



## Africa Fuel Quality Update - Progress & Challenges

Compared to other regions of the world such as Europe and North America, fuel quality in many African countries has generally lagged behind. Many factors influence this situation and they differ depending on the individual country. Recent initiatives and better coordination, however, aimed at improvements in fuel supply and quality have taken place in many parts of Africa. The results have been the near completion of lead phase-out for gasoline, reductions in sulphur levels in fuels, and new grassroots refinery processes to meet these higher fuel quality standards.

### REFINING & PRODUCT DEMAND

One challenge facing Africa's existing refining industry is the ability to implement upgrades to produce cleaner fuels that meet the requirements of modern vehicles. In many parts of the continent, refining capacity does not cover all of the demand, resulting in periodic fuel shortages and thus imports of petroleum products. Resources are also limited to monitor fuel quality when fuels are delivered. For the most part, limited complexity and low utilization rates mean the majority of new refining investment in Africa is directed towards grassroots development rather than upgrade projects.

Prior to the global economic recession, Africa experienced strong growth in gasoline and diesel fuel demand. For 2010, refined product growth is projected to increase by 2.8% and remain around this level through 2015, according to Hart Energy Consulting. A total of 1.4 million barrels per day of new refining capacity is in various stages of implementation. Total gasoline demand is estimated around 0.75 million barrels per day (middle distillate is the predominant refined petroleum product at 37% of demand). Nigeria has the strongest market growth for gasoline. In the region, Egypt is the largest demand center, accounting for 22% of overall refined product demand. South Africa is the second largest consumer of refined products.

### GASOLINE LEAD PHASE-OUT

According to the U.N. Environmental Programme (UNEP), over the past two years Tunisia and Morocco have become fully sup-

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plied with unleaded gasoline. Tunisia's fuel distribution became fully unleaded beginning January 1, 2010. Morocco accomplished its lead phase-out in 2009.

From UNEP, only two countries in the North Africa region continue to have leaded gasoline provided into their marketplace – Algeria (with both leaded and unleaded available) and Egypt (with about 90% unleaded). While Western Sahara officially bans the use of lead, actual content is uncertain. Algeria has unleaded gasoline in major cities, representing over 20% of sales. Current plans in Algeria are to move to European specification fuels, however these changes are not expected until at least 2013 or later when refining upgrades are completed.

The removal of lead-based additives in African gasoline demonstrates the successful efforts of many organizations to improve fuel quality, reduce harmful emissions, and bring significant public health benefits to the region.

### FUEL QUALITY SPECIFICATION IMPROVEMENTS

Gasoline quality specifications are generally in early stages of development in Africa. Several years ago, the African Refiners Association (ARA) adopted a fuel quality road map for the continent, called the AFRI specifications. This effort involved extensive discussions between ARA, its members, World Bank, UNEP, International Petroleum Industry Environmental Conservation Association (IPIECA), auto manufacturers and other stakehold-

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CLEAN AIR THROUGH CLEAN FUELS



## EXPERT TALK

# Interview with Mike Stead, Chairman, African Refiners Association, Specifications Working Group



Mike Stead chairs the African Refiners Association (ARA) Specifications Working Group. He currently works for Engen to interface with governments on regulatory issues affecting the refining industry in Africa. He has a distinguished career in a number of positions within the refining industry.

**Q: Could you briefly describe for us the primary functions of your group within the Association, and about your key responsibilities?**

The Specifications Working Group was established to provide the African Refiners Association with a single voice on future fuel specifications, vehicle emissions strategy and related matters. The working group coordinates issues on the development of fuels specifications strategy AFRI 1 – AFRI 5, biofuels strategy, creating awareness of the ARA fuel specifications and lobbying government stakeholders to formally adopt cleaner fuel standards.

**Q: What do you believe are the most significant issues confronting your Association regarding fuel quality requirements for meeting current and future specifications?**

Persuading the relevant authorities to raise Official Product Specifications on a regional basis with tailored processes to avoid product dumping from other refining centers is challenging. Other issues include delinquent practices and the encouragement of free trade, the promotion of a harmonized regional tax policy, import price parity structures to avoid delinquent practices, the encouragement of free trade and raising finance for investment.

**Q: What impacts and challenges do stricter air quality standards have on the production of transport fuels by your Association's members?**

The most significant challenge is the magnitude of investments required to produce cleaner fuels. This is followed by the tight state of the capital market, difficult market conditions (poor refining margins), and the very real risk of refineries closing down rather than investing.

The World Bank study on the industry spelt out a number of other factors that impact the economics of refineries and the general viability of clean fuels projects. These include small producers who do not have the benefit of scale, low prior investment, complexity, efficiency, access to quality crude oil and access to larger markets.

**Q: Last year, the African Refiners Association, with the World Bank, examined the potential for the refining sector to respond to global markets and clean fuels trends,**

**as steps to improve air quality through better fuel quality. Can you briefly tell us about the status of progress towards these goals and how your Association is adapting?**

The World Bank/ARA Refinery & Health Study concluded that an investment of US\$6bn in Sub-Saharan refineries was required by 2020 in order to comply with AFRI-4 specifications. This would allow benefits of US\$43bn in health savings to be reaped. The challenge for the refiner is to bridge the financing gap between the delayed health benefits which accrue to the State and the up-front investment which is borne by the refiner.

ARA representatives held a very constructive meeting with the World Bank and IMF in April 2010. It was widely accepted that it will take the combined efforts of governments and refiners (with support from the World Bank/IMF/IFC and the ARA) to develop a workable programme to achieve the upgrades necessary to realise the health benefits identified in the 2009 study. The World Bank is to decide on follow up steps to the 2009 study, while ARA will encourage members to submit plans to upgrade refineries to produce AFRI-4 specifications by 2020 for review at a future meeting.

**Q: Could you briefly describe general process changes, including blending components, used to help your Association's members to meet these improvements in fuel quality?**

Most Sub-Sahara Africa (SSA) refineries are not equipped to produce low sulphur fuels. Significant investments in hydrotreating and cracking process upgrades are needed. Plans for these upgrades are currently being collated and evaluated.

**Q: How does your Association, as key stakeholder, work with government agencies when developing quality standards and adopting timelines for implementing them?**

The Association has tabled a set of fuel specifications known as AFRI Standards (shown in Table 2). This scale was conceived as a roadmap to rope together a patchwork of different specifications in Africa.

The timing of the introduction for these specifications was discussed at a series of regional meetings last year. The Executive Committee endorsed the recommendations of the Working Group in January 2010, the resulting policy requires that official fuel specifications reflect AFRI-2 or better by the end of 2010, and AFRI-4 or better by 2020.

In association with these specification changes, government is required to adopt and enforce measures to improve the vehicle fleet, such as:

- All imported gasoline powered cars must have functioning catalytic converters.
- Establish a relevant inspection and maintenance program.
- Encourage the phasing-out of old, highly polluting vehicles.

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## Africa Fuel Quality Update - Progress and Challenges

(continued from p1) ers. AFRI specifications are voluntary and specific timing for implementation by any country that decides to follow them is not mandatory (see Expert Talk for further details on AFRI specifications).

Current key gasoline specifications for several major African gasoline markets are shown in Table 1. Most gasoline specifications in the region call for a maximum sulphur content limit between 500 ppm and 1,500 ppm. In many areas, refiners can process light, low sulphur indigenous crude oil, which would allow them to achieve sulphur content well below the average African quality.

With the near completion of lead removal, the next challenges facing African refiners for improving gasoline quality are sulphur reduction and octane increase. Both Algeria and South Africa have announced revisions to gasoline specifications to reduce sulphur, aromatics and benzene content, and to increase RON. Implementation timelines are indicated as 2013 to 2014. Oxygenate use (such as MTBE or bioethanol) is expected to slowly increase over the coming years to help refiners with fuel quality transitions.

The majority of African countries, however, are just implementing specifications that reflect AFRI I quality levels. Vehicle emissions controls are also slowly advancing in some countries. As the region moves to higher quality fuels and harmonization of standards such as the AFRI road map takes place, the production and import of “cleaner” vehicles will occur. Together, this strategy for clean fuels and vehicles will result in better air quality and public health benefits for citizens throughout the region.

**Table 1 – Select Gasoline Specifications for Several Major African Markets**

Country	Sulphur (ppm, max)	Aromatics (vol%, max)	Benzene (vol%, max)	RVP @ 37.8 C (kPa)	Oxygen (wt%, max)	Octane RON (Regular)	Octane RON (Premium)
Egypt	500	-	-	62 – 69	2.7	90	95
Nigeria	1,000	-	-	62	0	91	-
South Africa	500	50	5.0	45 – 75	2.8 – 3.7	91/93	95
Kenya	1,500	-	5.0	Report	0	87	91

Notes:  
 - RVP requirements may vary by season, region within country and gasoline blend type.  
 - Many countries only offer one octane grade, either RON 90 or RON 91.  
 - Actual gasoline quality in many countries may vary from established specifications.

Source: International Fuel Quality Center, Hart Energy Consulting, 2009

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- Encourage the phasing-out or banning of 2-stroke engines.

Without governmental cooperation on the above, the results of improving fuel quality are significantly less.

Members also need to actively engage with all government stakeholders in their respective countries regarding the process outlined here.

It should also be noted that ARA engages with many stakeholders on a regional / Pan African basis, including refiners, engine and vehicle manufacturers and assemblers, importers, World Bank, African Union, Regional Customs Unions, UNEP, IPIECA and PCFV.

**Table 2 – AFRI Standards**

Gasoline	AFRI – 1	AFRI – 2	AFRI – 3	AFRI – 4
Ron, min*	91	91	91	91
MON, min	81	81	81	81
Lead content**	Unleaded	Unleaded	Unleaded	Unleaded
Sulfur content, % mass, mix	0.1	0.05	0.03	0.015
Benzene content, % vol, max	to be reported	to be reported	5	1
Diesel	AFRI – 1	AFRI – 2	AFRI – 3	AFRI – 4
Sulfur content, % mass, max	0.8	0.35	0.05	0.005
Density at 15°C, kg/litre (min/max)	800/890	800/890	800/890	820/890
Cetane index (calculated), min	42	45	45	45
Lubricity (HFRR @ 60°C), micron, max	to be reported	to be reported	460	460

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### Upcoming Conferences & Events

**National Clean Fuels & Vehicles Workshop**  
21 July, Beijing

**Downstream Asia 2010**  
27-29 October, Singapore

**Petrotech 2010 – International Oil & Gas Conference**  
31 October – 3 November, New Delhi

**Better Air Quality Conference**  
9-11 November, Singapore



FEATURE

# EU Fuel Quality Monitoring Result Released

After some delay, the European Commission Directorate-General for Climate Action has published the European Union Fuel Quality Monitoring Summary Report for 2007. The report was prepared by the AEA Technology's Energy and Environment Unit, British energy and climate change consultancy. The report compiles the Member States' submitted reports under the EU Fuel Quality Directive 98/70/EC, as amended by Directive 2003/17/EC and Directive 2009/30/EC, and summarizes gasoline and diesel fuel quality for 2007.

The report includes data for 26 countries (all EU members except for Luxembourg) on fuel sales by gasoline and diesel grade, sulphur levels, refueling stations, vehicle fleets and temporal trends in numbers of samples exceeding limit values for specific fuel parameters. Fuel quality monitoring for the EU began in 2002. Monitoring and inspection systems were standardized since 2004 with some of the key criteria as follows:

- Country size and regions within country;
- Number of refueling stations and sales volume;
- Population and number of vehicles;
- Monitoring schedule set for twice yearly (once in summer and once in winter);
- Minimum number of sample sites for fuel grades (based on country size);
- Minimum number of samples/sites for fuel grades with less than 10% of sales; and
- Listing of retail (public vehicles) and commercial (private vehicles) fuel dispensing sites.

Based on the 2007 monitoring reports, RON 95 gasoline with 50 ppm max sulphur captured 49.7% of sales, followed by RON 95 gasoline with 10 ppm max sulphur at 35.2%. RON 91 gasoline with 10 ppm max sulphur had 6.3% of sales, and RON 98 with 10 ppm max sulphur showed 5.3% sales level. According to the report, homogeneity in the number of fuel grades available across the EU has increased substantially since fuel quality reporting became required. Many EU member states had begun to transi-

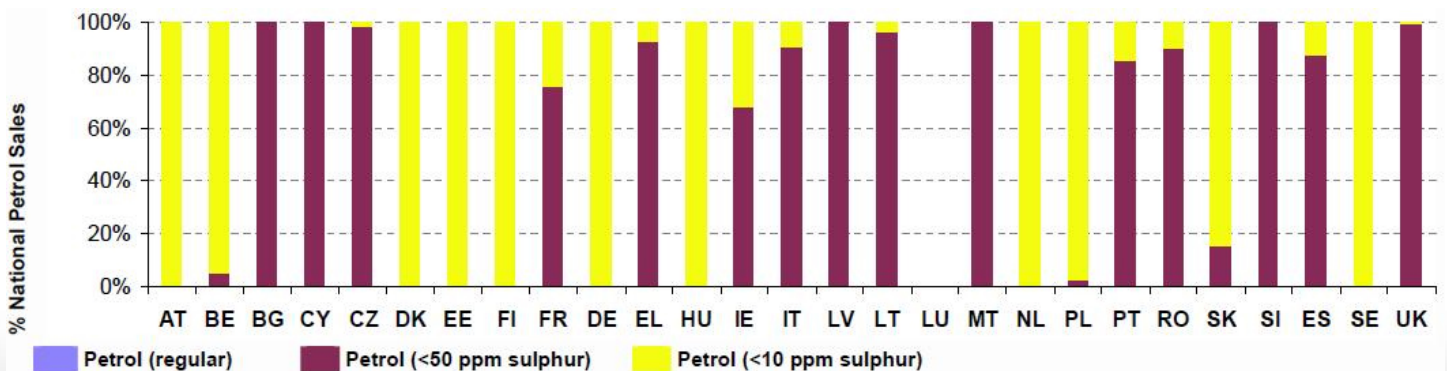
tion to 10 ppm max sulphur gasoline during 2007, although this specification was not mandated until January 1, 2009. Since fuel quality submissions started in 2002, the annual average sulphur content of gasoline has steadily declined with the fuel directives. Figure 1 presents the sales levels for different gasoline grades across the EU, as summarized in the AEA report.

In 2007, the EU-15 ("old" member states) has about 70 cases of noncompliance with specific fuel parameters, whereas the EU-12 ("new" member states joining in 2004 and afterwards) demonstrated about 150 noncompliance cases. There are, however, differences in the number of noncompliances with respect to particular parameters. For example, the number of samples in "new" EU-12 member states that did not meet the RON/MON limit value was five times more in comparison with the samples meeting the value in EU-15. Other key parameters that had reported noncompliances included summer vapour pressure and distillation (E100 and E150). Nonetheless, in 2007, fewer samples did not meet the limit values (and the limits of tolerance for the test methods) compared with the previous year.

The AEA summary report also noted that clear pump labeling did not appear in some member states for sulphur content. This lack of labeling undermines the value of having higher quality fuel available for consumers using vehicle technology that requires the lower sulphur limit.

The monitoring and reporting of fuel quality is a significant effort within the EU member states to ensure compliance with standards and specifications. The design and criteria of the programme can be models for other countries to consider to ensure fuel quality meets necessary requirements for vehicle operations and reducing emissions and air pollution controls. For more about the AEA summary report, you can contact the International Fuel Quality Center at +1-713-260-6474 ([www.ifqc.org](http://www.ifqc.org)), or access the report at: [http://ec.europa.eu/environment/air/transport/pdf/fqm\\_summary\\_2007.pdf](http://ec.europa.eu/environment/air/transport/pdf/fqm_summary_2007.pdf)

Figure 1 – National Sales of Gasoline Grades Across the EU (%)



Note: Excludes Luxembourg, which did not report in 2007.

Source: AEA summary Report, 2007 (Published 2010)



# Partnership for Clean Fuels & Vehicles Holds 8th Global Meeting

The Partnership for Clean Fuels and Vehicles (PCFV) recently held its 8th Global Partnership Meeting (8-GPM) in Washington, DC. The meeting, hosted by the U.S. Environmental Protection Agency (EPA), brought together officials and delegates from partner organisations and select observers to address leading global issues on cleaner fuels and vehicles. The PCFV is led by United Nations Environment Programme to carry out initiatives to promote and support cleaner fuels and vehicles activities and expand knowledge about these efforts. The 8-GPM agenda included reviews of successful initiatives, 2010/2011 work programme, budgets, and progress on major lead phase-out and sulphur reduction campaigns.

According to the PCFV, the global vehicle fleet is set to triple by 2050, with developing country fleets expected to increase over 5-fold by that time. Impacts on both urban air pollution and on global greenhouse gases (GHG) emissions could be substantial. Thus, there is an urgent need to advance the knowledge and technology transfer for cleaner fuels and vehicles to these developing countries. The 8-GPM therefore included special sessions on vehicles programmes and strategic discussions on PCFV's role on climate change.

Ms Michelle DePass, EPA assistant administrator for Office of International Affairs welcomed the partnership members to Washington, DC. Mr Mark Radka, Head of Energy Branch for UNEP's Division for Technology, Industry & Economics served as moderator for the general sessions. Several panels each chaired by PCFV strategic partners reviewed progress made in regions over the past few years and summarized key lessons that were learned from successes and challenges. Some of the main accomplishments noted include:

- Ten countries eliminated leaded gasoline, leaving only about nine countries still with leaded gasoline allowed;
- Four of the remaining leaded-gasoline countries have phase-out programs ongoing, with three of these already committed to implement national programmes to eliminate leaded gasoline;
- In Africa, 52 (out of 53) countries have adopted lower sulphur roadmaps and targets to achieve reductions;
- Clean Fleet Management Toolkit trainings in 37 countries, representing 119 organizations and 230 participants is resulting in several companies using the programme to develop clean fleet strategies;
- Supports to governments to adopt vehicle emissions standards and to develop improved fuel quality standards;
- Database development to provide up-to-date information on cleaner fuels and vehicles; and
- Implementing arm of the Global Fuel Economy Initiative (GFEI) to improve vehicle efficiency in developing countries.

One key focus for the PCFV will be in the area of communications. Three elements for enhancing communications will be upgrading and redesign of the website, production of several new publications and papers, and expansion of the clean fuels and vehicles da-

tabase. The database project, titled "Global Online Fuels, Vehicles and Automotive Fuel Efficiency Database," commenced in 2009. The project goal is to present fuels and vehicles data in a systematic and comprehensive manner, with output that is effective, efficient and user friendly. The website redesign will follow the restructure that took place with the UNEP page. The site layout will present information in a clearer and more accessible way that can improve search engine ratings and increase visits.

The 8-GPM examined forthcoming PFCV events for 2010 to consider programme agendas and focus. Several key planned activities include:

- Lead Phase-out Workshop during 2nd quarter in Yemen, and 3rd quarter in Myanmar
- National Workshop on Low Sulphur Fuel during 2nd quarter in Syria
- Launch of the GFEI Project & Training Workshop in the 3rd quarter in Indonesia
- Fuels & Vehicles Road Map Development Workshop during 4th quarter in Vietnam
- Clean Fuels Workshop during 4th quarter in Pakistan
- Clean Fleet Management Toolkit Session as part of BAQ2010 in November in Singapore

## STRATEGIC ISSUES AND FOCUS

Over 1 billion vehicles are expected to enter the consumer and commercial fleet in developing and transitional countries in the coming decade. How these vehicles are integrated into society and their impacts on global emissions and efficiency targets will be critical issues requiring comprehensive approaches to adequately address. Cleaner fuels and vehicles policies need to be tailor-made involving local actions and timeframes. The PCFV approach to help non-OECD countries includes networks, training and specific systems designed to manage these issues. The 2010/2011 programme of work will focus on completing lead phase-out, expanded national fuel sulphur reductions, clean vehicles campaigns, strengthen cooperation with regional anchors, and implementation of the Global Fuel Efficiency Initiative (GFEI).

Transportation often is one aspect of global climate change mitigation programmes that is missing. The GFEI is intended to address the deficiency, and to raise recognition as part of future agreements. This public-private enterprise through the UNEP will work to develop agreements on global fuel efficiency targets for 30% of new cars and 20% of national fleets by 2020.

The 8th PCFV Global Partnership Meeting also considered ongoing vehicles programmes (like second-hand trades), fuel sampling programme, global lead health impact study, and budgetary matters. The success of this event and the efforts of partner organizations can ensure continued progress to bring cleaner fuels and vehicles to the global community.



## Fuels Industry Updates

### SHANGHAI EPB AND U.S. EPA LAUNCH AIRNOW INTERNATIONAL FOR 2010 WORLD EXPO

The Shanghai Environmental Protection Bureau (EPB) and the U.S. Environmental Protection Agency (EPA) have launch AirNow International to provide real-time air quality data reporting for the 2010 World Expo. The Shanghai EPB is using technology developed by the EPA to send air quality data to citizens through the Internet.

The two environmental agencies developed the system based on Shanghai's existing air quality monitoring network and capability in analyzing air quality data. Shanghai has a population of more than 17 million people. The technical assistance provided by EPA allows reporting of data to the public as soon as it becomes available. The program also provides air quality forecasts to allow visitor coming to the 2010 World Expo advanced knowledge of air quality during their trips.

The collaboration between the two agencies includes advanced air quality modeling to better understand air pollution sources and how reductions in emissions from vehicles, power plants and other industries can be best achieved.

### SINOPEC ANNOUNCES EURO-5 EQUIVALENT GASOLINE & DIESEL CAPACITY

Officials with Sinopec recently confirmed that several of the company's refineries are now capable of producing Euro-5 equivalent specification gasoline and diesel fuel. Euro-5 equivalent specifications limit maximum sulphur content to 10 parts per million (ppm). The company's Shanghai Gaoqiao facility provided shipment of Euro-5 equivalent gasoline to Hong Kong this month.

According to Sinopec, the Yanshan petrochemicals facility and the Wuhan refinery have also acquired process technology to make Euro-5 equivalent fuels in their product lines. The Sinopec Group's refining units have started production of gasoline meeting National Standard III (which is Euro-3 equivalent fuel) since a product upgrading campaign started in January 2007.

The company is also under taking process design to meet Euro-4 equivalent standards (50 ppm sulphur limits) at refineries in Beijing and Shanghai. Emissions standards in China's major cities are tightening to combat air quality concerns, which in turn require improvements in fuel quality for vehicle performance and compliance.

### VIETNAM – DUNG QUAT REFINERY CAPACITY TO INCREASE

Dung Quat oil refinery, Vietnam's first crude processing facility, plans to expand crude distillation and product deliveries by 50% over the next two years. The expanded refinery design rate will be 10 million tons per year, up from the current 6.5 million tons. This capacity will match that of the country's recently announced Nghi Son refinery and petrochemical complex.

According to reports from the Binh Son Refinery and Petro-Chemical Company, the Dung Quat refinery is meeting about a third of the nation's 2010 refined product demand. When completed, the expanded refinery is expected to produce about 45% of 2010 equivalent product demand. Once the Nghi Son refinery complex begins operations in 2014, Vietnam will be internally producing 20 million tons of refined products, or about 90% of the nation's 2010 equivalent product demand. With anticipated economic growth in the country, continued expansions or imports will still be needed to meet internal demand rates projected in the years ahead.

### GUANGDONG PROVINCE WANTS EARLY ADOPTION OF VEHICLE EMISSIONS STANDARDS

China's Guangdong Environmental Protection Bureau (EPB) has directed nine cities to begin implementing China-IV vehicle tailpipe emissions standards ahead of the national deadline. This advanced compliance with the Euro-IV equivalent standards would apply to Dongguan, Foshan, Guangzhou, Huizhou, Jiangmen, Shenzhen, Zhuhai, Zhongshan and Zhaoqing. The notice published by the Guangdong EPB also asks the municipal governments to publish new guidelines as soon as possible.

The national standards, which take effect in 2011, set limits for vehicle emissions of carbon monoxide, hydrocarbons, nitrogen oxides, and particulate matter. China's State Council and the Ministry of Environmental Protection (MEP) issued implementation guidelines to municipalities of the province in May that call for the sale of only light-duty and heavy-duty vehicles that meet the China-IV emissions standards as of June 1, and to halt sales of the registration of vehicles that do not meet those requirements. ACFA had sponsored and provided research information to support the MEP with the design of final specifications for the standards. The early implementation will help improve air quality in the Pearl River Delta ahead of the 16th Asian Games, to be held in Guangzhou this November. Nationwide, the regulations apply to only heavy-duty vehicles sold after January 1, 2011, and to light duty vehicles sold after July 1, 2011.