

Cummins Westport
The Natural Choice



Cummins & Cummins Westport Update

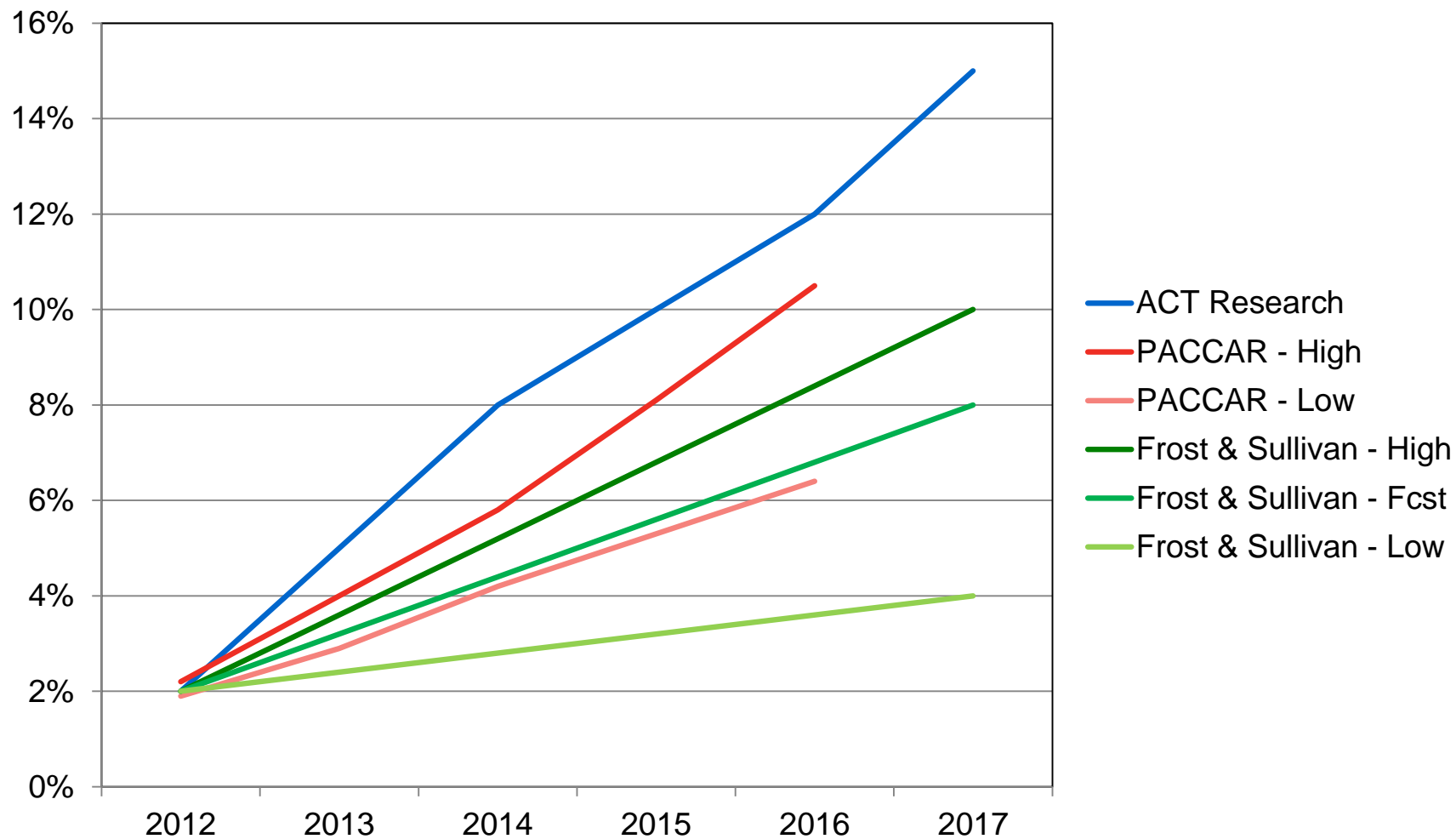
Darin Bridges

Automotive Sales Leader

Cummins Mid-South Inc.



Class 8 NG Penetration Forecasts



Three “Es” of Natural Gas

Economics

- Natural Gas costs 30-50% less than diesel
- Fuel use reduces payback time period

Energy Policy

- Abundant domestic supply of natural gas in North America
- The United States ranks in the top 2 for annual natural gas production*
- Reduce crude oil imports

Environment

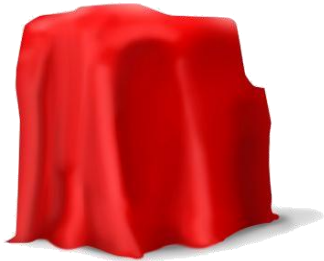
- Reduced GHG emissions
- Reduced engine noise
- Maintenance free exhaust treatment

Natural Gas Truck Engines

Natural Gas Truck Engines



ISB6.7 G



- CWI JV
- 6.7 Liter
- Spark Ignited
- 2015 launch

ISL G



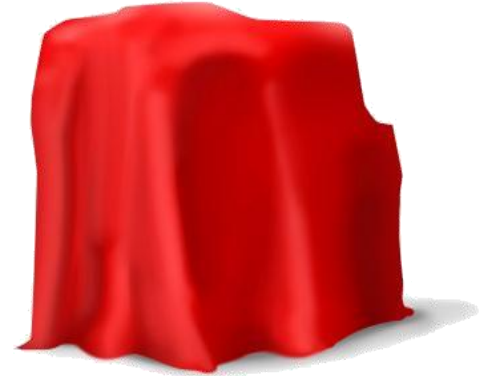
- CWI JV
- 8.9 Liter
- Spark Ignited
- 250-320 hp
- 660-1000 lb/ft

ISX12 G



- CWI JV
- 11.9 Liter
- Spark Ignited
- 320-400 hp
- 1150-1450 lb/ft
- 2013 launch

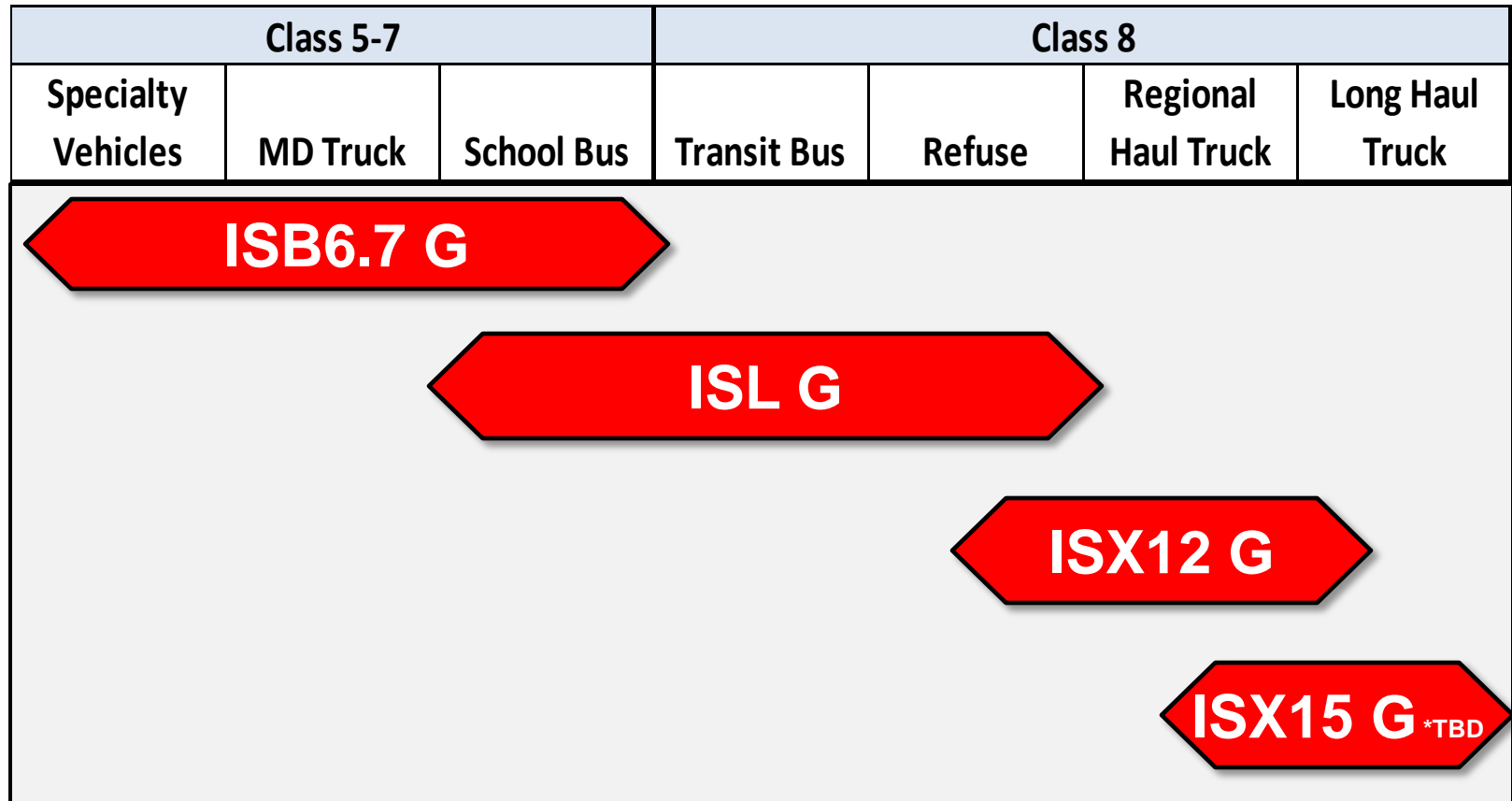
ISX15 G



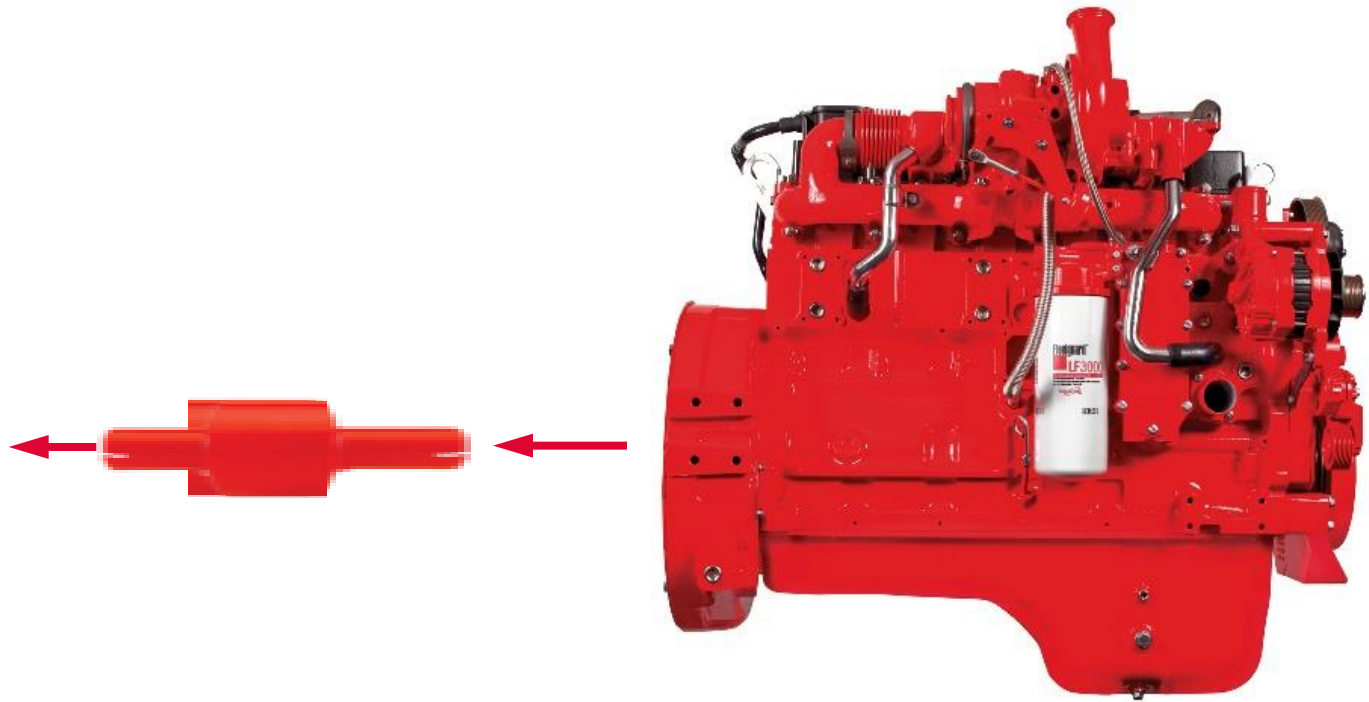
- Cummins
- 15 Liter
- Spark Ignited
- 400 – ? HP
- 1450 -1750 lb/ft
- TBD



By 2016*, there will be a natural gas product for any type of on-highway application.



Common Architecture Strategy

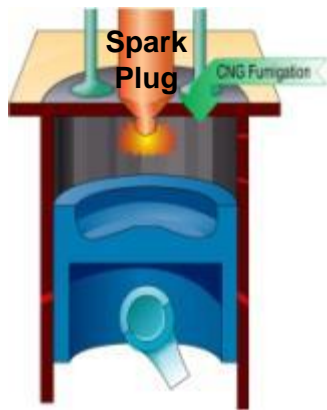


Three Way Catalyst

Spark Ignition

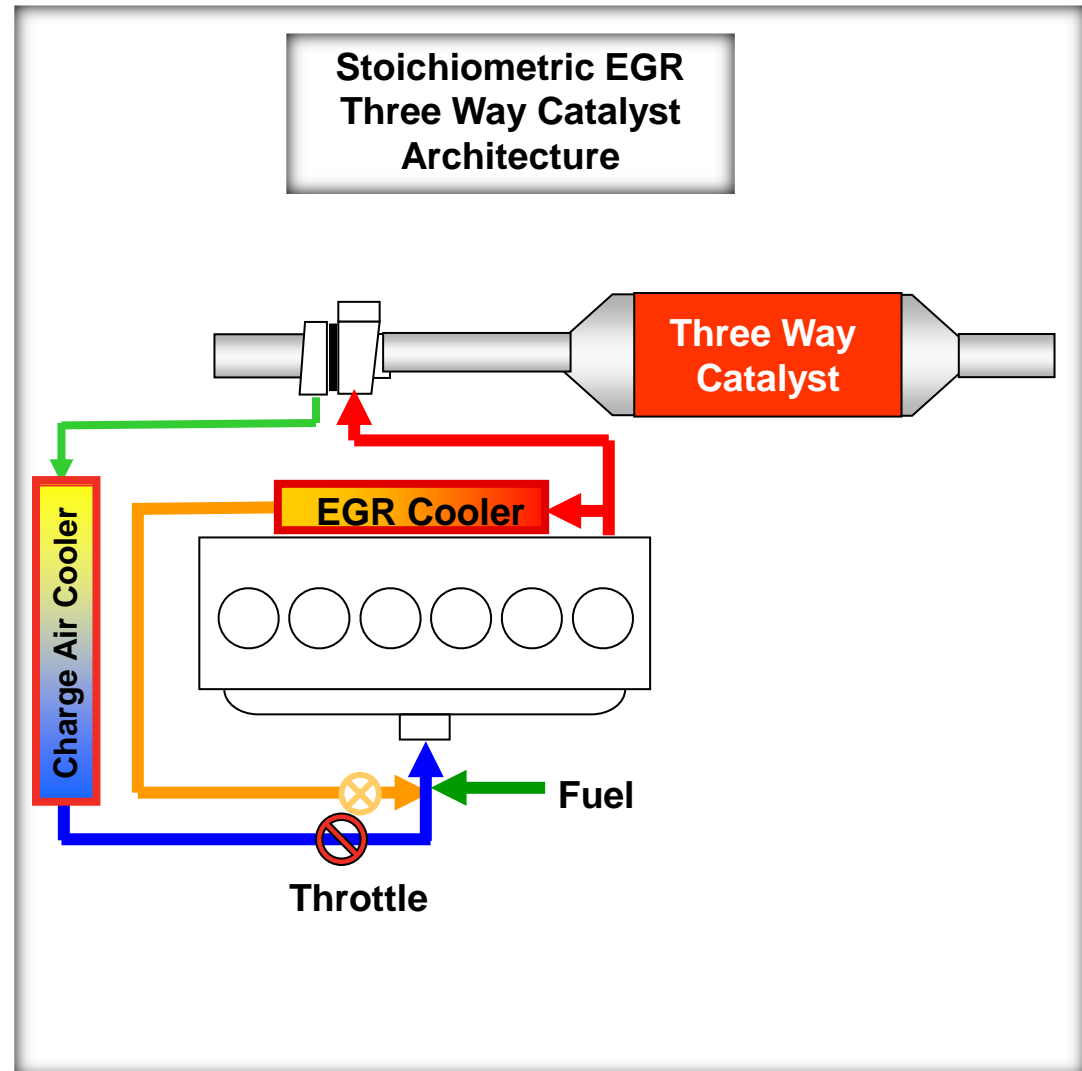
Introduced in 2007

Combustion Technology – Spark Ignited Stoichiometric with Cooled EGR



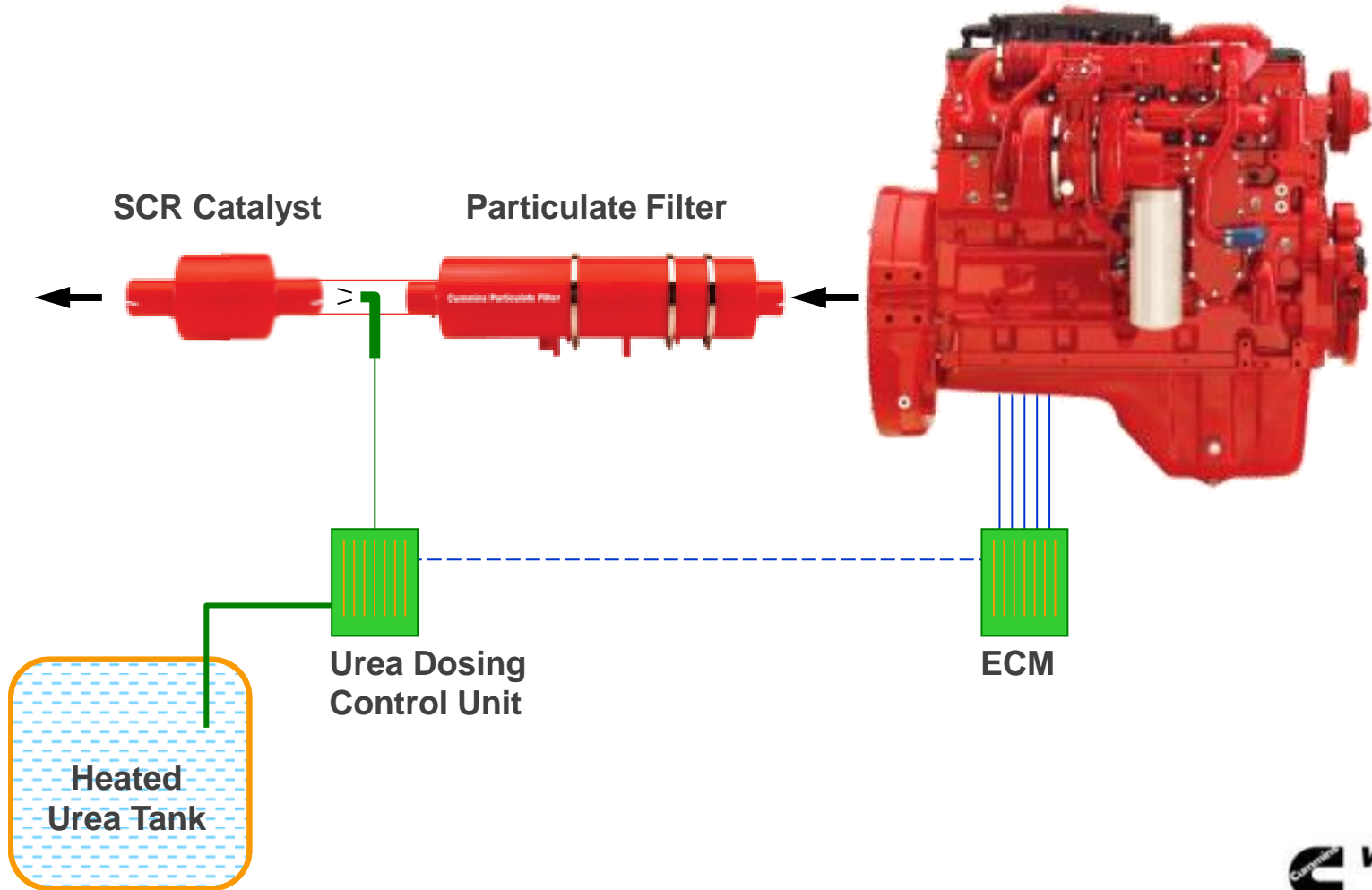
Spark Ignited

- Fuel and air are premixed outside the cylinder
- Spark plug ignites the mixture
- Air flow controls fuel flow
- Air/Fuel ratio controls emissions



ISL9

ISX12



ISL G

ISX12G

Three Way Catalyst



Three Way Catalyst Aftertreatment

- Similar to catalyst on gasoline passenger cars
- Packaged as a muffler with vertical or horizontal mount
- Weighs less than 100 pounds
- Passive device

- Benefits:

- Maintenance-free
- Reliable
- No regeneration events
- Easy to install in vehicle



Natural Gas Engines: Features

- ISX12 G : 12 Liters
- ISL G : 9 Liters
- Uses 100% Natural Gas
 - Capable of CNG, LNG or RNG
- In-line 6 cylinder
- Charge-Air Cooled (CAC)
- Stoichiometric EGR Combustion
- Spark Ignited
- Three Way Catalyst Aftertreatment
- Manufactured by Cummins in Jamestown, NY, USA



Natural Gas Engines: Technical Specs



ISL G

Horsepower	250-320 hp
Torque Range	660-1,000 lb-ft
Transmission	Automatic
Clutch Engagement	550 lb-ft
Engine Braking	No
System Weight	1,725 lbs

ISX12 G

Horsepower	320-400 hp
Torque Range	1,150-1,450 lb-ft
Transmission	Automatic / Manual
Clutch Engagement	700 lb-ft
Engine Braking	Yes
System Weight	2,750 lbs

ISX12 G Natural Gas Engine – Features

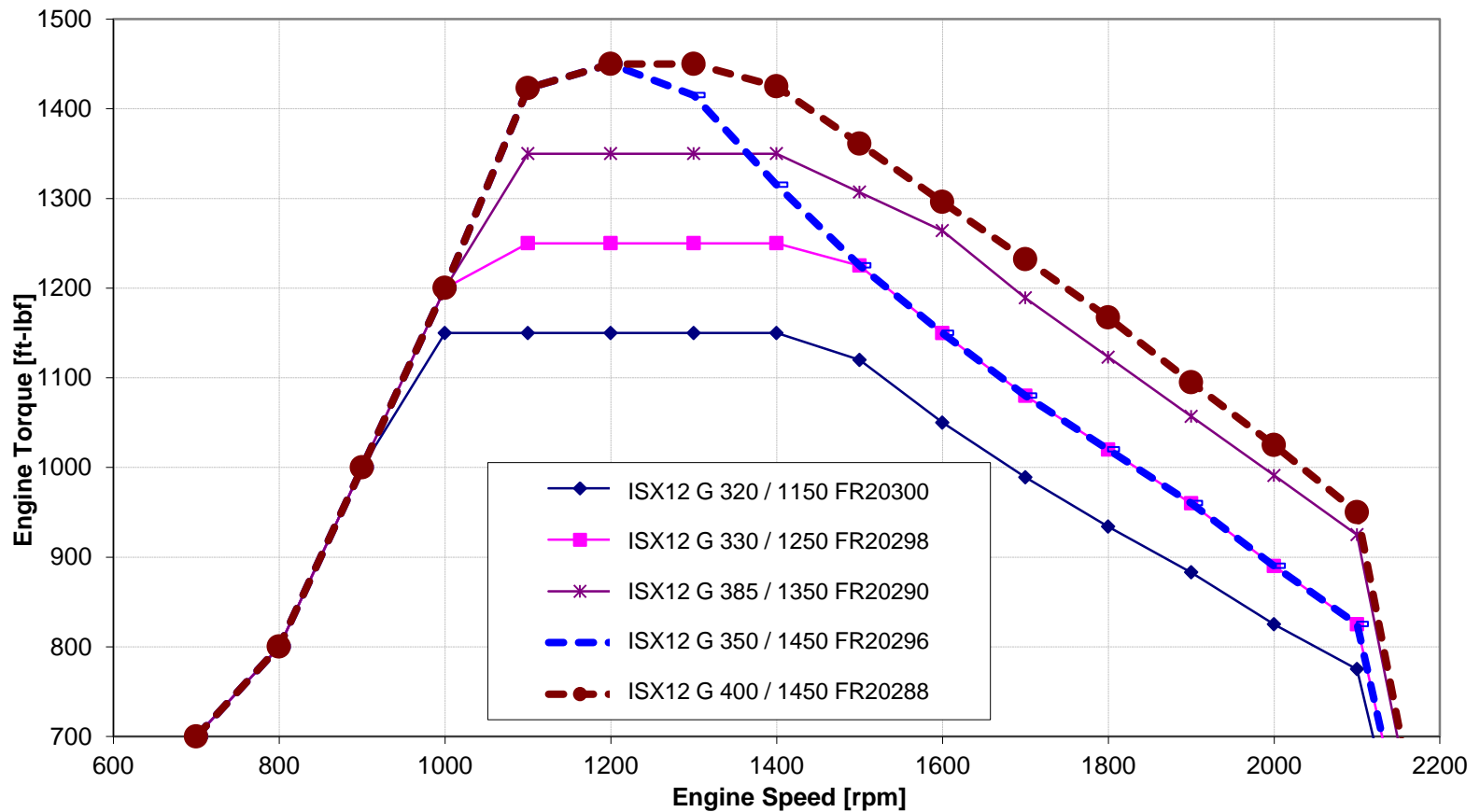
- Proven technology – Fuel system, combustion recipe and controls adapted from ISL G.
- Simplicity – Passive aftertreatment & wastegate turbocharger
- Fuel compatibility – CNG, LNG, RNG (BioMethane)
- Familiarity – 80% of parts common with ISX12 diesel
- Diesel-like torque curve (up to 400 hp)
- Engine compression brake available
- Compatible with automatic and manual transmissions,
- AMT approved this fall
- Cummins worldwide customer support

New



Similar Ratings

- Power and torque curves similar to ISX12 diesel



Normal Duty Truck ISX12 G Maintenance Intervals

Note: Normal Duty Truck, 45 mph Average Speed	Hours	Miles	Kilometers	Months
Spin-on Fuel Filter	Daily Check			
Oil & Filter*	500	25,000	NEW 39,000	6
Coolant Filter**	1,500	75,000	NEW 108,500	12
Spin-on Fuel Filter*	1,000	50,000	NEW 108,500	12
Spark Plugs*	1,500	75,000	NEW 108,500	12
Overhead Adjustment*	1,500	67,500	108,500	12
Engine Brake (Adjust)	6,000	270,000	435,000	24
Standard Coolant	6,000	270,000	435,000	24
Air Cleaner/Element	Follow vehicle manufacturers published recommendations			

- Intervals for normal duty - must be reduced for lower average speeds/duty cycles.
- Default interval is the hours stated. Interval is whichever comes first – hours, miles or time.
- Refer to Owners Manual for complete details on Maintenance Intervals.

*Assuming normal duty cycle/based on 45 mph average speed. Spark plug interval /overhead adjustment must be reduced for slower speed applications.

**Do not change if SCA above 3



ISL G Warranty & Extended Coverage

- Base warranty for Cummins Westport natural gas engines is the same as the Cummins diesel base platform
- 2 Years / 250,000 Miles Warranty
- Extended Coverage
 - 3 to 5 yr, 100,000 to 300,00 mile – Protection Plan 1
 - 3 to 7 yr, 100,000 to 300,00 mile – Protection Plan 2
 - 6 yr, 300,00 mile Major Component

ISX12 G Warranty & Extended Coverage

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- 2 Years / 250,000 Miles Warranty
- Extended Coverage
 - 3 to 5 yr, 300,000 to 500,00 miles – Protection Plan 1
 - 3 to 7 yr, 100,000 to 250,00 miles – Protection Plan 2
 - 5 to 7 yr, 500,000 to 700,000 miles – Major Components

Maintenance intervals align with parent diesel engine with a few exceptions.

Additions

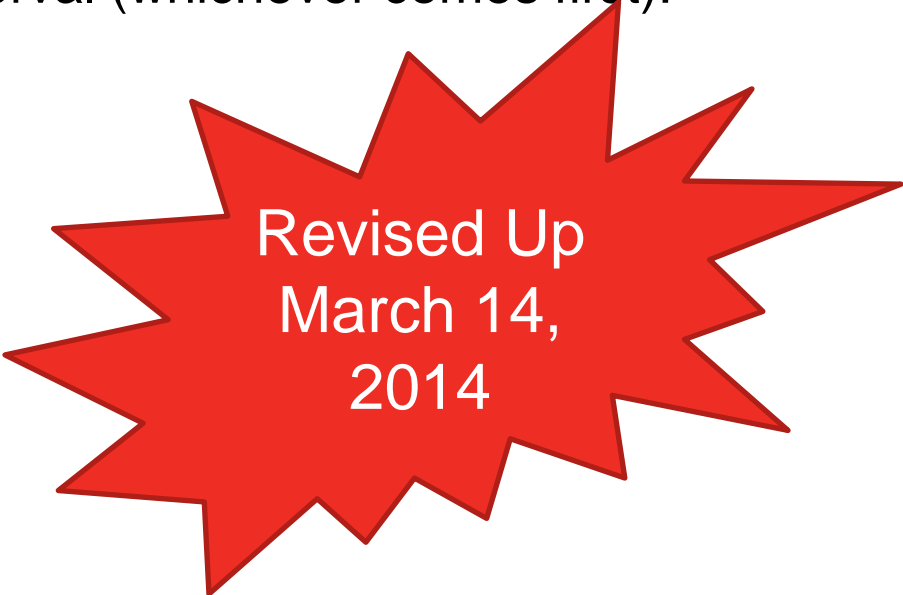
- Spark plugs
- Valve adjustment
- Fuel filter draining
- GEO lubricating oil

Deletions

- DEF filter
- DPF Particulate filter
- Doser injector

Spark Plug Maintenance

- Spark plug maintenance is critical to performance, economy, and reliability of a natural gas engine.
- Plug replacement interval (whichever comes first):
 - 1500 hours or
 - 75,000 miles or
 - 12 months



Revised Up
March 14,
2014

LNG Fuel System ~ 140 Diesel Gallon Equivalent (DGE)



2 X 70 DGE Frame Mounted System 2,200 lbs Full

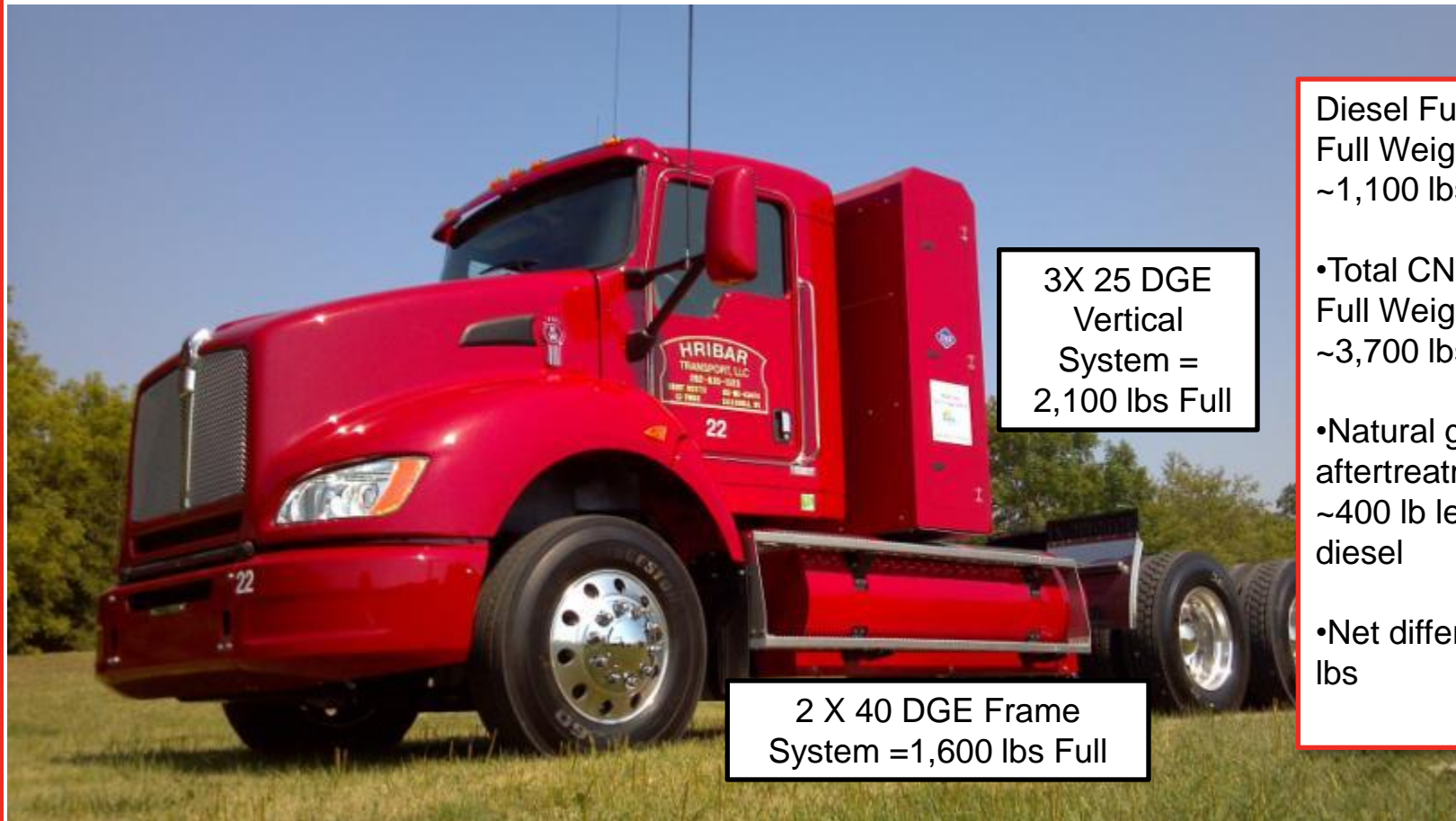
- Diesel Fuel System Full Weight ~125 gal ~1,100 lbs
- Total LNG System Full Weight ~125 DGE ~2,200 lbs
- Natural gas engine + aftertreatment weighs ~400 lb less than diesel
- Net difference ~700 lbs

Rated LNG Fuel Capacity – 140 Diesel Gallon Equivalent

Net LNG Full Capacity ~125 DGE



CNG Fuel System ~ 155 Diesel Gallon Equivalent (DGE)



3X 25 DGE
Vertical
System =
2,100 lbs Full

2 X 40 DGE Frame
System = 1,600 lbs Full

- Diesel Fuel System Full Weight ~125 gal ~1,100 lbs
- Total CNG System Full Weight ~125 DGE ~3,700 lbs
- Natural gas engine + aftertreatment weighs ~400 lb less than diesel
- Net difference ~2,200 lbs

Rated CNG Fuel Capacity –155 Diesel Gallon Equivalent

Net CNG “Fast Fill” Capacity ~125 DGE



OEM Launch Partners



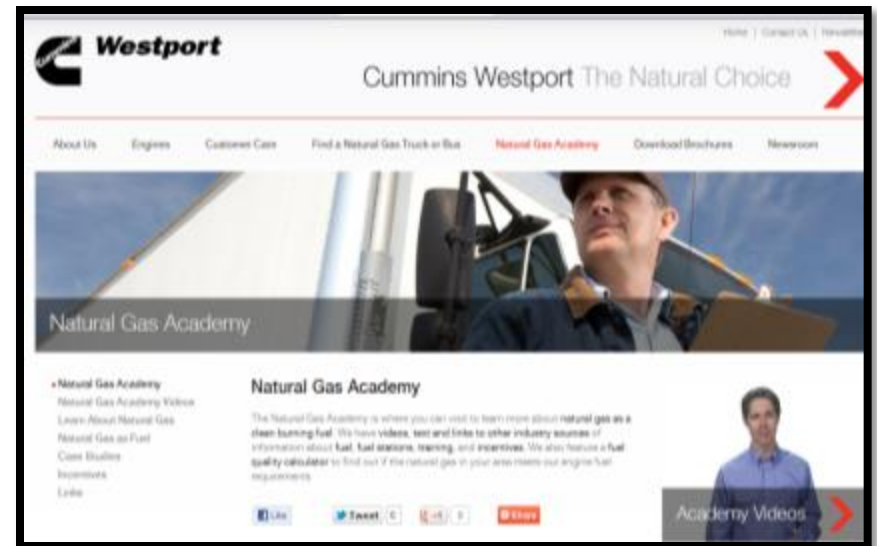
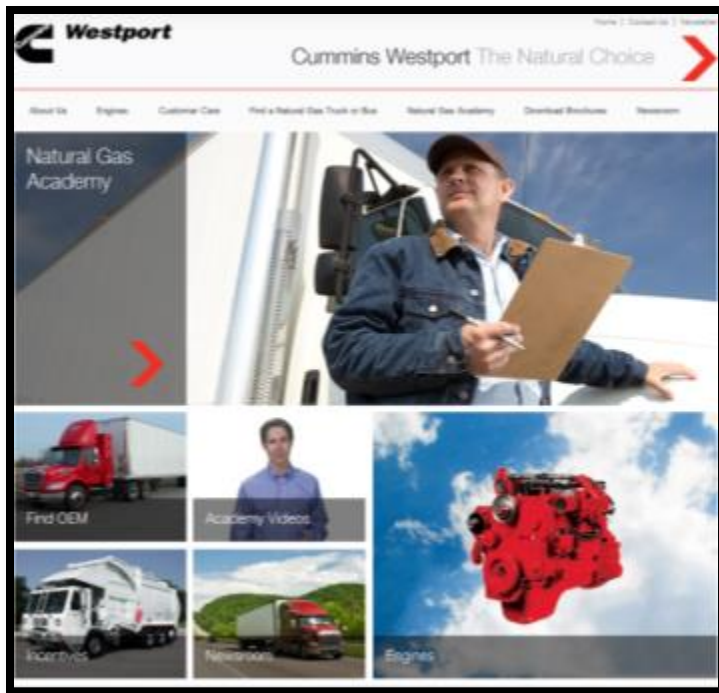
Truck OEM Availability

OEM		ISL G	ISX 12 G
Freightliner			
	M2 (4x2)		
	Cascadia		
Kenworth			
	T440 / T470		
	T660		
	T800		
	W900		
Mack			
	Pinnacle		*
	Granite		*
Navistar			
	TranStar		
	ProStar		*
Peterbilt			
	320		
	365		
	367		
	384		
	386		
Volvo			
	VNL		
	VNM		
Capacity			
	TJ9000		
	TJ5000		
Autocar			
	Xspotter		

Possible constraints to adopting natural gas in North American truck markets in early 2013

- Fueling infrastructure – Solutions are available.
- Engine availability – Engines are here and in production
- Truck availability – Truck OEMs are on-board
- On-board fuel storage manufacturing and fuel system installation capacity
 - More options now, many new players, 3M, Lockheed etc.
- Product Knowledge -
 - Complexity and Risk VS. Simplicity and Reward
 - NG engines are simpler than modern diesels

www.cumminswestport.com



- Great source of information about natural gas engines and vehicles.
- Features the **Natural Gas Academy**, a series of instructional **videos**
 - Designed to provide a general overview of natural gas as a fuel whether it is compressed (CNG) or liquefied (LNG), and how it is used with vehicles.
 - ISX12 G engine **walk around video** added Sept, 2012



Thank You!

Contact Darin Bridges at

Darin.Bridges@cummins.com

Or visit

www.cumminswestport.com

