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In Focus

Meeting Asia's Clean Fuel Challenge

Clean fuels, together with clean vehicles, play a critical role in alleviating the severe air quality issues in Asia. However, the region remains fragmented in the regulation and application of clean fuels. ACFA takes a look at the definition of clean fuels, their role as well as the issues and challenges Asia faces in meeting the clean fuel challenge.

- What are clean fuels?
- The role of Clean fuels in Asia
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- Challenges in pursuing clean fuels

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What are clean fuels?

If you conduct an online search of the term “clean fuels” on the Internet these days, chances are you will see a plethora of references that immediately connect it with “alternative fuels”. Indeed, the two terms are often used interchangeably in the current world of transport energy.

Many parties have offered definitions of clean fuels and invariably, these are shaped by the context in which the parties operate in and by the agendas they are pursuing. At the fundamental level and for the purpose of this article, **a clean fuel is any fuel that produces less pollution (i.e. low emissions) and has a relatively benign impact on the environment.**

The immediate future for transport fuel is still petroleum-based.

Many have argued and concluded or simply assumed that only alternative fuels – such as biofuels, liquefied petroleum gas (LPG), compressed natural gas (CNG), hydrogen, alcohol fuels, electric, gas to liquids (GTLs), biomass to liquids (BTLs), methanol to gasoline (MTG) and solar – are capable of being environment-friendly, especially

when compared to so-called conventional (petroleum-based) fuels. In fact, much of the hype in recent times surrounding “clean fuels” has centered on the promise that alternative fuels will one day replace regular gasoline and diesel.

To collapse the clean fuels and alternative fuels domains is to have only a partial view of the big picture and risks over-simplifying the clean fuel challenge. **The immediate reality is that oil remains the world’s vital source of energy and will remain so for the foreseeable future, even under the most optimistic of assumptions about the pace of development and deployment of alternate technology.** Petroleum-based gasoline and diesel fuels are the lowest-cost option to the consumer as the production and supply infrastructure is already well established, mature and available on a large scale.

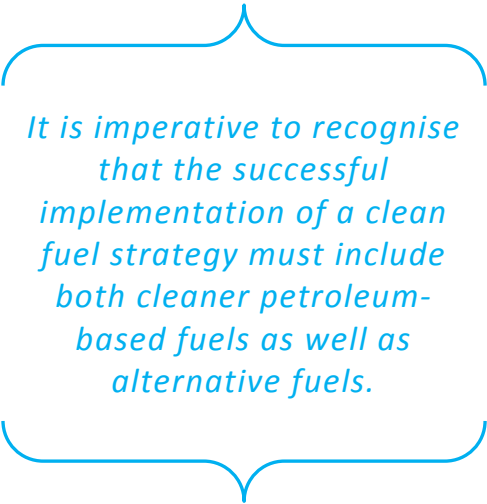
Major developed economic bodies such as the European Union (EU), the United States and Japan have indicated that fossil fuels will remain the primary choice of transportation fuels by up to 80% of their energy mix till Year 2030, even as they steadily increase the use of alternative fuels. **The immediate future for transport fuel is still petroleum-based.**

Against this backdrop, it is imperative to recognise that **the successful implementation of a clean fuel strategy must include both cleaner petroleum-based fuels as well as alternative fuels.**

Governments and policymakers in Asia have to reconcile with the complexity of this reality. The real policy challenge is to govern the use of cleaner petroleum-based fuels to the country's maximum advantage, while determining the optimal balance of conventional and alternative fuels that will best serve the country's long-term sustainable development needs.

The role of clean fuels in Asia

One of the areas that have benefitted significantly from the availability of clean fuels is air quality management (and air pollution control). Governments in Asia have been battling air pollution issues for years. Air pollution, especially in metropolitan areas, continues to pose a significant threat to the



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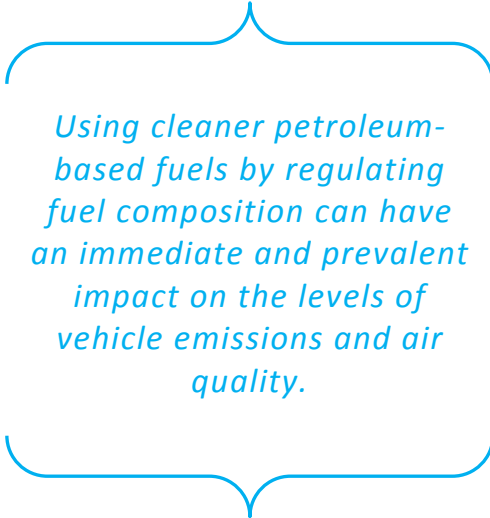
environment and quality of life and health in Asia. Major Asian cities are among the most polluted in the world. In fact, 13 of the 15 most polluted cities in the world are from Asia.

A study done by the Clean Air Initiative for Asian Cities (CAI-Asia), summarizing the air quality data from 20 cities in Asia from 1993 to 2005, showed that while the air quality in these cities has been improving, the pollution level remains far above recommended World Health Organization limits.

Transportation has been identified as the largest source of particulate pollution in most cities; in some cases up to 90% of pollution in a city comes from vehicle emissions. Various studies have shown that both fuels and motor vehicles are the major contributors to the degradation of air quality.

Governments in Asia, in recent years, have been pushing for new initiatives and legislations to regulate vehicle emissions and improve fuel quality standards. The region has largely gone unleaded. Fuel quality standards in the region tend to be aligned with fuel and emissions regulations in the European Union (EU), with Euro II equivalent standards the most common.

However, fuel quality standards in Asia are far from homogeneous. Japan, Hong Kong and South Korea are the front runners, followed by Taiwan. China has made significant progress with major cities Beijing, Shanghai and Guangzhou all adopting Euro IV-equivalent fuel specifications (although its emission standards lag behind). Several Asian countries have announced plans to move towards Euro IV and Euro V equivalent standards in the near future.



Using cleaner petroleum-based fuels by regulating fuel composition can have an immediate and prevalent impact on the levels of vehicle emissions and air quality.

Even so, there are vast differences in the sulphur limits amongst the countries. Fuels in most of the Southeast Asian nations contain 500ppm to 5,000ppm sulphur, although the more developed markets in North Asia use fuels with 50ppm or even 10ppm sulphur.

Considering that petroleum-based fuels continue to dominate the transport fuel landscape across the region, regulating fuel attributes and standards would be the most direct route to cut emissions and improve air quality.

Consumer acceptance is less of an issue (as long as the price is reasonable) compared to introducing new, and potentially more expensive, alternative fuels. Reducing the pollution threat to both humans and the pressure on the environment also buys time for countries to develop alternative energy strategies that matches their economic and social conditions.

Using cleaner petroleum-based fuels by regulating fuel composition can have an immediate and prevalent impact on the levels of vehicle emissions and air quality. The removal of lead in gasoline is a case in point; phasing out lead has reduced lead emissions from all vehicles overnight. That the positive impact can be achieved inside of existing infrastructure and distribution systems is an added advantage. The fuel blending, distribution, monitoring and other issues associated with cleaner fuels are well defined.

Indeed, the critical role of fuels in an effective clean air strategy is echoed by CAI-Asia in its November 2008 report “A Road Map for Cleaner Fuels and Vehicles in Asia”. The study concluded that “fuel quality is now seen not only essential for directly eliminating or reducing pollutants such as lead, but also a pre-condition for introducing many important pollution control technologies.”

Focus on petroleum-based transport fuels

While it is clear that alternative fuels present a broad range of opportunities and potential benefits to the transportation sector, countries in Asia still have some ways to go before the large-scale adoption of these fuels can be realised. **It is imperative that governments in Asia understand that meaningful progress in air quality management and environmental protection can be achieved by improving the current fuel regime, while they simultaneously explore the alternative route.**

Judging by the experience in the U.S, Europe and Japan, the most impactful, effective and prevalent method to improve emission standards is fuel quality improvements and vehicle technology upgrades.

The success of the U.S. and EU auto-oil programs in cutting pollutant emissions serves as a useful mirror for Asia. Charts 1 and 2 present compelling evidence that regulating the quality of petrol and diesel has substantial impact on cutting vehicle emissions.

Chart 1: USA Auto Oil Programs 1990-2010: Pollutant Emissions Decreased

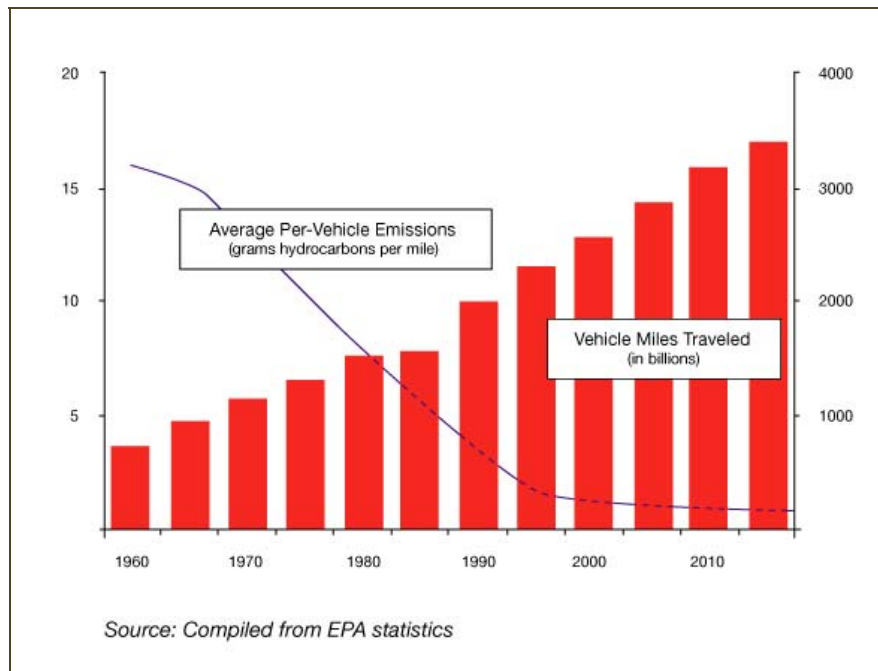
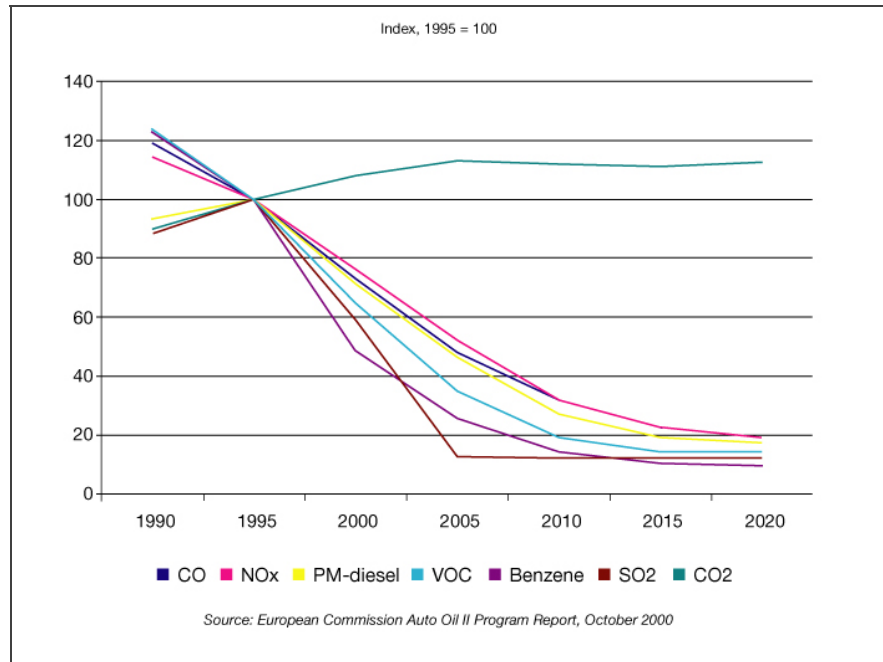


Chart 2: Road Transport Emissions in Europe



Since its implementation from 1993, European fuel emissions legislation has been adjusted progressively in line with the region’s policy goals and actual results achieved. Figures 3 and 4 chart the levels of key pollutants (including CO, NO_x and PM₁₀) against legislation developments from 1993 to 2014 (projected).

Figure 3

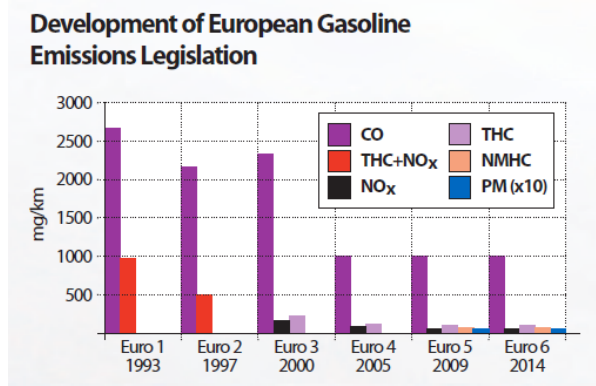
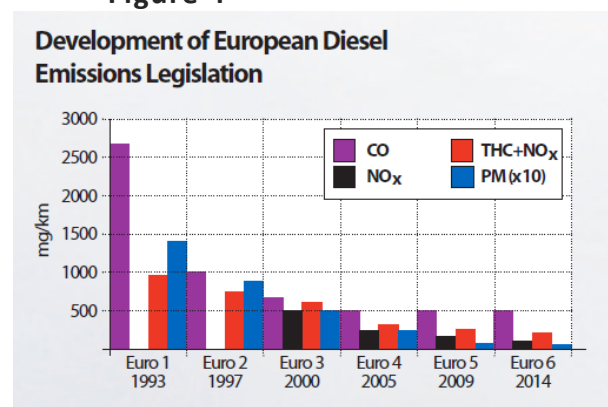


Figure 4



Source: Johnson Matthey PLC, 2008

Petrol and diesel have been getting cleaner over the years and vehicles using these fuels now emit less harmful gases than before. The European experience provides further proof that regulating emissions legislation can be extremely effective in pollution control.

The refining technology needed to produce cleaner fuels that meet Euro IV and above standards is well understood and has been widely implemented in practice.

Challenges in pursuing clean fuels

The reduction of known, harmful elements in petroleum-based fuels, in the case of gasoline, such as sulphur, benzene, aromatics and olefins using clean fuel components (like MTBE) is a proven path to cleaner fuels. **Actual experience in the U.S., EU and Japan indicates that the refining process technology is mature and accessible.** There is a cache of experience in installation and integration of new processes in existing refineries. Experience with the production, blending, distribution and quality monitoring of cleaner fuels and tools to optimize refining operations are also available.

In most of developing Asia, however, the benefits which can be derived from regulating fuel attributes and standards have not been maximized. **Even though there are no technical or scientific obstacles to hinder the production of fuels that meet stricter fuel standards, refinery economics continue to dominate.**

Part of Asia's clean fuels challenge is that the majority of the refineries in the region are not equipped to handle the complex refinery processes to produce clean fuels. The capital investments for infrastructure upgrades can be daunting and prohibitive for the smaller refineries. For government-owned refineries, such capital investments are in direct competition with other social expenditures for limited government funds. In competitive markets, some projects may be viewed to be not financially viable.

The lack of harmonized fuel standards as well as the varying vehicle profiles in the region adds another degree of complexity to refinery design; refiners are challenged to make investment decisions that will capture the biggest piece of the fuel market in Asia in the short to medium term.

That said these investments decisions have the benefit of past experiences in the U.S. and Europe, which spent 30 years refining its fuel strategy and the

entire transportation ecosystem. **The refining technology needed to produce cleaner fuels that meet Euro IV and above standards is well understood and has been widely implemented in practice.** The costs of the technology are well defined and supported by a variety of engineering and construction services related to refinery modifications. Developments in refining technology over the years have also helped to reduce capital costs.

The primary challenge for these countries in the more advanced phase of the evolution of fuel quality programs is to not be distracted by the potential of renewable and alternative fuels and lose sight of the clean fuel strategy that has served them well in the past two decades. At least for the foreseeable future, the two will need to co-exist until a balance is struck.

From a policy perspective, a clearly articulated fuel policy backed by strong political cum legislative commitment and a pragmatic yet comprehensive approach will provide the oil and automobile industries a clear direction to move forward.

Experience worldwide shows that a well-thought out fiscal boost through tax and pricing incentives can accelerate the use of cleaner fuels and their uptake in the fuels market. Governments in Asia have to justify using public funds to pursue cleaner fuels, especially in recent years of economic difficulty. The crux is to not compromise commitment to long-term sustainability for short-term agendas; transitional policy biases will undermine the chances of long-term success of a country's clean fuel strategy.

The North Asian countries have demonstrated that the U.S. and European experience can be replicated given sufficient political will and focus. Having moved through the stages of lead removal for gasoline, imposition of volatility controls and introduction of oxygenates such as MTBE as well as the reduction of sulphur, benzene, olefins and aromatic content, and in the case for diesel with cetane number, distillation end point, density, poly aromatics, these countries are now considering additional composition controls and also introducing renewable and/or alternative fuels (primarily biofuels).

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Clearly alternative fuels come with their unique set of challenges. Cost efficiencies and large-scale application are the key obstacles most, if not all, alternative fuels face. At present, biofuels appear to have made the most headway in Asia. However, biofuels have in all current cases required subsidies from governments to ensure economic viability.

Advocates maintain that biofuels can help reduce dependency on oil imports and lower greenhouse gas emissions, support the agricultural sector, and revitalize rural landscapes in both developed and developing countries. In contrast, opponents argue that biofuels compete with food crops for land, water, and agrichemicals, do not deliver cost-effective carbon emissions reductions, demand a disproportionate amount of subsidies and incentives, and negatively impact biodiversity. Others highlighted concerns with lower energy content, net negative energy balance, potential increased emissions in VOCs and NOx and vehicle performance issues.

A few Asian countries have in place biofuel policies and targets. However, the successful implementation of these mandates remains a challenge as the countries deal with resource limitations especially in feedstock sufficiency.◇