

How do you see the future?

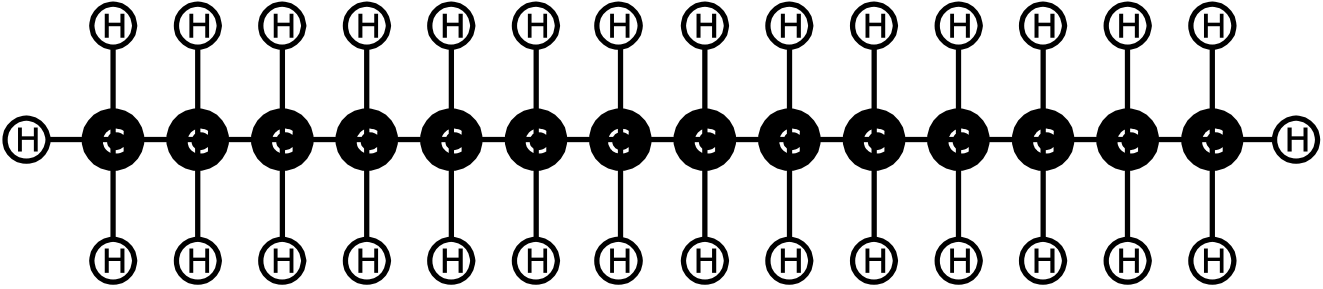
David Lynch

Cummins Westport Inc.

Simpler Cleaner Fuel

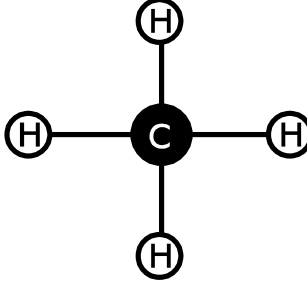
Diesel C₁₄ H₃₀

Complex Hydro Carbon



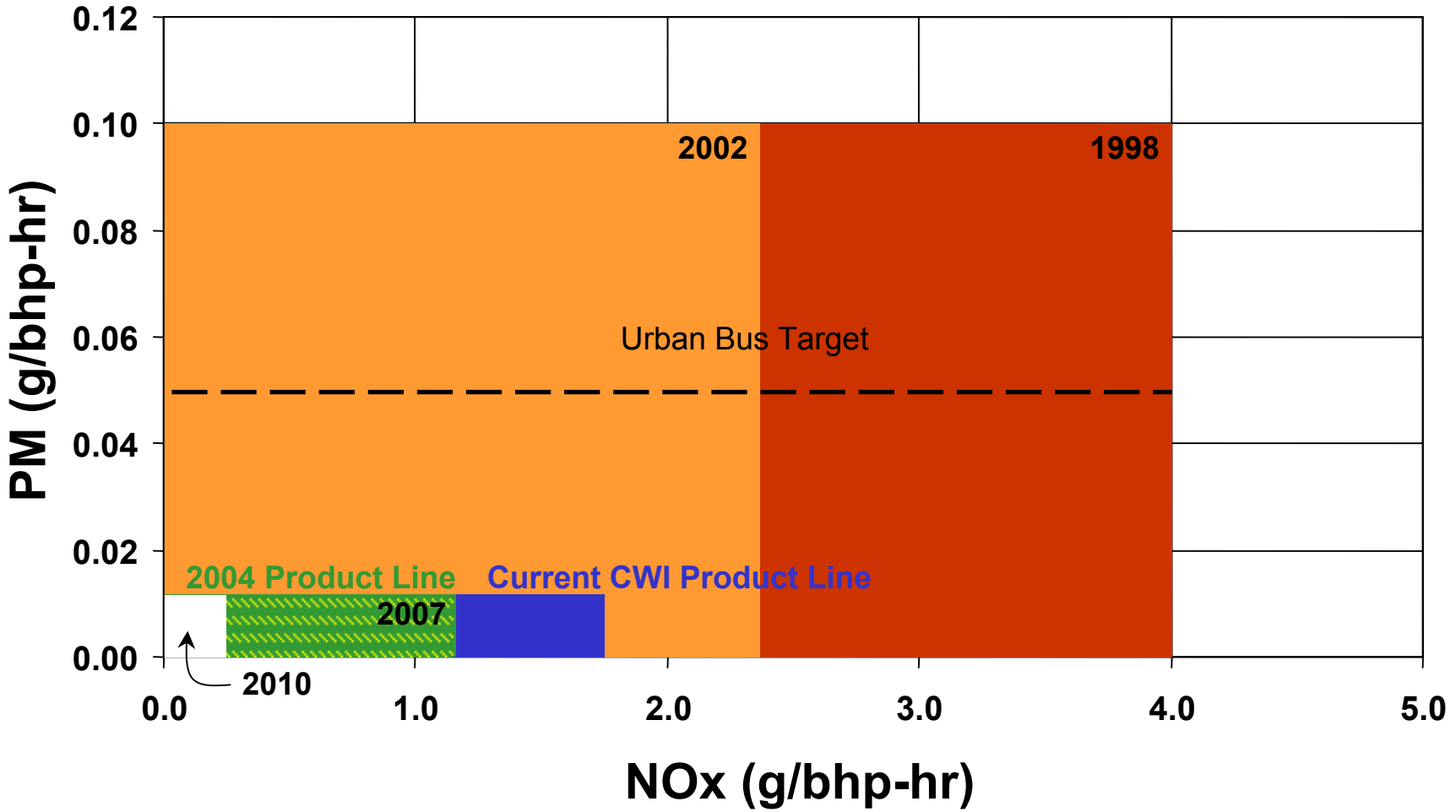
Methane CH₄

Simplest Hydro Carbon



Highest hydrogen-to-carbon ratio of any hydrocarbon

The Challenge!





New Diesel Fuel Economy Penalties

Lower NOx and Lower PM take a toll

<i>Emission control</i>	<i>Penalty for new diesel vs prior diesel</i>	<i>Penalty for the C Gas Plus</i>
NO_x (2.1 grams effective Oct 1, 2002)	2%- 5% *	None
PM (with soot filter)	1%-2% **	None
Low Sulfur diesel fuel price (30 ppm)	8% *** to 12% ****	None
Total fuel economy penalty	11% to 19%	None

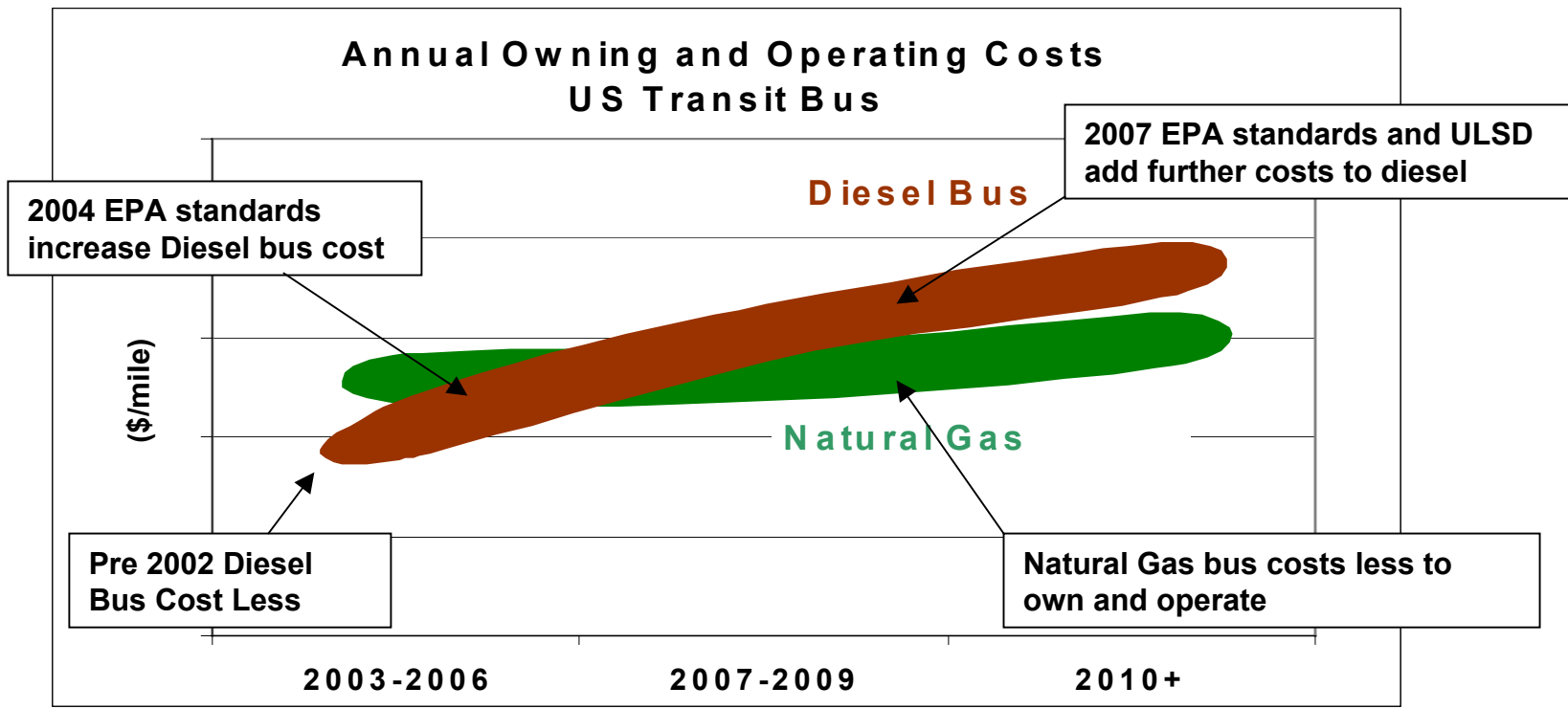
*EPA420-R-02-021 Final Technical Support Document: Nonconformance Penalties for 2004 Highway Heavy Duty Diesel Engines page 13, 24

**What Challenges For the Diesel Engine in 2000 and Beyond, Prof. F.X. Moster, Societe des Ingenieurs Automobile (SIA 2000/03/18) page 174.

***NYTC Experience with Clean Fuel Technologies, Heavy-Duty Clean Vehicle Technology Conference May 2, 2002. (12 cents per gallon price premium vs regular diesel fuel)

****T Buses shift to cleaner fuels, Boston Globe, April 18, 2002, Page B1 (17 cents a gallon price premium vs regular diesel fuel)

Cost per Mile Trends



Diesel Costs Increase:

- efficiency drops as NOx level drop
- engine system costs go up as NOx and PM levels drop
- Diesel fuel cost increases, specially with ULSD

Natural Gas Costs Remain Relatively Constant

- engine efficiency is expected to improve with EGR strategy
- technology may cost more, but that's offset by improved economy
- natural gas fuel prices lower than diesel

ULSD/CNG Requirements

Not That Different

ULSD

- New Infrastructure Requirements
 - Could cause lube problems with pre '07 engines
 - Added cost for ULSD-do you want to run in older engines
- Lube Oil
 - Will require new, more expensive oil
- Different oil filters
 - Will require new, more expensive filters
- Crank Case ventilation absorbed in '07
 - Sensor impact
- Oxidation Catalyst and DPF
 - Additional maintenance cost

Natural Gas

- New infrastructure
 - Will be consistent for all gas engines
- Lube oil
 - Low ash, already in place
- Oil Filters-
 - Already in place & proven
- Crank Case ventilation-
 - Already in place and proven
- Oxidation Catalyst
 - Already in place and proven
- DPF Not Needed
 - Gas is cleanest hydrocarbon

Engine Product Line-up



Advanced Lean Burn Spark Ignition

B5.9G International	Euro 2
B Gas Plus	1.8 NOx+NMHC/.01 PM
BLPG Plus	2.2 NOx+NMHC/.01 PM
C Gas Plus	1.8 NOx+NMHC/.01 PM
L Gas Plus	1.5 NOx+NMHC/<.03 PM

In Production

← 2004 Availability

B Gas Plus(HCNG) 0.9 NOx+NMHC

← In Demonstration

SI/EGR .2 NOx/.01 PM
Lower LCC

← Technology Evaluation

2007 Availability

CWI –Committed Today and Tomorrow

Natural Gas Recipe for 2007?

- LBSI with catalyst at 1.5 NO_x + NMHC
- PM at 2010 EPA levels today
- EGR will lower CNG NO_x
- Development target is at .2 gm NO_x in 2007
- Will not require complex aftertreatment - simple catalytic converter as part of system

Broadest Product Line

B GAS PLUS
B LPG PLUS

C GAS PLUS

L GAS PLUS



5.9 Litre

8.3 Litre

8.9 Litre

195–230 hp

250-280 hp

320 hp

420–500 lb-ft

750 – 850 lb-ft

1000 lb-ft

1.8 NOx+NMHC

1.8 NOx+NMHC

1.5 NOx+NMHC

0.01 PM

0.01 PM

<0.03 PM

B Gas Plus OEM Availability



School / Shuttle / Transit

- El Dorado National
- Thomas Dennis SLF
- Bluebird Ultra LF
- Optima Bus*
- Chance Coach*
- Goshen Coach
- Molly Trolley*
- Champion*



Europe

- CSAD/SOR (Czech)

Asia

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



Refuse – Specialty

- Crane Carrier (pending)
- Elgin (sweeper)
- TYMCO (sweeper)*
- Ottawa (yard spotter)



Medium-Duty Truck - Chassis

- Freightliner Custom Chassis



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

C Gas Plus OEM Availability

School/Shuttle/Transit

- NABI Low Floor, Compo
- New Flyer Low Floor
- El Dorado
- Orion Bus VII
- Neoplan
- Gillig (LNG)

Refuse/Specialty

- Crane Carrier
- AutoCar WX,WXLL
- Sterling - Condor
- Peterbilt 320
- Elgin(sweeper)
- Schwarze(sweeper)

H.D.Truck

- Freightliner FL70/80



OEM Availability-Refuse



Autocar WXLL



Autocar Expedito



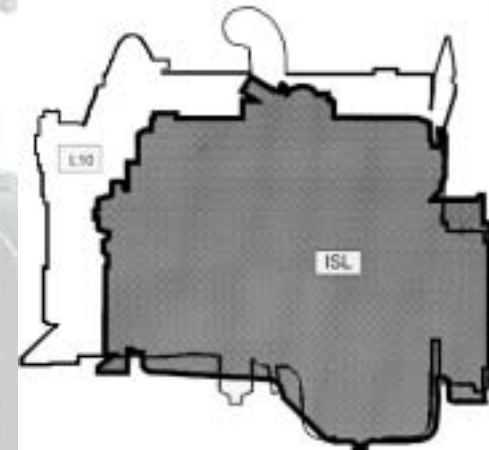
Peterbilt 320



Sterling Condor

The New L Gas Plus

- **8.9 L 320 hp / 1000 ft-lbs**
- **Superior power & torque vs. C Gas Plus for heavy duty truck, heavy refuse, heavy transit, and articulated transit**
- **Attractive packaging and weight vs. alternatives**
 - **Very similar to C Gas Plus Packaging**
 - **Installation Cost Savings**
- **Proven Plus Technology from C Gas Plus**
 - **Improved operating Reliability**
 - **Upgraded Ignition system for better performance and service intervals**
 - **Lower NOx levels than the C Gas Plus**
- **Commercial Availability 3Q04**
 - **Field testing to begin 4Q03**



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