

Environmentally sustainable transportation

Singapore's approach

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Air pollution is fast becoming a high priority issue in the rapidly growing cities in the Singapore region. Vehicular pollution, in particular, is one of the main contributors of poor air quality in many of the cities in this region, and a comprehensive approach is needed to tackle this problem. In its densely populated and highly urbanized cities, Singapore has attempted to adopt a holistic approach towards achieving a sustainable urban transport system - integrating land use, town and transport planning as well as stringent emission control programmes to provide seamless and environmentally sustainable transportation to the citizens. A comprehensive road and rail network, complemented by traffic and vehicle population management programmes, has served Singapore well and has kept it on the path towards environmentally sustainable transportation. This multi-pronged approach has also helped to ensure that Singapore's ambient air quality remains good.

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Air pollution is fast becoming a high priority issue in the rapidly growing cities in the Singapore region. Vehicular pollution, in particular, is one of the main contributors to poor air quality in many cities in this region. A comprehensive approach is needed to tackle this problem.

In fact, in recent years, a shift is seen towards longer-term programmes in the regional countries in which a more comprehensive approach, supported by enabling legislation and better institutions, has been adopted. The new approaches to transport planning, urban development, and cleaner fuels have increasingly replaced approaches,

which emphasize reducing pollution coming from the tailpipe.

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Singapore's multi-pronged approach in curbing vehicle emissions can be summarized as follows:

- Setting of emission standards for type-approval to ensure that only low-emission vehicles can be registered for use;
- Adoption of cleaner fuels;
- Legislation and enforcement;
- Education;
- Promotion of environment-friendly vehicles; and
- Promotion of public transport and other transport measures.

This multi-pronged approach is further elaborated in the paragraphs below.

Setting of emission standards

Petrol vehicles

The majority of vehicles in Singapore are petrol-driven.¹ The first emission standards for petrol vehicles were introduced in October 1984 and they were the United Nations Economic Commission for Europe Regulation No. 15.03 (UN/ECE R 15.03). In October 1986, UN/ECE R 15.04 was adopted in place of the UN/ECE R 15.03 standards.

From 1 July 1992, all petrol vehicles imported into Singapore had to comply with either UN/ECE R 83 (Euro I) or the Japanese emission standards (Article 31 of Safety Regulations for Road Vehicles). Only new petrol vehicles equipped with catalytic converters could meet the standards. Catalytic converters can reduce the levels of carbon monoxide, oxides of nitrogen and unburned hydrocarbons in the exhaust emissions substantially.

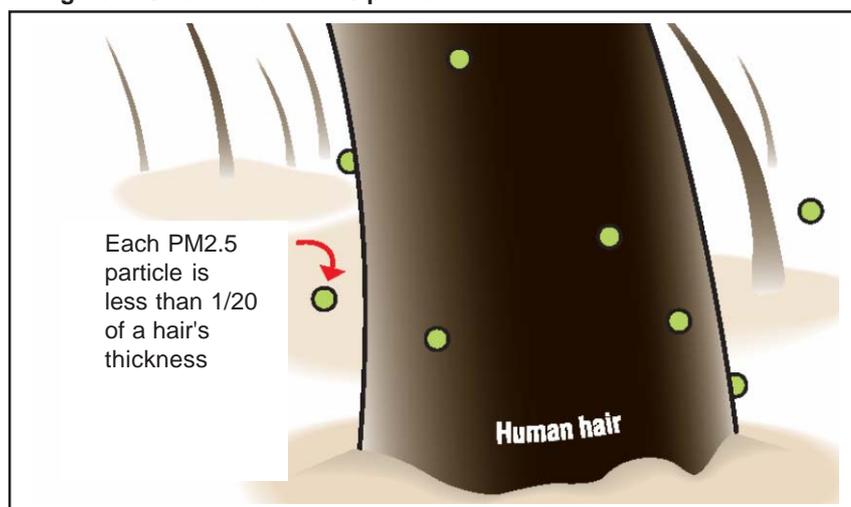
The more stringent Euro II (96/69/EEC) emission standard for petrol vehicles was implemented with effect from 1 January 2001.

Diesel vehicles

Prior to 1 January 1991, new diesel vehicles could be registered so long as the smoke emission was less than 50 Hartridge Smoke Units (HSU). From 1 January 1991 onwards, all new diesel vehicles had to comply with the UN/ECE R 24.03, which required the engines to meet smoke emission standards under load.

From 1 July 1997, new diesel vehicles with gross vehicle weight less than 3.5 tonnes had to comply with ei-

Figure 1: Size of each PM2.5 particle



ther the 93/59/EEC or the Japanese 93/94 emission standards, while those with gross vehicle weight above 3.5 tonnes had to comply with either the 91/542/EEC Stage I or the Japanese 94 emission standards. The Japanese standards were adopted to give motor traders sufficient time to meet the 93/59/EEC and 91/542/EEC standards and were done away with from 1 July 1998. The European standards were commonly known as the Euro I standard. From 1 January 2001, the Euro I emission standard was replaced by the more stringent Euro II emission standard for diesel vehicles in Singapore. Euro II refers to the standards set out in EU Directives 96/69/EC for passenger cars and light vehicles and 91/542/EEC-Stage 2 for heavy vehicles.

Recent scientific advances have revealed that fine particulate matter of less than 2.5 microns in size (PM2.5) poses an even greater health threat than PM10. In order to address concerns over PM2.5 emission, new diesel vehicles were required to comply with the Euro IV emission standard (EC Directives 98/69/EC for passenger cars and light vehicles and 1999/96/EC for heavy vehicles), with effect from 1 October 2006.

Motorcycles and scooters

Motorcycles, particularly those powered by 2-stroke engines, are prone to white smoke emission as their owners have the tendency to add too much 2-T lubricant oil to the petrol. Emission standards were introduced to reduce the

white smoke problem by ensuring that only motorcycles fitted with better quality engines are brought in.

From 1 October 1991, all new motorcycles and scooters had to comply with carbon monoxide and hydrocarbon emission standards specified in the U.S. Code of Federal Regulation 86.410-80. These were superseded by the 97/24/EC European standard from 1 July 2003.

Adoption of cleaner fuels

Fuels have a significant impact on the nature and amount of pollutants emitted by a motor vehicle. Hence, besides ensuring that the engines of motor vehicles are designed to minimize pollutive emissions, the quality of automotive fuels also has to be controlled in order to achieve optimum results.

Lead in petrol

Unleaded petrol was introduced in February 1991. Its use was promoted by restructuring the petrol taxes such that the price per litre of unleaded petrol was at least 10 cents lower than that of leaded petrol and through an intensive public education campaign. Concurrently, legislation was introduced to require all petrol vehicles registered on or after 1 July 1991 to be able to use unleaded petrol. The oil companies voluntarily phased out leaded petrol from 1 July 1998 after demand for leaded petrol became insignificant.

Sulphur in diesel

Maximum allowable sulphur content in diesel by weight was reduced from 0.5

Figure 2: Check on vehicles emitting smoke



to 0.3 per cent from 1 July 1996, and from 0.3 to 0.05 per cent from 1 March 1999. From 1 December 2005, the allowable sulphur content in diesel was further reduced to 0.005 per cent to pave the way for implementation of Euro IV emission standard.

Legislation and enforcement

Enforcement against smoke emitting vehicles

It is an offence for owners to operate vehicles emitting visible smoke on the road. The National Environment Agency or NEA carries out random checks daily, by recording images, using video cameras, of vehicles, particularly diesel vehicles, emitting smoke, to take enforcement action against them. These vehicles are sent to a vehicle inspection centre for a chassis dynamometer smoke test (CDST). The owners of the vehicles that fail the ensuing CDST are fined. They are required to repair the vehicles and then send them for retests until the vehicles pass the CDST before the vehicles are allowed on the roads again.

Mandatory periodic inspections

All in-use vehicles have to undergo compulsory periodic inspections at inspection centres approved by the Land Transport Authority to ensure that vehicles are roadworthy and meet emission requirements.

Education

NEA works closely with its partners to educate fleet operators and vehicle owners on the cause of excessive emissions. For example, information

booklets on prevention of black smoke emission from diesel vehicles, jointly produced with a major fleet operator, provide advice on issues such as the common causes of excessive emission, proper and regular maintenance, proper driving habits and proper payload to prevent excessive emission due to overloading of goods vehicles.

NEA also conducts regular dialogues and meetings with fleet owners, such as the taxi and public bus companies, and lorry and bus owners' associations, to update them on measures to control vehicular emissions and to work with them to tighten the maintenance of their vehicle fleets and implement self-regulating and self-monitoring measures to help reduce emissions from their vehicles.

Promotion of environment-friendly vehicles

Over the years, there have been great advancements in alternative fuels and propulsion technologies. Examples are vehicles powered by natural gas, electricity, hydrogen and hybrid electric-cum-internal-combustion-engines. On the whole, these vehicles, loosely referred to as 'environment-friendly' or 'green' vehicles, emit less pollution than conventional petrol and diesel vehicles.

To encourage the use of environment-friendly vehicles, rebates, called Green Vehicle Rebates (GVR), were introduced in 2001 for the registration and use of electric, hybrid and natural gas (CNG) cars. The GVR aims to narrow the cost differential between environment-friendly vehicles and conventional vehicles.

At present, environment-friendly (electric, hybrid and CNG) passenger

vehicles enjoy a rebate equivalent to 40 per cent of the car's Open Market Value (OMV)² that can be used to offset the fees and taxes payable at registration. The GVR will be further reviewed after 31 December 2009.

In addition, the government also had encouraged the early adoption of Euro IV diesel vehicles before they are mandatory and the switch from diesel to CNG vehicles.

Promotion of public transport and other transport measures

In parallel, the use of public transport among commuters is also promoted. The key strategy to encourage more commuters to use public transport is to make the public transport system of mass rapid transit, light rail and public bus network seamless by enhancing their accessibility and interconnectivity.

However, this in itself is not sustainable in the long run. As the population becomes more affluent, the ownership of vehicles is bound to increase if left unchecked. To mitigate the increase, Singapore has implemented measures to restrain car ownership and usage. To curb car ownership and usage, Singapore has implemented certain restraint and usage measures such as the Certificate of Entitlement (COE) Scheme and the Electronic Road Pricing (ERP) System.

The multi-pronged approach elaborated above has served Singapore well and has kept it on the path towards environmentally sustainable transportation. However, new challenges will arise in future and the country needs to be able to meet them using innovative and integrated solutions which help it achieve the environmental goals that it has set for itself.

Notes

1. As at end 2007, petrol vehicles make up 80 per cent of total vehicle population in Singapore.
2. OMV is assessed by the Singapore Customs, based on the price actually paid or payable for the goods when sold for export to the country of importation. This price includes purchase price, freight, insurance and all other charges incidental to the sale and delivery of the car to Singapore. □