

# Cummins Westport The Natural Choice



Clean Cities

CWI Product Update

Jerry Johnson

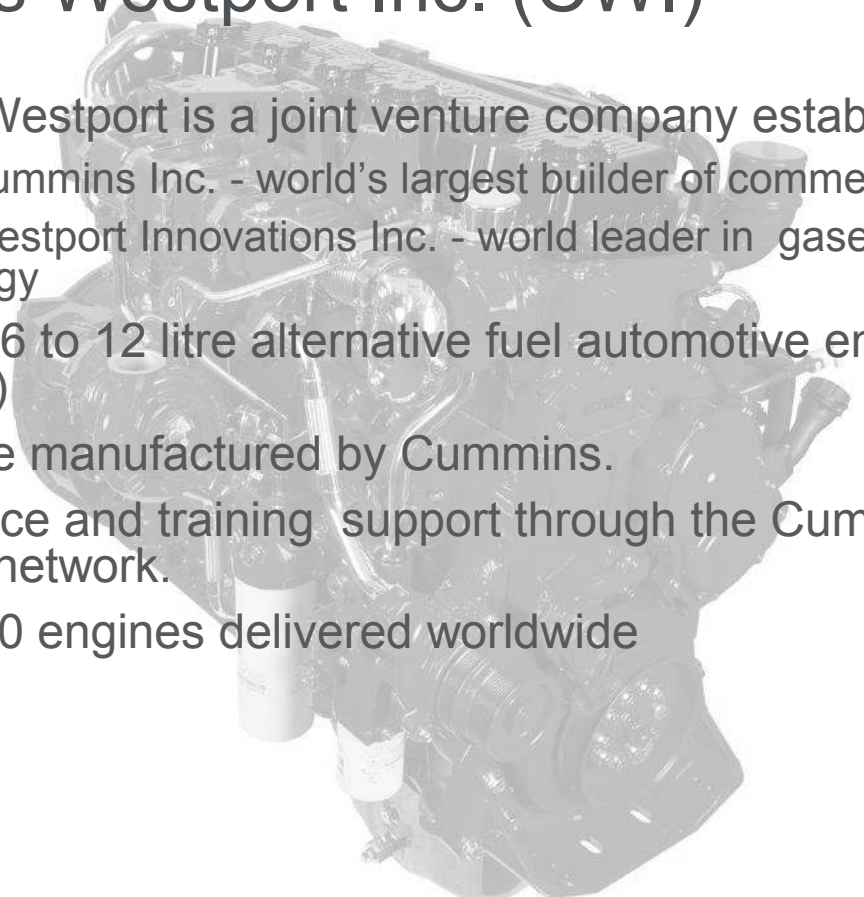
CWI Western Regional Manager

May 18, 2017



# Cummins Westport Inc. (CWI)

- Cummins Westport is a joint venture company established in 2001
  - 50% - Cummins Inc. - world's largest builder of commercial diesels,
  - 50% - Westport Innovations Inc. - world leader in gaseous fuel engine technology
- CWI offers 6 to 12 litre alternative fuel automotive engines. (CNG, LNG, RNG)
- Engines are manufactured by Cummins.
- Parts, service and training support through the Cummins Distributor network.
- Over 60,000 engines delivered worldwide



# Continued Emission Leading Performance

## C Gas Plus



First engine 2004 EPA  
Certified

1.8 g/bhp-hr. NOx

Lean Burn Combustion

## ISL G



First HD engine  
certified 2010 EPA/ARB

0.2 g/bhp-hr. NOx

SEGR Combustion

## ISX12 G



HD Truck engine  
certified EPA/ARB

0.15 g/bhp-hr. NOx

SEGR Combustion

## ISB6.7 G



Mid range engine  
certified EPA/ARB

0.1 g/bhp-hr. NOx

SEGR Combustion

## ISL G NEAR ZERO



First engine Certified  
Near Zero ARB

0.02 g/bhp NOx

SEGR Combustion

2001

2007

2013

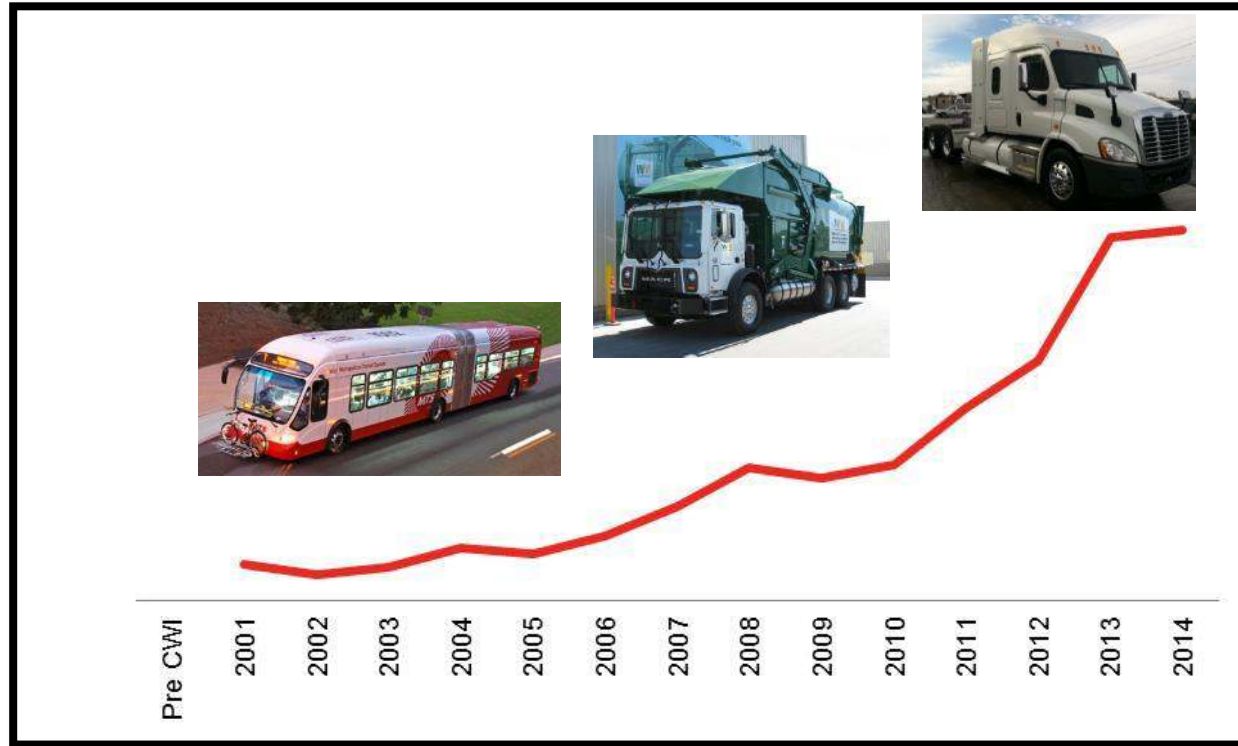
2016

2016

### Particulate Matter (PM)

All CWI engines have met the 2010 EPA/ARB Particulate Matter (PM) standard (0.01 g/bhp-hr.) with a catalyst since 2001

# Natural gas use in vehicles has grown and evolved over the past decade



# Cummins Westport Natural Gas Engines

70,000 engines delivered worldwide



**ISB6.7G**

**6.7 Litre**

Spark Ignited  
SEGR

Three Way Catalyst  
33,000 lb. GVW

School bus/MD Truck/Shuttle  
bus/Sweeper/yard spotter



**ISL G** NEAR  
ZERO  
**ISL G**

**8.9 Litre**

Spark Ignited  
SEGR

Three Way Catalyst  
66,000 lb. GVW

Refuse/Transit/Regional  
P&D Truck/Mixers



**ISX12 G**

**11.9 Litre**

Spark Ignited  
SEGR

Three Way Catalyst  
Up to 80,000 lb. GVW

Regional Haul  
Truck/Tractor/Refuse



Cummins Westport  
The Natural Choice



Introduction: CWI 2018 NA Products



# Move to Zero

Cummins Westport

Next Generation Natural Gas Engines

**ISX12N™ L9N™ B6.7N™**



# What is regulated Near Zero (NZ) NOx?

## California definitions for various vehicle emissions levels / technology

### LOW NOx

ARB defines three optional Low NOx standards to certify to:

0.1 g/bhp-hr  
0.05 g/bhp-hr  
0.02 g/bhp-hr

### NEAR ZERO EMISSIONS

0.02 g/ bhp-hr NOx  
(90% reduction from current EPA standard of 0.2 g/bhp-hr)

### ZERO EMISSIONS

No tailpipe emissions, regardless of how low. (NOx, PM, GHG etc)

CEC\* has defined this certified Near Zero emission level as equivalent to a 100% battery truck using electricity from a modern combined cycle natural gas power plant.

\*California Energy Commission



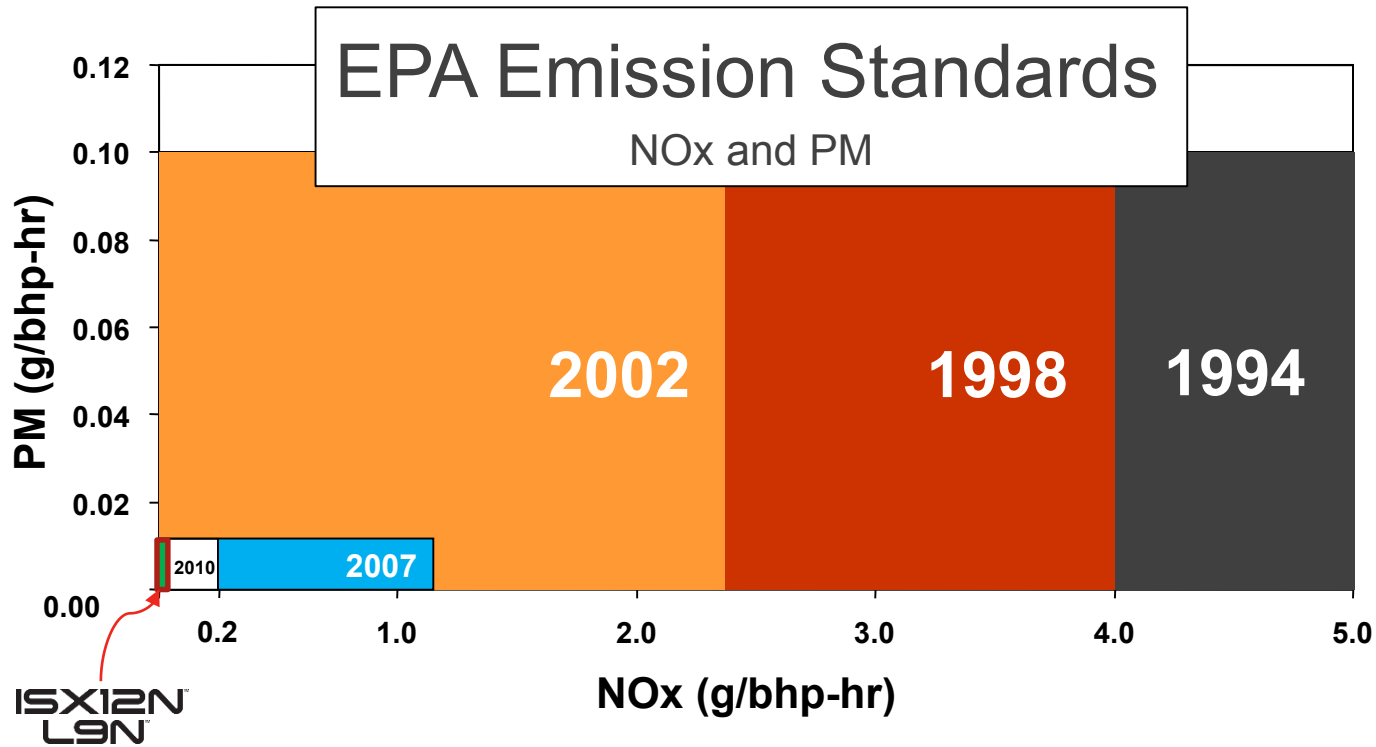


# The Move to Zero with Natural Gas

- CWI natural gas engine technology is here today to lower regulated NOx and CO2 emissions levels by up to 90%
- Natural gas is a low carbon fuel, and renewable natural gas is the lowest carbon fuel – even to sub zero levels
- Combining Ultra Low NOx engine technology with RNG is a Move to Zero emissions strategy available for many applications today.
- Move to Zero with natural gas is a lower cost emission reduction pathway for transit, truck and refuse fleets.



# CWI Ultra Low NOx Internal Combustion Engines



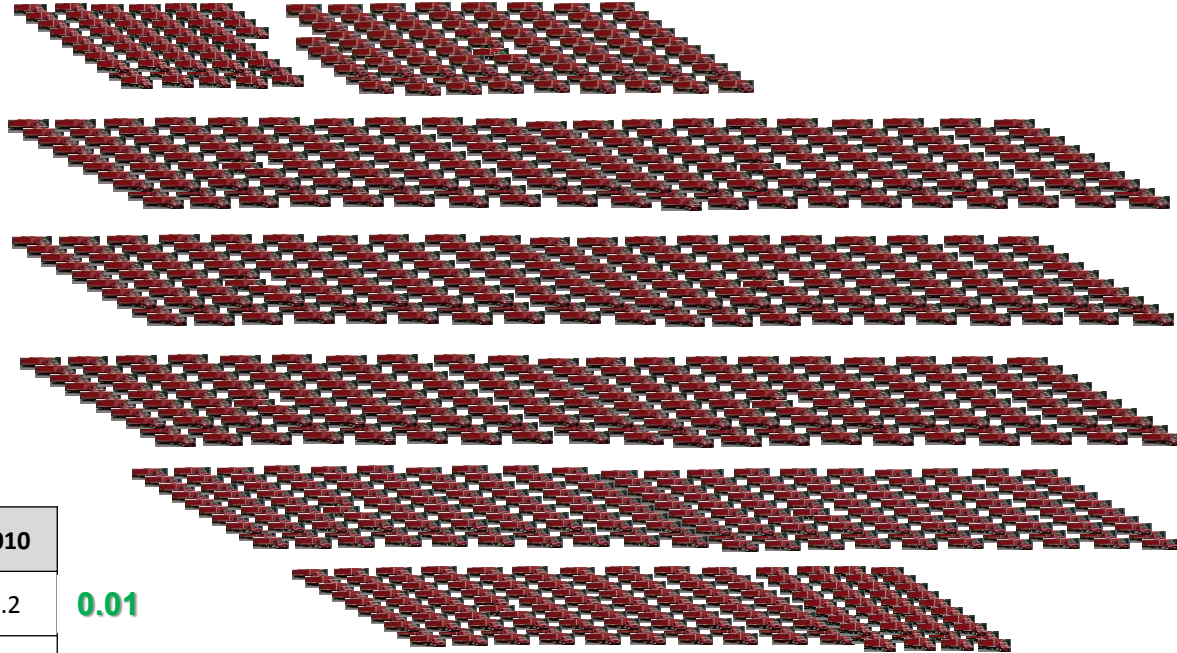
ISX12N  
L9N



# 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

0.01

54 1080

5  
4  
0



# 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™**



# New Engine Names

- The change in product names began in 2017 and is designed to create stronger consistency across the Cummins global product line.
- The new global engine names roll out with all new platforms and significant product or emission changes.
- EPA and California ARB Regulations require all natural gas engines to be OBD compliant for model year 2018, plus all engines certified at Near Zero NOx = significant product and emissions change for all CWI engines

**B6.7N™**



Series Letter

**L9N™**



Displacement  
(Decimal used below 9 litres)

**ISX12N™**



Natural Gas



# ISX12N™ NEAR ZERO

## ■ 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 Low NOx 0.02g Standard**
- Exceeds 2017 EPA GHG requirements
- **\*2018 On-board Diagnostic (OBD) compliant**
- Dedicated 100% natural gas engine
- Engine braking
- Manual/Automatic/AMT Transmissions
- Maintenance free Three Way Catalyst Aftertreatment
- Over 8,500 in service (+700 in Refuse applications)

*\* Indicates new product attribute for MY2018*



## – Changes for 2018

- Near Zero Emissions: 0.02 g/bhp-hr NOx emissions level
- 2018 HD OBD for optimal emissions performance
- Improved engine reliability & durability with new fuel system



### Engine Changes

New fuel system

On-engine electric CCV filter with 2 CCP sensors

CM2380 ECM

500 kbaud datalink

New wiring harness

New ICM (common with 2018 ISL G)

### Aftertreatment Changes

One-piece TWC

Mid-bed O2 sensor

OEM harnessing

Size increase for Near Zero



## ■ Key Product Attributes

- 4 cycle, spark ignited, in-line 6 cylinder, turbocharged, CAC
- Displacement - 8.9 Litre (540 cu. In.)
- Certified to CARB Optional Low NOx 0.02g Standard (ISL G NZ introduced in 2016)
- 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

*\* Indicates new product attribute for MY2018*





# – Changes for 2018

- 2018 HD OBD for optimal emissions performance
- ISL G NZ (0.02g NOx) introduced in 2016
  - Added CCV and other changes
  - ISL G (0.2g NOx) not available post 2017



## Engine Changes

Additional crankcase pressure sensor

CM2380 ECM

500 kbaud datalink

New wiring harness

New Ignition Control Module

## Aftertreatment Changes

TWC size similar to 2016 ISL G NZ

One-piece TWC

Mid-bed O2 sensor

OEM harnessing

# 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 0.1g 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

*\* Indicates new product attribute for MY2018*



# B6.7N™ – Changes for 2018

- 2018 HD OBD for optimal emissions performance
- ISB6.7 G (0.1g NOx) introduced in 2016

## Engine Changes

Additional crankcase pressure sensor

CM2380 ECM

500 kbaud datalink

New wiring harness

New Ignition Control Module

## Aftertreatment Changes

TWC size similar to 2016 ISB G NZ

One-piece TWC

Mid-bed O2 sensor

OEM harnessing



# Cummins Westport product plans

Engine	2016	2017	OBD	2018	2019
<b>ISB6.7G</b> *	Available	Available		Available	Available
<b>ISB6.7G NEAR ZERO</b>	Not Available	Not Available		Development Program Not Funded	
<b>ISL G</b>	Available	Available		Not Available	Not Available
<b>ISL G NEAR ZERO</b>	Available	Available		Available	Available
<b>ISX12G</b>	Available	Available		Not Available	Not Available
<b>ISX12G NEAR ZERO</b>	Not Available	Not Available		Available	Available

**Legend**

Available

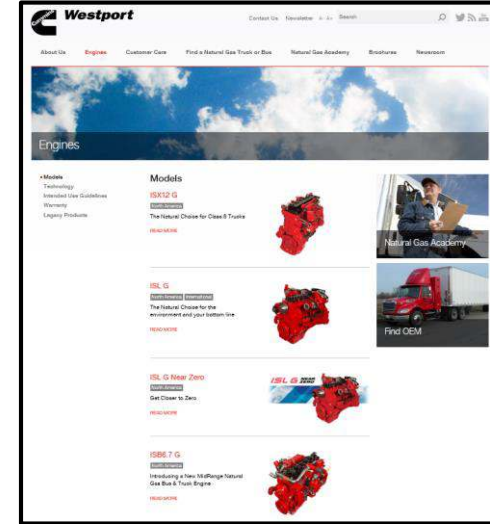
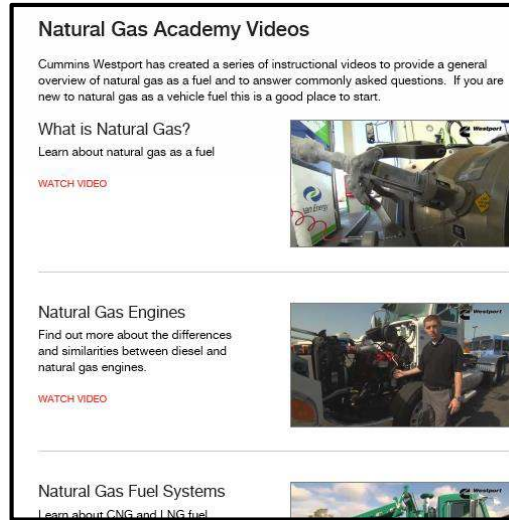
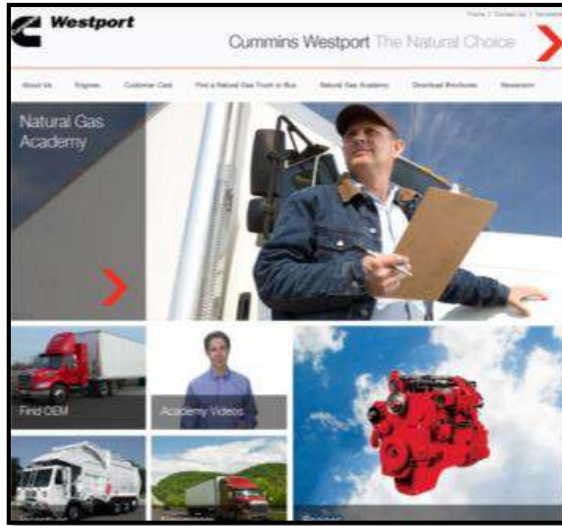
Not Available

\* ISB6.7 G was certified at launch to California ARB optional low NOx standard of 0.1 gram/bhp-hr.

“Near Zero” – A engine certified to ARB’s lowest optional low NOx standard of 0.02 gram/bhp.hr. An emission level ARB defines as ‘equivalent to a 100% battery truck using electricity from a modern combined cycle natural gas power plant’



# More information... [www.cumminswestport.com](http://www.cumminswestport.com)



- Natural Gas Academy: great source of information about NG, technology, vehicles
- Series of instructional videos, including engine walk-arounds and service & driver training videos
- Engine information – specs, features, maintenance intervals
- Product Brochures & Bulletins available for download

