



North Carolina Propane Gas Association



Propane is a big deal in NC

- A billion dollar industry in NC



Propane is a big deal in NC

- #1 nationally in total retail locations and bulk plants
- We deliver over 400 million gallons of propane in North Carolina every year
- We have customers and locations in all 100 counties of North Carolina



Propane is a big deal in NC

- Over 400 licensed dealers in North Carolina eager to serve the school bus market, and there is plenty of price competition.
- 95% of Propane in the US is produced domestically
- Propane companies offer free dispensing equipment with multi-year contract



North Carolina Propane Gas Association

- *“The replacement vehicles would largely be new diesel-powered school buses, with some propane-powered school buses, as well as pilots of fully electric school buses and the associated charging infrastructure.”*

Kevin Harrison – Dept of Public Instruction

“...Riding on outdated school buses each day can pose significant risks to students’ health. Since school bus replacement is already a State responsibility, using the VW settlement to replace older school buses gives us a terrific opportunity to invest in something that will reduce student health risks and improve student safety.” ...We hope North Carolina will join other states in considering using VW settlement money for school bus replacement purposes.”

Leanne Winner - The North Carolina School Boards Association

North Carolina Propane Gas Association

- We believe the best use of VW funds is to purchase propane school buses and to repower the existing used fleet of diesel buses, thereby reducing emissions in the most cost-effective way, protecting our children from emissions, and saving State funds.

North Carolina Propane Gas Association

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What is an engine repower?

A repower is a strategic and cost effective way to significantly reduce emissions, while allowing the original vehicle body and chassis to be maintained.

The proposal is to replace the VT365 Navistar Engine.

The VT365 engine is found in Type C school buses with model year 2007 and older.



Agility 488LPI Engine



Why propane repower benefits North Carolina

The average lifetime of a school bus is 12 to 15 years. Replacing the diesel engine with a liquid propane gas (LPG) engine repower package will provide additional years of operation using an environmentally cleaner, quieter and more reliable product compared to diesel.

In North Carolina, 800+ diesel-powered IC school buses have experienced premature diesel engine failure well ahead of the useful life of the vehicle.

By repowering a diesel-powered bus with a clean burning propane-powered engine, NOx emissions go down by a staggering 92 percent when replacing pre-2007 diesel buses.

Benefits of operating an LPG engine provides social, economic and environmental benefits:

- Lower fuel cost & operating cost per mile driven Lower maintenance costs
- Cleaner burning fuel
- Lower NOx emissions



Repower is a cost effective alternative

An engine repower is a strategic way to significantly reduce the emissions from an engine, but allow the original vehicle body and chassis to be maintained. This is more cost-effective than replacing the entire vehicle.

Eligible Mitigation Project Category	Average Cost
Repower with LPG engine	\$35,000
Propane school bus replacement	\$95,000
Compressed Natural Gas school bus replacement	\$125,000
Electric Vehicle school bus replacement	\$300,000



North Carolina repower proposal

- Powertrain Systems, a division of Agility Fuel Solutions, based in Salisbury, North Carolina is the sole vendor, providing jobs and economic growth to the state.
- Agility Fuel Solutions has a dedicated GM 8.0L propane fueled engine certified to meet EPA and CARB emissions regulations.
- The engine marketed to OEM's and fleets under the brand name Agility 488LPI is available with a complete state of the art liquid propane injection system that has been proven in the market for the past 10 years.
- CleanFUEL USA, now owned by Agility Fuel Solutions, has 15 years of aftermarket and conversion experience. Those same employees are spearheading this project for Agility.
- The 488LPI engine and fuel system is sold to a major OEM in North Carolina who utilize it in their school bus, truck and delivery truck applications.
- In early 2018, the engine and fuel system manufacturing and assembly will move to our 200,000-sq. ft. state of the art facility in Salisbury, North Carolina.



Location: Salisbury, North Carolina

- ✓ Provides Natural Gas, Propane, Hydrogen, Hybrid & Electric fuel solutions
- ✓ Tier One supplier to Freightliner Custom Chassis & Thomas Built Buses

Products	<ul style="list-style-type: none"> • Bus Systems • Refuse Systems • Truck Systems • Fuel Management Modules • Full Installations
Manufacturing Equipment	<ul style="list-style-type: none"> • CNC Laser • CNC Roll Form • CNC Press Brake • CNC Machining • Mazak CNC • Deburr • Mill • Multi Axis Extrusion Machine • Robotic Tube Bending • Automated Paint Shop • Installation
Footprint	200,000 Sq. Ft. / 18,580 Sq. M
Capacity	20% (Based on 2 shift Operation) – 24,000
Utilization	systems/year
Certifications	ISO 9000 and TS16949 in process



OEM supplier: school bus market



488 LPI Engine

- /// OEM, Thomas Built Bus manufactured in High Point, NC
- /// Agility 488LPI assembled and shipped from Salisbury, NC
- /// Long block 8.0 Liter engine from General Motors
- /// Liquid Propane Injection by Agility Fuel Solutions
- /// Engine built specific for propane market
- /// Hardened valve seats (intake and exhaust) for durability
- /// Roller rocker arms
- /// Allison transmission
- /// Coavis fuel pump



School Bus Replacement: A Cost Effective Solution to NOx Reductions



Why Propane

COST SAVINGS



DISTRICTS REPORT
SAVINGS OF UP TO
.37¢
PER MILE

NOISE REDUCTION



UP TO
40%
QUIETER

COLD STARTS



STARTS IN
TEMPERATURES
AS LOW AS
-30°F

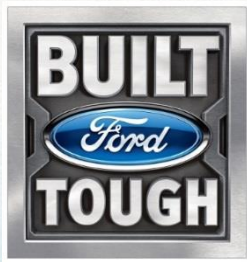
LOWEST EMISSIONS



**INCREDIBLY
REDUCED
EMISSIONS**



Partners that Deliver





Blue Bird Propane Buses Operating in the US

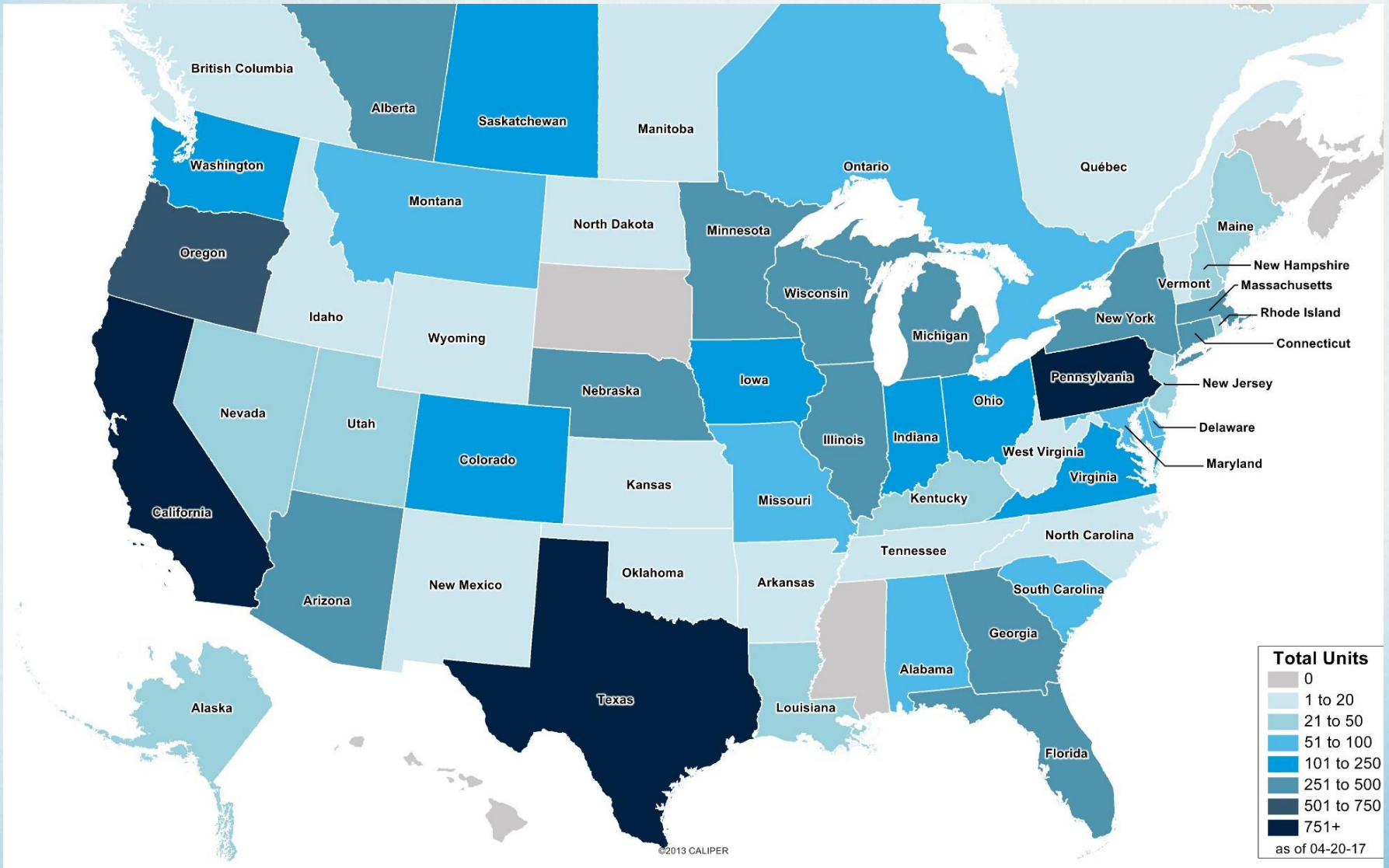
OVER
12,000
SCHOOL
BUSES



OVER
800
SCHOOL
DISTRICTS



Propane Deployments





June 7th 2017 ROUSH CleanTech announces achievement of very low NOx with the 6.8L V10 Engine.

- For the 2017 MY RCT LPG Blue Bird Buses are now certified to **0.05 g/bhp-hr NOx**.
- This is achieved with a few calibration changes and **no extra hardware or increased variable cost**.
- Included in our next certification we will be able to offer a **0.02 g/bhp-hr NOx** option.

Standard Changes for NOx

ROUSH CleanTech Low NOx Propane Engine

ROUSH CleanTech has the lowest nitrogen oxide (NOx) levels of any engine in class 4-7 vehicles. The engine is 75 percent cleaner than the Environmental Protection Agency emissions standard. It is certified at the low NOx standard set by the California Air Resources Board.

Vehicle Model Year	NO _x Standard (in g/bhp-hr)	ROUSH CleanTech 6.8L V10 3V propane engine (certified to NO _x level of 0.05 g/bhp-hr)
1998	4	99% cleaner
2002	2.5	98% cleaner
2007	1.2	95% cleaner
2010 - current	0.2	75% cleaner

The 2017 Blue Bird Propane Vision Propane comes equipped with the 0.05 g/bhp-hr low NOx engine. More than 10,000 Blue Bird propane autogas school buses are in operation at more than 750 school districts across the U.S. and Canada.



ROUSH
CLEANTECH



The ROUSH / Blue Bird low NOx propane engine is 75% cleaner than the current EPA standard, which diesel engines are certified to, and is 99% cleaner than pre-1998 diesel school buses.

AFLEET Results: NOx Cost Effectiveness

Argonne AFLEET 2017 Emissions Outputs

Fuel	Purchase Price	NOx Reduced	\$/lb
Propane	\$92,400	893.7	\$103
Diesel	\$83,500	67.7	\$1,234
Electric	\$350,000	1,119.0	\$313
CNG	\$113,500	818.6	\$139

Propane is 92% more cost effective at reducing NOx as compared to diesel.

Source: Argonne National Laboratory AFLEET 2017 Tool. School Bus purchase pricing based on North Carolina 2019 model year Blue Bird Vision school buses (propane, diesel, electric and CNG options with same configuration).

Argonne National Laboratory conducts applied research to develop sustainable innovative technologies to improve the efficiency of resource and energy utilization; to minimize our dependence on imported energy; and to enhance our national security. The AFLEET tool was developed by Argonne and the Department of Energy to examine both the environmental and economic costs and benefits of alternative fuel and advanced vehicles. The tool uses data from Argonne's GREET fuel-cycle model to generate necessary well-to-wheels petroleum use and GHG emission co-efficients for key fuel production pathways and vehicle types. In addition, Environmental Protection Agency's MOVES model and certification data are used to estimate tailpipe air pollutant emissions..



- ❖ **Our customers report**
 - **\$0.77 per mile on diesel buses**
 - **\$0.43 per mile on propane buses**

- ❖ **That's a savings of \$0.34 per mile, which means.....**

- ❖ **If you drive 12,000 miles per year and operate for 15 years...**
 - **1 bus saves \$4,080 in 1 year**

 - **1 bus saves \$61,200 in its lifetime**



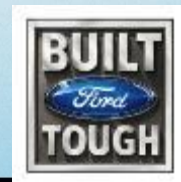
Maintenance Components Eliminated





Complexity and costs are estimated to continue increasing over the next few years as the new Green House Gas emission standards come into play.

*EPA and NHTSA, on behalf of the Department of Transportation, are each proposing rules to establish a comprehensive Phase 2 Heavy-Duty (HD) National Program that will reduce greenhouse gas (GHG) emissions and fuel consumption for new on-road heavy-duty vehicles including buses. This technology-advancing program would phase in over the long-term, beginning in the 2021 model year and culminating in standards for model year 2024 or 2027 depending on the final rule. **The agencies estimate that the additional costs to meet the proposed standards for vocational vehicles is in the range of \$1,150 to \$1,990 per vehicle in the first year (2021) and \$1,770 to \$3,590 per vehicle in years 2024-27.***



- ICCT: Negative health impacts from diesel-sourced NOx emissions are increasing, despite regulatory limitations
 - Lab-certified vehicles met mandatory emission limits but exceeded NOx emission limits for heavy-duty diesel vehicles, by 1.45 times on average in real world operation
 - Excess diesel NOx emissions contributed to an estimated 1,100 premature deaths in the United States in 2015
- UC-Riverside: SCR systems on today's new diesel vehicles fall short of controlling NOx emissions in many duty cycles

These studies beg the question...

Is it wise for states to use funds derived from high-emitting diesel vehicles to now fund high-emitting diesel vehicles?

\$47.3M Alternative Fuel School Bus Program

\$47.3M Scenario: Alternative Fuel School Bus Program	TOTAL
Total Buses Operating in State (# Units)	16,496
Est. Cost of 2019 Model Year Diesel Bus (\$)	\$83,500
Est. Cost of 2019 Model Year Propane Bus (\$)	\$92,400
Est. Cost of 2019 Model Year CNG Bus (\$)	\$113,500
Est. Cost of 2019 Model Year Electric Bus (\$)	\$350,000
Total North Carolina VW EMT Allocation (\$)	\$94,678,714
School Bus Program Funding Scenario (\$)	\$47,339,357
Propane Bus Incentive (\$), 50% of Total Bus Cost	\$46,200
CNG Bus Incentive (\$), Based on 50% of Total Bus Cost	\$56,750
Electric Bus Incentive (\$), Based on 50% of Total Bus Cost	\$175,000
Number of Estimated Bus Replacements, Propane Scenario	1,025
Number of Estimated Bus Replacements, CNG Scenario	834
Number of Estimated Bus Replacements, Electric Scenario	271
% of NC school bus fleet, propane scenario	6.21%
% of NC school bus fleet, CNG scenario	5.06%
% of NC school bus fleet, electric scenario	1.64%

Assumptions:

- *Total number of school buses estimated using R. L. Polk data.*
- *School bus pricing estimated and based upon model year 2019 Blue Bird Vision Type C school bus with fuel type option as indicated.*
- *Incentives are recommended portion NC DEQ to provide to grant recipient. Recipient to provide 50% as matching funds.*

\$47.3M Alternative Fuel School Bus Program

Propane School Bus Scenario: \$47.3M Funding	
<i>Assumptions: 1,025 school buses replaced, 2007 average model year replaced with 2019 model year Vision propane bus, 15 year service life, 12,600 miles per year</i>	POTENTIAL IMPACT
Cost of Propane School Bus (\$)	\$92,400
# of Propane School Bus Replacements (assuming 50% cost share)	1,025
% of NC School Bus Fleet Replaced	6%
Total Funding Proposed (\$)	\$47,339,357
Total NOx Reduction (lbs)	915,784
Cost Effectiveness (\$/lb)	\$103
Petroleum Reduction (gallons)	27,665,858
Est. Total Children Impacted Daily (# of Children)	73,776

A \$47.3 million investment in a North Carolina alternative fuel school bus program could produce the following results:

- *Replacement of 6% of the North Carolina school bus fleet*
 - *Reduction of 915 thousand pounds of NOx emissions*
 - *Over 73 thousand children impacted daily*
 - *Cost \$103/pound of NOx Reduced*



SCHOOL BUSES ARE A COST EFFECTIVE WAY TO REDUCE NOx!

Prioritize Alternative Fuels/Cost Effectiveness

Allow Rural Areas to Participate



THANK YOU!

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