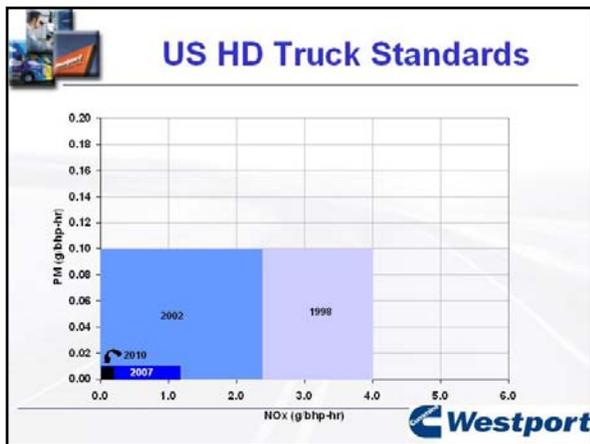


Emissions Laws Will Get Tougher

- This is a big deal for diesels!
 - More expensive
 - More complex
 - Reduced fuel economy
 - Reduced performance

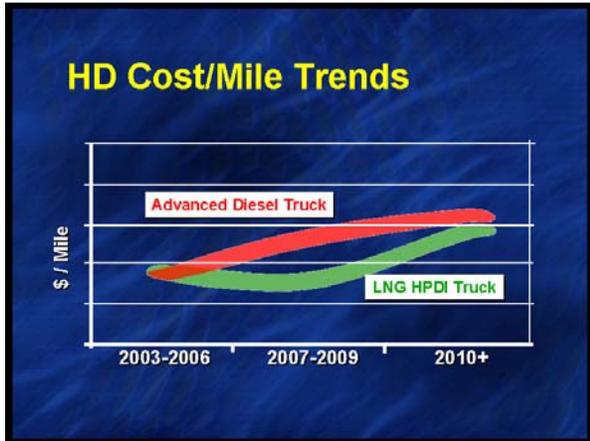
➔ Started 10/02

- Hard to see a technology road map beyond 2010



No easy solutions..Sooner or later

In-cylinder – Exhaust Gas Recirculation (EGR)	Introduced on Light-Duty, Heavy-Duty for EPA 2002, improves NOx, worsens PM
In-cylinder – Change the fuel	Synthetic fuels; biofuels; water blends; expensive, limited emissions reduction
In-cylinder - Change the operating cycle to spark ignition or dual fuel	Highly effective in many applications but do not match diesel performance and efficiency.
External - Clean up the exhaust	No good solution for NOx today. Affects durability and efficiency. Will be needed by end of decade.
Change to new technologies – fuel cells, hybrids	If all technical and infrastructure issues resolved, high costs remains a problem, especially in commercial applications



Westport
10 Reasons To Be Bullish About N/Gas

1: Concern About Air Quality is Growing

Urban Pollution
Global Warming

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10 Reasons To Be Bullish About N/Gas

2: Emissions Laws Will Get Tougher

- EPA & Euro will squeeze allowable emissions:
 - NOx - smog
 - PM - health issues
 - CO2 - global warming
- U.S. EPA NOx standard (g/hp hr)

• 2002	2.5g
• 2007	1.2g
• 2010	0.2g Proposed

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10 Reasons To Be Bullish About N/Gas

3: Many Regions Will Go Further than the Legal Minimum with a Stick or Carrot

- Mandates or regional rules will be more common
 - Like AQMD 1190 rules
 - » NO diesel school buses or refuse trucks in Southern California
- Incentives will increase & more programs to help adoption:
 - California Moyer Fund
 - U.S. federal bus funding pays 80% for clean buses
 - Powershift in U.K. pays 75%
 - Proposed US Clear Act

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4: Natural Gas Infrastructure is Improving

- More Fuel stations
- Long run economics look good
- LNG market is emerging:
 - more range
 - lower tank & vehicle cost

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10 Reasons To Be Bullish About N/Gas

5: NG Engine Technology is Getting Better

There's very few problems with natural gas power that can't be solved by just building better engines

- Current reliability is 3X better than 1995
- Finally more customers are satisfied than mad



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10 Reasons To Be Bullish About N/Gas

6: Nat Gas Trucks are Finally Available

- Technology has no value if you can't buy it
 - Autocar - available today
 - Freightliner Condor - available today
 - Freightliner Business Class - available soon
 - Peterbilt 320 - being evaluated



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7: The Silver Bullet of Alternate Technologies is Pretty Slow



Hydrogen is very compelling, but issues like economics / technology / availability = TIME

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10 Reasons To Be Bullish About N/Gas

8: Reciprocating Engines Will be Hard to Beat

- The economics for reciprocating internal combustion engines are undisputed
 - Cost effective & productive
- Advanced reciprocating technology can offer very low emissions, e.g.. HYBRIDS
 - Diesel hybrids make great sense
 - Natural gas hybrids make even more sense
- "Well to Wheels", "recips" are pretty good

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10 Reasons To Be Bullish About N/Gas

9: Natural gas is the ideal reciprocating engine fuel

- Clean, Abundant & Economic
- Lowest carbon fuel
 - 50 % lower NOx
 - 90 % lower PM
- May be our best alternative for energy security
- May be the path to the Hydrogen economy:
 - » Short term
 - » Natural Gas infrastructure
 - » Natural gas in reciprocating internal combustion engines

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10 Reasons To Be Bullish About N/Gas

10: Cummins Westport Commitment

1. Continue the development of spark ignited natural gas engines 150 – 320 hp  Available TODAY
2. Develop new Westport cycle technology for larger HD engines of 400 - 550 Plus Horsepower  Available 2004

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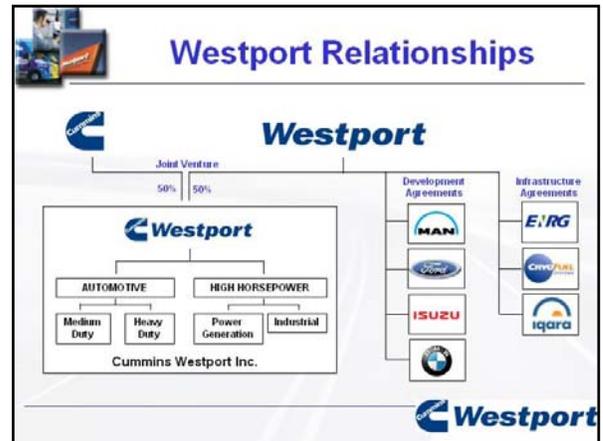
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Cummins Westport Inc

- 50 / 50 Joint Venture formed March, 2001
- Cummins
 - World's largest builder of commercial diesels
 - +26,000 employees
- Westport
 - Small incubation technology company focused on natural gas
 - 200 employees



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Westport's Views

- Diesel engines will continue to dominate commercial transportation and power generation markets for the foreseeable future
- Diesel fuel's environmental challenges are real and difficult; but will be solved – at a cost
- But leading customers have already begun the shift to natural gas fuel in many geographic markets
- *An historic opportunity to change the market over the next decade*

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The Joint Venture's Mission

Big in Clean Power

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The JV's Mission

Big in Clean Power

- Make the existing spark-ignited natural gas business work today
- Develop the new Westport HPDI Technology for the future

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Westport's HPDI Approach

Keep the diesel engine - - -

Change the fuel with HPDI
"plug-in" natural gas injection.

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HPDI Technology Proposition

HEAVY DUTY: YOU CAN HAVE IT ALL!

- Low Emissions	Natural Gas
- High Performance/BMEP	Like a Diesel package & performance
- High Efficiency	Same as diesel, better than Spark Ignited, better than "Dual Fuel"
- Economic Payback	Fuel Saving - 2-3 yr payback Low Maintenance -no spark plugs

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Direct Injection Technology

High-Pressure Direct Injection

- > Natural gas injected at hi pressure
- > Pilot diesel injected for ignition
- > Engine remains the same:
 - Same power and torque
 - Same high efficiency
 - Diesel cycle, not Otto cycle
 - not knock limited
 - not sensitive to natural gas
- > 40% less NOx
- > 60% less PM
- > 20% less CO₂

Average 95% Natural Gas

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Key HPDI Components

LNG Pump

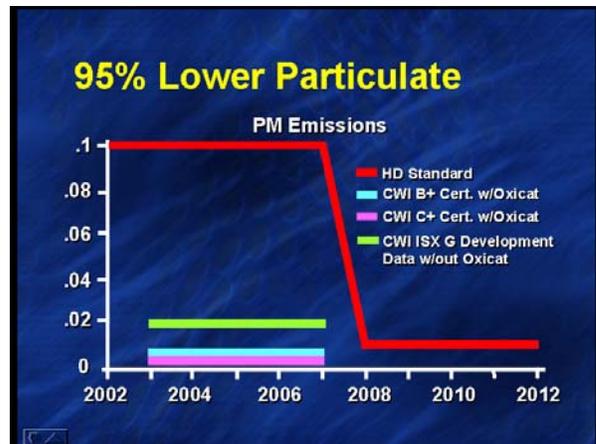
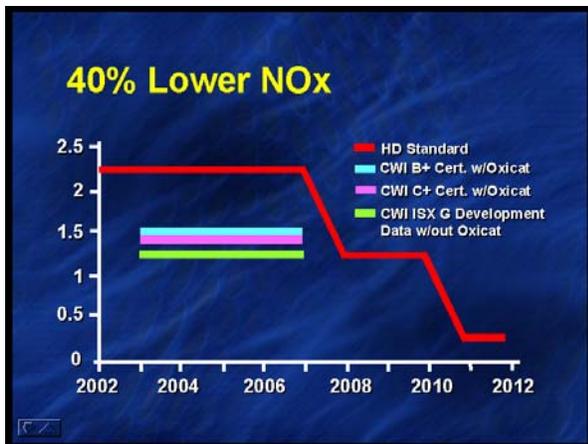
Electronic Control Module

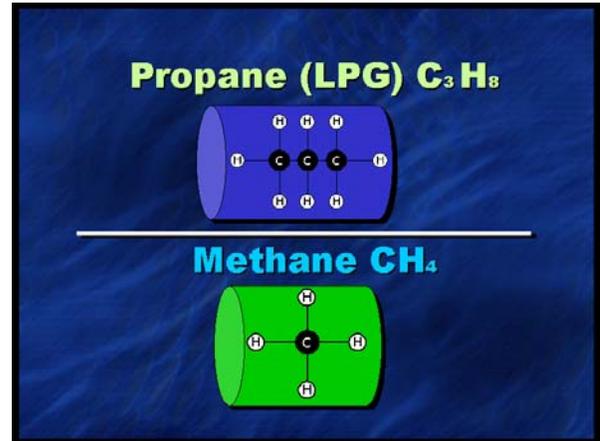
•HPDI Injector similar in design to diesel injector

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HPDI Technology is Real

HPDI version of ISX-400 (1450 ft-lbs)

- 2000 - Engineering Truck
- Jan 01 - Delivered Raley's Truck (KW T-800)
- Feb 01 - Certified to CARB Optional low NOx (2.5g) emissions standard
- Mar 01 - Delivered Bobell Truck (KW T-800)
- 3Q01 - 14 trucks to Norcal Waste Systems in San Francisco (Peterbilt 378)





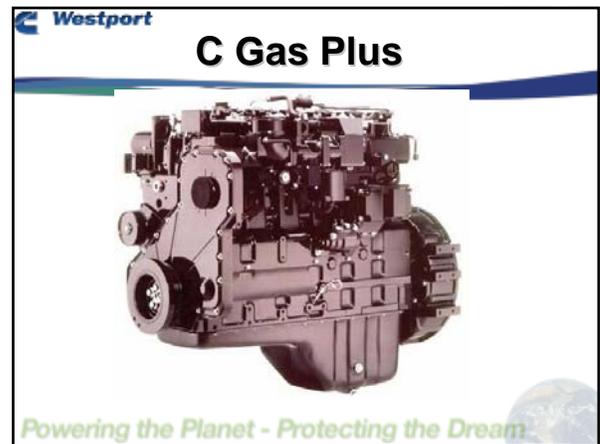
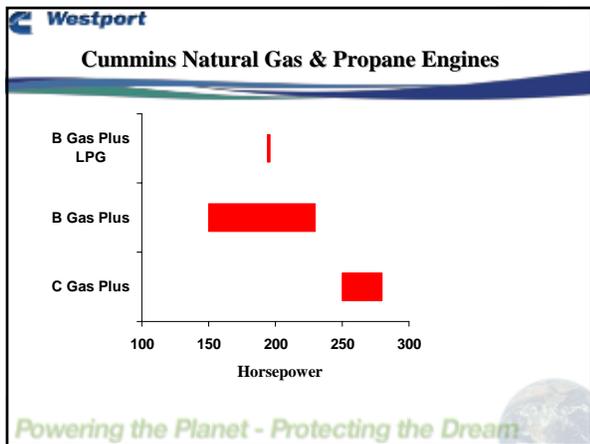
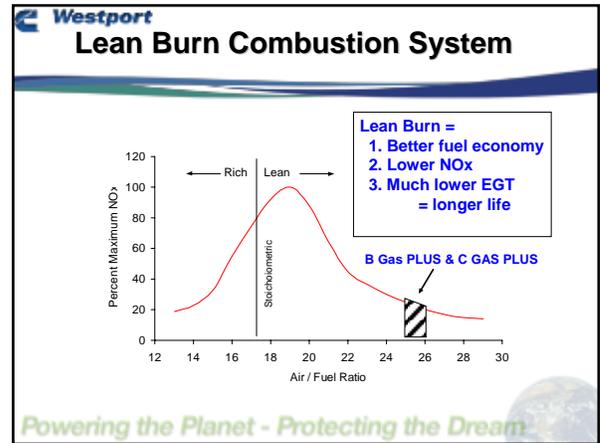
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The JV's Mission

Big in Clean Power

- Make the existing spark-ignited natural gas business work today
- Develop the new Westport HPDI Technology for the future

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Why the C Gas Plus is Better

- **By Design**
 - Engine back pressure compensation
 - Fuel supply pressure is measured
 - Cooling fan drive available
 - IMT monitor and protection
 - Supply voltage is measured
 - J1939 datalink
 - Diesel-like wiring
 - Diesel-like features





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Why the C Gas Plus is Better

- **By Design**
 - No Woodward governor
 - Wide range fuel composition capability
 - Knock sensing and control
 - Robust Oxygen sensor design
 - Improved oil consumption
 - Improved throttle actuator
 - Adaptive learn
 - Modern engine controller
 - Improved controls
 - More sensed parameters
 - Humidity sensing and compensation(Late '02)



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Cummins B Gas Plus B LPG Plus



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Plus Engine Diagnostics

Insite

Assists mechanics to quickly program engine, analyze faults & troubleshoot engines

Cummins QuickCheck

- PalmPilot handheld device to:
 - Displays SAE fault code information
 - View sensor output data




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C Gas Plus NGV OEM Availability

<u>School/Shuttle/Transit</u>	<u>Refuse/Specialty</u>	<u>H.D.Truck</u>
NABI	Crane Carrier	Freightliner FL70/80
New Flyer	AutoCar WX, WXL	
Ei Dorado	Sterling - Condor	
Orion Bus	Peterbilt 320	
Neoplan	Elgin Sweeper	
Gillig (LNG)		

Europe
Ponticelli (refuse)

Australia
Iveco ACCO (refuse)

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B Gas Plus NGV OEM Availability

<u>School / Shuttle / Transit</u>	<u>Refuse - Industrial</u>	<u>Medium-Duty Truck - Chassis</u>
Ei Dorado National	Crane Carrier *	Freightliner Custom Chassis
Chance Coach*	Elgin - sweeper *	
Specialty Vehicles	TYMCO - sweeper *	
Goshen Coach		
Ottawa *		
Molly		
Champion		

Europe
CSAD/SOR (Czech)

Asia -
Dong Feng Bus (China)
Anhui Ankai Motor (Bus - China)

* Denotes B5.9G was available. Availability of B Gas Plus being confirmed

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B LPG Plus OEM Availability

School / Shuttle / Transit	Refuse – Industrial	Medium-Duty Truck – Chassis
El Dorado National Specialty Vehicles*	Crane Carrier *	Freightliner Custom Chassis*
Dupont Trolley*	Elgin – sweeper *	
Ottawa * Capacity*	TYMCO – sweeper *	
Molly Trolley*		

* Denotes B5.9LPG was available. Availability of B LPG Plus being confirmed

1/03

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L Gas Development

- Cummins 8.9 litre ISL engine will be launched using “C Plus” engineering
- 320 horsepower rating
- Available 2004
- Aimed at urban transit and trucks needing more power than the C Gas Plus



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Builds on Strengths of Cummins, Inc. and Westport Innovations



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Westport INNOVATIONS INC.

Have you changed your view of the future?

How do you see the future?



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Cummins **Westport**



Cummins Westport Inc.

The Future is Clear

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