



West Coast Partnership to Promote Alternative Fuel Corridors

Natural Gas and Propane Technologies & Infrastructure

Alternative Fuel Infrastructure Corridor Coalition (AFICC)

Washington, Oregon, and California

Webinar Session #3

Thursday, November 1, 2018

2:30 p.m. – 4:00 p.m. PT

Overview

- Overview of the Alternative Fuel Infrastructure Corridor Coalition (AFICC)
- AFICC Technical Webinar Objectives
- Discussion Leader Presentations: Natural Gas and Propane Technologies and Infrastructure
- Workgroup Discussion

Alternative Fuel Infrastructure Corridor Coalition (AFICC)

1. Convene a stakeholder coalition focused on M/HD alternative fuel infrastructure deployment.
2. Conduct stakeholder workgroups & targeted outreach to identify desired and unfunded M/HD alternative fuel stations.
3. Synthesize stakeholder input into a plan document.
4. Use the plan to support project development, leverage existing funds, and seek joint applications to US DOT and other competitive funding programs.
5. Obtain federal funding assistance to help implement infrastructure in California, Oregon and Washington (i.e. natural gas, propane, electric vehicle charging and hydrogen for public and private M/HD fleets).



AFICC Project Overview



**Present
Outcomes to
Partners**

Needs

- Prioritize Hot Spots (Areas of Congestion, EJ Communities, Intermodal Freight Hubs)
- ID Alt. Fuel Infrastructure Gaps
- ID Best Techs/Fuels for Vocational/ Transportation Activities/Project Areas

Draft Implementation Plan

- Include Themes & Priorities
- Outline Strategy & Actions
- Provide Recommendations
- ID AFV Project Partnerships
- Estimate Project Costs & ID Funds

Develop AFV Stakeholder Synthesis

- Summarize Workgroup Feedback
- Respond to Questions
- Outline Critical Barriers & Challenges
- Evaluate Needs & Costs for AFV Infrastructure

**Facilitate
Workgroup Sessions
[CA, OR & WA]
Collect Feedback, Compile
Info, & Research Q's**

Establish Framework

- Define Workgroup Discussion Objectives
- ID Key Stakeholders
- ID Coalition-Supporting Resources
- ID Direct Outcomes

Opportunities

- ID partnerships with Freight Shippers, Carriers, BCOs, Ports, Railroads, Truck Associations (LMCs/IOOs) Truck Stops, Warehouses, EDCs, and Cities on Coordinated Alt. Fuel Corridor Projects

Today's Webinar Objectives

Learn from vehicle manufacturers, fuel suppliers and fleets about the benefits, application and business case for natural gas and propane vehicle technologies.

- 1) Latest emerging technologies and costs;
- 2) Operational suitability;
- 3) Infrastructure considerations;
- 4) Fleet best practices; and
- 5) Opportunities for alternative fuel corridors.

Our Next Technical Webinar

Plug- In Electric and Hydrogen Fuel Cell Technologies and Infrastructure Webinar

November 6th, 2018

10:30 a.m. – 12:30 p.m. (PST)

- Tim Weaver, VP of Corporate Development, Chanje
- Brendan Riley, President, GreenPower Motor Company, Inc.
- David Peterson, Director of Fleet Solutions, ChargePoint
- Rob Del Core, Managing Director, Hydrogenics USA, Inc.
- Alan Mace, Heavy-Duty Market Manager, Ballard Power Systems

Register Here:

<https://attendee.gotowebinar.com/register/926801834837034242>



Today's Discussion Leaders

Program Facilitators

- **Alycia Gilde**, Director, CALSTART
- **John Mikulin**, Environmental Protection Specialist, EPA Region 9

Presentations by:

- **William Zobel**, General Manager, Business Development & Marketing, Trillium CNG
- **Ruan Transportation Management Systems**, a Renewable Natural Gas Case Study
- **Joy Alafia**, Executive Director, Western Propane Gas Association
- **Todd Mouw**, President, ROUSH Clean Tech
- **Dan Zenger**, Equipment Services Superintendent, City of Vancouver, WA
- **Discussant: John Gonzales**, Senior Engineer, Advanced Deployment, National Renewable Energy Laboratory



West Coast Collaborative, Alternative Fuel Infrastructure Corridor Coalition Webinar

*CNG Market and Technology Overview
11/1/2018*



1-800-920-1166
loves.com/trillium

A  **Loves Company**

Who is Trillium



Trillium is the Alternative Fuel Brand for the Love's Family of Companies



CNG / RNG



Electricity



Hydrogen

- Trillium provides turn-key solutions for our CNG/RNG, EV Charging and Hydrogen fueling customers
 - Design and Build Refueling Centers
 - Provide Operations & Maintenance Services
 - Provide Retail Fueling
 - Provide Renewable Natural Gas (RNG) Supply
- Own/operate over 220 fueling stations nationwide



Current CNG Trends

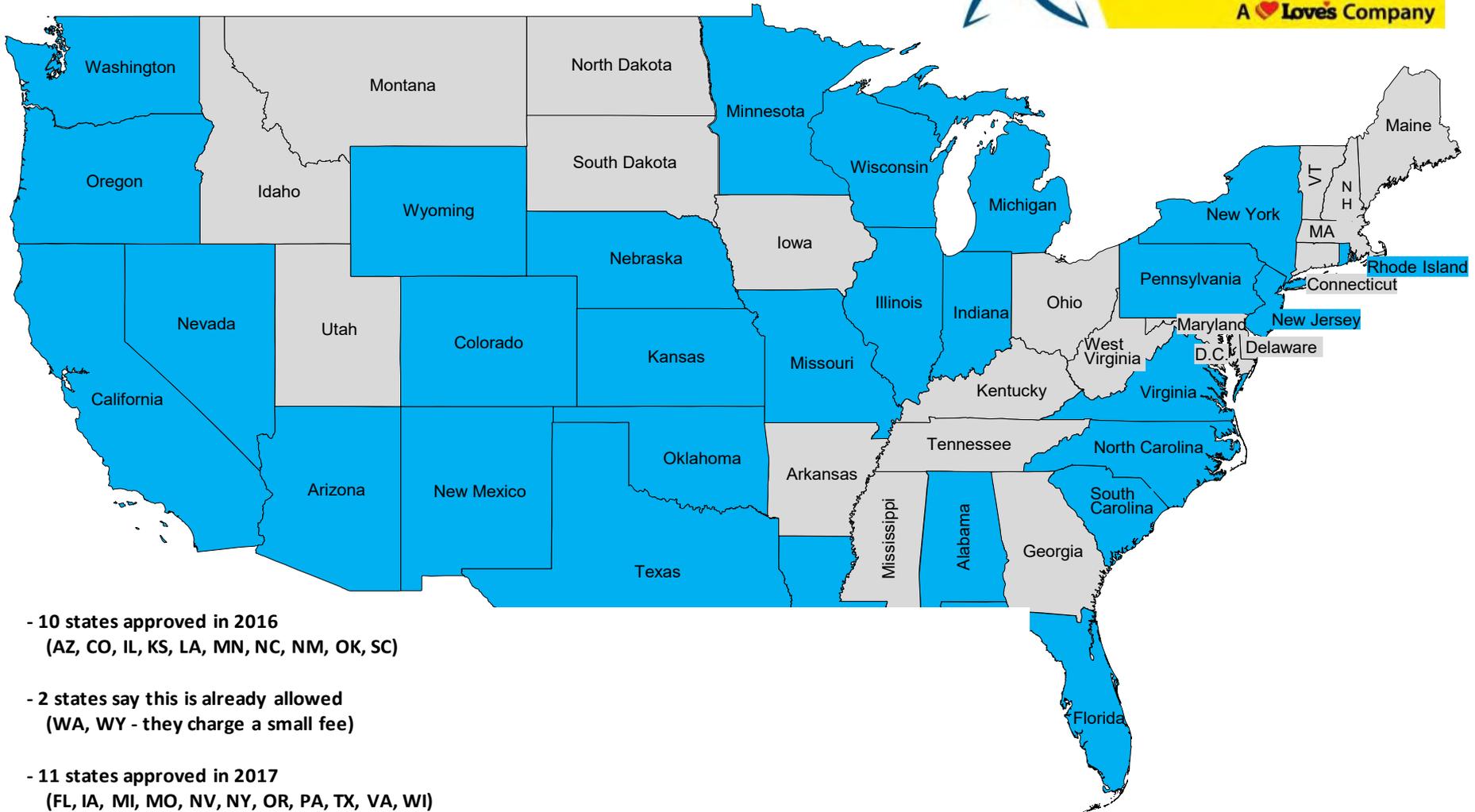


CNG Economics for Commercial Fleets are Very Attractive

- **CNG economics are very attractive**
 - Retail fuel spread vs. diesel is \$1.50 - \$2.00 in the west
 - Savings of \$0.05 – \$0.10 cents per mile
 - Incentives up to \$40,000/class 8 (OTR) truck
 - Fuel Providers are locking diesel minus value
- **CNG Trucks run reliably and clean**
 - New 12L LoNOx engine platform available
 - Cleanest commercially available HD truck
 - No DPF maintenance, No DEF
- **2,000 Lbs. weight exemption in 28 States**



US States with 2,000 lb. Weight Exemption Sept. 2018



- 10 states approved in 2016
(AZ, CO, IL, KS, LA, MN, NC, NM, OK, SC)
- 2 states say this is already allowed
(WA, WY - they charge a small fee)
- 11 states approved in 2017
(FL, IA, MI, MO, NV, NY, OR, PA, TX, VA, WI)
- 5 states approved in 2018
(AL, CA, NE, NJ, RI)

Which Fleets make sense for CNG Conversion?



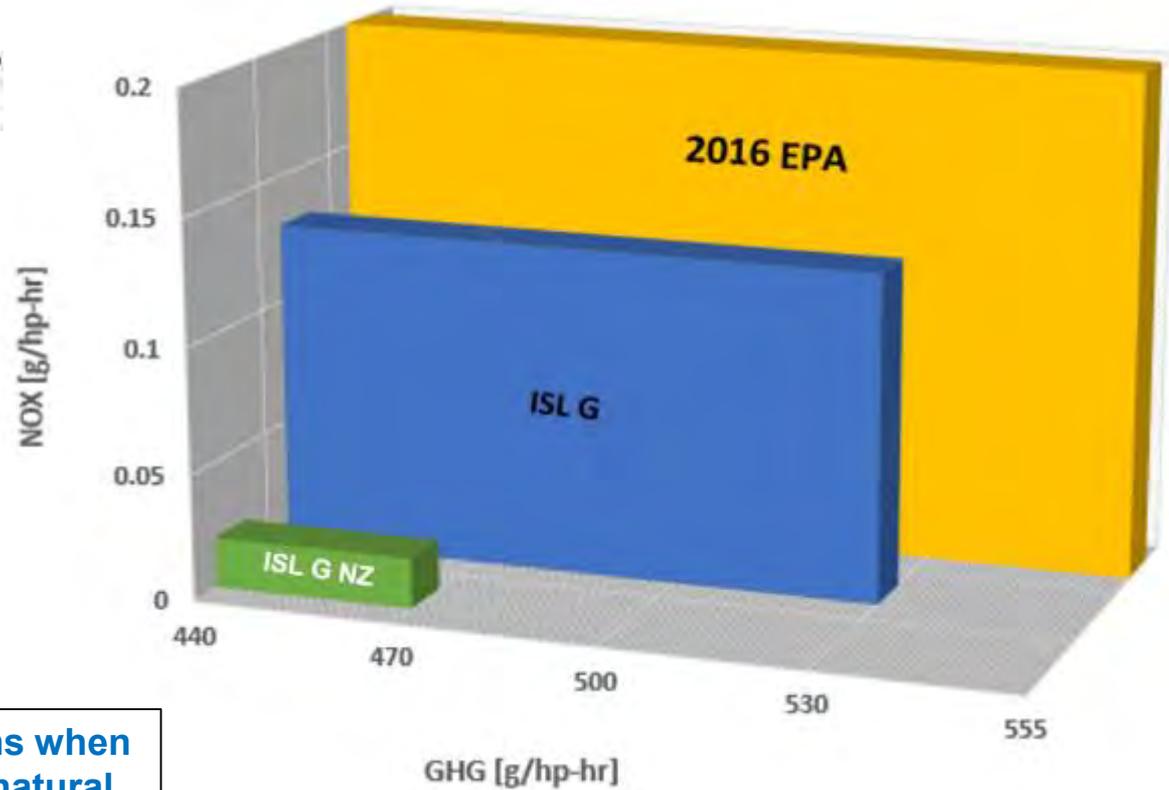
High Fuel Consuming Fleets Realize Savings with CNG

- **Fleets whose trucks consume a high volume of fuel**
 - Over the road trucking > 85,000/year/truck
 - Refuse and Transit
- **Fleets able to utilize state level grants**
 - Usage in specified states and air-sheds
- **Fleets with good maintenance practices**
 - On par to a few cents per mile more than diesel
- **Fleets Seeking a Competitive Advantage**
 - Sustainability Benefits for Shippers
 - Lower Cost per Mile
 - Low Fuel Price Volatility
 - Low Fuel Prices Long Term



Cleanest Commercially Available Engine

ISL G NEAR ZERO



Further GHG reductions when used with renewable natural gas (RNG)

*Information provided by Cummins Westport

CNG Engine Line-up



Product line

Over 60,000 engines delivered worldwide



ISB6.7G
6.7L

Spark Ignited, SEGR, TWC
Peak Rating: 260 hp
660 lb-ft torque
33,000 lb. GVW
School bus/MD Truck/Shuttle
bus/Sweeper/Yard spotter



ISL G
8.9L

Spark Ignited, SEGR, TWC
Peak Rating: 320 hp
1000 lb-ft torque
66,000 lb. GVW
Refuse/Transit/Regional P&D
Truck/Mixers



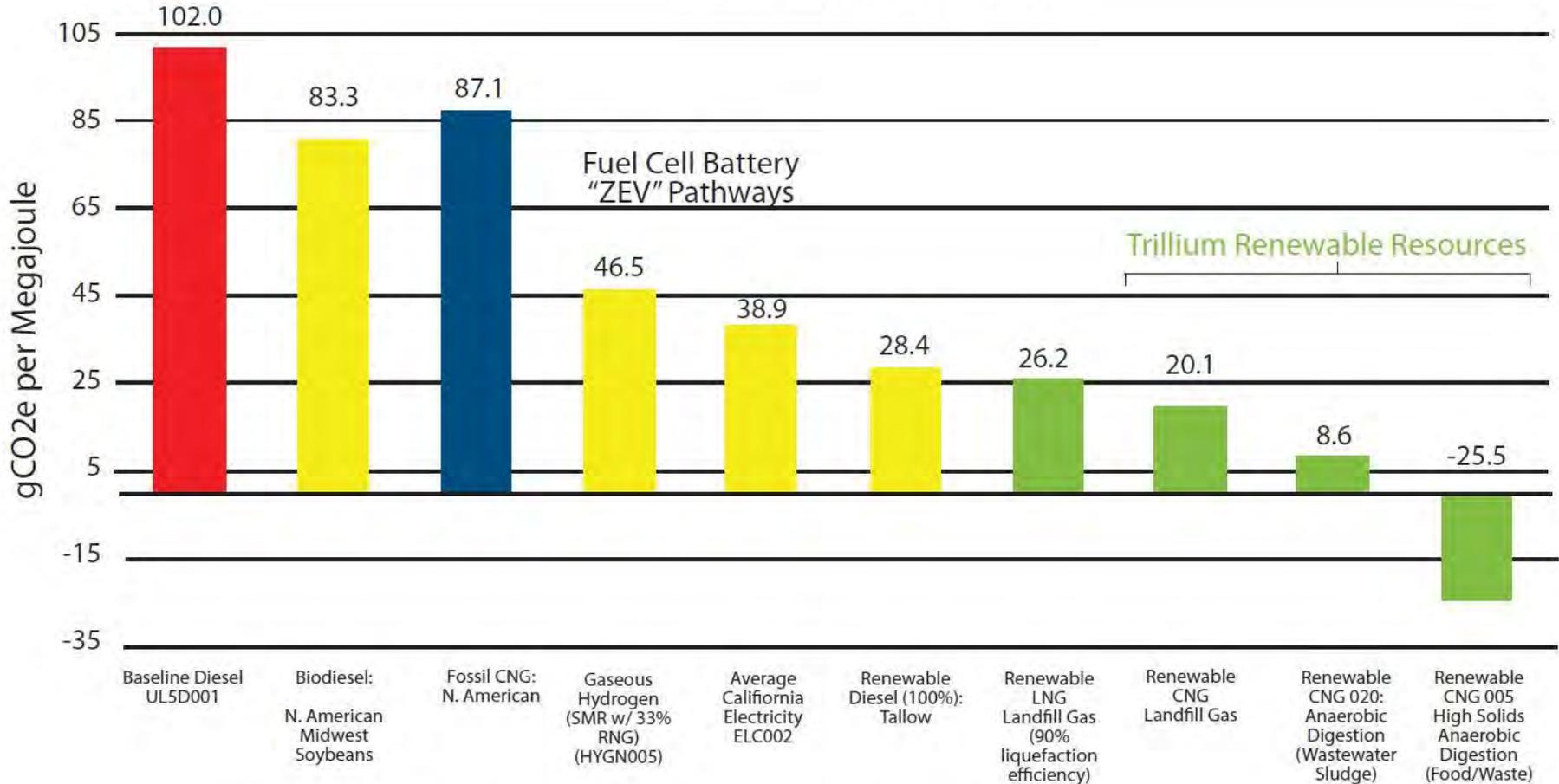
ISX12 G
11.9L

Spark Ignited, SEGR, TWC
Peak Rating: 400 hp
1450 lb-ft torque
80,000 lb. GVW
Regional Haul
Truck/Tractor/Refuse



Carbon Benefits of RNG

Carbon Intensity Scores



Bar Graph- Data provided by Gladstein, Neandross & Associates' "Game Changer" Report, May 2016. For more information, please go to www.gladstein.org.

CNG Refueling Infrastructure



Building CNG Refueling Infrastructure Right Pays Off

■ Keys to CNG Refueling Infrastructure

- Dependent on Fleet Operation
- Refueling Speed
- System Controls, Energy Mgt.
- Reliability – Preventative Maintenance
- 24/7 Monitoring
- Response Time
- Service Network
- Utility Connections



CNG Station Development



CNG Stations Are Easy to Locate

- New CNG Development
 - Commercial Corridors
 - High Capacity Designs
 - Retail Hospitality Centers
 - Card Lock Operations
 - Incentives Factor In

- Locating CNG Stations:

<https://www.afdc.energy.gov/stations/#/find/nearest?fuel=CNG>

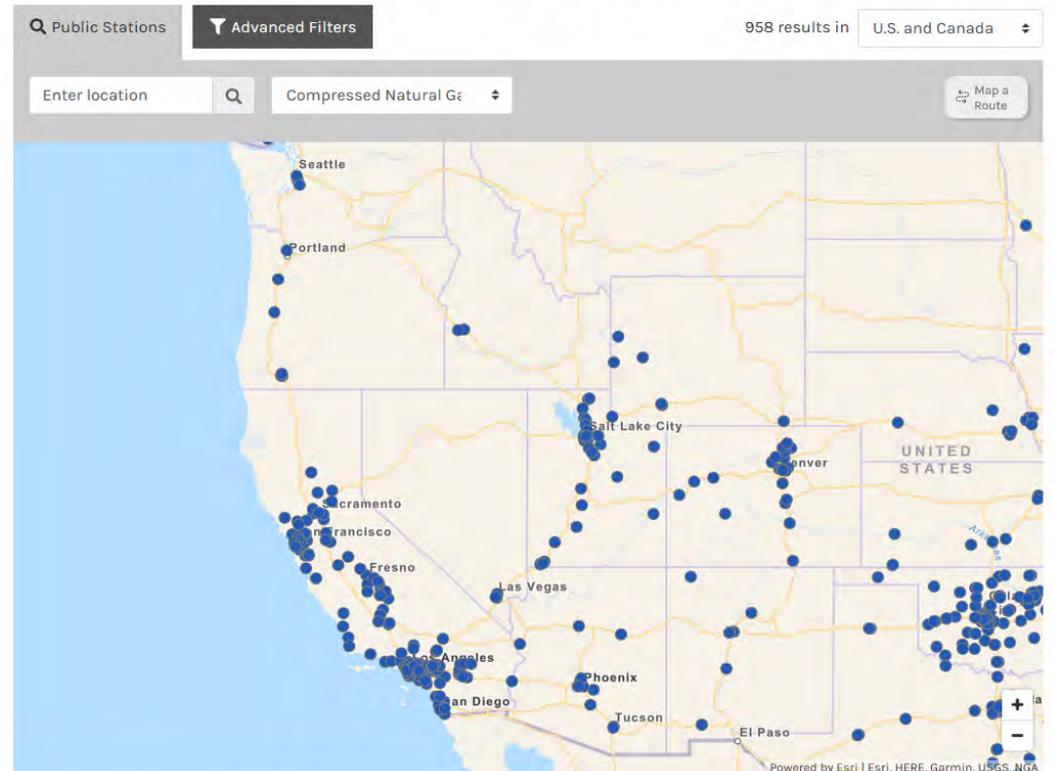
<https://maps.cngnow.com/>

<http://www.cngprices.com/>

<https://www.ngvamerica.org/fuel/ngv-station-map/#/find/nearest?fuel=CNG,%20LNG>

Alternative Fueling Station Locator

Find alternative fueling stations in the United States and Canada. For U.S. stations, see [data by state](#). For Canadian stations in French, see [Natural Resources Canada](#).



iPhone App for U.S. stations Android App for U.S. stations Developer APIs Embed Tool Submit New Station About the Data

Grants and Incentives



Grants and Incentives Improve Fleet Economics

- **Vehicles and Infrastructure**
 - State Level Programs – Ca, Co
 - Variety of market segments – HD, MD
 - Air Quality
 - Carbon Reduction (Ca)
- **VW Settlement Fund**
 - Much of the pie going to public schools and municipal government
 - Funding programs vary by state
 - <https://www.ngvamerica.org/vw-trust-action-center/>



Trillium

Bill Zobel: Vice President – Business Development & Marketing

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A  Loves Company



Logistics Management



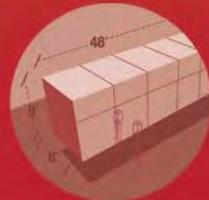
Dedicated Contract Carriage



Warehouse Management



Bulk Transportation



Custom-Built Transportation



Carrier Management



Kitting and Subassembly



Brokerage Services

RUAN

Class-8 CNG and RNG Experience

Natural Gas and Propane Technologies
& Infrastructure Webinar

West Coast Collaborative, Alternative
Fuel Infrastructure Corridor Coalition
(WCC-AFICC)

Ruan Transport Corporation
Steve Larsen 11/1/18

Ruan Introduction

- + Founded 1932 (John Ruan), Headquartered in Des Moines, IA
- + Primary business offerings
 - Dedicated Contract Transportation
 - Supply Chain Solutions
 - Warehouse Management
 - Integrated Solutions
- + National footprint with 300+ Operations
- + Approximately 4,000 Class 8 tractors / 9,500 trailers
- + Sustainability
 - Multiple time Excellence Award recipient – EPA Smartway Partner
 - Member of DOE National Clean Fleets Partnership
 - Heavy Duty Trucking “Top 50 Green Fleets” award winner
 - Named annually to Food Logistics’ “Top Green Provider” list
 - Named annually to Inbound Logistics’ “Green Supply Chain Partner” list



Compressed Natural Gas Fleet (CNG and RNG)

- + Over 90 million miles run on CNG equipment to date
- + Fleet at a glance
 - 120+ CNG 12L tractors in service
- + Fleet domiciles: IA, IN, MN, TX, WI



CNG vs. Diesel Decision Making Process – ROI Model

- + Generic assumptions (# of trucks, miles/yr, contract term)
- + Fuel Assumptions
 - MPG
 - Price per gallon
 - DEF usage rate and cost (diesel only)
 - Fuel credits or incentives (LCFS, RIN, VETC, IFTA discounted rates)
- + Equipment
 - Costs
 - Grants (if applicable)
 - Residual assumptions (to calculate depreciation)
 - Interest
 - Maintenance costs per mile
- + Other State-level impacts
 - Excise or Sales tax on purchase
 - Personal property tax
- + Calculation of total cost of ownership and resulting cost per mile
- + Decision based on costs, emissions benefits and customer needs

CNG – Ruan Experience

+ Equipment

- Various fuel system/tank suppliers
- Vehicle cost
 - Significant upcharge vs. diesel
 - Largest factor is the CNG tank selection
- Don't over-spec, but need to be comfortable with operating range/weight
- Depressed resale market led to decision to refurbish and run equipment for second life

+ Maintenance

- Many of Ruan's Fair Oaks, IN vehicles have over 1 million life-to-date miles (after refurbishment)
- Shorter maintenance intervals (oil changes)
- Spark plugs (n/a on HPDI diesel engines)
- Tank inspections every 36,000 miles
- Overall CNG equipment maintenance generally expected to be a little higher than diesel
 - Approximately \$0.02 per mile higher including inspection costs

CNG/RNG Station Considerations – Fleet

- + Ensure station specs are adequate for fleet operations
 - Class 8 accessible
 - Accessible location (controlled intersections, road type/condition, proximity to interstates)
 - Fleet cards accepted (i.e. Comdata)
 - Alphanumeric keypad (similar to National truck stop chains)
 - Redundant compressors
 - Fill rates (should be ~ 10 to 14 GGE per minute)
 - Card lock vs full service truck stop
 - Customer service phones available for drivers
 - Public vs. “behind the fence”
 - Multiple pumps/lanes

Renewable Natural Gas (RNG) – Ruan / Fair Oaks Farms

- + Anaerobic digestion – 32,000 dairy cows
 - ampCNG produces 2 million DGE/yr of RNG from dairy cow waste
- + Operation consists of 140 drivers, 40 tractors, & 85 tankers
- + 333,000 gallons of milk moved daily; 122 million gallons of milk per year
- + Approx. 60 million miles since 2011
- + RNG fueling displaces 1.8 million gallons of diesel annually
- + Fleet life extended with engine work and cab refresh
 - Many units in the CNG fleet have well over 1 million life-to-date miles



Special Considerations for Renewable Natural Gas Projects

+ Key RNG Stakeholders and their primary roles

- Natural gas producer – Capital investor (digester)
- Local Utility – Bringing RNG from digester to pipeline (Capital and rates/fees)
- Shipper – Willing to sign up for multi-year transportation commitment
- Carrier – Purchase vehicles, sign up for multi-year fuel supply agreement
- Fuel retailer / Station management – Card readers, site maintenance, fuel invoicing
- Governmental agencies – Grants / incentives, project permitting
- Maintenance provider – CNG compliant shops, maintenance contracts (or Carrier)
- Vehicle manufacturer – Appropriate vehicle specs and pricing

RUAN

Please reach out with questions:

Steve Larsen

slarsen@ruan.com



Propane Autogas & the Future for Fleets

Joy Alafia
President/CEO



WPGA[®]
WESTERN PROPANE
GAS ASSOCIATION

ROUSH[®]
CLEANTECH

PSI
POWER SOLUTIONS
INTERNATIONAL



Aftermarket Certified Fuel Systems (Outside California)







City of San Antonio



PRIME TIME
SHUTTLE

Why Autogas?

- Proven safe technology.
- Reliable performance.
- Affordable infrastructure.
- Domestic, portable, and clean.
- Ease of adoption.
- **Lowest total cost-of-ownership.**

Reliable

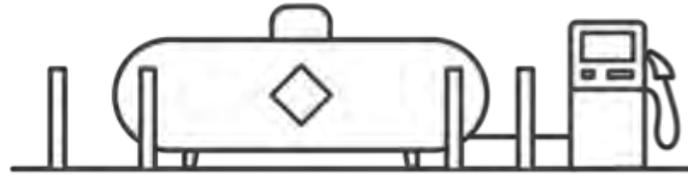
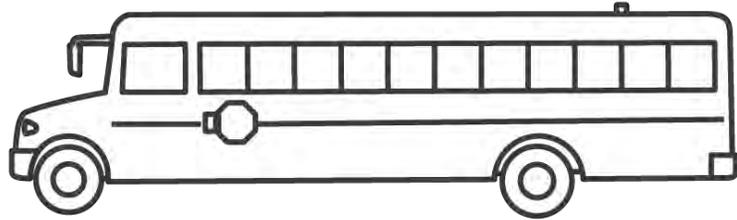
- Propane autogas performs in the coldest climates.
 - Cranks reliably down to -50F
 - No block heaters or fuel conditioners.
 - Fast warm up w/our lengthy idle periods.
 - Produces consistent heat throughout the passenger compartment.



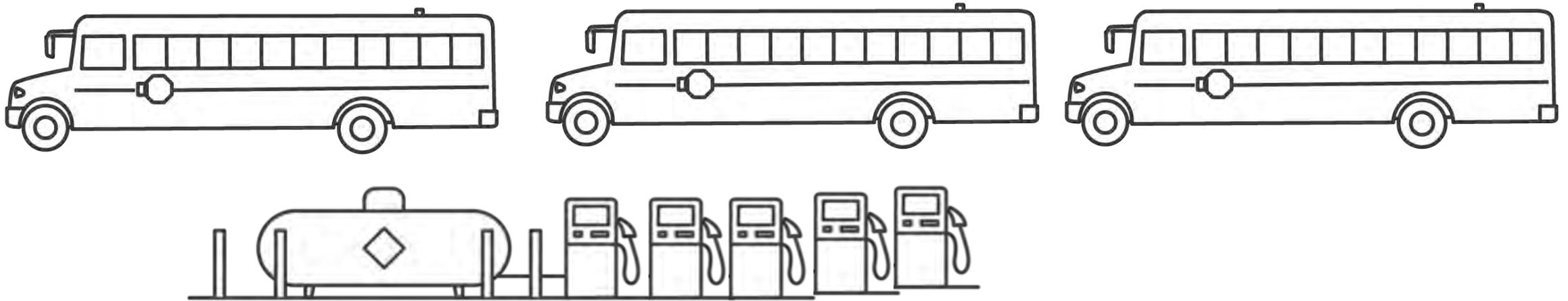
Efficient



Scalable Infrastructure Options

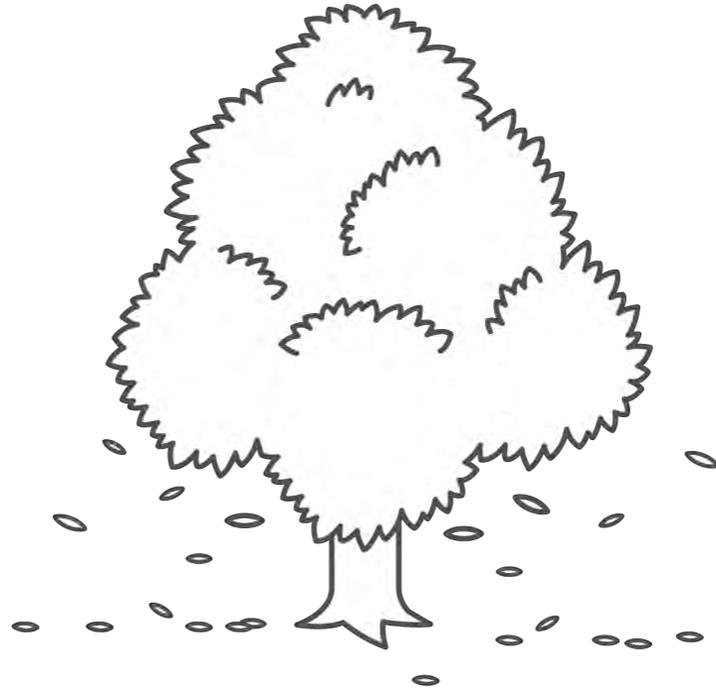


Scalable Infrastructure Options



**Non-toxic & non-contaminant of air,
soil & water resources**

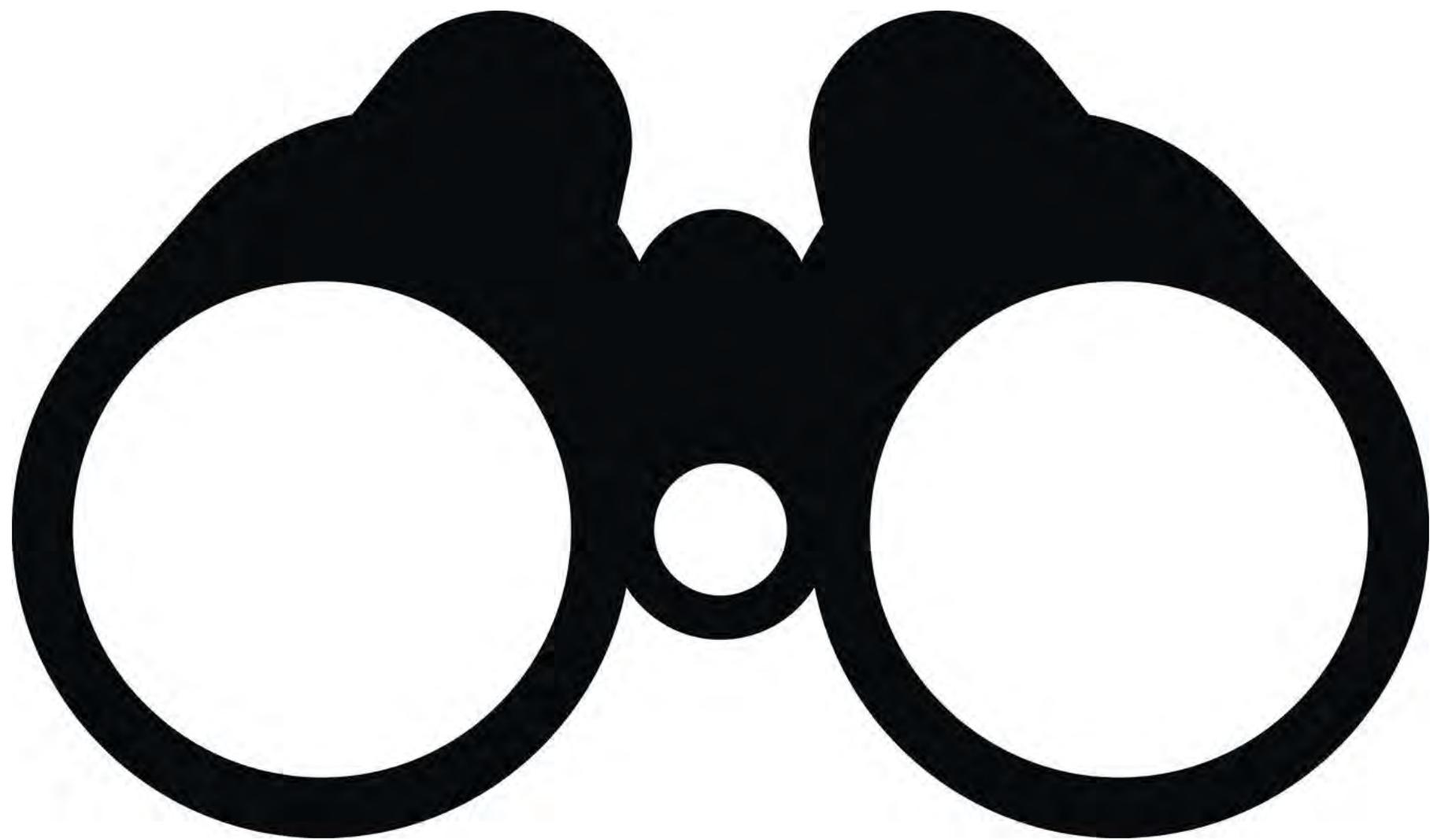
What's important for your company?



GREEN



GREEN







For General Information Visit
www.propane.com

For California Vehicle Incentive Visit
www.usecaliforniapropane.com



Joy Alafia
President/CEO

joy@westernpga.org
916-447-9742



WPGA[®]

**WESTERN PROPANE
GAS ASSOCIATION**



Propane Autogas Vehicles

Product Overview

Todd Mouw, President, ROUSH Clean Tech



ROUSH[®]

ROUSH Industries

OEM manufacturing, engineering, prototyping and design



Roush Fenway Racing

Dominant NASCAR Sprint Cup racing team



ROUSH Performance

Industry leading high performance vehicles

ROUSH[®]
CLEANTECH

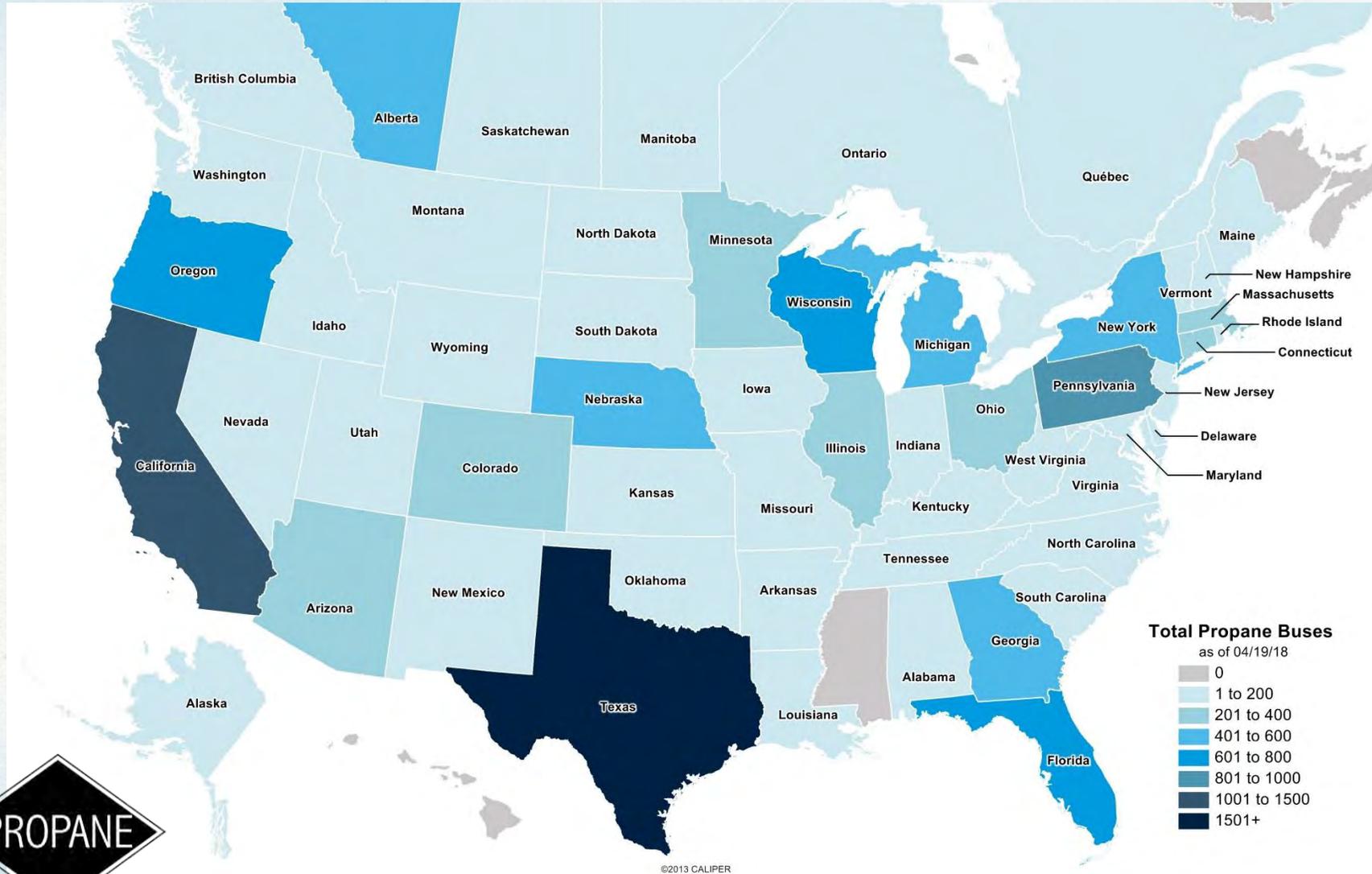
ROUSH CleanTech

Propane autogas powered commercial vehicles.

Your Fuel Options

					
Ease of Adoption					
Energy Independence					
NOx Emissions					
Fuel Infrastructure					
Cost of Ownership					
Range					
Maintenance					
Scalable					
Cold Weather Operation					

Propane School Bus Deployments



- Medium-duty Ford trucks, Blue Bird school buses.
- Factory Ford warranty maintained.
- No loss of HP / torque / towing capacity.
- Serviceable with existing diagnostic equipment.
- EPA & CARB Certified.



Ford F-53 / F-59

Ford E-450

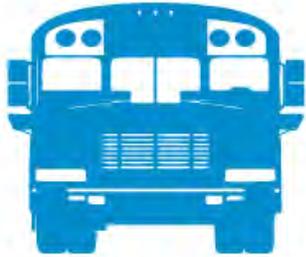
Ford F-450/550

Ford F-650/750

Blue Bird Vision

Micro Bird G5

Lowest NOx Offering

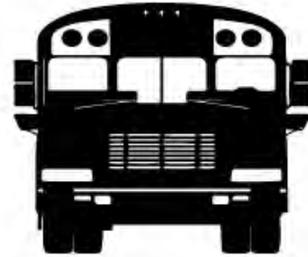


PROPANE

Purchase price: \$95,000

NOx reduced: 1,048.9 lbs.

**Cost per pound of
NOx reduced: \$91**

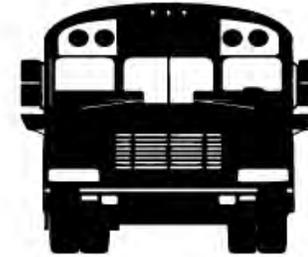


DIESEL

Purchase price: \$90,000

NOx reduced: 67.7 lbs.

**Cost per pound of
NOx reduced: \$1,330**



ELECTRIC

Purchase price: \$300,000

NOx reduced: 1,119 lbs.

**Cost per pound of
NOx reduced: \$268**





JOIN US NEXT WEEK

You're Invited: California Roadshow

Learn how propane autogas provides the most cost-effective solution to reduce your fleet's NOx emissions.

LEARN MORE



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ROUSHcleantech.com

City of Vancouver, WA

Dan Zenger

Equipment Services Superintendent

City of Vancouver, WA

ALTERNATIVE FUEL OPTIONS

- ▶ Ethanol
- ▶ Propane Autogas
- ▶ Biodiesel
- ▶ Renewable Diesel

PROPANE AUTOGAS IS SAFE...

- ▶ Meets all federal motor vehicles safety standards.
- ▶ Fuel tanks are 20 times more puncture-resistant than gasoline and diesel tanks.
- ▶ Stored at relatively low pressure, about 250 psi.

CITY FLEET ROI

- ▶ Unit life cycle is 12 years.
- ▶ Units will include Ford gaseous fuel prep package \$350 (Harden valves required)
- ▶ EPA Propane Bi-Fuel Conversion Kit average price \$9,000
- ▶ Projected 20% reduction in maintenance cost can be expected with propane Autogas compared to gasoline.

Capital Costs	Gasoline (V10)	Propane (V10)	Savings (Costs)
Base Ford Vehicle Purchase Price	\$27,000	\$27,000	
Ford Gaseous Prep Package (Harden Valves)	\$0.00	\$350.00	
Propane Conversion	\$0.00	\$8,000	
State or Federal Incentive (if applicable)	\$0.00	\$0.00	
Total Capital Savings (or Investment)	\$27,000	\$35,350	(\$8,350)
Operating Costs	Gasoline (V10)	Propane (V10)	Savings (Costs)
Total Vehicle Life (miles)	130,000	130,000	
Average Miles Per Gallon*	8.7	6.7	
Gallons of Fuel Over Lifetime	14,943	19,403	
Fuel Price**	\$3.00	\$1.15	
Fuel Tax Credit / Gallon	\$0.00	\$0.00	
Adjusted Fuel Price / Gallon	\$3.00	\$1.15	
Total Fuel Savings (or Costs)	\$44,828	\$22,313	\$22,514
Miscellaneous Costs	Gasoline (V10)	Propane (V10)	Savings (Costs)
Maintenance Costs***	\$64,000	\$51,200	
Maintenance Rate (cost per mile)	\$0.49	\$0.39	
Fuel Loss From Pilferage / Theft	\$0.00	\$0.00	
Total Misc. Savings (or Costs)	\$64,000	\$51,200	\$12,800.00

Gross Vehicle Lifetime Savings (Loss) \$35,314

Net Vehicle Lifetime Savings (Loss) \$26,964

Fuel Use

- ▶ Consumed ~8,300 gallons of Autogas since April
- ▶ Displacing ~5,810 gallons of Unleaded (70% MPG)
- ▶ Average Autogas fuel cost \$1.31 (including fuel site equipment surcharge)
- ▶ Average Unleaded fuel cost \$3.27
- ▶ 8,300 gallons Autogas @ \$1.31 = \$10,837.00
- ▶ 5,810 gallons Unleaded @ 3.27 = \$18,998.70
- ▶ Savings \$8,161.70 in the past 6 months

CONCLUSION

- ▶ ROI is the best!
- ▶ Maximized fuel range
- ▶ Fueling infrastructure is reasonably priced and can be found almost anywhere
- ▶ Fuel supply partners are numerous and financially sound
- ▶ EPA Certified Systems availability is the widest and deepest of all alternative fuels
- ▶ “Cradle to the Grave” emissions are among the best!

Thank You

- ▶ Dan Zenger
- ▶ Equipment Services Superintendent
- ▶ City of Vancouver, WA
- ▶ P: 360-487-8205
- ▶ Email: dan.zenger@cityofvancouver.us

Discussion

Please raise hand & submit a comment via GoToWebinar.

1. Where do we see important infrastructure development opportunities to support alternative fuel corridors for natural gas/propane fleets?
2. What incentives are available for natural gas and propane vehicles and infrastructure?
3. How can multi-state planning lead to more infrastructure deployment assistance resources?
4. Are any webinar participants interested in developing natural gas and/or propane fueling infrastructure for medium and/or heavy-duty equipment operating in California, Oregon, or Washington?



Join Us for Our Next Webinar

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