

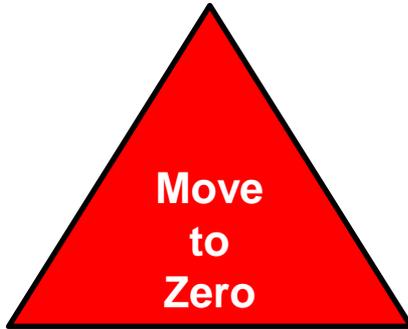
Cummins Westport, Inc.

February 5, 2018



**2018
Environmental Leadership**

- Lowest NOx
- 90% Below EPA Standard



Energy Security

- Domestic Fuel
- Renewable
- RNG = Sub-zero carbon intensity

Economic Advantage

- Mature
- Affordable
- Ready Now



For these reasons, natural gas adoption rate will continue to increase.

- Continued low NG fuel costs
- Increased fueling infrastructure
- More NG engines & vehicles available

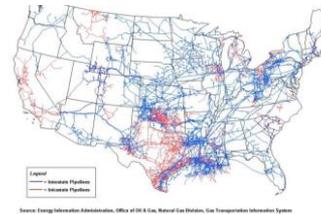
Market Segment	NG Market Adoption Rate	
	2016	2018 Projection
Transit Bus	25%	25-30%
Refuse Truck	49%	50-60%
HD Truck	< 1%	4-10%

Do NGV's make sense for me? - Infrastructure

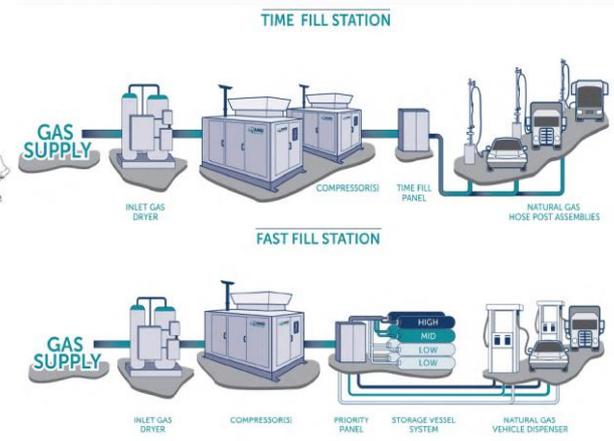
- Use Existing natural gas pipeline network
- Build fleet specific infrastructure, consider:
 - # vehicles in fleet
 - Daily fuel consumption
 - Do vehicles return to base every day
 - How much time is available for refueling?
 - Need for Fast Fill or Time Fill?



Type	Pressure	Time to Fill	Cost
LNG	Low	Similar to diesel	\$\$\$
CNG – Fast Fill	Higher	Similar to diesel	\$\$
CNG – Time (Slow) Fill (most School Bus fleets use Time Fill)	Lower	Overnight (>4hr)	\$



Source: Energy Information Administration, Office of Oil & Gas, Natural Gas Statistics, Gas Transportation Information System

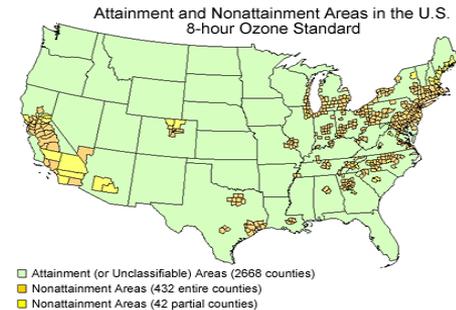


Why Zero Emissions?

- The Clean Air Act is a United States federal law designed to control air pollution on a national level. It is one of the United States' first and most influential modern environmental laws, and one of the most comprehensive air quality laws in the world.
- Much of urban California is not attaining Clean Air standards pushing government to take significant steps to improve air quality by reducing emissions, particularly from motor vehicles
- The focus is NO_x reduction, and California has defined new NO_x standards to reduce emissions.
- Many of the largest US cities are also not meeting Clean Air standards



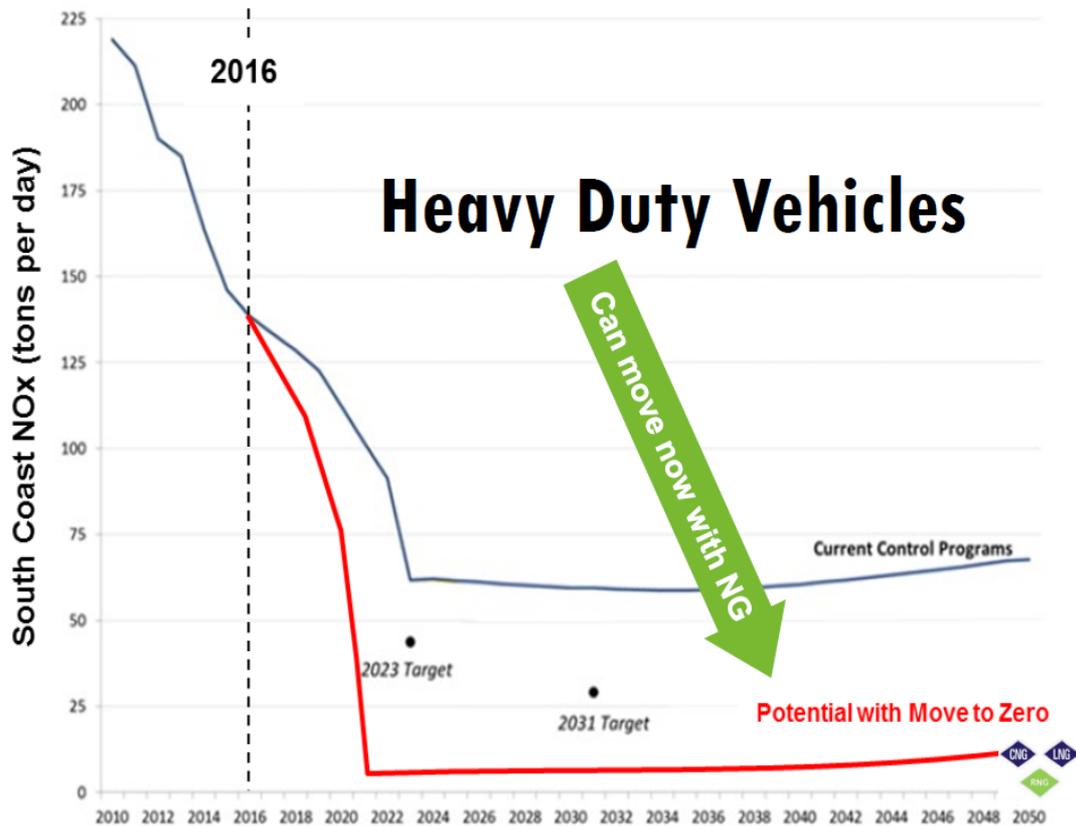
Federal Non-attainment Areas Ozone



Move to Zero

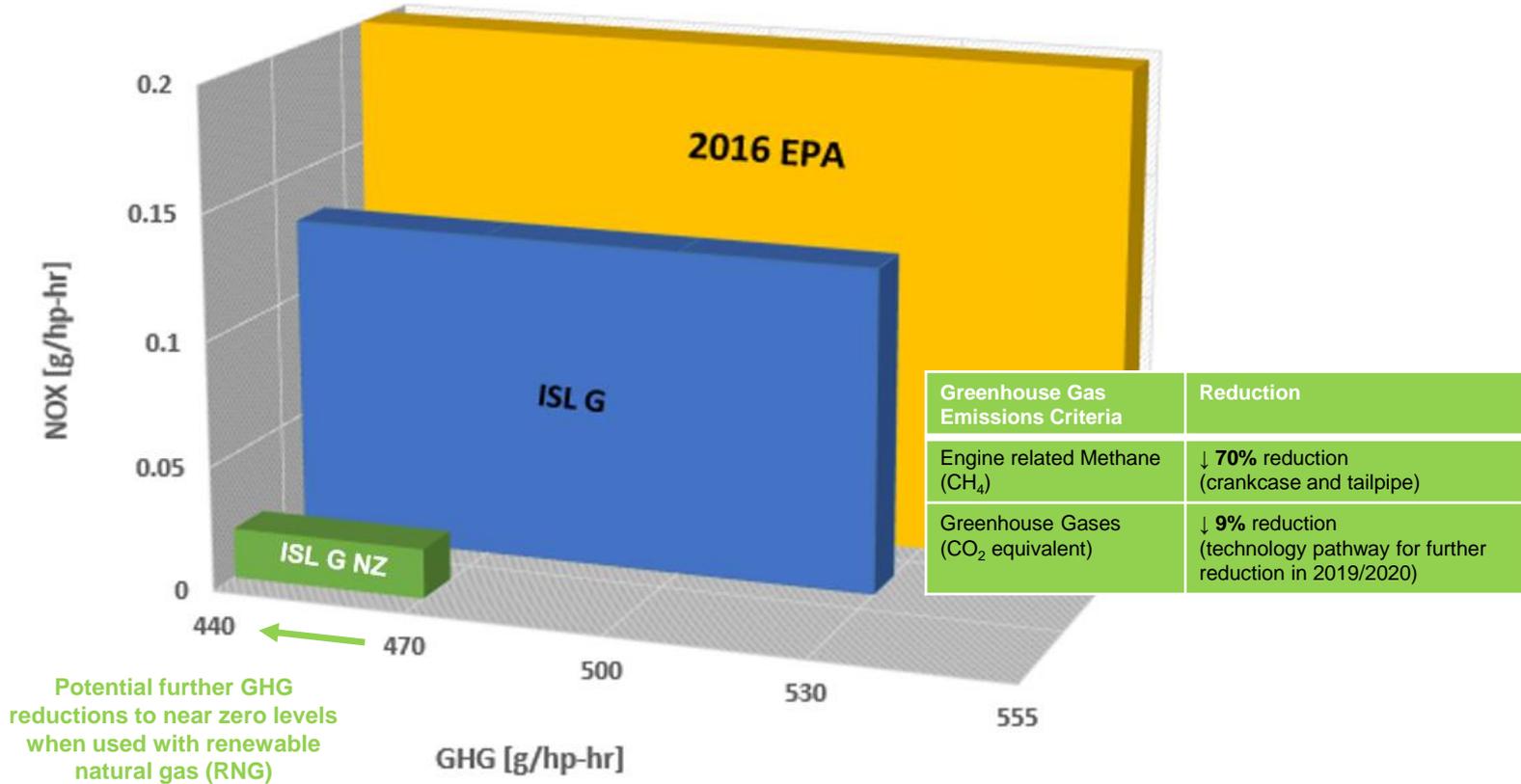
remembering why we did this

1. Air quality goals
2. Mobile sources key
3. Not just California



*The scenarios illustrated in this figure reflect natural turnover rates.

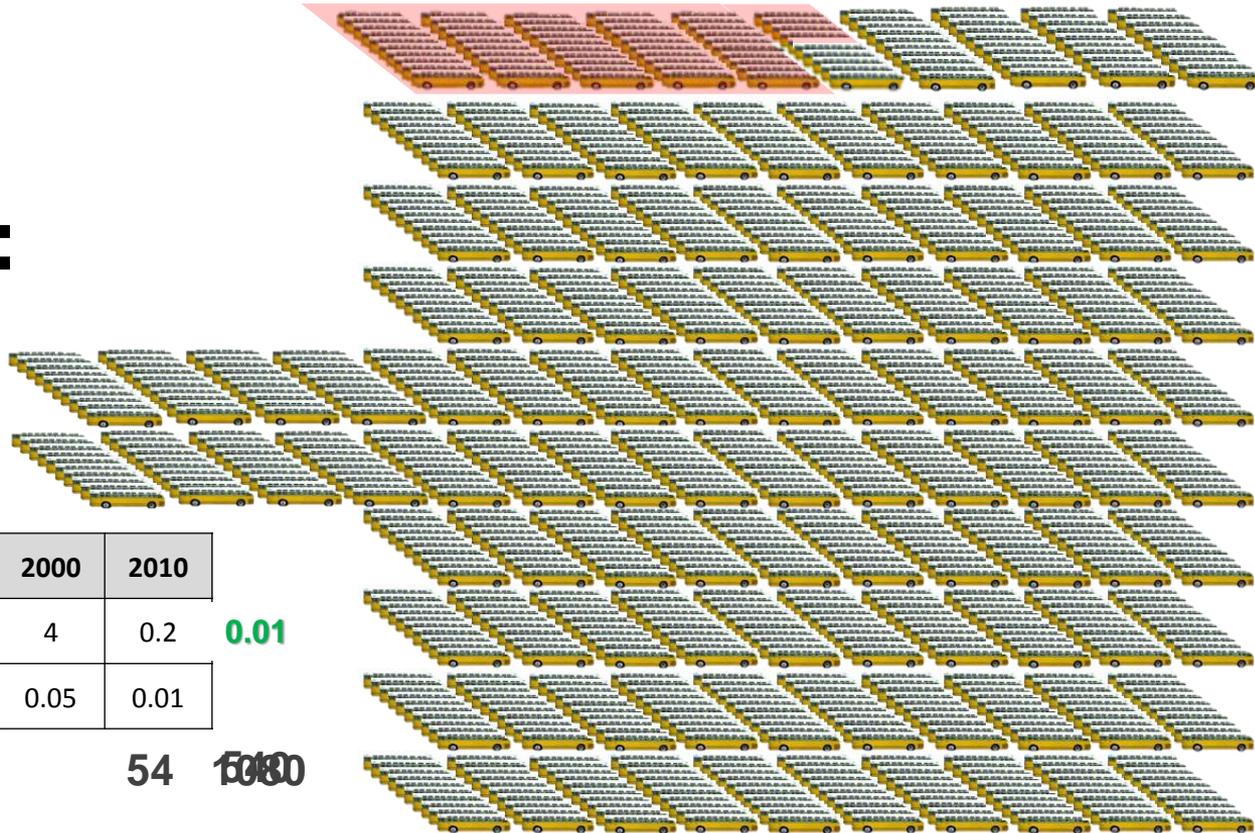
Greenhouse Gas Reduction



Emissions Reduction Impact - NOx



=



	1985	1990	1991	2000	2010
NOx (g/hp-hr)	10.8	6	5	4	0.2
PM (g/hp-hr)	0.59	0.59	0.25	0.05	0.01

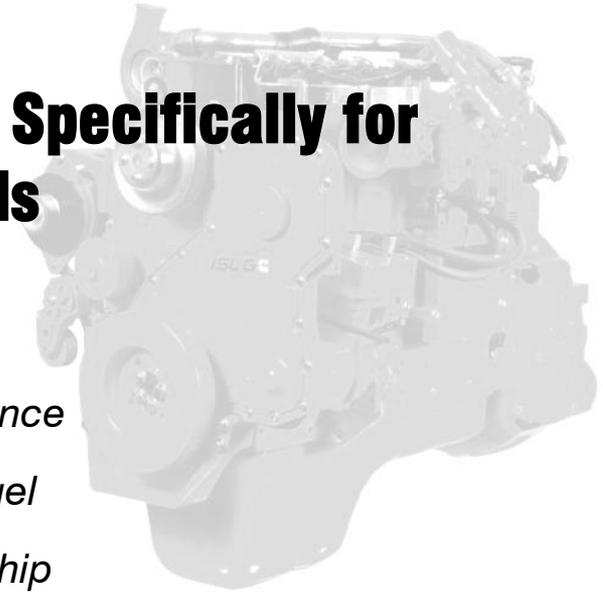
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Cummins Westport

Heavy Duty Engines Designed Specifically for Alternative Fuels

- *Based on Reliable Cummins Engine Platforms*
- *Common parts and design provide heavy duty performance*
- *Engineered and Optimized Specifically for Alternative Fuel*
- *Continued improvement in reliability and cost of ownership*
- *Service Support through the Global Cummins Distributor network*



Introducing CWI 2018 North American Products

- New Product Names
- EPA/ARB Ultra Low emissions certification
- Lowest Emission MR and HD engines in North America
- On-Board Diagnostics (OBD) applied for optimal emissions system performance



ISX12N™



L9N™



B6.7N™

2018 North America Product Line



B6.7N™

6.7L

Peak Rating: 240 hp / 560 lb-ft torque
33,000 lb. GVW
School bus/MD Truck/Shuttle
bus/Sweeper/Yard spotter
EPA/ARB Low NOx
0.1 g/bhp-hr (50% reduction)



L9N™

8.9L

Peak Rating: 320 hp / 1000 lb-ft torque
66,000 lb. GVW
Refuse/Transit/Regional P&D
Truck/Mixers
EPA/ARB Near Zero NOx
0.02 g/bhp-hr (90% Reduction)



ISX12N™

11.9L

Peak Rating: 400 hp / 1450 lb-ft torque
80,000 lb. GVW
Regional Haul Truck/Tractor/Refuse
EPA/ARB Near Zero NOx – 0.02 g/bhp-hr
(90% Reduction)



B6.7N™

■ Key Product Attributes

- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement – 6.7 litres (408.9 cu in)
- ***Certified to CARB Optional Low NOx 0.1 g Standard**
- Exceeds 2017 EPA GHG requirements
- ***2018 On-board Diagnostic (OBD) compliant**
- Dedicated 100% natural gas engine
- Peak rating: 240 hp, 560 lb-ft
- Maintenance free Three Way Catalyst aftertreatment
- Automatic Transmissions
- Base warranty will be same as ISB6.7 diesel
- Up to 33,000 lb. GVW



ISB6.7G

Natural Gas Engine

Customer Impacts

- Continued cost-efficient and ultra reliable performance from B6.7N with HD-OBD
- No changes to fuel economy expected, exceeds EPA / DOT 2017 GHG standards and a clear path to exceed proposed Phase II GHG standards
- Offering same ratings (power and torque curves) as ISB6.7 G
- Cost-efficient and ultra reliable performance continues with minimal engine changes for MY2018
- Technician certification requirement is same as ISB6.7 G
- Full production from Rocky Mount Engine Plant (RMEP) Q1 2018

Key Markets

- School Bus
- MD Truck (Class 6-8)
- Vocational
- Shuttle Bus
- Yard Spotters



L9N™

■ Key Product Attributes

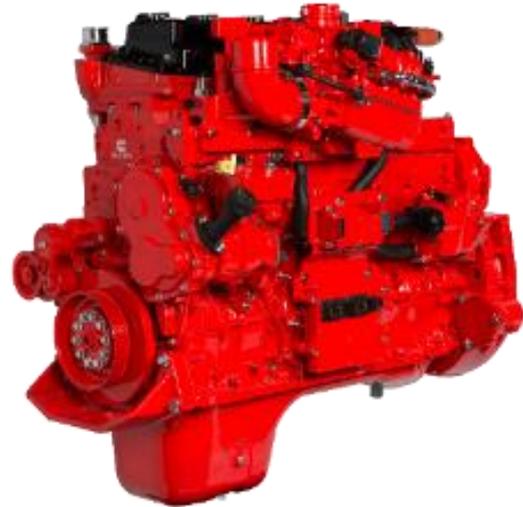
- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement - 8.9 Litre (540 cu. In.)
- ***Certified to CARB Optional Near Zero NOx 0.02g Standard**
- Exceeds 2017 EPA GHG requirements
- ***2018 On-board Diagnostic (OBD) compliant**
- Dedicated 100% natural gas engine
- Peak rating: 320 hp, 1000 lb-ft
- Maintenance free Three Way Catalyst aftertreatment
- Up to 66,000 lb GVW



ISX12N™

KEY PRODUCT ATTRIBUTES

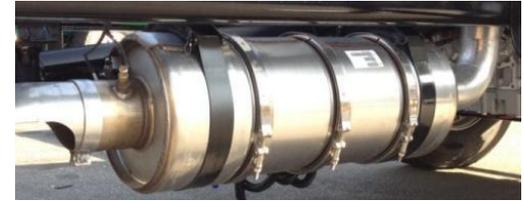
- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement – 11.9 litres (726.2 cu in)
- **Certified to CARB Optional Near Zero NOx 0.02g Standard**
- Exceeds 2017 EPA GHG requirements
- **2018 On-Board Diagnostics (OBD)**
- 400 HP, 1450 Ft/lbs Torque
- Engine braking
- Manual/Automatic/AMT Transmissions
- Maintenance-free Three-Way Catalyst after treatment
- Over 10,000 in service
- Up to 80,000 lb. GVW



Three Way Catalyst

- Reduces three harmful emissions:
NO_x, CO, HC → N₂, CO₂, H₂O
- Simple, passive device
 - No Regeneration
 - No SCR
 - No maintenance
- Consistent performance across all duty cycles

- Similar to catalyst on passenger cars
- Packaged as part of muffler. Vertical or horizontal mount.
- Weighs ~ 100 lbs.



Catalyst Inlet

NO_x

CO

HC



Catalyst Outlet

N₂

CO₂

H₂O

Why CWI NZ Technology?

■ Environmental Durability

- NOx is reduced by 90% below standard
- PM is reduced 90% below standard
- CO2 equivalent is 16% below standard

- RNG compatibility enables WTW GHG emissions reduction to Near Zero levels
 - Landfill source (GREET1_2015 and CA GREET2.0)
 - Up to 97% reduction in CO2
 - Up to 80% reduction in GHG

Natural Gas Playbook Emissions Calculator

cwiplaybook.com

RESULTS

Region	US Typical
GHG Specification/Model	GREET1_2016
Annual Total WTW GHG (CO2eq) Savings with NGVs (Metric Tonnes per year)	5,893.3
% Reduction Relative to Current Vehicle Fleet	80.4%
Truck Equivalent GHG Avoided by Converting to NGV	20.1
# of Near Zero Gas Trucks it Would Take to Generate GHG of Current Fleet	127.4
Tailpipe NOx Emissions Reduction with NGV	90%

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CWI ENGINE SELECTED

ISX12N



OEM Availability for 2018



B6.7N



- Saf-T-Liner C2



- Shuttle Bus



- Shuttle Bus



- Yard Spotter



L9N



- ACX - Xpeditor
- ACMD - Xpert



- 114SD
- M2 112



- Terra Pro
- LR



- Various



- Various



- All American RE



- Low Floor
- Low Floor BRT
- Low Floor BRT Plus



- Xcelsior



- LFS



- Saf-T-Liner HDX



ISX12N



- ACX - Xpeditor



- Commuter Coach



- Pinnacle



- Various



- 114SD
- Next Gen Cascadia



- VNL



- Various



Thank You!

- For more information:
Jorge Gonzalez
East Regional Manager
(330) 720-9785
or
bill.boyce@cummins.com
- Or visit
www.cumminswestport.com

