Executive summary

As part of its Regional Technical Assistance project to reduce motor vehicle air pollution, Asian Development Bank (ADB) organized a workshop on clean fuels in New Delhi, India on 2–4 May 2001. The *Cleaner Fuels Policy Guidelines* summarize the most important policy conclusions from the workshop regarding the critical role of fuels in determining vehicle emissions. The guidelines focus on (i) improvements that should be made to conventional fuels to reduce their negative impacts and (ii) the increasingly important role that can be played by alternative fuels.

In setting fuel quality standards, policymakers should be guided by the following general principles:

- Implementing a successful systems approach to setting fuel standards requires institutional mechanisms that involve a variety of stakeholders from government, private sector and civil society, and allows for extensive consultation. In countries where such an institutional mechanism is not yet in place, it should be created.
- Environmental and public health concerns are the driving force behind improvements in fuel quality, thus the Environment Department should have a major role in setting fuel standards.
- All countries should develop a short- and medium-term strategy that identifies standards to be adopted over the next several years so as to allow fuel providers and the vehicle industry sufficient time to adapt.
- The main impediment to adopting state-of-the-art new vehicle emissions technology (equivalent to European Step 3 and Step 4, also called Euro 3 and Euro 4) in Asia is fuel

quality, especially lead and sulfur levels in gasoline and sulfur levels in diesel. These parameters should receive the highest priority in the development of medium- and long-term strategies for fuel standards. Raising the necessary capital funds is the major issue in investing in refineries to manufacture low-sulfur diesel fuels.

- In developing fuel standards, countries should attempt to work closely with neighboring countries and harmonize standards where possible. This should not, however, be used as an excuse for delaying or watering down requirements, as harmonization does not mean that all countries must follow the same time frame.
- In order to implement stricter fuel standards and make associated costs more acceptable to consumers, countries should institute more and better awareness campaigns. Such campaigns must emphasize the public health consequences of not improving fuel quality.
- Subsidies that favor fuels which produce high emissions, should be eliminated; tax policies which encourage the use of the cleanest fuels, should be adopted.

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With regard to gasoline, the following policies are recommended:

- The addition of lead to gasoline should be fully eliminated in Asia as rapidly as possible.
- In order to maximize the performance of current catalyst technology, gasoline sulfur concentrations should be reduced to a maximum of 500 parts per million (ppm) as soon as new vehicle standards requiring catalysts are introduced. If the longer-term target is 50 ppm or lower, moving directly to this level in one step would reduce the overall cost and should be considered.
- Emerging advanced catalyst technologies capable of achieving very low emissions will require a maximum of 50 ppm sulfur or less. A plan to introduce such fuel quality should be adopted in the early stages of development of a long-term vehicle pollution control strategy.

- Gasoline vapor pressure should be reduced to a maximum of 60 kilopascals whenever temperatures in excess of 20°C are anticipated. In tropical or semi-tropical countries such as found in much of Asia, this means all the time.
- Benzene content should be reduced to a maximum of 1% by volume.
- To the extent that the long-term vehicle emissions standards strategy is to adopt Euro 4 standards for light duty vehicles, the European gasoline standards should be adopted in the same or earlier time frame.

With regard to diesel fuel, the following policies are recommended:

- To introduce European Step 2 (Euro 2) vehicle emissions standards, the maximum sulfur content should be reduced to 500 ppm; for Euro 3, the maximum should be no more than 350 ppm; for Euro 4, 50 ppm is required. Maximum emission reductions from Euro 4 or more advanced systems will be achieved with a maximum of 10-ppm sulfur. A plan for introducing such low-sulfur fuels should be adopted early in the development of a long-term integrated vehicle pollution control strategy.
- To the extent that the long-term vehicle emissions standards strategy is to adopt Euro 4 standards for light duty vehicles and European Step 5 (so called Euro 5) standards for heavy duty vehicles, the European diesel fuel standards should be adopted in the same or earlier time frame.
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- When low-sulfur diesel fuel is introduced, strong consideration should be given to retrofitting existing vehicles with oxidation catalysts (500 ppm maximum sulfur) or diesel particulate matter (PM) filters (50 ppm maximum) which can achieve significant and rapid PM reductions.
- An effective way to encourage the rapid introduction of low-sulfur fuels beyond the traditional command-and-control regulations is to adopt a tax policy that results in higher pump costs for higher-sulfur fuels. Hong Kong, China has successfully implemented such a strategy.
- While less critical, other diesel fuel properties such as cetane number, density, distillation and polyaromatic content can also have positive or negative impacts on emissions and should be carefully evaluated.

Considering the current stage of development and emission reduction potentials of alternative fuels, the following policies are recommended:

- Where compressed natural gas (CNG) is readily available in a given locality, and where very low-sulfur diesel (50 ppm or less) is not readily and reliably available, strong consideration should be given to replacing diesel buses with CNG buses. Other centrally-fuelled fleets such as refuse trucks or local delivery trucks are also attractive candidates for replacement. (As previously noted, where diesel fuel with 50-ppm sulfur or less is available, or mandated to be made available within a reasonable time period of a maximum of 3 years or less, particulate filter retrofits should be considered as a possible lower cost option.)
- Where CNG or liquefied petroleum gas (LPG) is readily available in a given locality, strong consideration should be given to replacing other high-polluting vehicle types such as 2-stroke engine autorickshaws with CNG or LPG. Conversion to both LPG and CNG has been well established as a viable technology. In terms of PM and hydrocarbon (HC) emission reductions, the most successful strategy for three wheelers is to replace the existing gaso-

line-fuelled, 2-stroke engine with a CNG- or LPG-fuelled 4-stroke engine.

- There are several obstacles to the widespread use of CNG- and LPG-fuelled vehicles. These include the absence of transportation and storage infrastructure, additional cost primarily of the fuel storage tanks, loss of cargo space, increased refuelling time, and lower driving range. Therefore, economic incentives in the form of lower fuel taxes and others should be considered as a means to stimulate the introduction and acceptance of these fuels.
- Where LPG is readily available, and where ultra-low sulfur diesel (ULSD) is not readily and reliably available, strong consideration should be given to replacing diesel or petrol taxicabs with LPG.
- Conversion of existing diesel vehicles to natural gas is difficult and problematic, and very often results in higher nitrogen oxide (NO_x) emissions. Therefore, for diesel vehicles, replacement should be considered rather than conversion.
- Conversion of existing gasoline-fuelled vehicles to CNG or LPG is not very difficult, and if done well, can result in emission reductions. Conversions should, thus, be considered wherever such fuels are available in a given location, and catalytic converters should be used to gain maximum benefits from switching to CNG or LPG.
- An inherent advantage of gaseous fuels is the assurance that adulteration will not be a problem. They are also inherently low in PM. These factors should be fully taken into account when considering whether or not to switch vehicles to these fuels.