
I. INTRODUCTION

Vehicles are one of the dominant sources of urban pollution in the developing world that threatens both people's health and economic activity. While this is common to growing urban areas throughout the world, it is particularly severe in Asia where majority of vehicles are two- and three-wheelers made up of less efficient and poorly-maintained engines. In the Philippines, for example, motorcycles¹ and tricycles² comprise 34% of vehicle population. Because they are less expensive than other vehicles, they play an important role in the country's transport market. They are very visible in most cities of the country providing an alternative mode of transport for short distances.

About 94% of these motorcycles and tricycles have 2-stroke engines³ emitting fine-particulate matter, which pose a danger to public health. Epidemiological studies revealed that fine particles have serious health effects including premature mortality and such nonfatal effects as respiratory symptoms, exacerbation of asthma, and changes in lung function.⁴ Two-stroke engines typically have a lower fuel efficiency compared with 4-stroke engines, with as much as 15-40% of the fuel-air mixture escaping from the engine through the exhaust port.⁵ As such, the incompletely-

burned gasoline and lubricant are emitted as small oil droplets, which in turn increase visible smoke and particulate emissions.

Moreover, vehicle age, poor maintenance, lubricant misuse, and fuel adulteration exacerbate emissions. Most of the tricycles in the country are aging and poorly maintained. Because tricycles are used commercially, their operation is often extended beyond their useful life in order to maximize income while their maintenance is often postponed due to the opportunity costs associated with this. The problem of maintenance is particularly severe when drivers lease their tricycles, because neither the driver nor the owner feels solely responsible for the mechanical condition of the vehicle.

Most drivers also use excessive quantities of lubricant either because of their lack of knowledge on the correct lubricant-gasoline ratio, or their perception that adding extra lubricant increases fuel economy and provides greater protection against piston seizure.

Many tricycles do not use the quality of lubricant recommended by vehicle manufacturers for economic reasons. Instead they apply untreated used oil sold in bulk at some gasoline stations, which is equivalent to only P10.00 or \$0.18 per liter. Recycled (treated) engine oil, however, costs around P50.00 or \$0.90 per liter while specially formulated virgin 2T oil costs around P90.00 (\$1.64) per liter. The use of untreated used oil leads to greater deposit build-up in the tricycle engine and higher emissions.

Adulteration of gasoline with kerosene also increases emissions. Higher boiling point

¹ Motorcycles are two-wheeler vehicles like mopeds, scooters, etc., like those used for personal transportation.

² Tricycles are three-wheelers or motorcycles with sidecars that could carry between 3 to 10 passengers.

³ University of the Philippines-National Center for Transportation Studies (UP-NCTS). 2003. *Standards Development for Local Motorcycle/Tricycle Sector: 4th Quarter Progress Report*. Quezon City: UP Diliman.

⁴ Kojima, M. et al. 2000. *Improving Urban Air Quality in South Asia by Reducing Emissions from Two-Stroke Engine Vehicles*. World Bank.

⁵ Ibid.

of kerosene makes it more difficult to burn compared with gasoline and thus, resulting in deposits build-up in the engine and more unburned hydrocarbons are emitted in the exhaust gas. Such adulteration practice can be attributed to the huge gap between the prices of these fuel types.

Due to the social and technical complexity behind the subsector, it has been difficult for both central and local governments to develop appropriate strategies to overcome the environmental issues related to it. For instance, the emission standard of hydrocarbon (HC) for motorcycles and tricycles set for urban centers is 7,800 ppm, which is an extremely low standard. The standard is not difficult to be complied with by tricycles while it compromises the public's health and environmental standards. According to the Department of Environment and Natural Resources' (DENR) schedule, the standard will be reviewed and revised, if necessary, in 2006.

A. Past and Present Initiatives in the Tricycle Subsector

A number of programs have been initiated by different sectors in the country to improve the environmental performance of the tricycle subsector ranging from engine modifications, fuel and additive quality improvement, proper vehicle use and maintenance promotion to traffic management enhancement. However, most of them failed, thus the problem of air and noise pollution from tricycles prevail.

The failures experienced in past initiatives show that there is relatively low and ineffective coordination of efforts among concerned stakeholders. It boils down to the absence of proper planning on the part of lead

agencies and therefore, to the lack of integration of efforts that often results in neglect, overlapping and duplication of activities. On top of that, there is also weak monitoring and assessment of the program's effectiveness, leaving all the lessons behind.

Reliable baseline data to back-up tricycle pollution reduction programs are also absent. In fact, even the official data on tricycle registration at the municipality or provincial level is not readily available because of complex institutional arrangements on tricycle franchising and registration. Thus, the fragmented, ad hoc and short-term solutions of dealing with the problems associated with the subsector often lead to debates, as they are perceived as threats to the drivers' livelihood.

B. The Technical Assistance

In 2004, ADB sponsored a special study under a technical assistance⁶ to assist the local governments of Quezon City and Puerto Princesa to develop effective air emission reduction strategies for the tricycle subsector. Specifically, it assisted the local governments in identifying the: (1) factors affecting the supply of and demand for tricycles; (2) potential environmental and health damages from tricycles; (3) current practices and future scenarios in tricycle operations; and (4) advantages and disadvantages of possible pollution-reduction strategies in the subsector. The study results led to the selection and development of a city-wide strategic plan for each of the two local governments to address tricycle pollution. This publication documents the results of the special study.

⁶ ADB. 2002. *Technical Assistance for Promotion of Cleaner Production in the Philippines*. Manila.