



# South Shores Clean Cities Propane Autogas

August 14, 2018



**800.59.ROUSH**

**ROUSHcleantech.com**

# Enterprise Brand Portfolio



## **ROUSH Industries**

OEM manufacturing, engineering, prototyping and design



## **Roush Fenway Racing**

NASCAR racing team(s)



## **ROUSH Performance**

Industry leading high performance vehicles



## **ROUSH CleanTech**

Propane autogas powered commercial vehicles.





- Founded in 2010.
- Dedicated to developing quality alternative fuel solutions.
- Propane autogas focus.
- EPA and CARB certification.
- Platform customization to suit customer needs.
- Reduces operating costs, carbon footprint.
- OEM support through Ford and BPN dealers.
- Creating opportunities for partner companies.
- Using American fuel and American technology.



OVER

**17,500**

VEHICLES ON  
THE ROAD

ACCUMULATED  
OVER

**430**

MILLION MILES

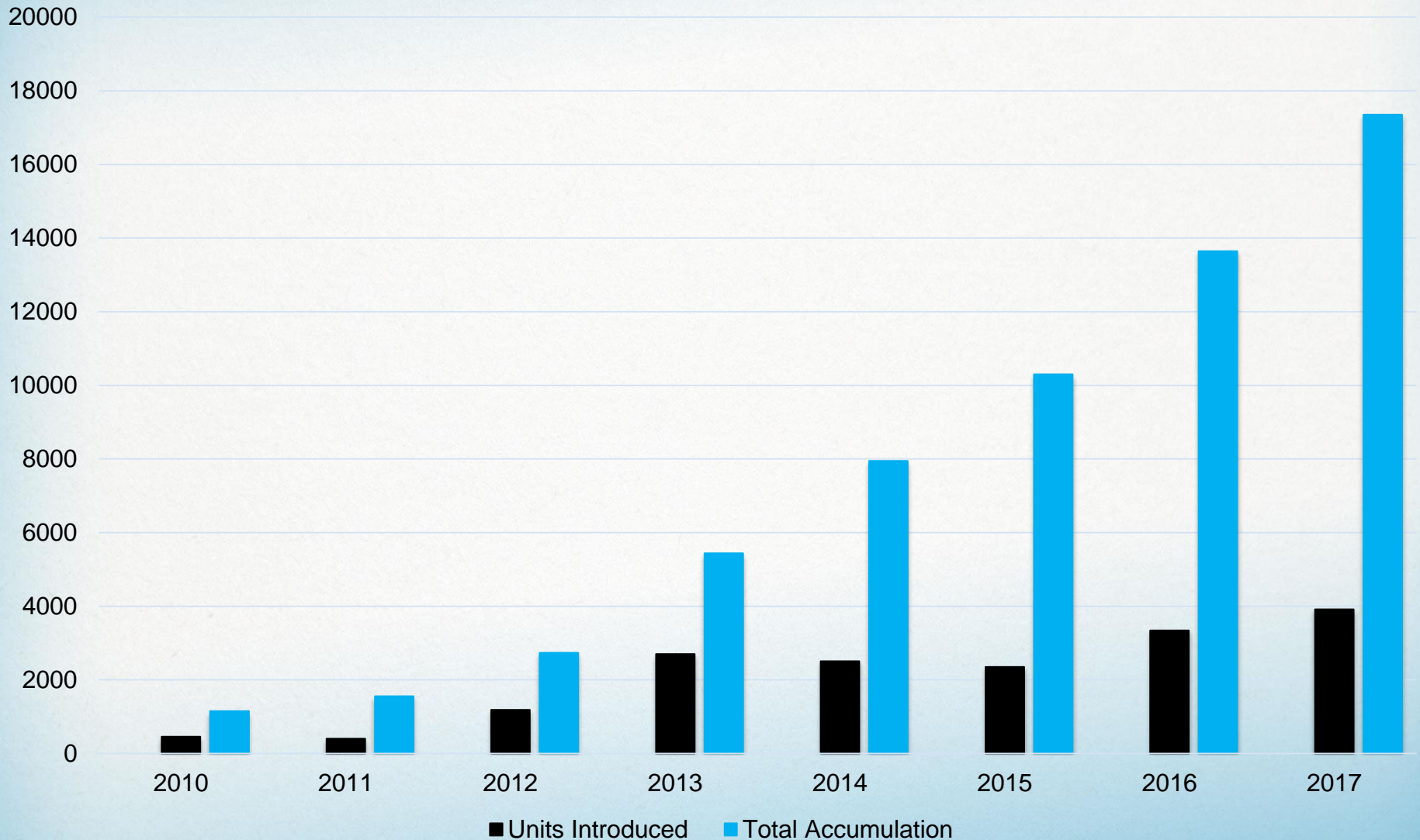
OVER

**720**

SCHOOL  
DISTRICTS



# Units in Operation



# Why The Hockey Stick?

- Reliable Technology & Robust Service Program
- Strong OEM Partners/Ford & Blue Bird
- Diesel Displacement/Medium Duty
- 1,000 Customers & 400 Million Miles of Data
- Low Cost Infrastructure and Easy to Scale
- Safe
- Plentiful Fuel
- Emerging Low NOx Certifications



## Drive for Reduced NOx

- ARB is encouraging all Manufacturers of Record (MORs) to overachieve on the NOx standard to support smog reduction.
- ARB has issued alternative standards at 0.1, 0.05 and 0.02g/bhp-hr for NOx.
- The recent VW settlement also includes funding that supports NOx reductions across all 50 states that off sets the increase in NOx caused by their diesel emissions.

# RCT Status of Low NOx

July 31, 2018 ROUSH CleanTech announces achievement of very low NOx with the 6.8L V10 Engine.

CALIFORNIA AIR RESOURCES BOARD		ROUSH INDUSTRIES, INC		EXECUTIVE ORDER A-344-0086 New On-Road Heavy-Duty Engines Page 1 of 2 Pages									
Pursuant to the authority vested in California Air Resources Board by Health and Safety Code Division 26, Part 5, Chapter 2; and pursuant to the authority vested in the undersigned by Health and Safety Code Sections 39515 and 39516 and Executive Order G-14-012;													
IT IS ORDERED AND RESOLVED: The engine and emission control systems produced by the manufacturer are certified as described below for use in on-road motor vehicles with a manufacturer's GVWR over 14,000 pounds. Production engines shall be in all material respects the same as those for which certification is granted.													
MODEL YEAR	ENGINE FAMILY	ENGINE SIZE (L)	FUEL TYPE <sup>1</sup>	STANDARDS & TEST PROCEDURE	INTENDED SERVICE CLASS <sup>2</sup>	ECS & SPECIAL FEATURES <sup>3</sup>	DIAGNOSTIC <sup>4</sup>						
2018	JRIIE06.8BW2	6.8	LPG	Otto	HDO	TWC, HO2S, SFI, ZWR-HO2S, ECM	OBD(P)						
PRIMARY ENGINE'S IDLE EMISSIONS CONTROL <sup>5</sup>		ADDITIONAL IDLE EMISSIONS CONTROL <sup>5</sup>											
N/A		N/A											
ENGINE (L)	ENGINE MODELS / CODES (rated power, in hp)												
6.8	See Attachment												
<sup>1</sup> not applicable. GVWR=gross vehicle weight rating; 13 CCR xyz=Title 13, California Code of Regulations, Section xyz; 49 CFR 88.abc=Title 49, Code of Federal Regulations, Section 88.abc; L=liter; hp=horsepower; kW=kilowatt; hr=hour; <sup>2</sup> CNG/LNG=compressed/liquefied natural gas; LPG=liquefied petroleum gas; E85=85% ethanol fuel; MF=multi fuel a.k.a. BF=bi fuel; DF=dual fuel; FF=flexible fuel; <sup>3</sup> L/M/H HDO=light/medium/heavy heavy-duty diesel; UB=urban bus; HDO=heavy duty Otto; <sup>4</sup> ECS=emission control system; TWC/OC=three-way/oxidizing catalyst; NAC=NOx adsorption catalyst; SCR-U / SCR-N=selective catalytic reduction - urea / - ammonia; WU (prefix) =warm-up catalyst; DPF=diesel particulate filter; PTOX=periodic trap oxidizer; HO2S/O2S=heated/oxygen sensor; HAFS/AFS=heated/air-fuel-ratio sensor (a.k.a. universal or linear oxygen sensor); WR-HO2S=wide range oxygen sensor; TBW=throttle body fuel injection; SFIMFI=sequential/multi port fuel injection; DGI=direct gasoline injection; GCARB=gaseous carburetor; IMDDI=indirect/direct diesel injection; TC/SC=turbo/super charger; CAC=charge air cooler; EGR / EGR-C=exhaust gas recirculation / cooled EGR; PAIR/AIR=pulsed/secondary air injection; SPL=slope puff limiter; ECM/PCM=engine/powertrain control module; EM=engine modification; 2 (prefix)=parallel; (2) (suffix)=in series; <sup>5</sup> ESS=engine shutdown system (per 13 CCR 1956.8(a)(6)(A)(1): 30g-30 g/hr NOx (per 13 CCR 1956.8(a)(6)(C); APS =internal combustion auxiliary power system; ALT=alternative method (per 13 CCR 1956.8(a)(6)(D); Exempt=exempted per 13 CCR 1956.8(a)(6)(B) or for CHG/LNG fuel systems; N/A=not applicable (e.g., Otto engines and vehicles); <sup>6</sup> EMD=engine manufacturer diagnostic system (13 CCR 1971); OBD(F) / (P) / (S)=full / partial / partial with a fine / on-board diagnostic;													
<p>Testing are: 1) the FTP exhaust emission standards, or family emission limit(s) as applicable, under 13 CCR 1956.8; 2) the SET and NTE limits under the applicable California exhaust emission standards and test procedures for heavy-duty diesel engines and vehicles (Test Procedures); and 3) the corresponding certification levels, for this engine family. "D" and "Q" SET and NTE certification compliance may have been demonstrated by the manufacturer as provided under the applicable Test Procedures in lieu of testing. (For flexible- and dual-fueled engines, the CERT values in brackets [ ] are those when tested on alternative test fuel. For multi-fueled engines, the STD and CERT values for default operation permitted in 13 CCR 1956.8 are in parentheses.)</p>													
		NMHC		NOx		NMHC+NOx		CO		PM		HCHO	
	FTP	SET	FTP	SET	FTP	SET	FTP	SET	FTP	EURO	FTP	SET	
STD	0.14	*	0.02	*	*	*	14.4	*	0.01	*	0.01	*	
CERT	0.04	*	0.01	*	*	*	5.0	*	0.002	*	0.000	*	
NTE													
<sup>4</sup> g/bhp-hr=grams per brake horsepower-hour; FTP=Federal Test Procedure; SET=supplemental emissions testing Steady-State Cycle; NTE=Not-to-Exceed emission limit; STD=standard or emission test; EEL=family emission limit; CERT=certification level; NMHC/NMHC+NOx=non-hydrocarbon/total hydrocarbon; NOx=oxides of nitrogen; CO=carbon monoxide; PM=particulate matter.													





# STUDENT TRANSPORTATION

# A Growing Trend

OVER  
**10,000**  
SCHOOL  
BUSES

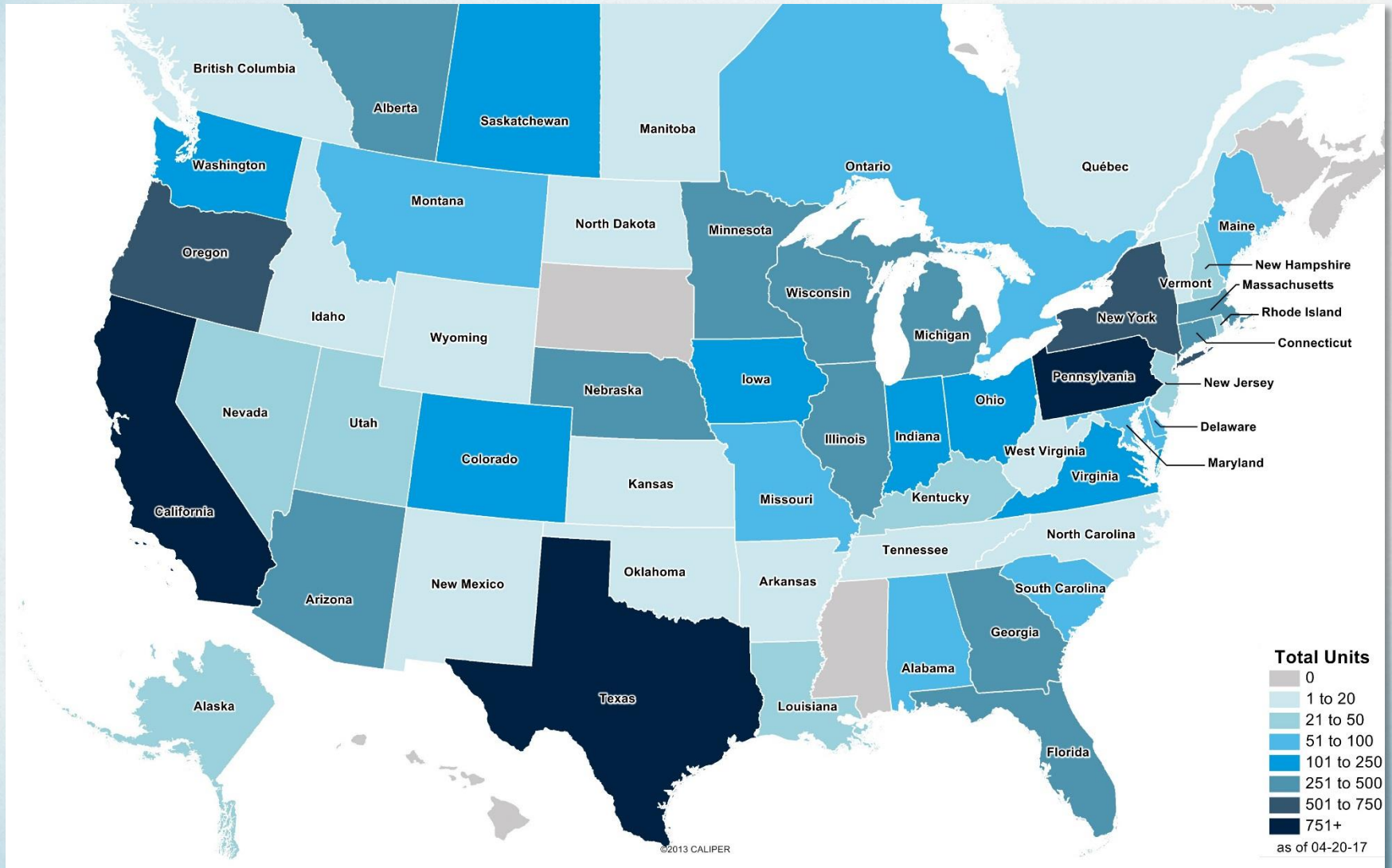


OVER  
**720**  
SCHOOL  
DISTRICTS





# Propane School Bus Deployments





## Model Year

2018

## Engine Size

6.8L V10 (3V) Ford Engine with exclusive ROUSH CleanTech Propane Fuel System

## Applications

169" / 189" / 217" / 238" / 252" / 273" / 280"  
wheelbase configurations

6-speed automatic transmission

## Fuel Tank Capacity

Short: 47 gallons (usable)

Standard: 67 gallons (usable)

Extended: 93 gallons (usable)

## Technical Specifications

EPA and CARB approved.

GVWR: 33,000 lbs.

Up to 77 passengers

## Order Availability

Blue Bird dealers

## Blue Bird Vision (Type C)



**BLUE BIRD**







## Model Years

2018

## Engine Size

6.8L V10 (2V)

## Applications

158" / 176" / 186" / 190" wheelbase configurations.

Chiller required for vehicles operating in temps  $\geq 110^{\circ}\text{F}$

5-speed automatic transmission.

## Fuel Tank Capacity

Aft-Axle: 41 gallons (usable)

## Technical Specifications

EPA and CARB approved.

GVWR: 14,500 lbs.

Up to 30 passengers

## Order Availability

Blue Bird dealers

## Micro Bird G5 (Type A)





# COMMERCIAL FLEET



# Propane Autogas Product Lineup

- Medium duty Ford trucks, chassis cabs, cutaways, and stripped chassis
- Factory Ford warranty maintained.
- No loss of HP / torque / towing capacity.
- Serviceable with existing diagnostic equipment.
- EPA & CARB Certified
- HD OBD Compliant



Ford F-53 / F-59



Ford E-450



Ford F-450/550



Ford F-650/750

	 Linen	 Food/Bakery	 Beverage	 Transit	 Vending	 Logistics	 Propane
Ford E-350 / E-450 6.8L V10 2V		●		●	●	●	
Ford F-450 / F-550 6.8L V10 3V Low NOx			●	●	●	●	●
Ford F-650 / F-750 6.8L V10 3V Low NOx	●	●	●		●	●	●
Ford F-53 / F-59 6.8L V10 3V Low NOx	●	●				●	

- Additional Industries
  - Airport
  - Tree and Landscape
  - Towing
  - Government



## Ford F-450 / F-550 – Class 4 / 5

- 6.8L V10 3 Valve – Low NOx
- <19,500lbs GVWR
- >169"WB and 64"CA
- Driver / Passenger Side and After Axle

### Tank Options

- 35, 50, and 65 Usable Gallons
- Range: 150 – 320 Miles



# Ford F-450 / F-550 – Class 4 / 5 Cont.





## Ford F-650 / F-750 – Class 6 / 7

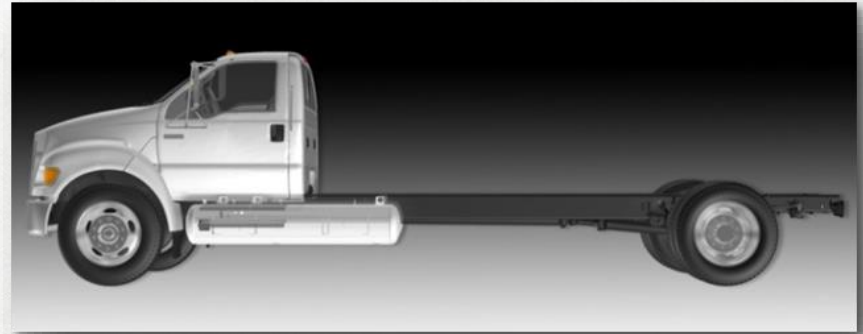
- 6.8L V10 3 Valve – Low NOx
- <33,000lbs GVWR
- All Configurations
- Dual Saddle Mount Short Tanks -
  - Drop Frame – Non Clean C/A
- 55 Usable Gallons
- Range: 160 – 220 Miles
- RPO Frame Piercing





## Ford F-650 / F-750 – Class 6/7

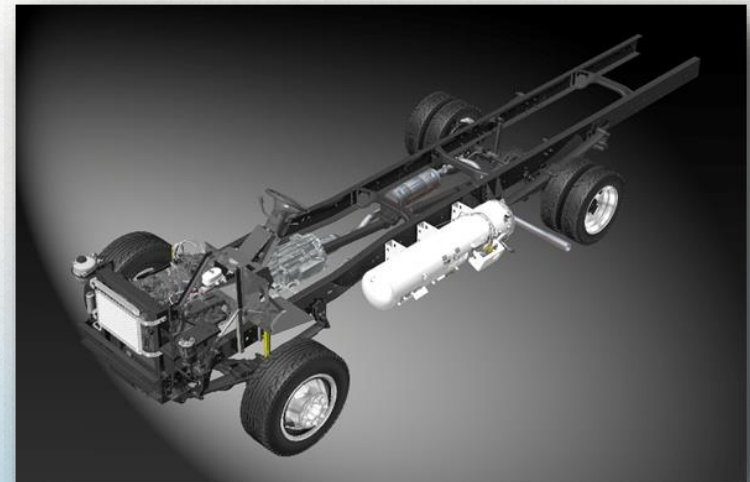
- 6.8L V10 3 Valve – Low NOx
- <33,000lbs GVWR
- All Configurations
- Driver Side Tank
- 50 Usable Gallons
- Range: 160 – 230 Miles
- RPO Frame Piercing





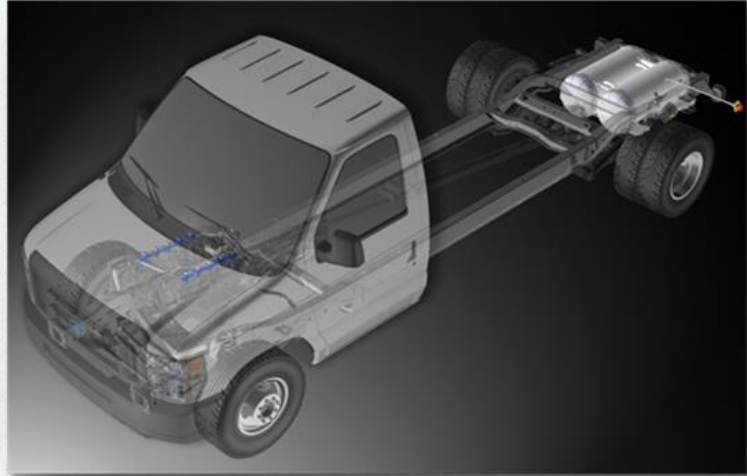
## Ford F-53 / F-59 – Class 5 / 6

- 6.8L V10 3 Valve – Low NOx
- 16,000lb – 26,000lb GVWR
- All Configurations
- Driver Side and After Axle Tank
- 45 and 65 Usable Gallons
- Range: 200 – 320 Miles
- <300lbs



## Ford E-350 / E-450 – Class 3 / 4

- 6.8L V10 2 Valve
- <14,500lbs GVWR
- Any WB and CA
- After Axle Tank
- 41 and 64 Usable Gallons
- Range: 240 – 380 Miles





## In Summary...

- Strong OEM Partners
- OEM Purpose Built and Proven Engine/Fuel System
- Robust and Proven
- Nationwide Service Network
- HDOBD Compliant
- EPA and CARB Compliant
- Ultra-LOW NO<sub>x</sub>; 0.02 g/bhp-hr
- Domestic and Economic Fuel
- Diesel Displacement
- Low Cost Infrastructure and Easy to Scale



**THANK YOU**

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