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**POLICIES AND LEGAL OPTIONS TO  
PROMOTE THE ENERGY EFFICIENCY  
OF PRIVATE MOTOR VEHICLES**

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## **Policies and Legal Options to Promote the Energy Efficiency of Private Motor Vehicles**

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### **I. INTRODUCTION**

1. Road transport causes vast environmental, planning and sociological problems in modern society. The increasing dominance of motor vehicles since the early 1900s as a means of transport has caused the rapid depletion of indigenous oil reserves, poor air quality in urban areas and declining quality of life in the inner cities as a result of traffic congestion. A gradual decline of public transport has led to increased reliance on private motor vehicles, causing major traffic flow problems in many of the rapidly growing cities.

2. Perhaps the greatest effect of the modern obsession with motor vehicles has been on the design of major towns and cities. The 20th and early 21st centuries have seen the creation of sprawling outer suburbs, poorly serviced by other forms of transport and services, where life is effectively impossible without motor vehicles.

3. Transport is also a significant contributor to climate change, as the sector is responsible for more than 23 per cent of all global atmospheric carbon emissions. Within the transport sector, road transport is responsible for 73 per cent of all transport GHG emissions (Ramanathan and Carmichael, 2008).

4. In light of the on-going review by the Commission on Sustainable Development in its nineteenth session of progress in the implementation of decisions relating to transport and sustainable development, it is timely to consider appropriate national legal and policy responses to improve energy efficiency in the road transport sector.

*Disclaimer: The views expressed in the background paper are those of the author and do not necessarily reflect those of the United Nations.*

## **II. ROLE OF THE LAW**

5. The primary area of focus for improving motor vehicle fuel efficiency is technological. Development is ongoing and many advances in relation to the weight of components and motors have been made over the past 30 years (DeCicco, 2001). In addition to technology, however, the law has a vital role to play. One important role of the law is to enact legislation and regulations proscribing undesirable activity and developments and/or requiring certain positive activity and developments. Regulation can also be used to promote consumer awareness and change consumer behaviour. In addition to regulating, the law has the capacity to provide fiscal incentives to encourage positive activity and to educate the public as to the relevance and importance of energy efficiency.

6. It is not necessary to make a choice between the regulation and fiscal incentives as sometimes the law may adopt both of these approaches simultaneously. Such fiscal measures might be introduced as an alternative, or in addition, to various forms of regulation. A combination of regulatory and fiscal measures may well be the most effective approach to take in many cases. The regulatory measures could require manufacturers or consumers to adopt a minimum standard of compliance, while the fiscal measures could encourage and reward them to go as far as possible beyond the specified minimum. This is sometimes referred to as the “carrot and stick” approach. This paper will examine the actual and potential role of the law in relation to both regulatory and fiscal measures. It will also consider the most appropriate means of enacting the proposals into law.

7. In the case of both regulatory and fiscal measures, the Constitution of each country will determine which legislative body has the power to enact the appropriate reforms. In many countries the legal responsibility for enacting reforms affecting energy efficiency in respect of motor vehicles is shared between the different levels of governments (national and local governments, and (in the case of federal jurisdictions) state governments. Any dispute between the different governments as to which one has the constitutional power in any given case is normally resolved by the highest court of the country (e.g., in the United States the Supreme Court, and in Australia the High Court).

## **III. REGULATORY MEASURES**

8. A number of different regulatory measures have been adopted in different countries designed to improve fuel efficiency in the road transport sector. The most significant options will be considered here below.

### **A. Fuel economy standards for motor vehicles**

9. Fuel economy standards were first enacted in the United States over 35 years ago and represent one of the earliest energy efficiency legislative measures undertaken at national level. Pursuant to the terms of the Corporate Average Fuel Economy Standards (CAFE), enacted in 1975 under the Energy Policy and Conservation Act, motor vehicle manufacturers were required to

progressively improve the overall fuel consumption of their fleet each year over a specified twenty year timetable approved in the 1975 legislation. Under the CAFE system, the federal government established an average fuel economy standard that each vehicle manufacturer need to attain each year with respect to all vehicles produced during that year. Two separate standards were introduced: one for passenger vehicles and one for light trucks. In respect of passenger vehicles, the standard was initially set at 18.0 miles per gallon for model year 1978 and was progressively increased to 27.5 miles per gallon in 1985 and later years.<sup>1</sup>

10. In respect of light trucks, the standard was increased from 16.5 miles per gallon in 1979 to 20.5 miles per gallon in 1994. The manufacturers objected at the time that such a rate of change was unrealistic. In reality, however, the timetable was largely kept. By virtue of the Energy Independence and Security Act 2007, the CAFE standards will be gradually increased annually from 2011 until they reach 35 miles per gallon for passenger vehicles by 2020 (United States, 2007). Such legislation provides a useful illustration of the role of the law in forcing technological change. A similar CAFE scheme has also been adopted in Canada under the Motor Vehicle Fuel Consumption Standards Act, which entered into force in November 2007.

11. There has been some critical analysis of the law in effect in the United States, the most comprehensive being that of the National Academy of Sciences (National Academy of Sciences, 2002). The Academy found that the CAFE programme had clearly contributed to increased fuel economy, and that if fuel economy had not improved, fuel consumption would be about 2.8 million barrels above what it was at the time of the report. Further findings were that the fuel economy improvements had been achieved without any loss of vehicle performance as measured by acceleration times. The Academy concluded that raising CAFE standards further would undoubtedly reduce future fuel consumption, but that other policies could achieve the same result at lesser cost. These policies might include tradable credits for fuel economy improvements, feebates, higher fuel taxes, standards based on vehicle attributes (e.g. weight, size or payload), or a combination of some of these measures.

12. The Republic of Korea initially published fuel economy targets, which were non-binding. However, in 2005 the Republic of Korea adopted its Average Fuel Economy programme, which is similar to the United States' CAFE system. In the Republic of Korea, the standards apply to all domestic vehicle manufacturers which sell more than 1,000 passenger vehicles annually.

13. Japan has also been an early adopter of fuel economy standards. These standards were initially introduced as non-binding targets, with targets set in 1978 and then strengthened in 1990. In 1998, the Japanese government enacted its Energy Conservation Law, which makes vehicle standards binding. The Japanese system is called the "Top Runner" programme, whereby standards are determined based on the performance of the vehicles on the national market with the best fuel efficiency. The most efficient model currently on the market is used to set the standard to be attained by all manufacturers within a specified period. 2010 Standards were established in 1999, and improved 2015 Standards were promulgated in 2010. These standards now apply to both light duty and heavy duty vehicles.

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<sup>1</sup> The CAFE standards for passenger vehicles were temporarily relaxed in 1986-88 to 26.0 miles per gallon and in 1989 to 26.5 miles per gallon. It was restored to 27.5 miles per gallon in model year 1990.

Table 1  
**2015 Standards for the “Top Runner” programme in Japan**

Category	Vehicle weight (kg)	Target standard value (km/L)
1	Less than 600	22.5
2	601-740	21.8
3	741-855	21.0
4	856-970	20.8
5	971-1080	20.5
6	1081-1195	18.7
7	1196-1310	17.2
8	1311-1420	15.8
9	1421-1530	14.4
10	1531-1650	13.2
11	1651-1760	12.2
12	1761-1870	11.1
13	1871-1990	10.2
14	1991-2100	9.4
15	2101-2270	8.7
16	More than 2270	7.4

14. Studies on the Japanese model show that the system has received widespread public acceptance and that no producer has been advertised as non-compliant. Statistical information shows that the required increase of 22.8 per cent in the fuel consumption for passenger vehicles by the year 2010 was reached as early as 2005. Manufacturers reported that while they would have eventually adopted new technological developments to improve fuel efficiency, the existence of the “Top Runner” programme led them to introduce these measures several years before this would otherwise have occurred (Kimura, 2010; Automobile Fuel Efficiency Standards Subcommittee, 2007). Several reasons have been offered for the success of the Japanese programme (Nordqvist, 2006):

- Primary stakeholders (those subjected to the regulation) are themselves involved in setting targets. This means that awareness and commitment levels are high. It also ensures that targets are feasible and not overly ambitious.
- Industrial stakeholders in Japan are used to and at ease with close collaboration with national regulators. In other countries, where leaner government and individual stakeholder integrity are highly prized, a similar scheme layout may be problematic due to perceptions of regulatory intrusiveness.
- The instrument is designed to be flexible, dynamic and adaptive, allowing failures and shortcomings to be addressed and remedied.
- Energy-efficiency in products is usually perceived as a competitive advantage, meaning that no manufacturer has a stake in the opposition of the scheme’s objectives.

- The “Top Runner” approach turns the free-rider effect into an advantage: actors who perform well already at the start of a cycle become free-riders in the sense that they need to invest less additional effort during the compliance period that follows.
- Name-and-shame sanctions are effective deterrents in Japan.

15. China has also mandated fuel efficiency standards for passenger cars, and has progressively made the requirements more stringent (Wang and others, 2010). The current Phase 3 standards are designed to take effect in 2012. The standards are classified into 16 separate categories based on the weight of the vehicle. Different standards are applied to manual and automatic transmission vehicles. These standards are maximum limits for each vehicle type, not the average for all vehicle categories, as in the United States. The Chinese law requires manufacturers to have each vehicle type certified that it complies with the prescribed standard before it can be marketed.

16. Voluntary systems to improve vehicle fuel economy also exist in the European Union and Australia, but do not yet have the force of law.

## **B. Fuel consumption labelling for motor vehicles**

17. Fuel consumption labelling requires the compulsory disclosure of the fuel efficiency of each new vehicle by means of a label attached to the vehicle in the showroom. Compulsory labelling systems exist in many developed and developing countries, including the United States, the European Union, Australia, Japan, the Republic of Korea, and Singapore. In Singapore, for example, the law is contained in the Environmental Protection and Management (Energy Conservation) Regulations, made pursuant to the Environmental Protection and Management Act 2008. The major justification of this law is to educate the public in the importance of motor vehicle fuel efficiency by bringing this issue to the attention of potential vehicle purchasers. The law enables customers to make an informed choice between various competing products, provides an incentive to manufacturers to design more energy efficient vehicles, and promotes energy conservation in general.

18. Mandatory systems of fuel consumption labelling have been criticised on the basis that the fuel consumption figures achieved under test conditions could never be achieved under road conditions, and that this would lead to unfair criticism of vehicle manufacturers. While it is true that road conditions significantly increase fuel consumption over test conditions, the figure or figures displayed on the label can be modified to take account of this fact. This occurs in the United States where, under rules produced by the Department of Transportation pursuant to the Motor Vehicle Information and Cost Savings Act, two fuel consumption figures are displayed, one for fuel consumption in city conditions, and one for fuel consumption in highway conditions. These figures are calculated by discounting the figure for city driving by 10 per cent from the figure obtained during test conditions, and by discounting the figure for highway driving by 22 per cent. Any overall fuel consumption figure displayed must be calculated using the discounted figures above and on the assumption that the vehicle will be driven 55 per cent under city conditions and 45 per cent under highway conditions.

19. The law implementing mandatory fuel consumption labelling must prescribe the exact form of the label. As the labelling system is designed as a consumer protection and information measure,

it is essential that the label be carefully designed so as to disclose the relevant amount of information in a manner that is easy to understand. The label must be neither too vague nor too complex and difficult to understand. In some countries (e.g., the United States) the label consists simply of fuel consumption information. In the majority of countries, the label uses a star-rating system, grading the fuel efficiency of the vehicle from 1 star or tick (the least fuel efficient) to 5 or 6 stars or ticks (the most fuel efficient). There is no consistency between the different forms of the label: some give additional information, such as the estimated annual fuel cost for the vehicle, others indicate the range of fuel consumption figures obtained by passenger vehicles and light trucks generally for comparative purposes.

### **C. Compulsory fuel information in model-specific vehicle advertising**

20. The proposal for legislation requiring that specified fuel efficiency information be included in all model-specific legislation has its origin in Australia. The proposal for such legislation was recommended for adoption by the Economically Sustainable Development Transport Working Group, which stated that all advertising in relation to the sale of new vehicles should make precise reference to the fuel consumption figures. It was previously reported by the Australian Department of Primary Industries and Energy that only about 10 per cent of model-specific motor vehicle advertisements contain statements about fuel consumption, and that many of these statements are misleading. The proposal was justified on the basis that it would raise the public awareness of fuel consumption as a factor in the purchase decision, that it would put fuel consumption information before the prospective buyer at an early stage in the purchasing process, and that it ranks fuel efficiency alongside other attributes in the overall image of desirability of ownership delivered by the advertisement. This reform has not yet been enacted by the Australian government.

21. The first legislation to adopt a legislative provision of this nature was the Republic of Korea. The Rational Energy Utilization Act article 18(4) states that if a manufacturer, importer or distributor of specified products makes any advertisement of the efficiency of the product, he or she must include the energy consumption efficiency or quantity consumed and the method of use in the contents of the advertisement.

### **D. A compulsory system of periodic inspections for motor vehicles**

22. Many countries now require by legislation periodic inspections of all private vehicles in order to achieve registration, but the requirements that each vehicle must satisfy in order to pass the test vary widely from one jurisdiction to another. Periodic vehicle inspections were originally designed exclusively as a safety measure, as the requirements were limited to defects that might lead to increased risk of accidents.

23. In many jurisdictions periodic inspections are still limited to safety issues, although in some jurisdictions, such as Singapore, the inspection includes environmental factors (Lin Heng, 2008). Energy efficiency of vehicles can be significantly improved if the inspection includes the need for proper tuning of the vehicle. Poorly tuned vehicles use significantly more fuel than well-tuned vehicles. This is the simplest of all possible fuel efficiency measures as the costs associated with the tuning are in most cases quite minor. From an implementation perspective, in jurisdictions with



existing periodic inspections, the proposed reform could be implemented by a small regulatory amendment.

### **E. Compulsory retiring of motor vehicles after a fixed period of time**

24. In order to promote fuel economy, it is important to remove older, less efficient vehicles from the road as soon as reasonably possible. A youthful vehicle fleet ensures that at all times vehicles are up-to-date with modern technological developments promoting fuel efficiency, safety and pollution avoidance. It also ensures that the time lag between the implementation of fuel economy improvements and their impact on fuel saving is reduced to a minimum. One way to achieve this would be for legislation to require all passenger vehicles to be compulsorily retired at a designated time after initial registration. Alternatively the same result can be achieved by the use of vehicle inspection tests. It is axiomatic that the stricter the system of compulsory periodic vehicle inspections, the earlier it will be that owners will choose to retire older vehicles. The strictest system occurs in Japan, where vehicle inspections occur every two years after initial inspection and the cost can range up to 200,000 Yen. The result is that most vehicles are retired after four or five years and with comparatively low mileage.

25. The major objection to proposals of this nature is that they unfairly penalize the poorer section of the community, who may be unable to afford to replace their aging vehicles. This objection can be overcome by simultaneously introducing a “cash for clunkers” (or “accelerated vehicle recovery”) programme whereby vehicle owners are given a government cash grant when retiring a vehicle over a prescribed age. A programme of this nature has been adopted in a number of both developed and developing countries, including China, Egypt, Germany, Italy, the Republic of Korea, Spain, the United Kingdom, and the United States (Peterson Institute, 2009). In many cases the programme is temporary in nature, and the accompanying regulations are stated to expire at a certain date.

26. In Japan, for example, until September 2010 consumers were eligible for a 250,000 Yen subsidy if they turned in a vehicle that was at least 13 years old. During 2009, Germany had a programme whereby consumers who scrapped a vehicle at least nine years old received a 2,500 Euro subsidy. The Egypt Vehicle Scrapping and Recycling Programme of Activities, which supports Traffic Law number 121 (2008), provides that vehicle owners may voluntarily surrender their vehicle for scrapping and recycling in return for a specified reduction of up to 25,000 EGP towards the price of a new vehicle.

27. A “cash for clunkers” programme does not necessarily have to co-exist with a system of compulsory retirement of motor vehicles of a fixed age. Such a programme is helpful at any time in reducing the age of a country’s vehicle fleet and by doing so improving the overall average fuel efficiency of the registered vehicles.

### **F. Restricting the import of used motor vehicles**

28. Many developing countries accept the importation of used vehicles from developed countries. There is a substantial international trade in such vehicles from some industrialized

countries whose vehicles are viewed as attractive as a result of the national compulsory vehicle inspections law and/or strict compulsory vehicle retirement policy.

29. Left legally uncontrolled, there is a substantial danger that developed countries will simply export their environmental problems and inefficient fuel consumption caused by motor vehicles to developing countries. While it is understandable that some developing countries may wish to import used vehicles in light of the expense of importing new vehicles (especially as few developing countries possess a substantial vehicle manufacturing industry), it is important that developing countries do not simply become dumping grounds for inefficient vehicles from developed countries. This problem can be resolved by the introduction of national legislation in imposing controls on or prohibiting the import of used vehicles. In some countries this has already been achieved. In Argentina, Brazil and Colombia, for example, the importing of used vehicles is prohibited; in Indonesia, Singapore and Sri Lanka it is illegal to import used cars that are over three years old, while in Egypt it is illegal to import used cars that are over one year old.<sup>2</sup> The United Nations Commission on Sustainable Development may wish to consider options for harmonizing regulations pertaining to the trade in used vehicles.

#### **G. Demand management programmes to reduce the need and amount of private vehicle use**

30. A wide range of laws has been adopted at local, state and national government level in both developed and developing countries that are designed to reduce fuel consumption by reducing the demand for private vehicle use.

#### **Road space rationing**

31. There are numerous different systems of road space rationing in existence in both developed and developing countries, with many of them introduced at local government level and applicable specifically to large cities. In many cases these systems are aimed primarily at reducing urban air pollution, but will usually also reduce fuel consumption.

32. Bogota, Columbia, has pioneered the “Pico y Placa” (peak and license plate system). This system operates during peak hours, defined as from 6-8 am towards work, from 7-8 am towards schools and universities, and from 6-8pm towards home. During these periods it is prohibited for certain vehicles to circulate on the roads. The extent of the prohibition is determined by the last digit of the number plate of the vehicle. Under the current system, vehicles with the following last digits are prohibited on the following days: Mondays, 1, 2, 3 and 4; Tuesdays, 5, 6, 7 and 8; Wednesdays, 9,0,1 and 2; Thursdays, 3,4,5 and 6; and Fridays, 7,8,9 and 0. Exceptions are made for emergency vehicles, diplomatic vehicles and operative vehicles of public utility companies. The effect is that each vehicle is prohibited on two days each week. There have been multiple benefits for energy conservation: reduction of duration of commuting time, increase in traffic velocity and increase in the use of public and alternative means of transportation.<sup>3</sup>

<sup>2</sup>Available from [www.directimported.com.au/import-regulations.php](http://www.directimported.com.au/import-regulations.php); and Available from [www.lta.gov.sg/motoring\\_matters/motoring\\_vo\\_tax\\_pte.htm](http://www.lta.gov.sg/motoring_matters/motoring_vo_tax_pte.htm).

<sup>3</sup> Available from <http://ecoplan.org/votebogota2000/general/pico.htm>.

33. Some municipalities have adopted No Driving Days. An illustration is Mexico City, where the law prohibits driving one day during the week (weekends excepted) and two days during serious pollution events. This scheme was introduced in November 1989 as a temporary measure during the winter temperature inversion season, but was then made permanent. Unfortunately, studies have shown that many members of the public have sought to counter the effect of the programme by buying an additional vehicle so that they would always be able to drive to work, and that there are now more vehicles on the road than there would have been if the programme had not been introduced (Godard, 1997). A similar although not identical scheme operates in Sao Paulo, Brazil.

### **Congestion charges**

34. The first major city to adopt congestion charges was Singapore in 1976. The original system was a paper-based system whereby drivers purchased daily licenses for the right to enter the central zone during peak traffic times. Studies showed that traffic entering the zone dropped by 44 per cent after implementation of the scheme, and that travel speeds increased from 11 to 21 miles per hour (Environment Defense Fund, 2006; Seik, 1997). The system was modified in 1988 with the introduction of electronic road pricing. The peak fee for passenger vehicles was reduced to S\$4.00, but this fee is paid for each entry into the congestion zone rather than representing a daily fee for unlimited entries.

35. London and Stockholm also have congestion charge schemes. The London scheme was introduced in 2003 to reduce traffic and air pollution.<sup>4</sup> The scheme has proved to be acceptable to the public, and the charge has since been increased from GBP 5.00 to GBP 8.00, with the area subject to the controls being doubled in size.

### **High vehicle occupancy**

36. A common measure on major highways in large cities around the world are High Vehicle Occupancy (HOV) lanes, which are typically reserved for public transport, taxis and private vehicles with a specified minimum number of passengers (usually 2 or 3). This system acts as a fuel conservation measure in that it encourages car pooling and discourages individual travel in urban areas. The system can be made even more effective from an energy efficiency perspective by allowing energy efficient vehicles and vehicles using hybrid propulsion or alternative fuels to use HOV lanes even if they do not contain the minimum number of occupants. A measure of this nature was adopted in the United States in August 2008 pursuant to federal regulations made under the Federal-Aid Highway Programme. The Federal Government has modified Title 23 of the United States Code so as to provide expanded options for States operating HOV facilities. States are given the option to allow some vehicles, including hybrid and energy efficient vehicles, to travel exempt from the minimum vehicle occupancy requirements. The issue is for each State to resolve, and if a State decides to act in favor of increased exemptions of this nature it must comply with specified federal administrative requirements.<sup>5</sup>

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<sup>4</sup> See Greater London (Central Zone) Congestion Charging Order 2004, made pursuant to the Greater London Authority Act 1999(UK) and the Transport Act 2000 (UK).

<sup>5</sup> Specified in 23 USC 166(b).

### **Control of the vehicle fleet**

37. Due to increasing concerns about road congestion and to ensure sustainable economic growth, in 1990 Singapore introduced a Vehicle Quota System, pursuant to which anyone who intends to purchase a car must first acquire a Certificate of Entitlement (COE) (Fwa, 2009). The goal is to limit the annual increase in passenger vehicles to 3 per cent. The government allocates the appropriate number of certificates each month through a tendering process. COEs are obtained by potential purchasers engaging in an open bidding system for the right to register a vehicle. If the government allocates 1000 vehicles per month, for example, the highest 1000 bidders that month are successful and have to pay the lowest bid in order to acquire a COE. Each COE expires after 10 years. If the owner wishes to retain the COE after that date, he or she must renew the COE by paying the prevailing COE price. The city of Beijing, China, has also introduced a system of auctioning licenses to register private vehicle purchases starting from 2011.

### **Parking, bridge and road toll policies**

38. The availability and price of parking spaces in urban areas have a significant impact on the choice made by individual citizens on driving private vehicles or using public transport. Any increase in the costs and decrease in the availability of parking places is likely to lead to reduced private vehicle use. Such a change would also have other beneficial environmental effects, including less urban atmospheric pollution, reduced congestion and a corresponding reduction in fuel consumption. Parking policies can thus complement and reinforce the effectiveness of the other demand management programmes discussed in this section of the paper.

39. Parking policies are invariably a matter for local government control. The most usual form of charge is a flat rate per hour during business and/or shopping times, and either free or reduced charge parking at all other times. The obvious change in policy is to increase parking charges in high density areas. Other possible alternatives are to introduce variable time-of-day charges, so as to impose higher costs at times of maximum congestion, and to restructure the costs of parking so as to increase the hourly parking charge for longer stays. In many cities, hourly parking charges are reduced for longer stays or are sometimes free after five or six hours for the remainder of the 24 hour period. Imposing higher charges for parking beyond (say) three hours would have the effect of discouraging people driving to work on a regular basis, but would recognize the need for short visits.

40. Bridge or road toll policies can also play a part in controlling traffic congestion and, as a consequence, vehicle fuel consumption. Time-of-day charges can be varied so as to encourage drivers to use the facilities outside peak hours. An illustration of such a measure are the Sydney Harbour Bridge and Tunnel, which impose different prices for different hours of the day, with the price charged at the time being indicated at the entrance to the bridge and tunnel.

## IV. FISCAL MEASURES

Fiscal measures have been used primarily in developed countries where the more sophisticated nature of the tax regime and the breadth of the tax base permit a variety of different possible responses to improving energy efficiency in motor vehicles.

### A. Differential sales tax/goods and services tax/value-added tax

41. The majority of nations impose indirect taxes in the form of either a sales tax, a goods and services tax (GST) or a value-added tax (VAT).<sup>6</sup> This tax legislation could be amended to introduce either a skewed sales tax/GST/VAT where higher charges are imposed on the purchase of motor vehicles with a high rate of fuel consumption; or a sales tax/GST/VAT increase and rebate programme where higher rates of tax for inefficient vehicles are combined with tax rebates for relatively efficient vehicles.

### Skewed sales tax/ goods and services tax/value-added tax

42. The essential feature of a skewed sales tax system is that it imposes higher charges on vehicles with low levels of fuel efficiency. The tax may be levied on the manufacturer or the consumer (at the point of wholesale or retail sale). The penalty may take the form of a lump sum payment or a higher tax rate imposed on the value of the motor vehicle.

43. Governments could model the skewed tax on the system currently in place in the United States, where a supplementary lump sum tax is imposed on manufacturers on the sale of new passenger motor vehicles that do not meet prescribed standards of energy efficiency. This system was devised in the United States and has been in operation since 1978. It is commonly referred to as the “gas guzzler tax” (United States, 2009).

44. Emergency vehicles such as ambulances and police cars are exempt from the tax. The legislation defines the terms “automobile”, “fuel economy”, “model type”, “model year” and “manufacturer”, and also explains how fuel economy is to be measured.

45. The imposition of such a system would raise additional tax revenue. The reform could also be made revenue-neutral and could provide additional incentive for the purchase of fuel-efficient vehicles if the system was modified and expanded so as to give a lump sum reduction for the sale of each vehicle that meets or exceeds the specified fuel consumption standards. The introduction of a sliding scale would result in a significant price reduction for the most fuel-efficient vehicles.

46. A similar system exists in Canada, pursuant to the Excise Tax (Green Levy) on fuel inefficient vehicles. Vehicles that have a weighted average fuel consumption of 13 or more litres per 100 km are subject to tax as follows: between 13-14 litres per 100 km: \$1,000; between 14-15 litres per 100 km: \$2,000; between 15-16 litres per 100 km: \$3,000; 16 or more litres: \$4,000.<sup>7</sup>

<sup>6</sup> Occasionally these taxes are combined. For example, in Canada the Federal Government levies a GST while the Provinces (apart from Alberta) impose a sales tax.

<sup>7</sup> Available from <http://www.cra-arc.gc.ca/gncy/bdgt/2007/xcs-eng.html>.

Table 2  
**Schedule of imposing supplementary federal tax in the United States**

<b>If the fuel economy of the model type in which the automobile falls is:</b>	<b>The tax is:</b>
At least 22.5 miles per gallon (mpg)	\$0
At least 21.5 but less than 22.5 mpg	\$1,000
At least 20.5 but less than 21.5 mpg	\$1,300
At least 19.5 but less than 20.5 mpg	\$1,700
At least 18.5 but less than 19.5 mpg	\$2,100
At least 17.5 but less than 18.5 mpg	\$2,600
At least 16.5 but less than 17.5 mpg	\$3,000
At least 15.5 but less than 16.5 mpg	\$3,700
At least 14.5 but less than 15.5 mpg	\$4,500
At least 13.5 but less than 14.5 mpg	\$5,400
At least 12.5 but less than 13.5 mpg	\$6,400
Less than 12.5 mpg	\$7,700

Source: United States (2009). United States Code 26: section 4064.

47. Rather than imposing lump sum payments, governments could impose differential sales tax/GST/VAT rates based on motor vehicle fuel efficiency. Under this proposal, the existing tax rates could be modified so as to increase the rate of tax payable in respect of fuel-inefficient vehicles and (possibly) to reduce the rate of tax payable for fuel-efficient vehicles. This approach is more consistent with the current sales tax regime in most countries, which specifies rates rather than lump sums.

### **A feebate system**

48. A second option is to combine the imposition of higher sales tax/GST/VAT for inefficient vehicles with tax rebates for relatively efficient vehicles. Such a system would specify a sliding scale of charges for vehicles of lower efficiency (gas guzzlers) and incorporate a sliding scale of rebates for vehicles of higher efficiency (gas sippers). The tax (or rebate) would be paid (or received) by the consumer at the point of retail sale. This tax or rebate would take the form of a lump sum payment. This option is commonly referred to as “feebates”. In 1990, the government of Ontario, Canada introduced a system of this nature, known as the Tax for Fuel Conservation, as part of its Retail Sales Tax Act (Ontario, 1990). The additional tax ranges between \$75 and \$4,400 for vehicles with fuel consumption ratings in excess of nine litres per 100 km. A \$100 tax rebate is given to purchasers of vehicles with fuel consumption ratings below six litres per 100 km. SUVs are not eligible for this tax rebate.

## B. Skewing motor vehicle registration charges towards higher charges on inefficient vehicles

49. Another tax policy option is to require the owners of cars with a high rate of fuel consumption to pay increased annual motor vehicle registration charges. Most jurisdictions have legislation imposing differing registration fees. Currently, registration charges are normally based on a number of factors, such as the type of vehicle to be registered, the weight of the vehicle to be registered, the number of cylinders of the motor vehicle and whether the vehicle is to be used for private or commercial purposes.

50. An illustration is Australia, where the six States and two Territories apply separate registration rules. In South Australia, for example, the charges over a 12 months registration period for private and small commercial motor vehicles depend on the number of cylinders. Effective in July 2009, for vehicles with four cylinders or less the charge is \$A99; for five or six cylinders, \$A201; and for seven or more cylinders, \$A292. Large commercial vehicles exceeding 1,000 kg pay between \$A95 and \$A280, depending on the number of cylinders; those exceeding 1,500 kg pay \$A356 (South Australia, 2009). Conversely, in New South Wales the charges are based on the weight and primary use of the vehicle.

Table 3

### Weight differentiated Tax application for vehicles in New South Wales of Australia (effective in February 2010)

Weight of vehicle		Private use	Business use
Exceeding kg	Not exceeding kg	\$A	\$A
....	975	231	341
976	1,154	254	375
1,155	1,504	285	429
1,505	2,504	406	619

Source: New South Wales (2010): Motor Vehicle Taxation Act 1988, section 5 (as amended).

51. In Singapore the national vehicle registration fee is reduced under the terms of the Green Vehicle Rebate. Pursuant to this law, new cars and imported used cars using electric, hybrid petrol-electric, CNG or petrol-CNG fuels between October 2006 and December 2011 are eligible for a rebate of 40 per cent on the tax otherwise payable.<sup>8</sup>

## C. Increasing petroleum excise tax

52. Petroleum excise tax is levied directly on the consumers of petrol at the point of sale on a cents-per-litre basis. Such a tax is consistent with the “user pays” approach and provides an incentive to consumers to reduce the use of petrol and to purchase fuel-efficient cars. In the

<sup>8</sup> Available from [www.lta.gov.sg/motoring\\_matters/motoring\\_vo\\_tax\\_pte.htm](http://www.lta.gov.sg/motoring_matters/motoring_vo_tax_pte.htm).

United States, as far back as 1991 the Study on Potential to Improve Fuel Economy of Motor Passenger Vehicles suggested that motor vehicle fuel efficiency could be significantly improved by eliminating or reducing sales tax on cars and raising petroleum excise tax to compensate for the lost revenue (Nelson English, Loxton & Andrews Pty Ltd, 1991). The econometric model used in this study predicted that an increase of 50 cents per litre in 1988 prices would produce an overall saving in fuel slightly in excess of one third in 2000. This study was not acted upon in the United States.

53. In December 2009, the Netherlands government announced that during 2010 it would introduce the Road Pricing Act, pursuant to which all fixed car taxes would be replaced by a system of kilometer pricing. This system uses two different rates: a base tax rate and a surcharge rate for periods of heavy congestion. The base tariff varies according to the type of car and is designed to reflect the environmental characteristics of the vehicle. The rush hour tariff is a fixed sum for all road users. The new law is designed not just to discourage excessive driving, but also to reduce road congestion on a permanent basis.<sup>9</sup>

#### **D. Income tax incentives**

54. Income tax is normally imposed under separate legislation. It is calculated by applying the appropriate tax rate to the taxable income and then subtracting any rebates or credits. Taxable income is determined by subtracting allowable deductions from a taxpayer's assessable income.

55. Governments could offer income tax rebates or credits on the purchase of motor vehicles that meet specified fuel economy standards. This concept is similar to the various incentive programmes in the United States that are designed to stimulate the purchase of alternative-fuel vehicles and the conversion of petroleum-based vehicles to alternative fuels. In the United States, for example, the American Recovery and Reinvestment Act of 2009 provides a tax credit for qualified plug-in electric drive vehicles purchased from January 2010. The minimum amount of the credit is between US\$2,500 and US\$7,500, depending on the type of vehicle. Vehicles must be newly purchased, have a gross vehicle weight rating of less than 14,000 lbs, and use a battery with at least four kilowatt hours rechargeable from an external source of electricity.

56. Some American States have also taken legislative action in this field. In Colorado, the legislature enacted HB09-1331 in April 2009 revising the State's income tax credit system for energy efficient vehicles. For tax years commencing July 2000, but prior to January 2016, any person is allowed to claim a tax credit for any alternative fuel or hybrid-powered vehicle. The tax credit is limited to US\$6,000, except for converted plug-ins. For tax years between 2010 and 2016, vehicles are divided into categories based on vehicle class and environmental performance that determines the percentage of the incremental cost covered by the tax credit.

57. In 1990 California enacted a legislation which was providing an income tax credit to individuals and businesses that either purchased new alternative fuel vehicles, or retrofitted their standard vehicles using an alternative-fuel conversion kit certified by the California Air Resources Board (CARB). Under this low emission vehicle (LEV) credit, a taxpayer could receive a tax credit at 55 per cent of the incremental cost (that is, the cost above the purchase price of an equivalent

<sup>9</sup> Available from [http://english.verkeerenwaterstaat.nl/english/topics/mobility\\_and\\_accessibility/road\\_p...](http://english.verkeerenwaterstaat.nl/english/topics/mobility_and_accessibility/road_p...)



standard fuel vehicle) associated with purchasing a new vehicle that meets specified emission standards or converting an existing vehicle so as to meet the same standards. The maximum credit was US\$1,000 for vehicles under 5,750 pounds and US\$3,500 for vehicles over 5,750 pounds.<sup>10</sup>

### **E. Fringe benefits tax incentives**

58. Fringe benefits tax (FBT) is currently imposed in the United Kingdom and Australia, and has been proposed for adoption in Canada (Black, 2008; David Suzuki Foundation, 2005). FBT is a separate tax paid by employers, regardless of the employees' liability for income tax. In Australia, for example, the relevant legislation is the Fringe Benefits Tax Assessment Act 1986.<sup>11</sup> Liability for tax is assessed on an annual basis, but is paid in quarterly installments. Fringe benefits tax is payable on the "tax inclusive" value of benefits, that is, the "grossed up" taxable value of the benefits. The grossed up taxable value of fringe benefits is calculated by using the formula:  $\text{Aggregate FBT Amount} \times 1/(1-\text{FBT rate})$ , where the "aggregate FBT amount" means the aggregate FBT amount in relation to that employer for the year of tax, and the FBT rate is the rate applicable for the year of tax. The tax rate applicable to the total taxable value of fringe benefits is currently 46.5 per cent.

59. The fringe benefits legislation sets out particular rules for assessing the value of car fringe benefits. As a general rule, liability for FBT will arise where an employee has the private use of an employer's car. The car may be leased or owned by the employer. Exemptions from FBT normally apply to certain types of commercial vehicles where the only private use of the vehicles is for work-related travel.

60. Governments could seek to encourage the purchase or lease by businesses of more fuel-efficient motor vehicles by providing FBT incentives, in the form of tax deductions or rebates. Such deductions or rebates would reduce the cost for businesses of providing vehicles to employees. In a similar fashion to the applicable for sales tax/GST/VAT, a skewed system could be employed whereby FBT surcharges on the provision of energy-inefficient cars to employees would coexist with FBT rebates for fuel-efficient vehicles.

### **F. Grants, low interest loans or loan guarantees to businesses or state or territory agencies for the lease or purchase of fuel-efficient vehicles**

61. Another option to encourage the use of more fuel-efficient vehicles by businesses is government subsidisation of the purchase or lease of fuel-efficient vehicles by grants, low-interest loans or loan guarantees. In addition, national governments could provide assistance to local and/or regional government agencies for the lease or purchase of fuel-efficient vehicles.

62. In many jurisdictions each level of government currently operates a fleet of motor vehicles, comprised of various types of vehicles. Many of these vehicles are large and energy-inefficient. In South Australia as of September 2007, the vehicle fleet consisted of 7,470 vehicles, of which only 1,568 were classed as small or medium cars and thus energy-efficient. Although fuel efficiency

<sup>10</sup> The Californian regulation has evolved and changed several times since 1990: see [http://en.wikipedia.org/wiki/California\\_AB\\_1493](http://en.wikipedia.org/wiki/California_AB_1493).

<sup>11</sup> The relevant legislation in the United Kingdom is the Income Tax (Earnings and Pensions) Act 2003, ss 120-172.

may be a factor that governments take into account when determining the composition of their vehicle fleet, it is only one of many factors. The national government could influence the local and regional governments' vehicle mix by making the selection of fuel-efficient vehicles more economically attractive. This could be achieved by providing funding for the purchase and/or the operating costs of fuel-efficient vehicles.

### **G. Grants to purchasers of fuel efficient vehicles**

China currently levies a reduced sales tax of 7.5 per cent on small-engine vehicles (vehicles with engines smaller than 1.6 litres). The normal rate of tax is 10 per cent. The Chinese government announced in June 2010 that it intends to further subsidise purchases of energy efficient vehicles with a 3,000 Yuan (US\$ 460) grant. Buyers of hybrid and electric vehicles will be eligible for subsidies of up to 50,000 Yuan (US\$ 8,930) and 60,000 Yuan (US\$ 9,100) respectively in cities taking part in the pilot programme (Shanghai, Changchun, Hangzhou, Hefei and Shenzhen). China has a goal for the future development of the new-energy auto industry. It aims to have more than 500,000 battery electric vehicles (BEV) and plug-in hybrid electric vehicle (PHEV) on the road by 2015 and five million by 2020.<sup>12</sup> The incentive policies are bound to spur on a rapid growth and large-scale application of related auto parts technology.

On 7 January 2011, the Ministry of Industry and Information Technology (MIIT) said in a statement that the government had paid 1.81 billion Yuan (USD 274 million) in subsidies to promote energy-saving vehicles in the six-month period of June to November 2010. MIIT stated that 604,100 vehicles buyers have received subsidies by November 2010, since China began the subsidy programme for purchases of energy-saving vehicles in June 2010. MIIT also announced it had established a working group with the Ministry of Finance and the National Development and Reform Commission to enhance supervision of the subsidy programme and to promote sound and sustainable development of China's auto industry.<sup>13</sup>

### **H. Company cars**

63. Cars owned and operated by private and public corporations represent a sizeable proportion of private vehicles on the road in all developed countries and in some developing countries. The national company tax legislation in most countries permits the full costs of registering and operating vehicles to be set off against liability for company tax as a tax deduction. The cost of the vehicle itself is usually set off against company tax by means of a depreciation allowance. This traditional approach of taxation laws provides no incentives for companies to reduce fuel consumption by purchasing smaller, more fuel efficient vehicles. This problem could be easily solved by amending national company tax regimes so as to reduce or exclude from the allowable tax deductions company vehicles over a certain engine capacity or vehicles with a fuel consumption rating higher than a designated amount.

<sup>12</sup> Available from [http://www.chinadaily.com.cn/business/2010-12/10/content\\_11683025.htm](http://www.chinadaily.com.cn/business/2010-12/10/content_11683025.htm). Accessed 31 January 2011.

<sup>13</sup> Available from [http://biz.zeenews.com/news/news\\_content.aspx?newscatid=5&newsid=19322](http://biz.zeenews.com/news/news_content.aspx?newscatid=5&newsid=19322). Accessed 1 February 2011.

## V. CONCLUSIONS AND RECOMMENDATIONS

64. There is no one-size-fits-all-approach to regulate fuel efficiency in motor vehicles. However, most of the regulatory measures discussed in this paper could co-exist together. Fuel consumption labelling and advertising measures can be justified as consumer information measures designed to educate the public as to the environmental significance and importance of fuel efficiency and conservation. Fuel economy standards go one stage further by requiring specified technological energy efficiency improvements to be incorporated into vehicles and go hand-in-hand with consumer information measures. Clearly, however, fuel economy standards along the lines discussed earlier are only appropriate for introduction in countries that have a substantial vehicle manufacturing industry.

65. The remaining regulatory measures focus on modernising the private vehicle fleet and introducing demand management programmes designed to minimise fuel consumption. While the nature of the regulatory measures introduced will depend on the level of economic development of each country and on the state of the industry in that country, there is scope for useful reforms in all countries.

66. As for the demand management programmes, these will usually require local government controls and will be highly dependent on such local factors as the availability of public transport as an effective alternative to private cars in the city, the density of traffic at peak periods and the number and quality of local roadways.

67. The following discussion will briefly examine the advantages and disadvantages of each option of the financial mechanisms considered in this article and make recommendations to member states for possible improvement. However, it must be stressed that a full understanding of the distributional effects of the combination of options proposed, particularly in comparison to the outcomes of other possible combinations of measures, will only be achieved by appropriate econometric modelling. Such empirical research is beyond the scope of this paper.

68. It is recommended that member states discard changes to annual motor registration charges or fringe benefits tax incentives as possible options. One advantage of changing the FBT regime is that the negative equity effects for low income earners are minimal, as the tax operates directly upon companies and not individuals. However, the costs of FBT are small relative to other costs of vehicle operation, and very large additional imposts (or incentives) would be required to have any impact on vehicle purchasing decisions (perhaps in the order of three times the existing charges). This option is rejected for its limited effectiveness in achieving fuel efficiency improvements (unless the changes are so large as to be unacceptable to business).

69. As with changes to the FBT, very large additional changes to annual registration charges would be required to have any impact on vehicle purchasing decisions. A skewed registration system also raises equity issues. Because of the tendency for lower income groups to own a greater proportion of older, higher fuel consumption vehicles, those who can least afford higher charges may pay more in registration fees. This regressive effect could be solved or minimised by adopting a system of “grandfathering”, whereby the skewed registration scheme would apply only to new cars purchased after a specified date and would exempt all existing vehicles. However, such a

system would have two disadvantages: firstly, it would disadvantage owners of existing low fuel consumption cars as compared to owners of new low fuel consumption cars; and secondly, it would encourage consumers to keep older, less efficient cars on the road to avoid paying higher registration charges. This would delay the permeation of fuel efficiency improvements. If a system of “grandfathering” was not adopted, the improvement in fuel economy would be expedited, but at equity costs for low income groups. Accordingly, it is recommended that member states discard this option as it has minimal effectiveness in achieving fuel efficiency goals whilst involving regressive distributional effects.

70. Sales taxes/GST/VAT and feebates offer a number of advantages. These taxes/incentives directly affect the purchasing decisions of consumers by altering the price of vehicles. Sales taxes/GST/VAT and feebates are flexible, in that they may be applied either across-the-board, or to specific classes of vehicle. Negative equity effects are minimized because low income earners tend not to buy new cars. Fuel efficiency improvements are achievable through flow-on effects to used car markets, with used high-consumption vehicles becoming more expensive relative to second-hand low-consumption vehicles. Revenue outcomes are easily controlled by the government. Sales taxes/GST/VAT and feebates have the disadvantage of lock-in effects, where owners of high-consumption vehicles delay the purchase of new vehicles, thereby slowing the permeation of fuel economy improvements. Sales taxes/GST/VAT or feebates should be given priority as they are direct and powerful tools for achieving fuel efficiency goals with minimal equity effects for low income earners.

71. The proposed sales tax/GST/VAT changes should exist concurrently with increases to the petroleum excise taxes. Fuel taxes are an up-front and highly visible charge on the use of fuel. By directly increasing the price of fuel, such taxes are a powerful and effective tool for achieving improvement in fuel economy by reducing travel and fuel use, and stimulating demand for fuel-efficient vehicles. There may also be positive environmental side effects in the form of reduced congestion and noise in urban areas. Increases to petroleum excise taxes may be used to compensate for any revenue shortfall that would be caused to the government by the reduction of sales tax/GST/VAT for a significant proportion of motor vehicles. Such increases can also be justified as being consistent with the “user-pays” system for maintenance of the highway system. The combination of skewed sales tax/GST/VAT and higher excise charges would amount to a “carrot and stick” system for the purchasers of new vehicles, whereby the consumer would be rewarded for taking the right approach to vehicle fuel economy (in this case, by reduced sales tax/GST/VAT) and punished for taking the wrong approach (by higher petrol excise taxes). The two tax changes thus mutually reinforce each other.

72. The major disadvantage of fuel taxes is their negative distributional effect. Petrol prices tend to form a greater percentage of household expenditure for low income earners than for those on high incomes. Higher fuel prices will thus impact more adversely on low income households. This is exacerbated by the fact that low income earners cannot afford to purchase new fuel-efficient vehicles to minimize the costs of fuel. Low income earners living on the fringe of cities where public transport systems tend to be poorer will be more heavily disadvantaged than high income earners. In addition, higher fuel prices may adversely affect those who live in rural areas, who must travel longer distances. This may be seen as unfair, particularly as most pollution occurs in urban areas.

73. The fuel tax is a powerful and effective tool for achieving fuel economy goals. It is nevertheless suggested that such taxes should be substantially increased, with any welfare losses resulting from additional fuel tax being compensated for, at least partially, by the government devoting a proportion of the extra revenue gained from the increased tax to targeted welfare programmes to aid the financially disadvantaged.

74. Changes to company tax deductions for vehicles, sales tax/GST/VAT and fuel taxes should be implemented in addition to the provision of government grants, low interest loans or loan guarantees to businesses for the purchase of vehicles of a high fuel economy standard. The purchasing decisions of individuals and corporations are affected by sales tax/GST/VAT and fuel tax regimes. However, government grants or loans to businesses are aimed at influencing large-scale purchasing decisions made by corporations. Such loans and grants would provide a strong incentive to businesses to convert their vehicle fleets to more fuel-efficient models. Any eventual problems or inequities in the operation of the scheme could be alleviated or avoided through careful framing by the government of the rules of eligibility for a grant or low-interest loan.

75. It is accordingly submitted that a skewed sales tax/GST/VAT regime, increased petroleum excise tax, modified company tax deductions and depreciation allowances for vehicles, and government loans, grants or loan guarantees to businesses and local/regional government agencies, could all be adopted on a national basis. The environmental problems associated with the use of fuel in transport transcend national borders. Vehicle fuel consumption is growing rapidly. Effectively adjusting the challenges of transport and sustainable development is increasingly urgent. All countries, both developed and developing, may therefore consider some of the aforementioned options in the scope of their regulatory reforms.

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