

## H) Improving Private Vehicle Operating Standards

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### 1. Introduction

This guidebook describes a range of measures to develop transport services in ways that reduce greenhouse gas emissions, including shifting to mass transit, walking and cycling, reducing the need for travel, and introducing new fuels and electric and other vehicle technologies that reduce and even eliminate emissions from vehicles. All this can require money and time, but there are simple things that can be done immediately to the present vehicle fleet. This chapter shows how fuel use, local air pollution and noise can be reduced through a range of measures: regular maintenance, use of the right type and quality of fuel, appropriate retrofitting, restriction of vehicles allowed on the roads, and the timely retirement of vehicles.

More particularly, it discusses programs and policies that governments and national leaders can implement to advance these objectives.

Although the level of private vehicle use in developing countries is low compared with the level in developed countries, such vehicles are still a major source of emissions, particularly in megacities. This is because standards of maintenance tend to be poorer, the average age of vehicles is substantially higher, and fuel quality is often low, with, for example, a high sulphur content in diesel.<sup>1</sup> Fortunately, almost all countries have removed lead from their petrol, and this demonstrates what can be achieved through cooperative global action.<sup>2</sup> Numbers of private vehicles in many parts of the developed world are rapidly increasing with economic growth, so it is critically important to have in place policies that can help to ensure that conventional vehicles on the roads are operating as efficiently as they can be, thus minimising greenhouse gases emissions.

Accordingly, this section considers the following policy areas, through which to pursue these objectives:

- standards for vehicle fuel economy
- standards for vehicle emissions
- vehicle inspections
- adoption of particular technologies
- taxation and pricing measures for vehicle performance
- inclusion of emissions standards in warranties
- getting older vehicles off the roads
- standards for fuel quality
- driver or owner education.
- Benefits of improved operating performance

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## 2. Economic benefits

More efficient and better maintained vehicles save fuel, run well for longer and have fewer breakdowns that can cause business disruption. Fewer accidents and less pollution and noise mean low health care costs and less time away from work as a result of illness or accidents.

### Social benefits

Reduced pollution and noise mean that people's health is better and their lives are more pleasant, and if vehicle inspections also include safety checks, as they often do, then there will be fewer accidents as well. If people rely on private transport, having more efficient, better maintained vehicles means their transport is more reliable, whether they are travelling to work, education, the shops or any other activities of daily life.

### Environmental benefits

More efficient, better maintained vehicles lead to reductions of greenhouse gases, local pollutants and noise, and they reduce consumption of non-renewable fuels that are in diminishing supply.

## 3. Greenhouse gas emissions reduction potential

A well-maintained vehicle uses between 3 and 7% less fuel, and hence leads to a similar CO<sub>2</sub> reduction.<sup>3</sup> However, the 'Jevons effect' (also called the rebound effect) needs to be considered. This is when cost savings from more fuel efficient vehicles encourage people to drive more, thus cancelling out savings in greenhouse gas emissions. This does not mean that efficiencies should not be pursued; rather it means that other policies are needed as well to reduce vehicle travel before the full benefits of vehicle efficiencies can be seen.

## 4. Details of the policy measures and their implementation

### Standards for fuel economy for new vehicles

Most countries have vehicle fuel economy standards. Those in the European Union and Japan are the most stringent, and China's standards are now more stringent than those in the United States, Canada and Australia.<sup>4</sup> The standards can be mandatory or voluntary, with mandatory ones achieving the best results. When it comes to standards setting, fuel economy/efficiency standards are the most direct way of reducing greenhouse gas emissions, because reductions in fuel use mean the same level of reductions in greenhouse gas emissions, and fewer local pollutants are emitted as well.

However, there are several problems with mandating vehicle fuel economy standards as a way of reducing greenhouse gas emissions. Firstly, improved fuel economy means cheaper travel, and this can encourage people to drive more (the Jevons effect). Thus, demand management measures should accompany it, or even replace it. One study found that carbon taxes are much more effective at reducing greenhouse gas emissions than are fuel economy standards.<sup>5</sup> This makes sense. While greater fuel economy makes travel cheaper, carbon taxes make it more expensive, with travel in less fuel efficient vehicles the most expensive.

A second issue with fuel economy standards is that they only apply to new vehicles, and a third problem is that, except for countries like China, India and Brazil that manufacture their own vehicles, developing

countries can only control vehicle fuel economy standards by banning imports of vehicles not meeting those standards. Many have received cheaper second hand vehicles phased out in wealthier countries, usually vehicles with much worse fuel economy, so a more consistent global approach to fuel efficiency standards would contribute to greenhouse gas reductions.

## Standards for vehicle emissions

Vehicle emission standards are worthwhile for reducing emissions that cause local pollution, such as suspended particulate matter (SPM), oxides of nitrogen (NO<sub>x</sub>), carbon monoxide (CO) and volatile organic compounds (VOCs), but they do not necessarily lead to fewer greenhouse gas emissions because these local air pollutants can be curtailed without reducing fuel consumption, by the fitting of emission control devices in vehicles. However, it may be argued that tighter emissions standards can be part of a basket of measures that, over time, will bring about a newer, more efficient and better maintained fleet of vehicles on a nation's roads.

Vehicle emission standards have been widely implemented in Latin America and Asia,<sup>6</sup> and this is having an impact on pollution levels. For example, in Mexico City, CO levels in 2000 were 48 percent lower than two years earlier, while NO<sub>x</sub> levels were 26 percent lower. China adopted Euro 1 standards in 2000, and aims to meet current European standards with a 4-6 year time lag.<sup>7</sup>

## Vehicle inspections

Full inspections usually assess (and sometimes adjust) vehicle performance, emissions and safety, so it can enable vehicle owners to reduce their emissions of greenhouse gases, as well as reducing local pollutants.

There is much debate about the cost-effectiveness of vehicle inspections as a device for reducing emissions. Some analysts see them as critical measures for achieving this,<sup>8</sup> while others maintain that they have only generated small environmental benefits and are not highly cost-effective.<sup>9</sup> However, the testing of vehicle emissions is necessary for many of the other measures discussed in this section, specifically, those that require emissions readings in order to charge fees, put vehicles off the road, order retrofitting, ban imports of low quality vehicles, or reach decisions on warranty matters. The effectiveness of emission inspections is likely to depend on a range of factors, including:

- their prevalence – the higher the proportion of vehicles checked the more polluting vehicles are put off the roads and the stronger incentive there is for owners to have low emitting vehicles, because they have more chance of getting caught
- whether inspections are planned or random – the latter will have a greater deterrent effect
- the degree to which inspection processes are properly carried out, with effective and well-maintained equipment, adequately trained staff, and strong safeguards against corruption
- the extent to which failing an inspection test has real consequences
- the overall level of emissions in a nation's vehicle fleet, which will in turn be influenced by the range of other measures adopted to reduce emissions – the rarer it is to find vehicles with over-the-limit emissions, the less cost-effective it is to have an extensive inspections system.

From this perspective, inspections may be especially valuable in countries and cities with very bad air pollution, provided the process is efficient and uncorrupted. Programs in China and Mexico are particularly cited as being successful.<sup>10</sup> Across the developing and developed world, a small proportion of vehicles

are responsible for a large proportion of pollution. One study found that 10% of vehicles were responsible for half of the emissions.<sup>11</sup> Inspections are likely to lead to faster adoption of emission control devices and a faster turnover of vehicles. But if a program is ineffectively implemented, the benefits will not follow. For example all vehicles in India are supposed to be inspected every three months for a 'Pollution Under Control' certificate, but proportions of vehicles in any one year in the 1990s with a valid PUC certificate ranged from 9% to 23%. Furthermore, only 1% of owners of vehicles found to be non-compliant were fined in 1997 (partly because of the paperwork required), and the practice of cancelling the PUCs of non-complying vehicles was discontinued in that year following public pressure. Moreover, an alarming 44% of new vehicles tested did not meet standards, and there is also a high level of adulteration of fuels in India.

It is best to separate the processes of inspecting and repairing vehicles, with the inspections conducted by centralised systems, and repairs and maintenance carried out by decentralised operators. This removes conflicts of interest and reduces corruption, and a centralised inspection system ensures greater consistency, cost-effectiveness, professionalism, and credibility in the eyes of the public. Inspection systems can be contracted out by public tender. There should also be random roadside vehicle inspections, but it is suggested that these be carried out by different bodies from those conducting the fuller inspections, to avoid a conflict of interest, and that roadside inspections be in the hands of a government organisation to enable the government to assess the effectiveness of the overall inspection system.<sup>12</sup> There is now low-cost technology to check the emissions of moving vehicles.<sup>13</sup> Inspections should target the kinds of vehicles generating the worst emissions. Ways of covering the costs of inspections are discussed later in this section.

### **Mandatory adoption of particular vehicle technologies or design standards**

One way for emissions to be reduced is for governments to mandate particular technology design standards for new cars, or the retrofitting of technologies for vehicles already on the road. For example, catalytic converters are now compulsory in many countries, both for new and existing vehicles, because they prevent emissions of many local pollutants, and any countries that do not already require them for all vehicles should do so.

Many countries have adopted particular standards for vehicles permitted on their roads. For example, a large number of Latin American and Asian nations have adopted such standards, normally expressed in terms of their conformity to European or American standards (for example, Euro 1,2,3 and 4, and USETA).<sup>14</sup>

India's Supreme Court, following a long and complex court case about the rights of New Delhi's residents to breathe unpolluted air, directed the phasing out of the city's commercial vehicles that were more than 15 years old, the replacement of the city's pre-1990 autos and taxis with new vehicles using cleaner fuel, and the conversion of the city's auto-rickshaw and bus fleet to the use of compressed natural gas (CNG). The local government in New Delhi was required to enact this change, and this law eventually led to the Government of India mandating emissions standards aimed to achieve the goal set by the Supreme Court. The conversion of vehicles, especially the auto-rickshaws and buses in Delhi, has now been followed by Mumbai, Kolkata and other Indian cities with immediate improvements to air quality. The same approach is now being enacted in Indonesia to control the worst vehicles, especially their Bajajs (auto-rickshaws).

Thus, government can decide on a case-by-case basis whether to require the adoption of particular technologies or design standards, or to mandate specific emissions or fuel quality standards, in order to reduce levels of emission of local pollutants or greenhouse gases.

## Taxation and other pricing measures for vehicle performance

A range of financial incentives and disincentives can be used to encourage appropriate practices related to the buying, operating and maintaining of private vehicles. For example, taxes on fuels can help to induce people to buy the most fuel efficient vehicles, maintain them better and drive them less. Evidence from the North shows a strong correlation between fuel prices (including taxes) and the average fuel efficiency of cars. Differential taxes on fuels can also alter relative prices of different fuels in order to encourage use of the cleaner ones. Grants or tax credits can be given for the adoption of particular technologies. For example, in Kolkata, India, auto-rickshaw owners are being given grants of Rs 12,000 to switch from petrol two-stroke to LPG four-stroke engines.<sup>15</sup>

**Figure 3.35 The Toyota Prius allows you to monitor your emissions output**



*Picture Credit : It's Our City.*

It has also been suggested that an emissions fee might be levied, following an inspection, as an alternative to a simple pass/fail ruling. The fee would increase with the emissions level. This would have the advantage that emissions levels not serious enough to have the vehicle banned could still be subject to a fee that would act as an incentive to lower emissions, while those vehicles with more serious emissions that would have seen them banned receiving heavy to prohibitive fees depending on the exact level.<sup>16</sup> If the fee was also related to distance travelled then there would also be an incentive to drive less, but such a policy really requires tamper-proof odometers.

Yet another alternative is to have an emissions fee that is simply determined by the model and year of the vehicle, rather than actual emission levels, on the grounds that this is administratively easier and cheaper and based on the assumption that there will not be large differences between vehicles in the same category. This would encourage people to buy newer, cleaner vehicles, and there could also be a provision whereby they could claim a rebate for getting certain repairs or maintenance done.<sup>17</sup>

Fees and taxes can be especially hard on those on low-incomes, but if the poor are compensated in other ways then they can be, on average, no worse off as a result of these measures.

### **Inclusion of emissions standards in warranties**

Requiring manufacturers and sellers of new cars to include emissions levels in their warranties creates an incentive for them to do what they can to lower emissions.<sup>18</sup> Drivers and owners would also have more incentive to have their vehicle checked if they knew that the cost of any repairs or maintenance work would be covered by a warranty. Of course, the warranty could require certified regular maintenance by the owner, as most warranties already do. Vehicles under such a warranty could be exempt from any emissions fee.

Nations that only import vehicles and do not manufacture them are unlikely to have the power to require vehicle manufacturers to include emissions in their warranty cover, but they can more easily require local car retailers to provide this coverage.

### **Getting older vehicles off the roads**

Emissions of pollutants and greenhouse gases tend to be much worse in older vehicles, and this is partly because emissions control equipment deteriorates in performance over time. Also, newer cars tend to be much more fuel efficient and have better emissions reduction technology. Furthermore, a British study of the total life cycle of a car found that only 9% of emissions occur during its manufacture,<sup>19</sup> which means that a new, efficient car can start to generate lower net emissions in a relatively short time. So it makes environmental sense to have newer cars on the road.

This can be encouraged through lower taxes of all kinds on newer and more efficient vehicles. It is also worth considering that taxes on new vehicles (such as import tariffs) or on vehicle sales may have the effect of encouraging people to hold on to older vehicles longer. Singapore, which has a registration fee for new vehicles of 150% of the vehicle's cost, has gone some way to addressing this problem by providing a rebate on this fee if an old car is scrapped in the process. In Brazil, if an old car is scrapped in the process of buying a new car with a catalytic converter, the buyer is exempted from the initial lump sum tax and road tax for five years.<sup>20</sup>

Another option is a simple payment to vehicle owners to scrap a vehicle, but this is a drain on government funds – as opposed to taxes on older vehicles which are a source of funds. The scrapping price needs to be higher than the used car price in the marketplace, although this scrapping price is likely to raise the price of the used vehicles – because the government, as a buyer of the vehicles, is creating extra 'demand' for them while the supply diminishes.<sup>21</sup>

Some nations, including a number in Latin America, have banned imports of used cars as a way of preventing an accumulation of older vehicles in their national fleets.<sup>22</sup> Other options are to impose a heavy import tax on used vehicles or engines as a disincentive, or to require them to pass a stringent emissions test as a condition of registration.<sup>23</sup>

### **Standards for fuel quality**

As of May, 2010 there were only 11 countries in the world that still had leaded petrol. This demonstrates how change can occur through concerted international action. Sulphur in diesel fuel remains a serious



**Figure 3.36 In Cairo and elsewhere in the world older vehicles need to be replaced to reduce greenhouse gas emissions and local pollutants**



Picture Credit : Karl Fjellstrom, itdp-china.org.

problem in many countries, but there is no reason why governments cannot simply mandate substantial sulphur reductions as occurred with lead. This has already happened in developed countries and parts of Asia and Latin America.

Cleaner fuels have an immediate impact on the emissions of both new and existing vehicles. They can reduce the level of local pollutants, but they do not reduce fuel use and greenhouse gas emissions if they are just purer versions of the same hydrocarbons. This requires a switch to more efficient vehicles, reduced use of vehicles, or a lower carbon fuel such as compressed natural gas or ethanol. Some countries mandate the blending of fuels, requiring that they contain certain proportions of ethanol or biodiesel, for example. This is mainly done for energy security reasons, but it will also lower CO<sub>2</sub> levels in most cases. Care should be taken to ensure that the production of biofuels is a net carbon reduction process, and does not involve deforestation or the use of land required for food production. Alternative fuels are discussed in more detail in another section of Chapter 3, *Vehicle and fuel technologies*.

Even though measures to improve fuel quality do not always reduce greenhouse emissions, building a culture of responsibility for the emissions that vehicles emit – among drivers and among vehicle and fuel related businesses – must encompass responsibility for reducing or eliminating both local pollutants and

greenhouse gases. Developing a sense of responsibility about each of these issues will make it easier to develop a sense of responsibility about the other.

One problem is that countries without their own refineries have little or no power over the composition of fuels coming out of refineries. However, they can decide whether to impose import bans on particular fuels, or rely on technology within vehicles to remove pollutants. They can also inspect fuel at the retail level or in vehicles, because in some countries, such as India, there is a high level of adulteration of fuels.

### **Driver or owner education**

If people are to drive or ride motorised vehicles, they need to learn the physical skills and judgement required to manage this, and they need to learn the road laws. If they are to own a vehicle, they should also learn about buying or selling a vehicle wisely, and about keeping that vehicle well-maintained. This will benefit them practically and financially, as well as making their vehicle safer and better for the environment. These skills and knowledge can be learnt voluntarily, but the learning will happen on a much larger scale if it must be learnt and is tested as part of the process of obtaining a driver's licence. (This in turn presumes that the licence is only given to those who genuinely pass a test of driving skills and knowledge.)

To help prospective drivers gain this information about buying and selling vehicles and keeping them properly maintained, governments or private organisations can run courses on it, or include it in broader driver education courses. Thus, prospective drivers or riders can learn about:

- the cleanest, most fuel efficient vehicles
- what regular servicing needs to be done (and what can happen if this is not done)
- the small things owners or drivers can do themselves, such as keeping tyres properly inflated
- the fact that their vehicle may be inspected, and the consequences of failing this inspection
- the right time to sell their vehicle.

**Figure 3.37 New drivers need to learn how to take care of their car as well as how to drive it**



*Picture Credit: Ildar Sagdejev.*



These are the sorts of subjects covered by a campaign called Auto\$mart, which was started by Natural Resources Canada's Office of Energy Efficiency. Auto\$mart encourages the public to make sound decisions about vehicle purchases (such as how to choose the most fuel-efficient vehicle), about vehicle maintenance and driving habits. This is also covered in driver education programs that Auto\$mart runs for novice drivers, and more than 270,000 people have participated in these. They learn how to drive efficiently, when to drive (when you cannot walk or use transit), how to buy and maintain a vehicle with fuel efficiency in mind, and how what's good for your car is also good for your wallet and the environment. Most of the fuel-efficient driving techniques taught through the Auto\$mart program also contribute to safer driving.<sup>24</sup>

## 5. Costs and sources of funds

Compared with the costs of developing transport infrastructure, the costs to government of administering the measures described in this section are relatively small, or in some cases government actually earns income from them. The income raising measures include all the taxes and fees designed to deter certain practices, such as driving inefficient vehicles. Many measures are inexpensive for government because they are just matters of regulation of fuel economy and fuel quality standards, the inclusion of minimum vehicle emission standards in warranties, and bans on imports of low quality used vehicles and engines. Policing emissions standards, while also a matter of regulation, is more expensive because it involves the checking of large numbers of individual vehicles. But this checking is done by vehicle inspection services, and there is a range of ways to pay for such inspections. Vehicle owners can pay a fee for the inspections and another for the certificate they receive. Governments can provide land to contractors for test facilities, reducing the costs of tests for the owners. A calculation, in a 2005 publication, of the costs of an overall check of a passenger car in Indonesia (emission and safety checks, plus tuning and simple repairs not involving spare parts) found it to be around US\$22, but a simple emissions test would be much cheaper.<sup>25</sup> The cost of driving lessons and tests can also be charged to those taking them. There can also be cross-subsidisation of measures that cost the government money by those measures that earn it money.

For vehicle owners and for vehicle and fuel related businesses there may be significant up-front costs, but once made the greater efficiencies involved lead to reduced transport operating costs and in some cases reduced government charges.

If the costs these measures impose on vehicle drivers or owners seem unduly harsh, two things need to be remembered. Firstly, they represent an effort to require private vehicle drivers to pay the full costs of their trips, including environmental and social costs, thus lessening the practice of allowing such costs to be borne by society as a whole. Motor vehicle accidents are now a huge cost to society and these costs are larger on a per vehicle basis in developing nations. The costs of climate change are beginning to be understood and could also be very substantial. Secondly, they can also act as demand management measures, encouraging drivers to switch to safer, more efficient, low-carbon transport modes.

## 6. Conclusion

The measures outlined in this section are part of a bigger picture. Reduced greenhouse gas emissions will result from shifts to other transport modes, from reduced levels of travel, and from the adoption of new vehicle technologies and fuels. But at least in the short to medium future, these measures cannot, either individually or together, entirely reduce greenhouse gas emissions to the extent that is necessary. It is also essential that conventional private vehicles on the roads now and in the future are as fuel efficient and non-polluting as possible. The policy options just described are some avenues to achieve this.

## Endnotes

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