded from PERC website: https://propane.com/research-development/emissions/decarbonization-of-md-hd-vehicles-with-propane/

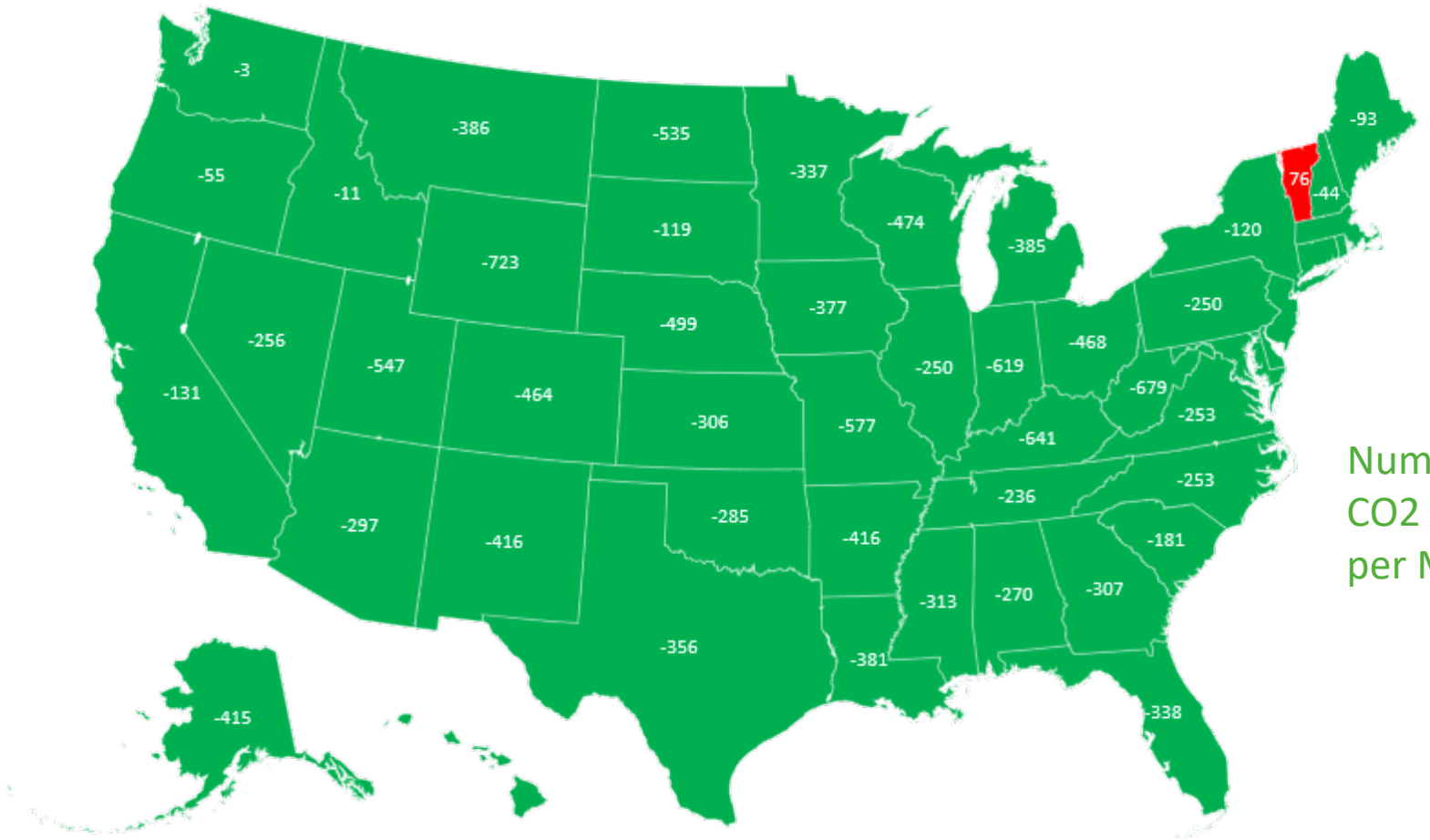
Case-I: $\Delta CO2_{eq}$ for One Truck:
Green - Propane is Better, Red – MDEV is better



Numbers represent ΔLC CO2 emissions in US tons per MD vehicle

Today, Propane is a cleaner solution for 38 states and DC

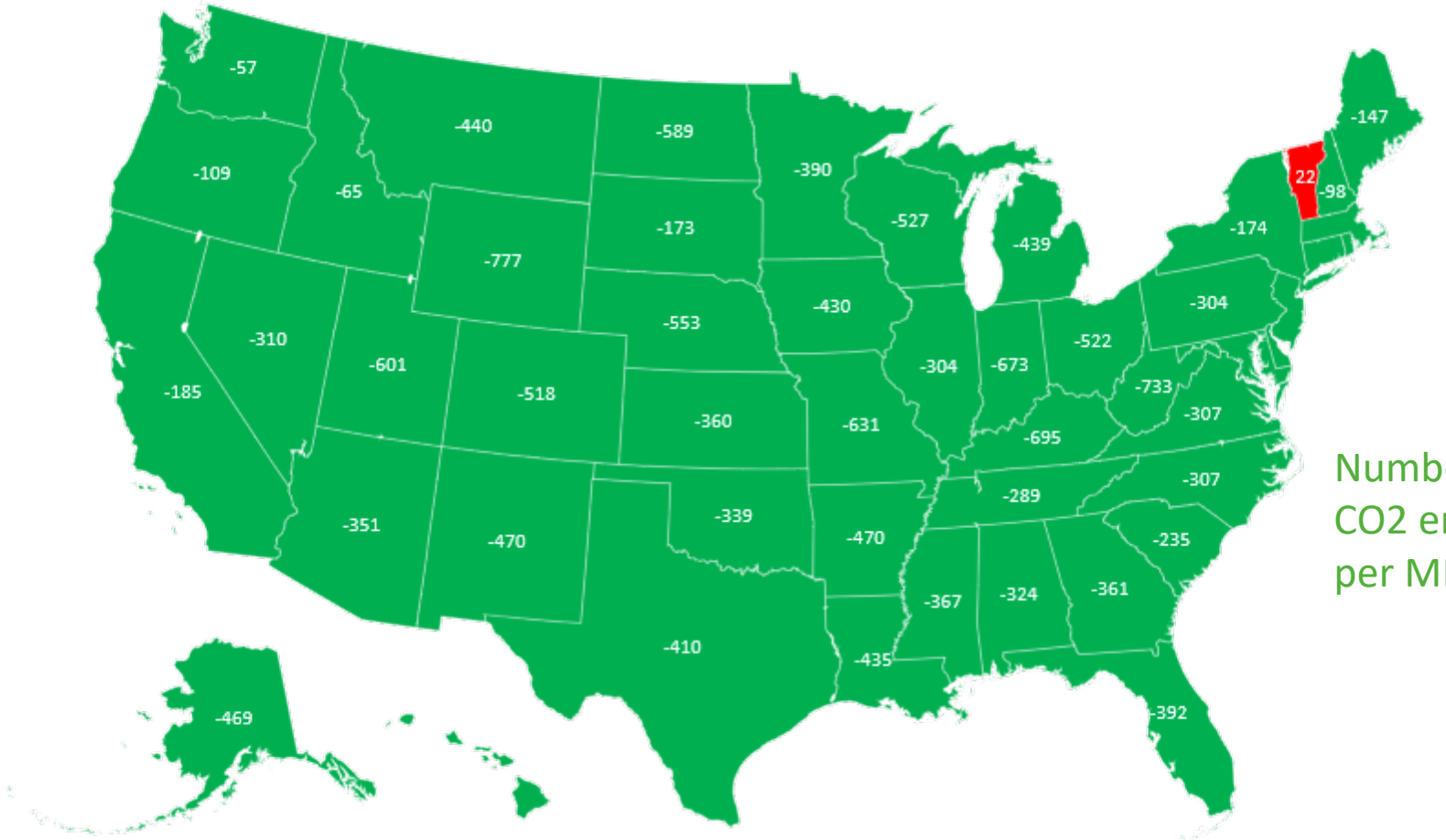
Case-II: $\Delta CO2_{eq}$ for One Truck:
Green – Renewable Propane is Better, Red – MDEV is better



Numbers represent ΔLC CO2 emissions in US tons per MD vehicle

Today, Renewable Propane is a cleaner solution for all states (and DC) but Vermont

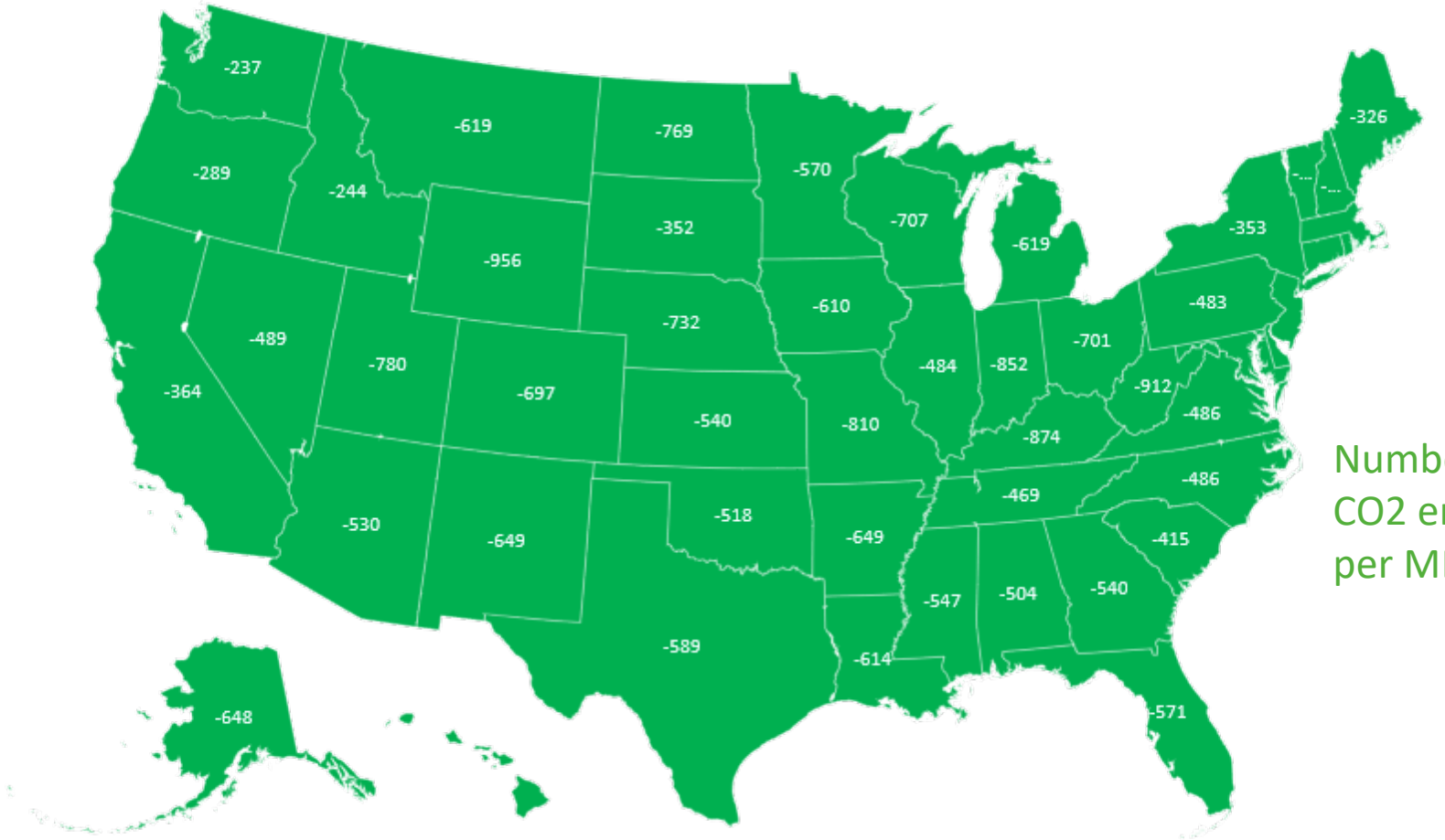
Case-III: $\Delta CO2_{eq}$ for One Truck:
Green – Propane/R-DME is Better, Red – MDEV is better



Numbers represent ΔLC CO2 emissions in US tons per MD vehicle

Today, Propane/R-DME blend is a cleaner solution for all states (and DC) but Vermont

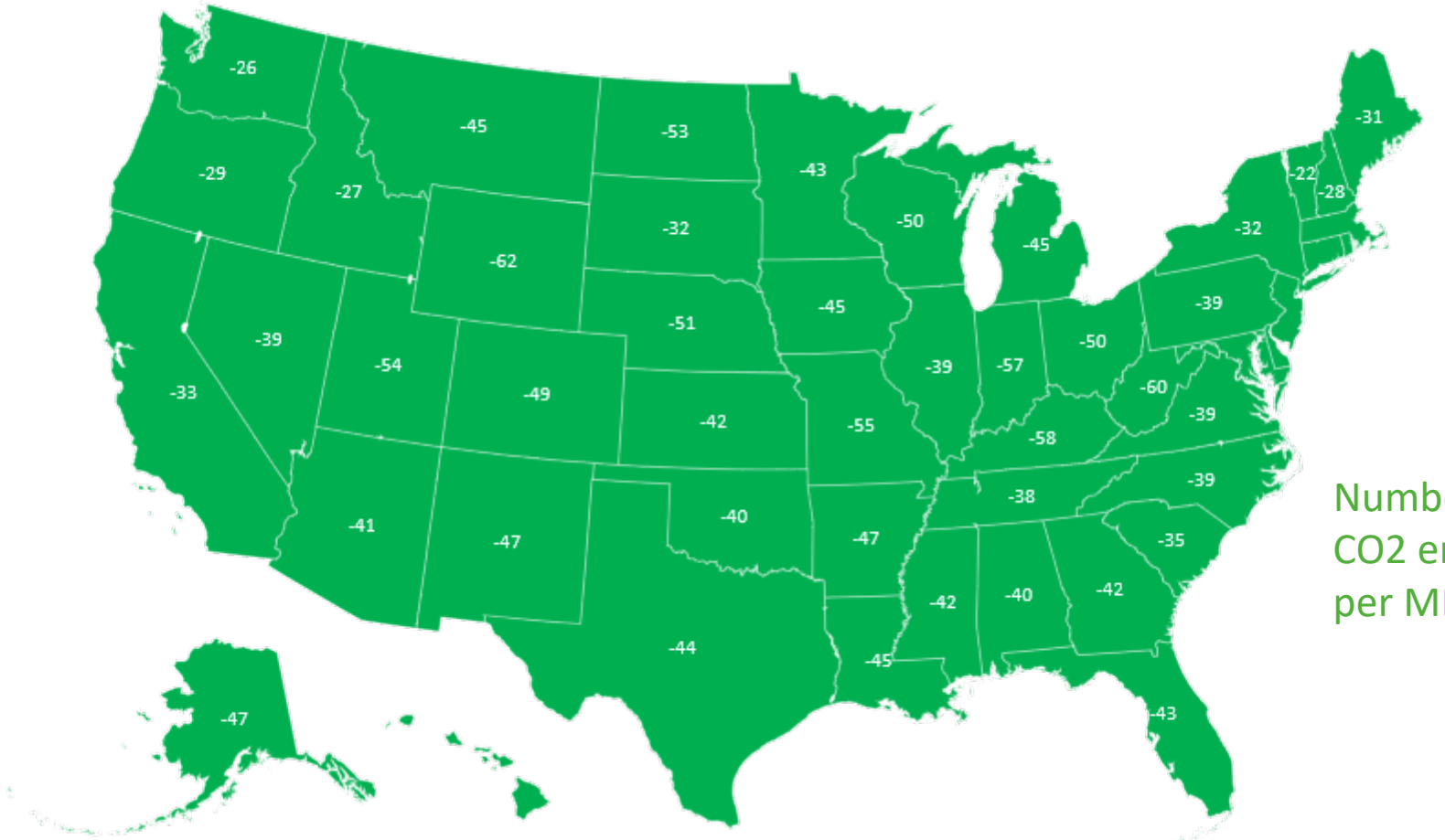
Case-IV: $\Delta CO2_{eq}$ for One Truck: Green – R-Propane/R-DME is Better



Numbers represent ΔLC CO2 emissions in US tons per MD vehicle

Today, R-Propane/R-DME blend is a cleaner solution for all states and DC

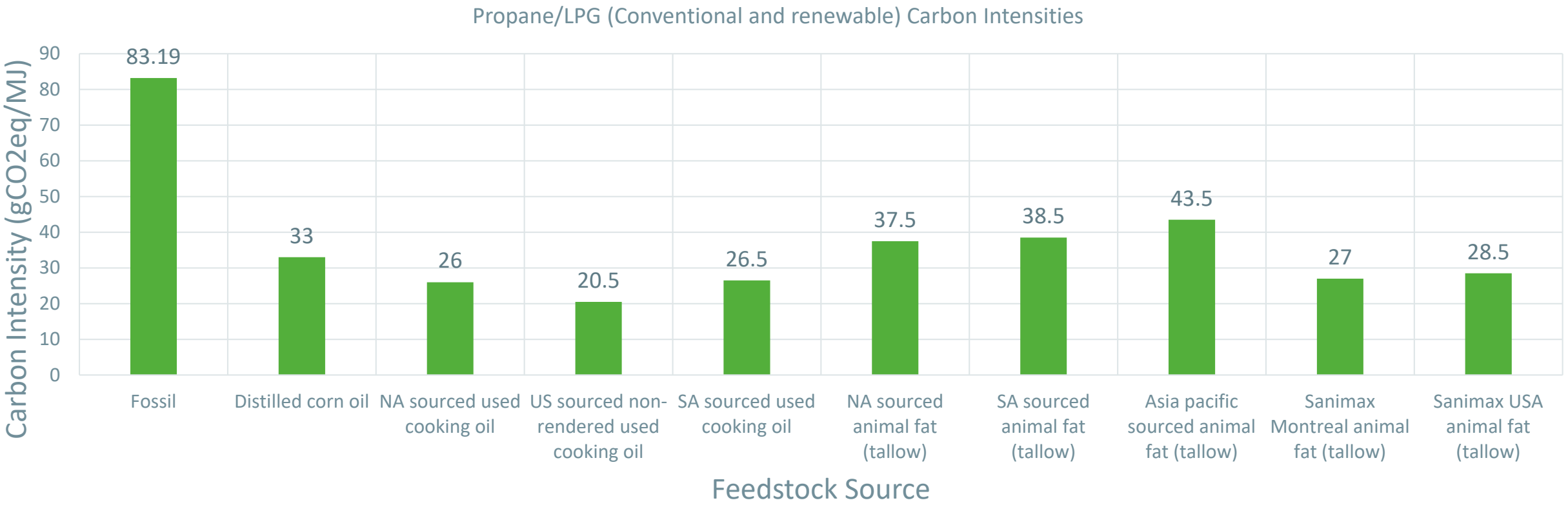
Case-V – Utopian Future - $\Delta CO2_{eq}$ for One Truck: Green – R-Propane/R-DME is Better



Numbers represent ΔLC CO2 emissions in US tons per MD vehicle

Even with 2035/2040 electric grid goal, renewable propane/renewable DME blend vehicle is a cleaner solution than MDEV for all states and DC

Renewable Propane – CARB Provisional Carbon Intensities



Carbon intensity can be 4X lower than conventional propane.

Source: CARB

Conclusions

- Propane vehicles can enable a low carbon footprint society today.
- Even in the distant future, blended renewable fuels (propane and DME) offer a solution for decarbonization
- The cost-effectiveness, energy density of fuel, and zero penalty in payload are additional benefits that propane vehicles offer today.

What Makes an Alternative Energy Adoption Successful?

- ✓ There is reduction in emissions over the lifecycle of the energy used in the vehicle without increasing cost or losing efficiency.
  - ✓ 38 states show lower carbon footprint of varying degrees for conventional propane vehicles over electric vehicles
  - ✓ NOx emissions are 96% lower than diesel vehicles
- ✓ Total cost-of-ownership reduction or a return on investment long before the end of the vehicle lifecycle.
  - ✓ 4% lower than diesel, 9% lower than gasoline and 35% lower than EV for Class-6
- ✓ The vehicle performs as well or better than the original fuel without compromising range.
  - ✓ On par range that is not affected by ambient conditions. No penalty in payload.
- ✓ There must be a high-volume supply of energy domestically sourced.
  - ✓ ~30 billion gallons of propane are produced in the U.S. and nearly 55-60% is exported.

Propane Education & Research Council

Benefits of Propane/Renewable Propane

- Cost Effectiveness
  - MD Propane averages 15% of vehicle cost
  - MD EV averages 250% 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)

Benefits of Propane/Renewable Propane

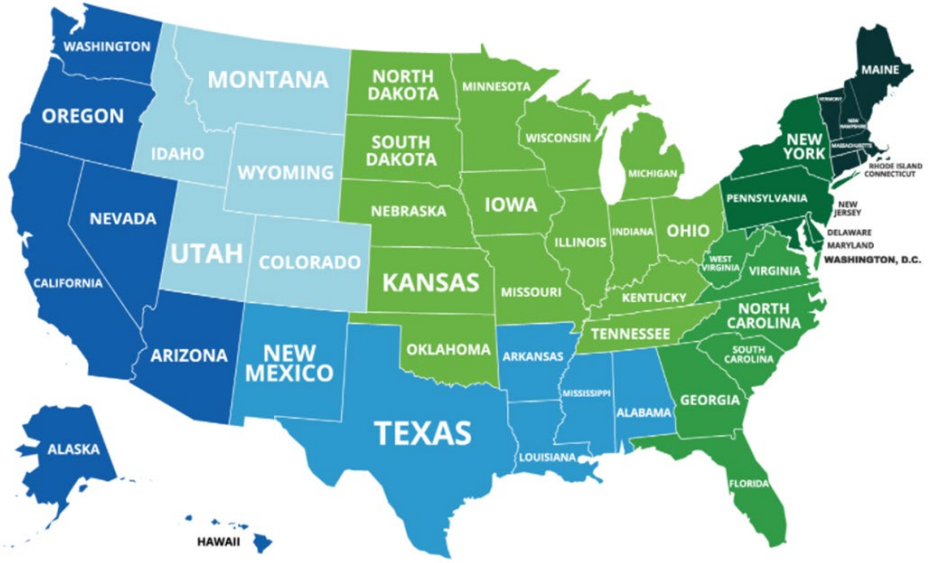
Average Price Per Gallon for the week of September 1, 2021

These prices are based on National averages. To receive a custom quote with your local autogas pricing, contact us today.

Learn more about the savings and stability of autogas.

*Autogas price estimates do not reflect the current federal tax credit.

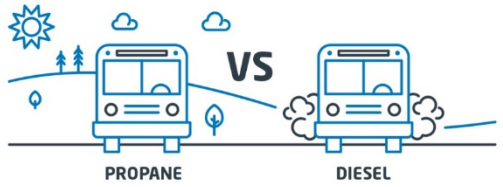
West Coast	Rocky Mountain	Gulf Coast	Midwest	Lower Atlantic	Central Atlantic	New England
$1.98	$2.02	$1.94	$2.06	$2.01	$2.06	$2.01



96%

NOx REDUCTION VERSUS CLEAN DIESEL BUS

Duty cycle: Low speed, stop-and-go route



Source: 2018 West Virginia University study, comparing 2015 LPG Blue Bird school bus (6.8L, 10 Cylinder) with 2014 ultra-low sulfur diesel Blue Bird school bus (6.7L, 6 cylinder).

PROPANE.COM

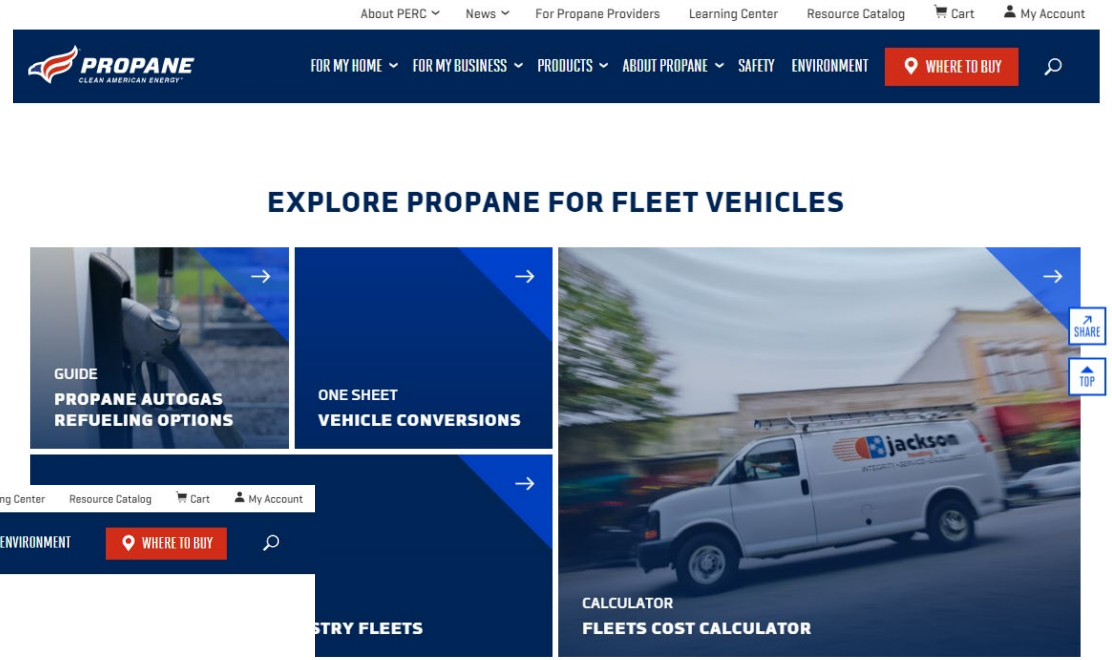
South Coast Air Quality Management District:

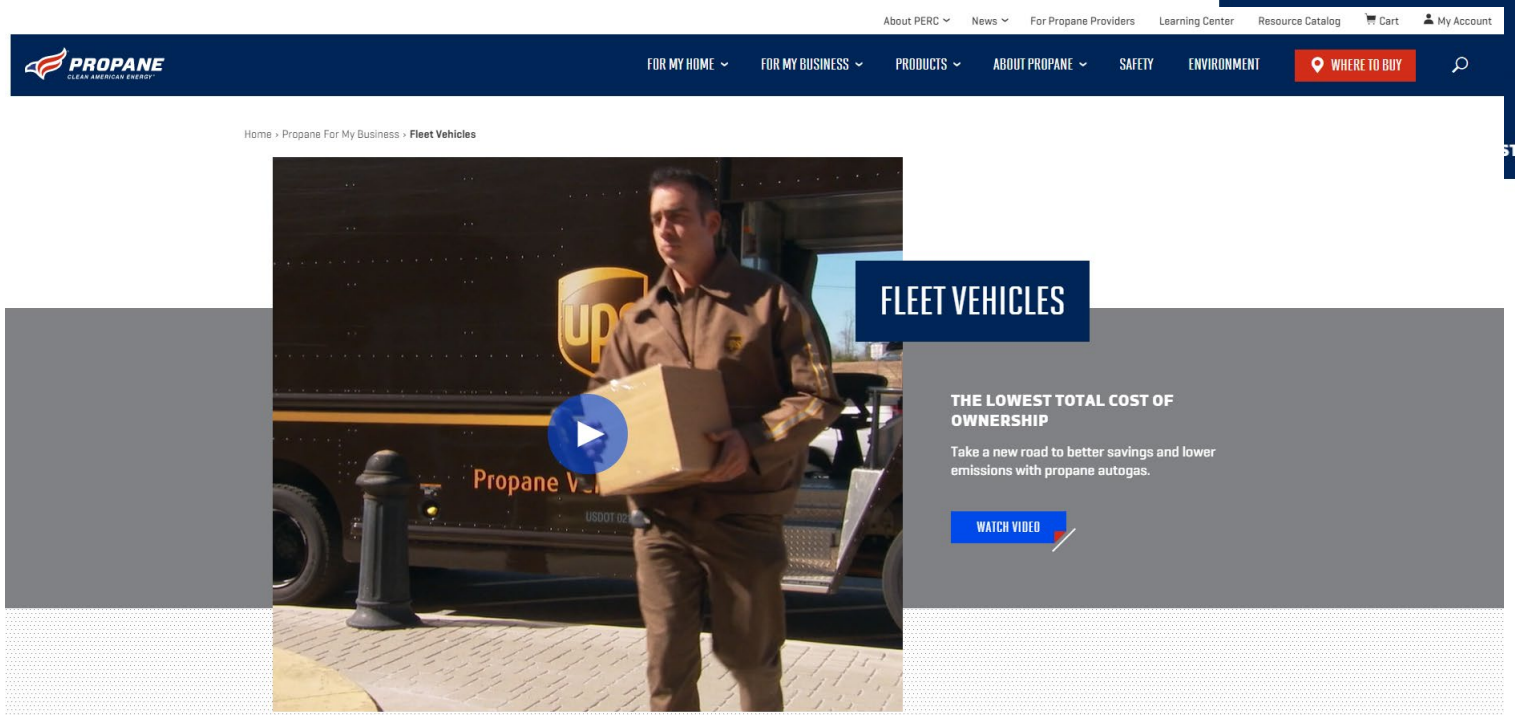
“We face a rapidly approaching hard legal deadline in 2023 to meet the 1997 ozone standard, and 2031 for the 2008 ozone standard. The only way to get there is a massive push for cleaner heavy-duty trucks – the largest source of smog-forming emissions in our region - as soon as possible. While the amount of emission reductions needed to attain clean air standards is daunting, it would be irresponsible for our agency to effectively throw up our hands and not explore all options for reducing emissions now.

Near-zero emission (NZE) technology has been commercially demonstrated and is available today, has sufficient fueling infrastructure that is largely funded by the private sector, and is at least 90% cleaner than new diesel trucks on NOx and 100% cleaner on cancer-causing diesel particulate matter. When fueled by renewable natural gas, these vehicles can also provide a substantial GHG emission reduction. Further, these vehicles are far more cost-effective than ZE trucks, allowing limited incentive funds to stretch further.”

Office of the Executive Officer – Wayne Nastri
8/3/2021

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





STEVE WHALEY

DIRECTOR OF AUTOGAS

BUSINESS DEVELOPMENT

PROPANE EDUCATION &

RESEARCH COUNCIL

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Mike Vittese
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949.437.1286

- Business Development Manager at Clean Energy
- More than 10 years experience in MD/HD truck and transportation industry
- US Navy Veteran

Clean Energy

Renewable Natural Gas for Transportation

America's Best Kept Secret

Mike Vittese
Business Development Manager

Clean Energy

CE at a glance

560+ Stations throughout the U.S. and Canada

Blue chip customer base

amazon

ups

UNITED STATES POSTAL SERVICE

Leading RNG player in the US

Partnerships with global energy leaders

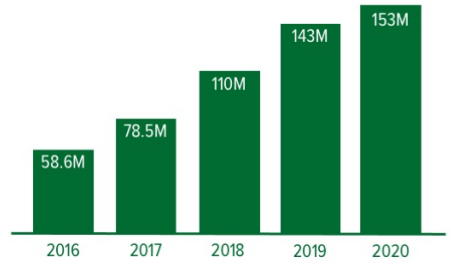
Chevron

bp

TotalEnergies

Environmental credit leader

Growing RNG fuel volumes



Our customers

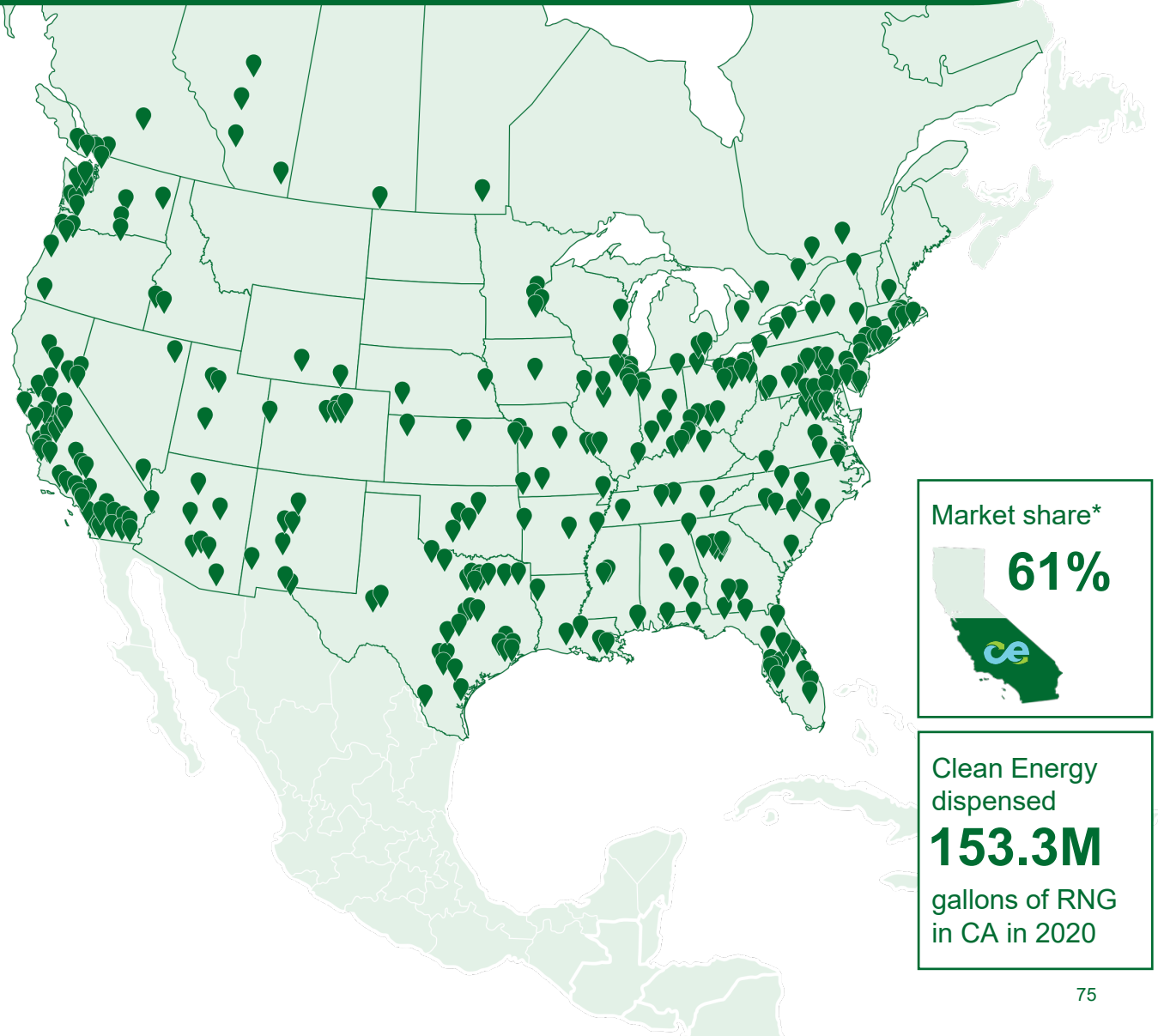
Clean Energy has the RNG Station Infrastructure

Environmental credits are created when fuel is dispensed into vehicle.

Clean Energy owns or operates 150+ California RNG delivery points and 275+ national delivery points, more than any competitor.

Low CI projects contract with Clean Energy for access to California fueling.

Our infrastructure affords us a comprehensive view of supply deals.



Market share*

61%

Clean Energy dispensed

153.3M

gallons of RNG in CA in 2020

**Market share based on California Air Resources Board data and company deliveries of RNG in 2020.*

More than just fuel: turnkey fueling solutions

RNG, CNG & LNG fueling services

Compressors & equipment

Low carbon RNG

RNG supply investment

Engineering & construction
770+ Projects

Environmental credit generation & monetization

Grants & financing
$466M in awards

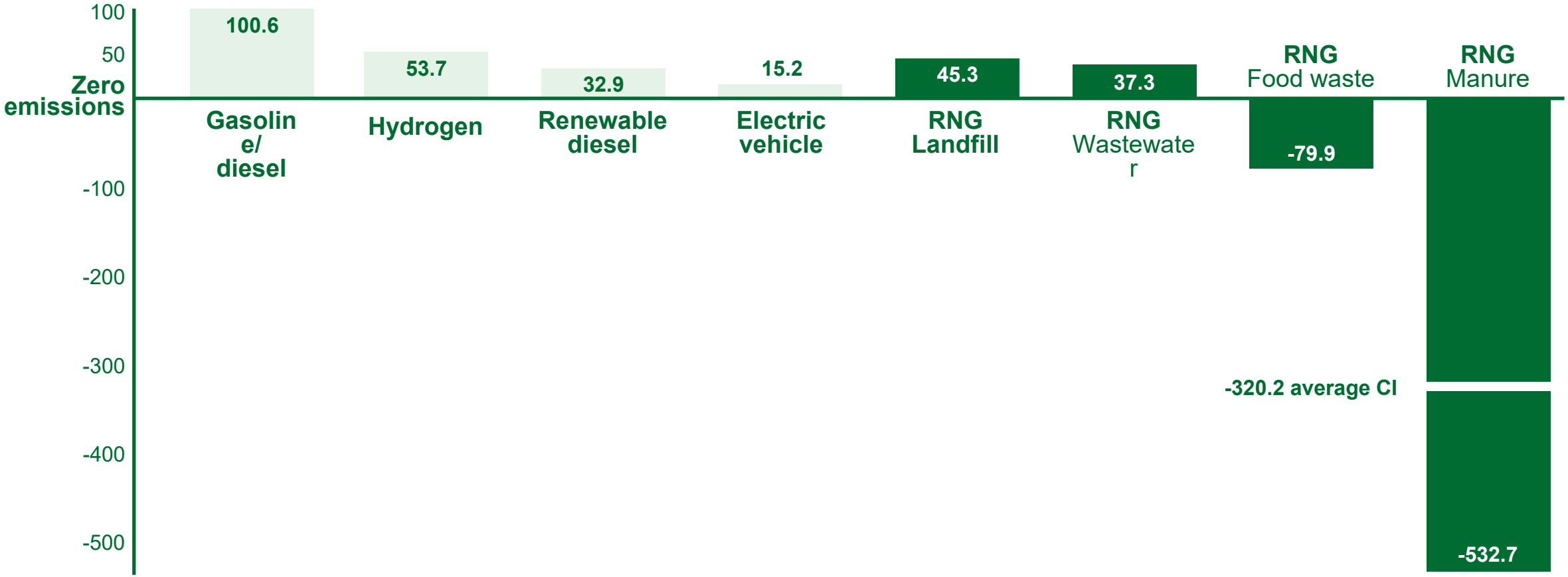
Facilities modification

24/7 Service & support
232 Station operations personnel

Carbon Intensity of transportation fuels

RNG is the cleanest transportation fuel

As shown in the table below, Bio-CNG/RNG is the only fuel that can offer negative carbon benefits.



Source: California Air Resources Board, Q4 2020 LCFS data, and certified pathways as of May 11, 2021.

Heavy-duty truck comparison

Near zero natural gas truck

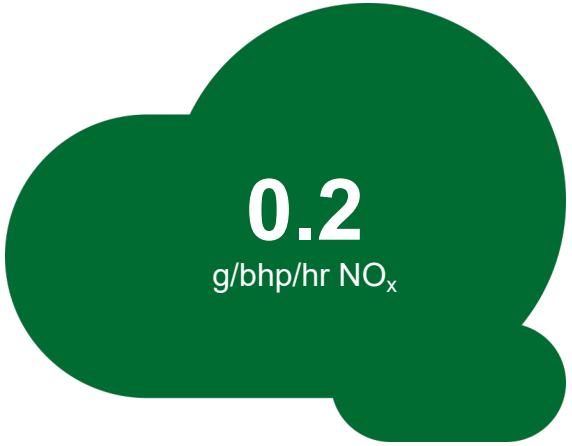
0.02
g/bhp/hr NO_x

A Near Zero natural gas truck is certified to produce 0.02 g/bhp/hr NO_x

Electric truck

A battery electric truck plugged into the California grid produces 0.07 g/bhp/hr NO_x

Diesel truck



A diesel truck produces 0.2 g/bhp/hr NO_x

Source: California Air Resources Board and Industry Data

Here's how RNG is made

Farm
Organic waste is collected and taken to a digester.

Digester
The digester processes the waste and captures the biogas.

Upgrading
The biogas is purified into RNG and injected into the local pipeline.

CE stations
CE distributes the RNG to our stations nationwide, including 65 in California.

The remaining digestate can be used as fertilizer and dry bedding for the farm.

What is renewable natural gas?

Replacement for diesel
RNG is an alternative fuel for heavy-duty trucks, buses, and other large vehicles.

Not a fossil fuel
Made entirely from organic waste, RNG does not involve drilling or fracking.

Renewable
We capture the naturally-occurring biomethane released from landfills and dairies and turn it into RNG.

Decarbonizing fuel
RNG reduces carbon both at the source where it's made and on the road, making it the only fuel that can be carbon-negative.

The benefits of RNG

Sustainable:
Lowers carbon emissions by up to 500%

Renewable:
Made from organic waste, not drilling

Clean air:
Reduces tailpipe emissions by 90%

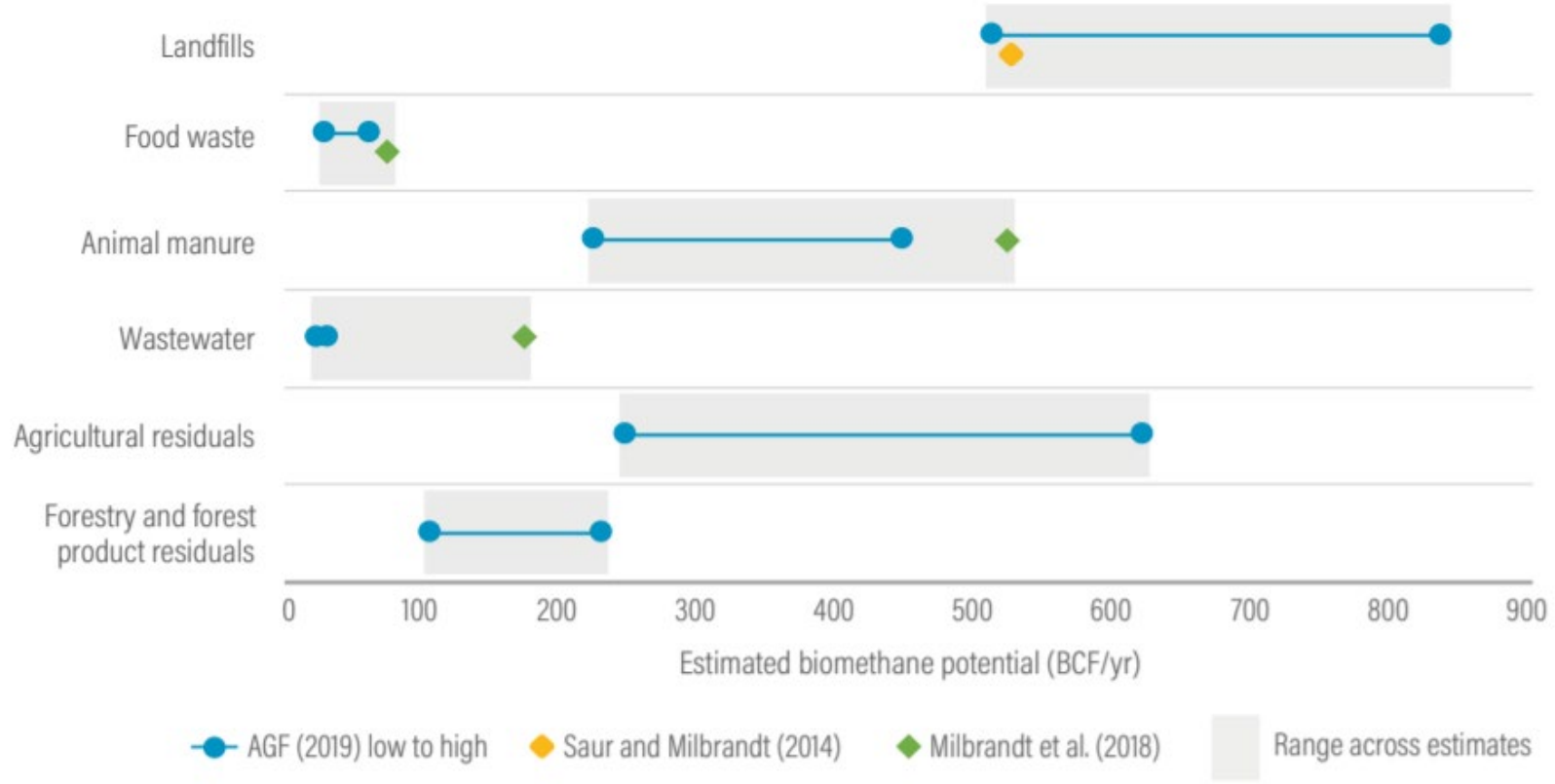
Accessible:
Extensive network of fueling stations nationwide

Affordable:
Stabilized prices and lower maintenance costs

Proven:
Trusted by companies like Amazon & UPS and major transit fleets in NY & LA

How much RNG is there?

Figure 1-2 | National Resource Potential by Feedstock



Note: Studies vary in terms of assumed yield, amount of supply that may be made available, and other factors.
BCF/yr = Billion cubic feet/year.
Sources: Based on raw data from AGF (2019); Saur and Milbrandt (2014); and Milbrandt et al. (2018); aggregated and modified by WRI.

RNG Trade Group – Coalition for Renewable Natural Gas

Why we win with RNG producers and customers

RNG producers
Want a portfolio of customers so that they are not dependent on any one customer.

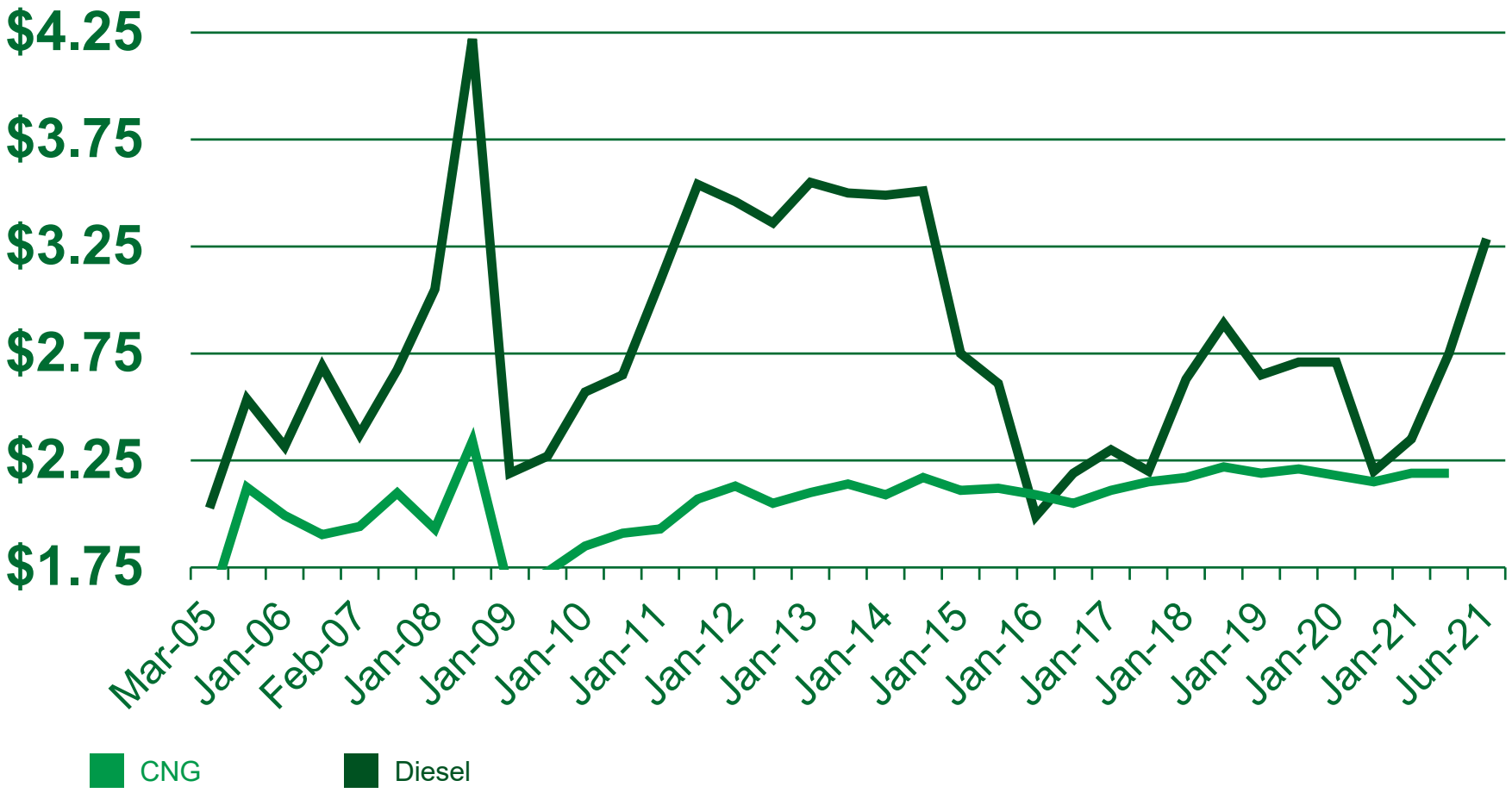
Reinforcing and growing network of producers and customers

RNG pathways to highest value

Federal and state environmental credit generation and monetization

RNG customers
Want a portfolio of producers so that they are not dependent on any one RNG project.

Nationwide Predictability at a Low Price



Sources: Alternative Fuels Data Center: https://afdc.energy.gov/fuels/prices.html and
June 2021 Diesel Price: https://www.statista.com/statistics/204169/retail-prices-of-diesel-fuel-in-the-united-states-since-2009/

CE Exclusive Zero Now Program

Purchase CNG Tractors at Diesel Tractor Prices

- Partnership among Cummins, major OEMs and fuel system providers
- Exclusive Truck Pricing
- CE Participation in Cost of Truck
- Touchpoint Training
- Five Year Engine Warranty INCLUDED

Guaranteed Fuel Spread

- CNG Priced as low as $1.50 below Diesel
- Five Year Guaranteed Discount
- Eliminates Financial Risk

Zero Carbon Emissions Now

- CARB-Certified Near Zero
- Meets 2023 CARB Certification for operation in California
- 100% Renewable Natural Gas
- Up to 90% Reduction in Criteria pollutants

Natural Gas Trucks 2.0

	2014	Today
Engine Reliability	Challenging	Proven
Engine Certification	2010 (0.2 grams)	2023 CARB (0.02 grams)
Warranty	2-Year / 250,000	5-Year / 375,000 CE Standard
Residual	ISX12G	ISX12N Near-Zero 90% Emission Reduction
Renewable Natural Gas	Developing	Nationwide – LCFS Programs in CA, OR, WA & More States to Come
Fuel System Advancement	Utilitarian & Analog	Lightweight, Aerodynamic, Digital (Telematics, Etc.)
Operating Range	400 Miles	700-1,000 Miles
Oil Change Intervals (Average 25+ Speeds)	25,000 Miles	40,000 Miles
Federal GVW Allowance	N/A	+2,000 lbs.
Integrated Aero-Kits	No	Yes
Infrastructure	Dozens of Truck Friendly Stations Regionally	Hundreds of Truck Friendly Stations Nationwide

Say Goodbye to Aftertreatment…

- No Diesel Particulate Filter (DPF)
- No Regens
- No DPF Cleaning
- No Selective Catalytic Reduction (SCR)
- No Diesel Exhaust Fluid (DEF)

=

- No retrofits
- Greater Safety
- Increased Fleet Uptime
- Less Complexity
- $ Savings

2021 CE Demo Trucks Available

Peterbilt 579 Day Cab

Freightliner Cascadia Day Cab

Peterbilt 567 Heavy-Duty Day Cab

Peterbilt 539 Medium-Duty Straight Truck

Clean Energy

CleanEnergyFuels.com

Thank you

Chelsea Jenkins
chelsea.jenkins@roush.com

- Vice President of government and industry relations for ROUSH CleanTech
- Leads strategic efforts including building partnerships with government and nongovernmental organizations
- Prior experience as the Virginia Clean Cities executive director and program coordinator
- 2009 Clean Cities Coordinator of the Year award, she was inducted into the Clean Cities Hall of Fame in 2011
- Degree from James Madison University in Integrated Science and Technology with dual concentrations in Transportation and Environment

ROUSH CLEANTECH

September 2021

SFT Conference:

Alternative and Renewable Fuels for MD/HD Fleet Decarbonization

September 2021

ROUSH® CLEANTECH

ROUSH AT A GLANCE

Privately Held

Michigan-based

Founded in 1976

5,000+ Employees

3 MILLION sq. ft. office / development space

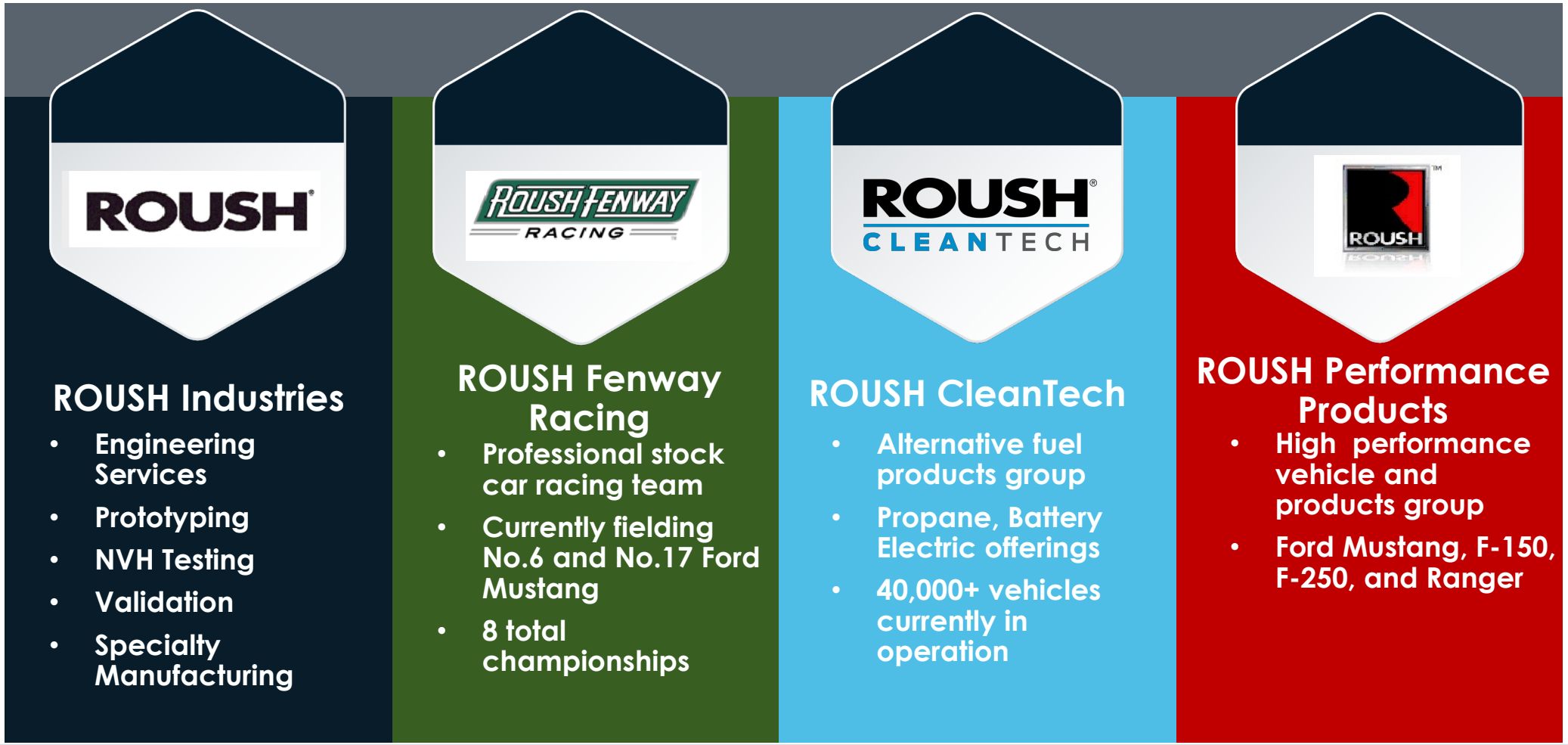
50 YEARS of product development expertise

PRIMARY ACTIVITIES

Design | Engineering | Prototyping | Testing | Manufacturing

Enterprise Brand Portfolio

ROUSH is a group of companies, with private equity ownership.



ROUSH IN THE ELECTRIC VEHICLE INDUSTRY

1998 — Ford Ranger EV Prototyping

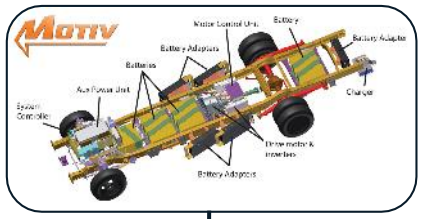
1999 — 1st Hybrid Transmission Prototype Build & Test

2005 — Ford Escape HEV Prototyping

2008 — Fisker Design Engineering

2009 — Roush Electric Vehicle

2011 — Motiv BEV Assembly; Blink Charger Assembly



2012 — VIA Motors Design & Prototyping

2014 — Google Firefly Design & Production

2017 — Cummins AEOS Class 7 EV Demo

2018 — Farmwise Agribot

2019 — Canoo

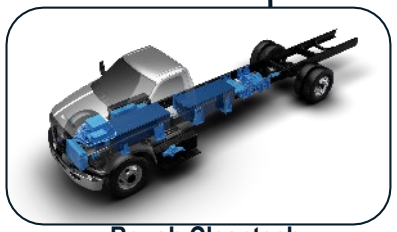
2019 — CONFIDENTIAL Series Hybrid Commercial Truck

2019 — CONFIDENTIAL Mobile High Voltage Charging Vehicle

2020 — CARB UPS Hydrogen Fuel Cell Electric Vehicle

2021 — Nuro AI Delivery Bot

2021 — Roush Cleantech F650 BEV



1998 1999 2005 2008 2009 2011 2012 2014 2017 2018 2019 2020 2021 2022 2023 2024

Strong Tailwinds

REGULATORY

- California Advanced Clean Truck
- 15 states MOU 100% ZEV
- Global Drive to Zero
- CA & OR LCFS
- Fed & CA GHG regs

OEM COMMERCIALIZATION

- Volvo
- Tesla
- Proterra
- Daimler
- Rivian
- Nikola
- Ford

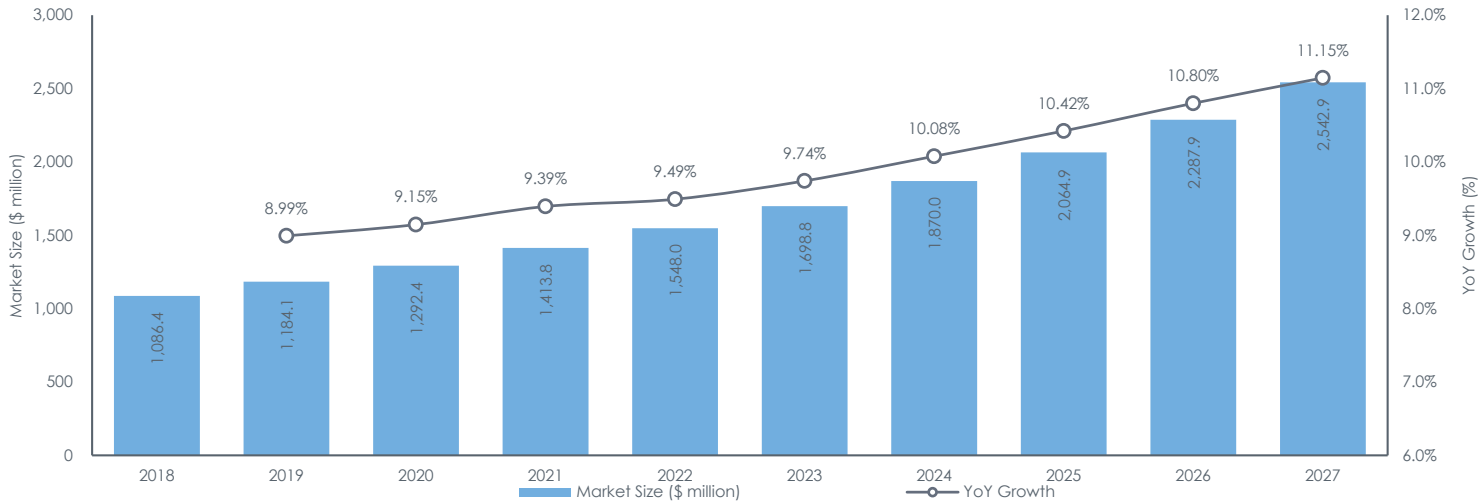
INCENTIVES

- Favoring EVs
- Federal, state & utility
- Carbon credits
- COVID impact / recovery

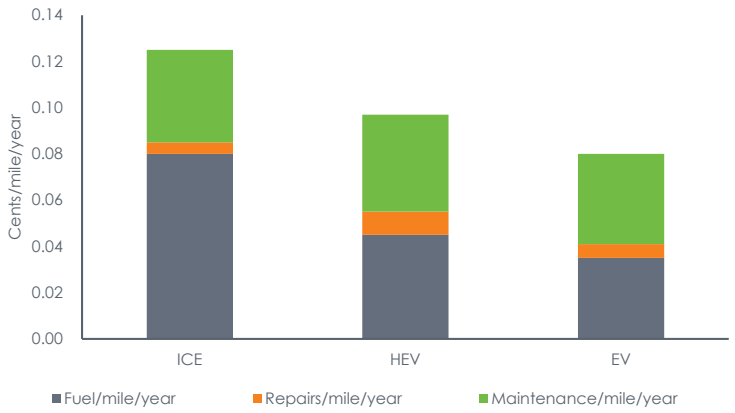
FUTURE OF MOBILITY

- Electric
- Autonomous
- Hydrogen
- Connected Vehicle
- Fleet Services

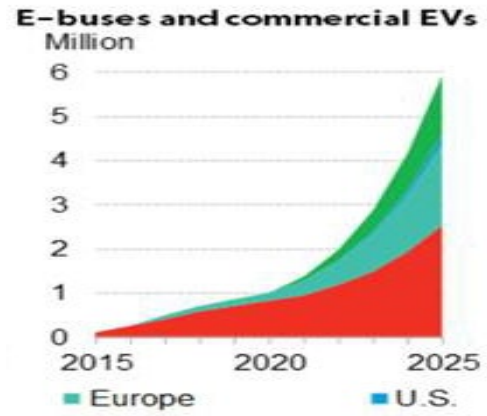
North America Commercial Vehicle ("CV") Market



EV/Hybrid Variable Operating Costs



Global EV Fleet by Segment & Market



Sources: Company information, Morningstar, The Insight Partners, BNEF

Grid Ready?

A U.S. DOE study found that **increased electrification across all sectors of the economy could boost national consumption by as much as 38% by 2050**, in large part because of electric vehicles. The environmental benefit of electric cars depends on the electricity being generated by renewables.

So far, states predict they will be able to sufficiently boost power production. But whether electric vehicles will become an asset or a liability to the grid largely depends on when drivers charge their cars.

A November report sponsored by the U.S. Department of Energy found that there has been almost no increase in electricity demand nationwide over the past 10 years, while capacity has grown an average of 12 gigawatts per year (1 GW can power more than half a million homes). That means energy production could climb at a similar rate and still meet even the most aggressive increase in electric vehicles, with proper planning.

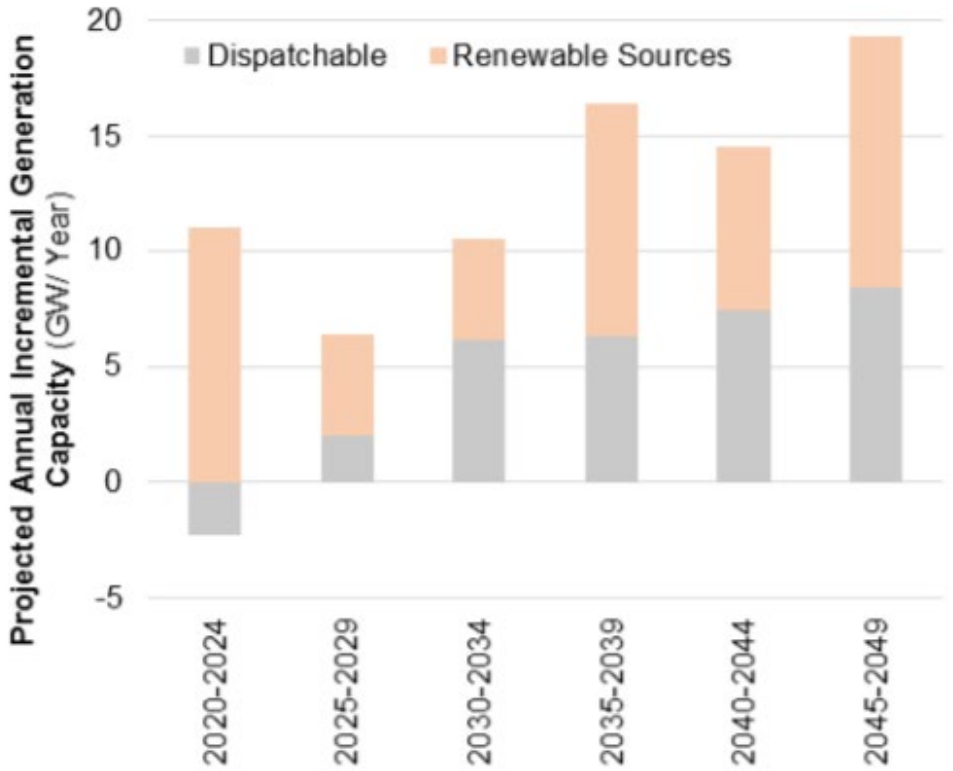
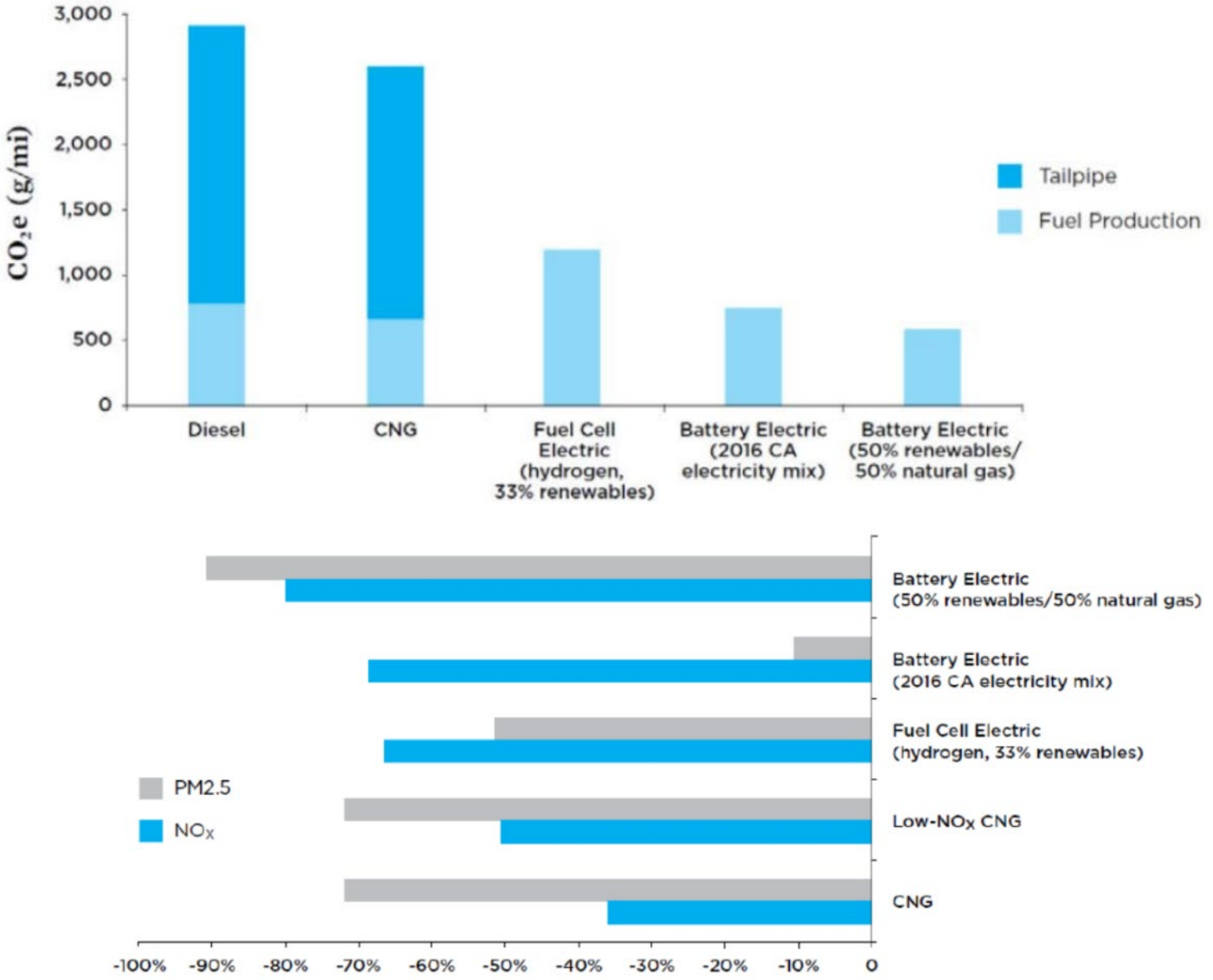


Figure 8 U.S. projected annual incremental generation capacity for2020 to 2050 [21].

The overarching conclusion is that EVs at Scale will not pose significantly greater challenges than past evolutions of the U.S. electric power system

Environmental and Climate Benefits

Electric Vehicles have far fewer GHG, PM2.5 and NOx emissions than diesel. And, the emissions benefits are even greater when (in the future) we could get to a 50-50 mix with renewable and natural gas power generation.



Source: American Council for an Energy Efficient Economyv (ACEEE)
Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers: 2021 Update

Total Cost of Ownership – Billion Dollar Question

Regional Answer

- Low Carbon Fuel Standard
- Utility Participation
- Utility Rates
- State level funding
- Federal Funding
- Vehicle to Grid

ROUSH CLEANTECH	GAS	Diesel	EV
FUEL			
Annual Miles per Bus	25,000	25,000	25,000
Years Operated	10	10	10
Total Miles Lifetime Miles per Bus	250,000	250,000	250,000
Fuel Economy (mpg)	6.00	7.50	1.40
Gallons Used Annually per Bus	4,166	3,333.00	929
Gallons Used Total per Bus	41,666	33,333.00	9,295
Fuel Price / Gallon	$2.75	$2.95	$4.90
PREVENTATIVE MAINTENANCE			
Oil Interval	5,000	7,000	10,000
Oil Capacity (Quarts)	7	21	3
Oil Filter Cost	$5.00	$9.36	
Cost per Oil Change	$22.50	$61.86	$7.50
Lifetime Oil Change Total Cost	$1,125.00	$2,209.29	$188
DEF Lifetime Cost		$2,520	
Fuel Filters Change Interval		15,000	
Fuel Filters Cost		$12.99	
Total Filters Changes		16	
Fuel Fiter Cost Lifetime		$207.84	
Total Cost	**Gasoline**	**Diesel**	**EV**
Lifetime Cost	$175,707	$173,269.45	$170,687.50
Lifetime Savings	-$2,437		$2,582
Cost per Mile	$0.70	$0.69	$0.68
			Grants

Fuel	Propane Fuel Price	$1.30	Diesel Fuel Price $2.95
	Gasoline Fuel Price	$2.75	Electricity kWh $0.13
MPG	Propane MPG	4.50	Gasoline MPG 6.00
60%	Diesel MPG	7.50	EV Efficiency kWh/Mile 1.40
Vehicle	Years Operated	10	Gasoline Truck Price $60,000
	Annual Miles per Bus	25,000	Diesel Truck Price $70,000
	Propane Truck Price	$0.00	EV Truck Price $250,000.00
Grants			EV Bus Grant $125,000.00
	LPG Bus Grant	$0.00	Diesel Bus Grant $0.00

Current Offering

Ford F-650

- Range: 120 miles (Maximum Payload)
- Payload: 14,500lbs (8500 w/upfit)
- Gross Vehicle Weight: 26,000lbs
- Charging: Level 3 –DC Fast Charge
- Proterra Powered – 165KwH

Current Deployments:

- City of Los Angeles
- ROUSH Fenway Racing
- Penske
  - Bimbo / Iron Mountain / Costco / Nestle

ROUSH CleanTech BEV F-650 Applications

Last Mile

Hub & Spoke Routes

Dry Freight

Public / Private

Operator Experience

- "The [driver] is in love with the truck and after speaking with him I called his manager just to see if he might have said something he did not want to tell me. Both stories were the same and you will most likely have to pry that truck out of his hands when you try to take it. It's a Roush…what do you expect?"

BIMBO BAKERIES USA

- "I would keep the EV, you don't have to worry about refilling it up with diesel which saves a lot of time on the route. I don't have to worry about in the back of my mind returning the unit if the unit is low on fuel"

ROUSH CleanTech Battery Electric Ecosystem

Transition to Battery Electric can be a complex task from a cost and operational standpoint. ROUSH has the partners and technology to streamline the process.

Customer Success

Service Parts

Forecasting

Pricing

Set-up

Sales

Contact Center

Case Management

Omni-Channel Support

Customer Self-Service

Feedback / surveys / VOC

Warranty

Emerging Issue ID

Escalation Processes

Technical Support

Field Service

On-Site Troubleshooting

Service Network Management

Technical Training

Training

Learning Management System

Factory Workshops

On-Site Training

Employee Training

Technical Publications

Version Management

Capture, Document, Edit, Publish

Tech Tip Videos

Knowledge Base Administration

Thank You

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