



Challenge on Emission Compliance - From Automakers' Perspective

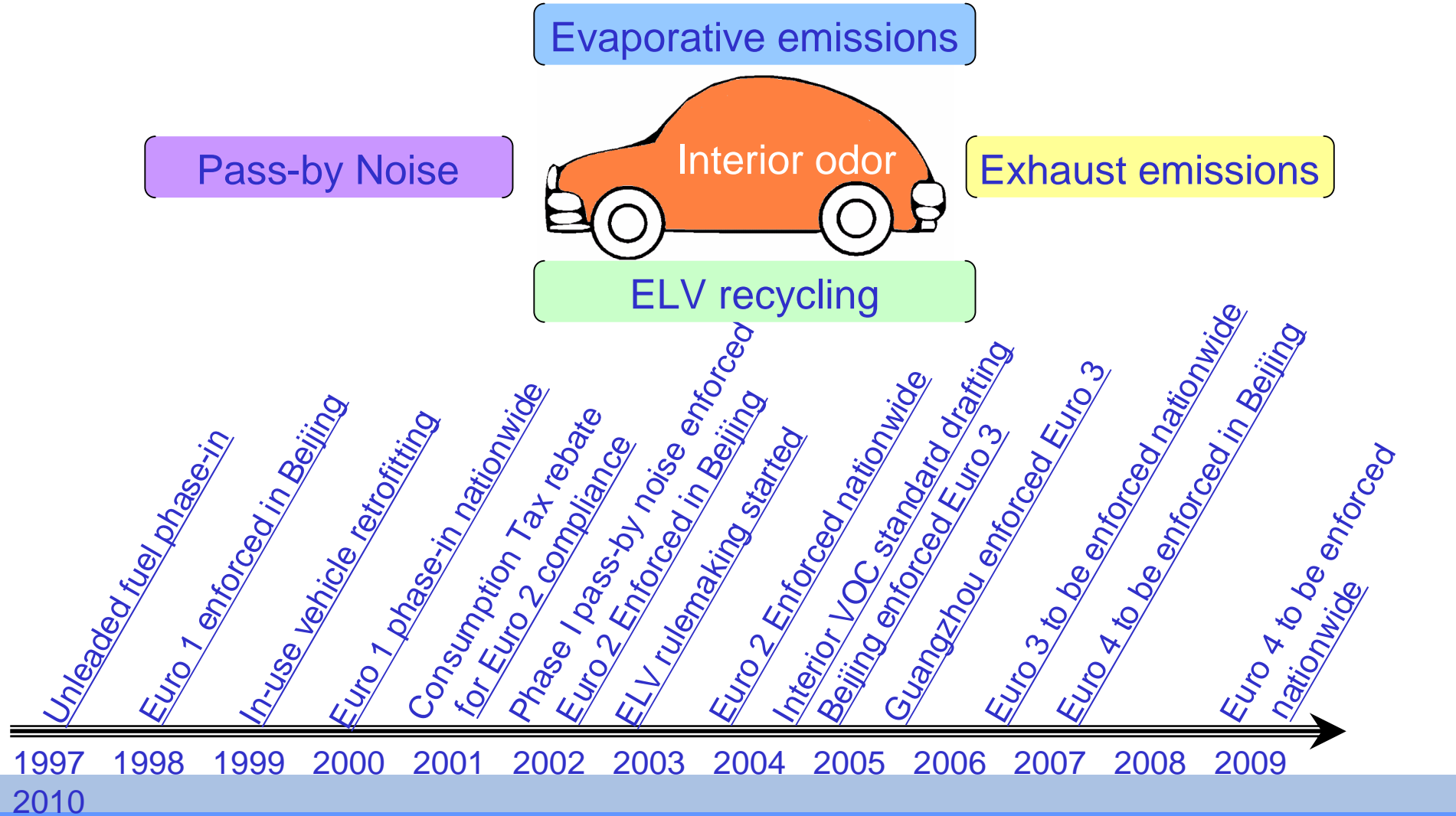
David Chen, Vice President
General Motors China

Vehicle Pollution Control International Workshop
Beijing, China
December 7th & 8th, 2006



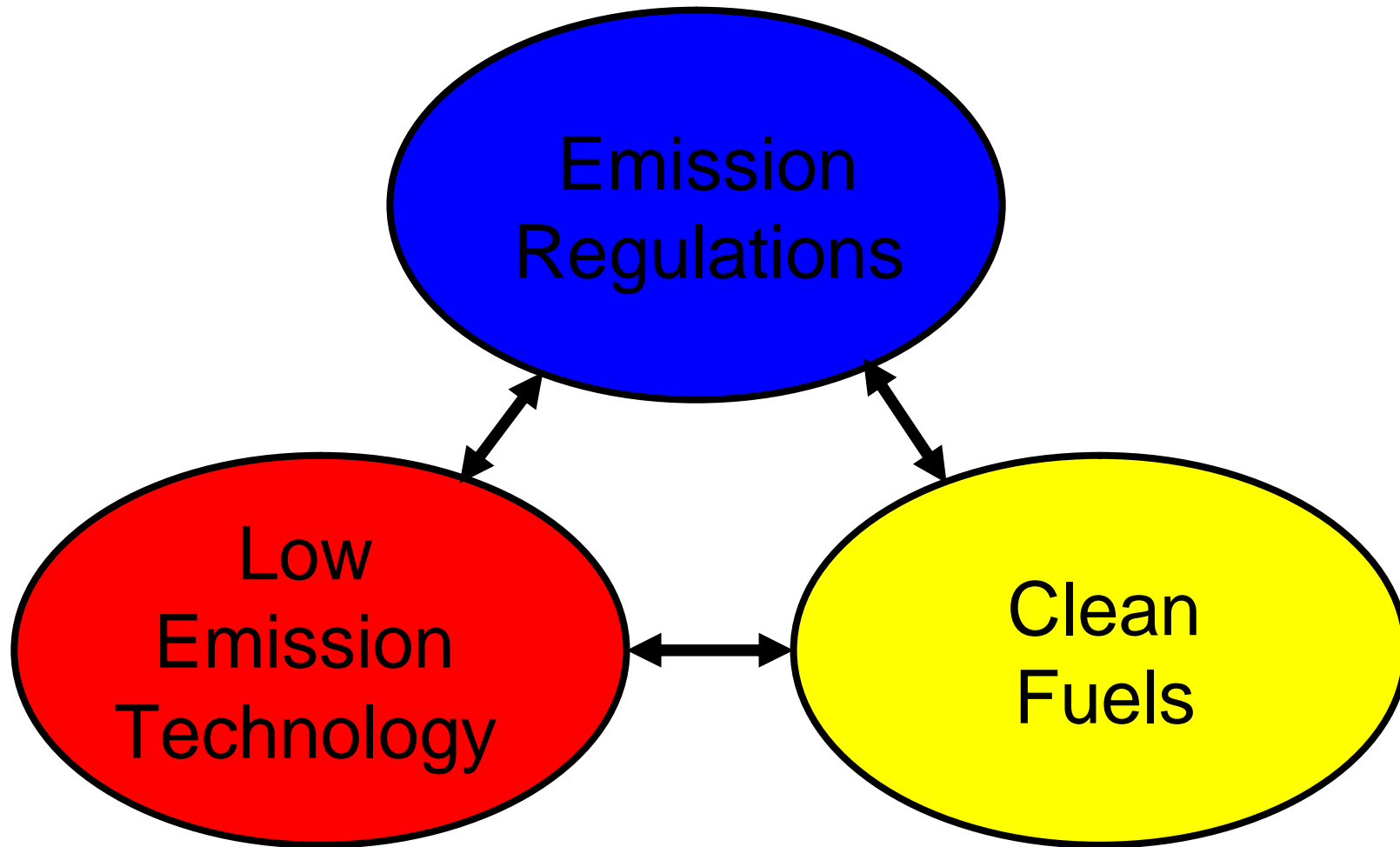


Environmental Requirements for Vehicles



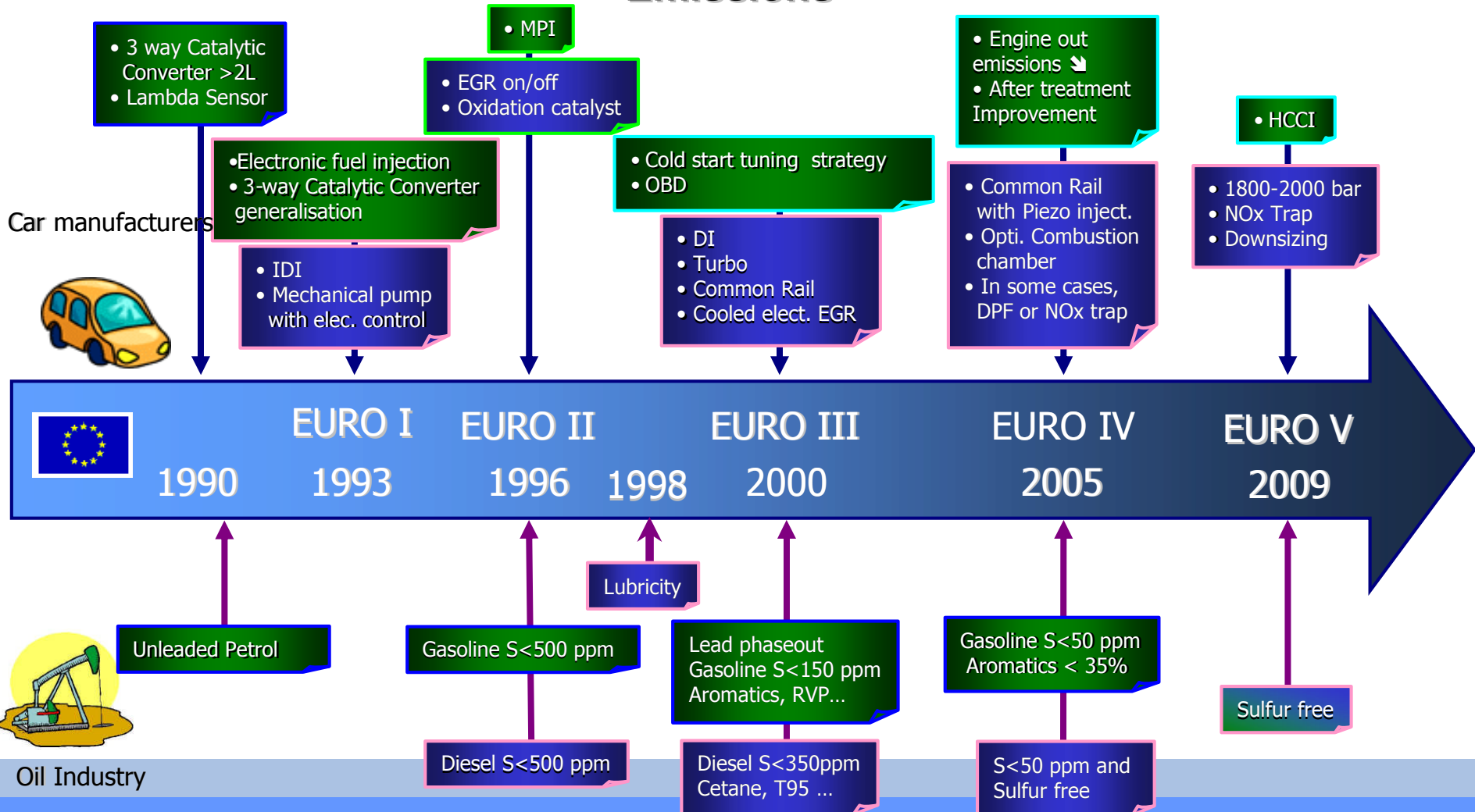


Success Requires Linkage



Trends of Fuel/Emission Development

Road Map ---Evolution of Fuels, Enabling Lower Emissions





In-Use Emissions Compliance Challenges

- Vehicles and fuels must be treated as a “system”
 - Automakers are using a variety of new technologies to meet the standards
 - Many of these technologies are sensitive to fuel quality
- Fuel quality improvement is essential
 - To reduce emissions from in-use fleet
 - To obtain optimum performance from existing emission controls
 - To enable new technologies
 - To address fuel consumption and GHG emission concerns
- Current marketplace gasoline quality will not allow optimal Powertrain and Emissions performance over the vehicle life



Low Sulfur

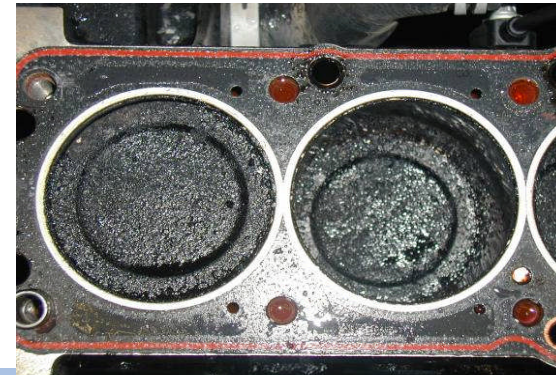
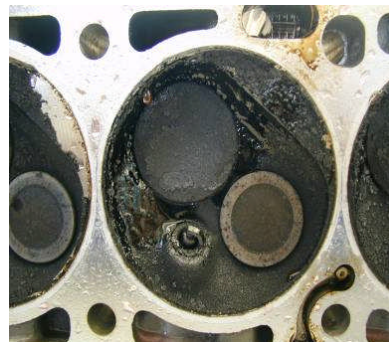
- Clean, low sulfur fuels are needed to achieve low vehicle emissions
- Current catalyst equipped vehicles will benefit immediately from low sulfur (30 ppm) gasoline
- 30 ppm gasoline is needed to attain lower emissions standards (i.e. Tier2/Euro4)
- Diesel powered vehicles must have low sulfur fuel to achieve low emissions
- Near zero sulfur fuels are required to support future standards
- The need for low sulfur fuels is recognized around the world



Olefin/Gum

- Olefins come from the gasoline refinery process
- Gums may come from extended gasoline storage, especially with high olefins and elevated temperature
- High olefins may lead to gum formation in the fuel system, which will deposit on injectors, valves and throughout induction system
- It's verified by SGM after service survey with customers in the field

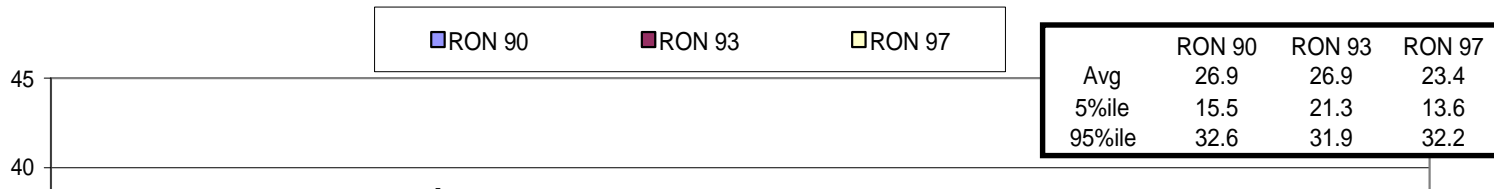
Port Fuel Injection Engine Hardware



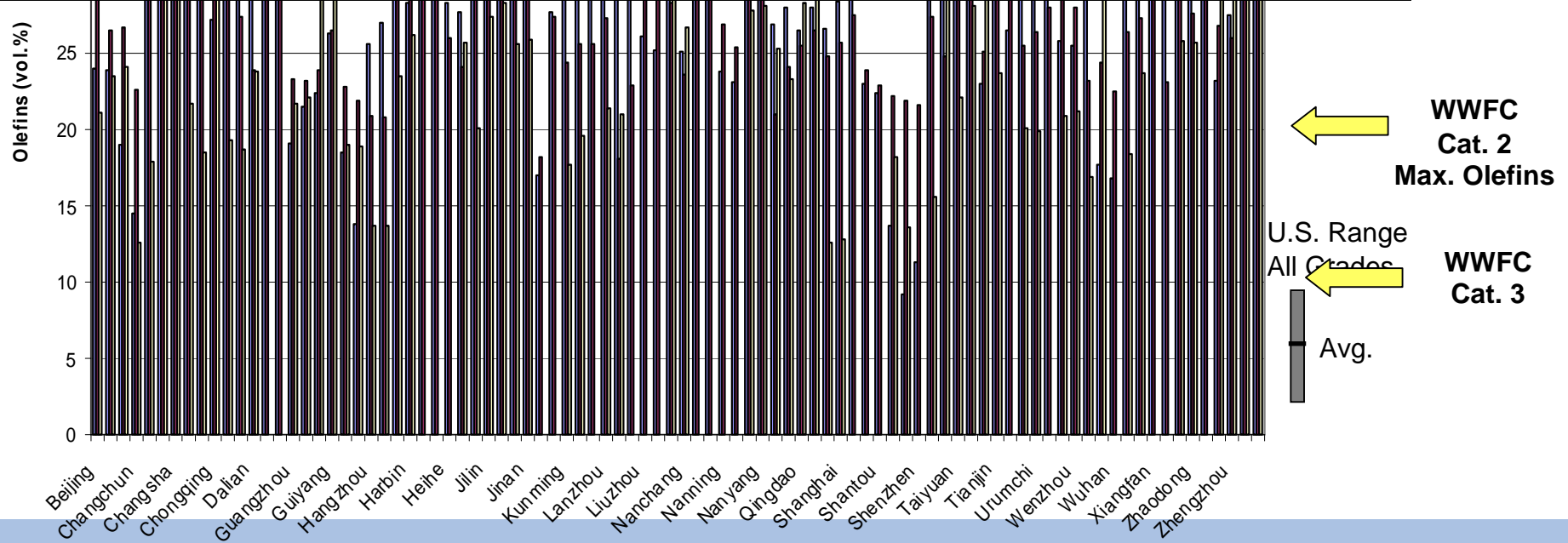


Olefin Content in China Gasoline

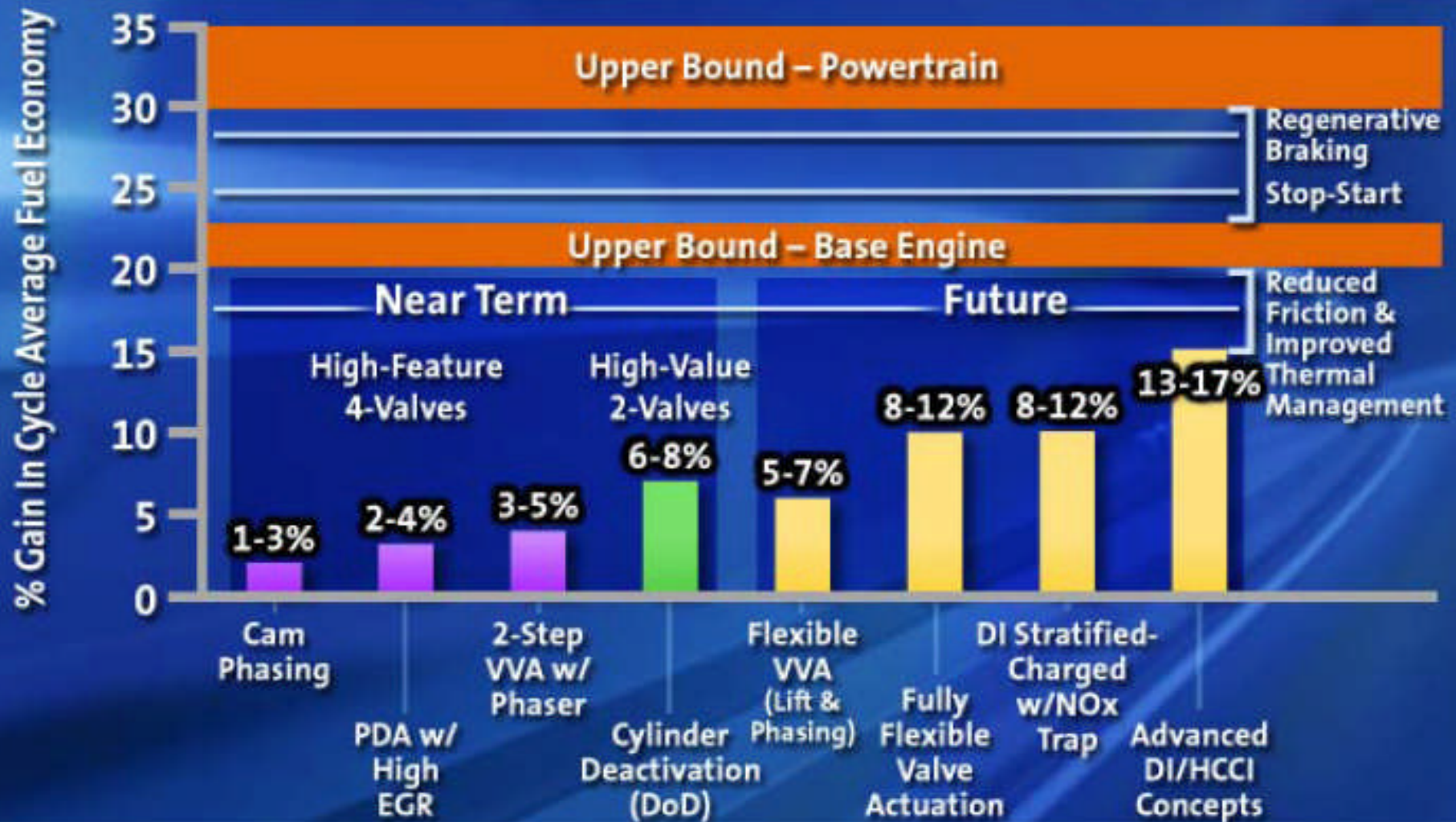
Fuel Survey Data: SGS China Winter 2004 / 2005 Season
Olefins - All Grades



WWFC Category Definitions
 Cat. 1 – Markets with No or Minimal Emissions Requirements for Emissions Controls
 Cat. 2 – Markets with stringent emissions requirements or other market demands. Ex. US Tier 0 or 1, EU 1,2
 Cat. 3 – Markets with advanced emissions requirements or other market demands. Ex. US Calif. LEV, ULEV or EU 3,4



SIDI Engine Fuel Economy Potential





Use of Detergent to Mitigate High Olefin/Gum

- Injector fouling is a concern in China without gasoline detergent additive addition
- Gasoline detergent additives are effective in reducing injector plugging
 - Detergent levels at 28 mg/ 100 ml unwashed existent gum (ASTM D381) or higher are needed to ensure injector performance
 - Poor quality gasoline detergents and even too much detergent additive can be problems also
- The Petroleum, Automotive and Detergent Additive Industries should work together to recommend a more specific detergent amount and compliance plan to SEPA



MANGANESE (MMT)

- Alliance emissions study
 - LEVs: higher emissions, lower fuel economy with MMT
 - Several LEVs failed NMOG certification standard
- Global automakers are on record all opposing the use of ash-forming metallic additives (see WWFC)
- As an alternative, ethanol could be used as an additive to increase octane number

in-use 80,000km US market*



in-use 33,000km China market*



***2001MY vehicle representative of Tier 2 emission technology. Both 600 CPSI.**

*AAM-Alliance North American Fuel Survey, Winter 2005 and Summer 2004

**ICCT-International Council on Clean Transportation



MMT: Neurotoxic



Neurotoxic Action: Outcomes of **DECLARATION OF BRESCIA on PREVENTION OF NEUROTOXICITY OF METALS** - Italy - June 2006

Posted on: <http://www.ntoxmet.it/>

- ▶ Exposure of pregnant women and young children to **manganese** needs to be reduced to prevent subclinical neurotoxicity
- ▶ Exposure standards for **manganese** need to be reconsidered
- ▶ The addition of organic **manganese** compounds to gasoline should be halted immediately in all nations
 - ▶ The data presented in the Brescia Workshop raise grave concern about likelihood that addition of manganese to gasoline could cause widespread development of toxicity **similar to that caused by worldwide addition of tetra ethyl lead to gasoline**. In light of this information, it would be extremely unwise to add manganese to gasoline



Fuel Adulteration

- We observed methanol blending in some areas in China
- Concerns on Methanol
 - Public health concerns
 - Acute methanol toxicity
 - Formaldehyde emission
 - Current vehicle can tolerate ZERO methanol content due to corrosion
 - Higher evaporative emission

	MeOH %v/v	MeOH %m/m
Changchun	1.82	1.97
Nanyang	2.53	2.72
Kiamusze	15.08	16.25
Jinan	3.51	3.76
Xiangtan	14.91	16.00
Kiamusze	17.98	19.69
Jinan	4.49	4.81
Taiyuan	19.03	20.41
Taiyuan	13.30	14.23



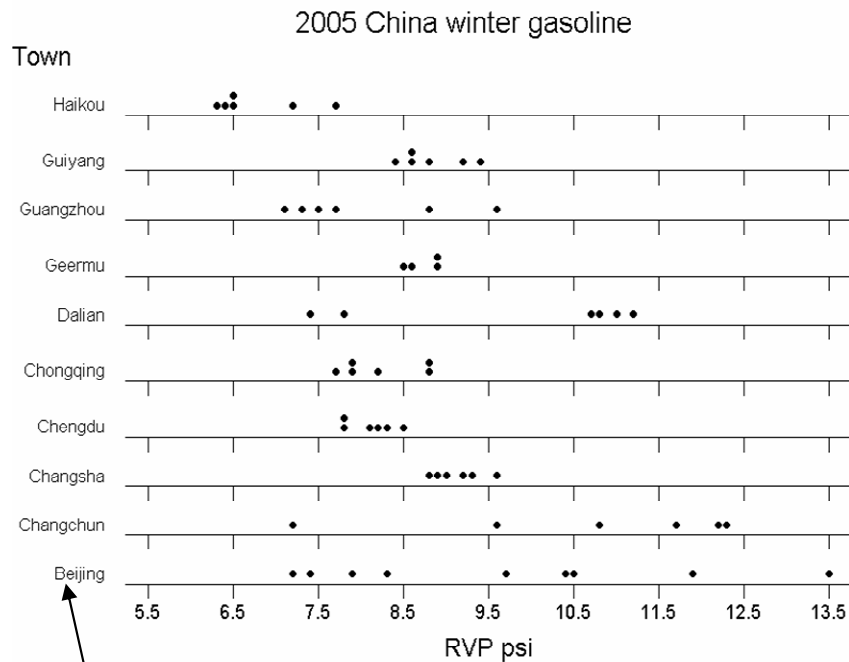
Emission Certification Test Fuel

- Detailed Certification Test Fuels Required
 - Batch to batch consistency to evaluate hardware & calibration effects
 - Enable comparison of Lab to Lab data
 - Current fuels specifications adopted from European Emissions Regulation should be sufficient in detail
- U.S. and European Emissions Testing Experience is that over time, all emissions laboratories buy fuel from dedicated high quality suppliers with tight fuel property control



China Case

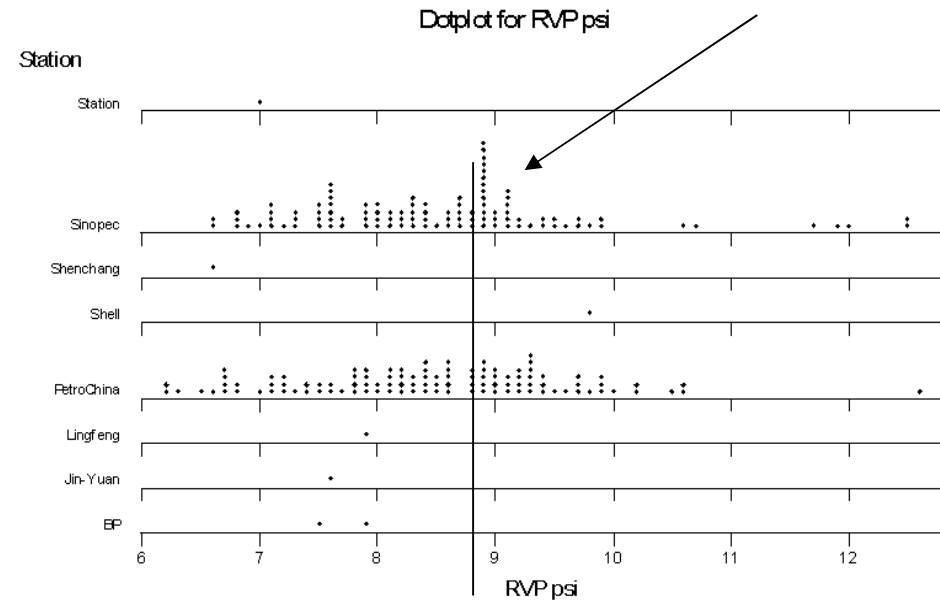
“Street Gasoline” too varied for Emissions Certification



**Beijing RVP Range – Very wide
Low values could lead to driveability
and starting problems.**

**China Gasoline – SGS Survey Data
Insufficient RVP Control for each Season**

**Summer 2006 SGS Fuel Survey
All RVP's should be below 9.0 psi.
High values could lead to hot restart problems**





Conclusions

- Fuel quality should be in line with emissions standards
- World Wide Fuel Charter Category 3 or higher Fuel Specifications needed to enable emissions reduction hardware
- Improved market fuel quality is critical to ensure in-use vehicle emission compliance
- Fuel Suppliers required to be capable of making high quality, consistent emissions certification fuel that meet the specifications
- General Motors is very interested in being part of the team to rapidly establish improved fuel quality throughout China