



Reducing Air Pollution from Urban Transport

Companion

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Foreword

Urban air pollution from road transport is a growing concern in many developing country cities. With rising incomes, motorized transport is expected to continue to increase in the coming years, further threatening air quality. Poor air quality in turn has been shown to have serious effects on public health. The World Health Organization estimated that 650,000 people died prematurely from urban air pollution in developing countries in 2000.

The need to tackle air pollution from transport is widely acknowledged. But the menu of options available is varied and can be daunting. Are there key questions that should be answered to guide policymaking? Under what conditions are the different mitigation measures likely to achieve pollution reduction? Are there critical steps to be taken or underlying conditions that must be met, without which pollution reduction is unlikely? Which mitigation measures are robust, which may be implemented successfully, and which are still in the area of pilot testing?

This report is an abridged version of the full report and is intended as a companion to it. It was prepared to provide guidelines and principles for answering the questions above and other related questions. Given the varying nature of air pollution, pollution sources, and available resources, answers and even key policy questions will differ from country to country. Hence, the report does not attempt to provide precise prescriptions applicable to all circumstances. It rather draws on lessons from international experience to propose a framework in which policy selection and implementation should occur. The three sectors most closely linked to vehicular air pollution are environment, transport, and energy. The report places a special emphasis on how to coordinate policies across the three and how to reconcile their sometimes conflicting objectives and demands in order to achieve environmental improvement.

We hope that this report will stimulate and contribute to a discussion on how best to coordinate policies across different sectors to their mutual benefit in an environmentally sustainable manner.

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Abbreviations and Acronyms

CBD	Central business district
CNG	Compressed natural gas
CO	Carbon monoxide
CO ₂	Carbon dioxide
EGR	Exhaust gas recirculation
EU	European Union
GHG	Greenhouse gas
I/M	Inspection and maintenance (systems)
LPG	Liquefied petroleum gas
MTBE	Methyl tertiary-butyl ether (an oxygenate)
NGO	Nongovernmental organization
NO	Nitric oxide
N ₂ O	Nitrous oxide (a powerful greenhouse gas)
NO ₂	Nitrogen dioxide
NO _x	Oxides of nitrogen
PM	Particulate matter
PM _{2.5}	Particulate matter of size 2.5 microns or smaller in aerodynamic diameter, also referred to as respirable particulate matter or fine particulate matter
PM ₁₀	Particulate matter of size 10 microns or smaller in aerodynamic diameter, also referred to as inhalable particulate matter
SO ₂	Sulfur dioxide
TSP	Total suspended particles
U.S. EPA	U.S. Environmental Protection Agency

Units of Measure

g	Grams
g/kWh	Grams per kilowatt-hour
km	Kilometers
km/h	Kilometers per hour
kWh	Kilowatt-hours (a unit of energy)
ppm	Parts per million. 10,000 ppm is 1 percent, 1,000 ppm is 0.1 percent, and so on.



Executive Summary

Urban transport is essential to social and economic development. In the coming decades, the demand for transport will increase rapidly in developing countries with rising income. But motorized transport also carries social and economic costs, not least of which is its adverse effect on urban air quality. The costs of air pollution include reduced visibility and damage to vegetation and buildings, but by far the greatest cost is the damage to human health where the pollutant of most concern is fine particulate matter. In a number of cities, ambient concentrations of ground-level ozone are also rising; they are alarmingly high in some cities. Although not necessarily the most important source at present, transport's contribution to these harmful pollutants is increasing, necessitating a proactive policy to limit transport emissions.

Air pollution from motorized vehicles is a concern for agencies across many different sectors and affects the role of agencies in covering social needs that include mobility, safety, and public health protection. Thus, designing strategies to reduce air pollution from mobile sources calls for actions that are compatible with the primary interests of most, if not all, of the agencies and actors involved. Where there are trade-offs to be made, they should be discussed openly through political and consultative institutions.

Policies for environmental improvement in urban transport can broadly be categorized into those that target the technology of individual vehicles and their fuels, and those that are concerned with management of the urban transport system as a whole. Both approaches are equally important for effective air quality management and require actions at national and city government levels.

Improving Transport Technology

Appropriate, well-designed, and effectively implemented standards are a fundamental requirement, molding the behavior of vehicle owners in vehicle purchase, operation, and use. Vehicle and fuel standards are usually the prerogative of central governments. Modern vehicle technologies can lower emissions significantly, but some have demanding fuel requirements. In some cases, trade-offs, such as between two pollutants or between fuel economy and reducing pollutant emission, may have to be faced. The largest absolute gains in pollution reduction have typically been achieved through the first steps in establishing new standards. For example, going from uncontrolled to controlled vehicles, such as the adoption of the European Union emission standard Euro I, results in large emission reductions. For coun-

tries that have already taken these first steps, the immediate reduction of sulfur to 500 parts per million (ppm) affects all vehicles and yields high returns.

A key policy question is how quickly to move to much lower sulfur levels. The answer is to move in concert with the introduction of advanced vehicle technologies that can take advantage of low fuel sulfur levels. The benefits of ultralow sulfur fuels accrue primarily to advanced-technology vehicles; thus, a reduction to 50 ppm or lower should be accompanied by introduction of emission control technologies that take advantage of very low fuel sulfur levels. With that in view, the development of both maintenance capability and concomitant investment in the necessary emission control technologies are two important considerations.

Vehicles fueled by gas emit much fewer fine particles than those with conventional liquid fuel technology, but certain conditions need to be met for gaseous fuel programs to be sustainable and commercially viable. They include the existence of a natural gas distribution pipeline network; availability of gas priced competitively with conventional liquid fuels; and the technical capability to maintain gaseous-fueled vehicles, often fostered through management commitment and training.

Poor vehicle maintenance is a common problem. Where governments are committed to providing adequate supervision, automation, and audits, well-designed inspection and maintenance programs operated by the private sector can be effective.

Managing the Transport System

City governments are typically able to exert the most influence on transport-related air pollution through system-oriented measures including traffic management, regulation and control of public road transport, provisions for non-motorized transport and for mass rapid transit, physical restraints, parking policies, and road pricing and land use policies.

Traffic management aims to secure uninterrupted movement at free-flow speed with existing traffic volumes. A major component of traffic management is separating different traffic modes. Mixing public transport vehicles with other vehicle categories reduces the average speed of all traffic compared with what could be achieved if traffic were segregated. Public transport priorities, in the form of dedicated lanes or totally segregated busways, are essential to counteract the problems of mixed traffic. Fundamental to the successful implementation of traffic management measures is the establishment of a traffic management unit at the local government level with the consolidated authority and ability to plan and implement suitable traffic management schemes.

Because improved traffic flow encourages more or longer trips, traffic management is likely to be effective in reducing vehicular emissions only if supported by measures to restrain the generation of new traffic. Total transport demand can be restrained by urban planning ori-

ented to public transport, by pricing policies, by parking control, and by direct restraints on traffic movement—all in the context of an integrated strategy.

Bus transport can be an instrument for air quality improvement if bus occupancy is high and emission levels are reasonably low. This requires realistic fare and finance policies and efficient operational management; these can be achieved through well-managed competition. The cities that have most satisfactorily reconciled efficient and clean operations with low budget burden are those that have introduced orderly competition for franchises. This “competition for the market” allows the authority to control the main policy-sensitive variables—such as fares, environmental performance, and service structures—while mobilizing competition to get the desired level of service and at the same time limit emission levels at the lowest possible cost.

Non-motorized transport, including walking, is entirely emission-free but is frequently ignored or discouraged by policymakers. A more positive policy stance is required, involving a comprehensive package of measures. These may include segregated infrastructure, provision for modal integration with public transport, and promotion (particularly through safety and security campaigns).

Central governments can assist local transport system policies by supporting fiscal and trade policies. Fuel taxation serves multiple objectives that necessitate a package approach to transport taxation. Gasoline taxes should be above general tax rates and diesel taxes may also need to be increased, with the possibility of rebates for non-automotive uses. Import duties based on market value may discourage imports of new “clean” vehicles. Trade policies should discourage imports of “dirty” and older vehicles.

Considerations for Policymakers

Global experience is a useful guide, not least in educating behavior, but careful adaptation to local situations is critical because the nature and sources of air pollution differ from city to city. Where it is sensible to adopt measures from other countries, policymakers still need to establish a timetable for phasing them in. Whenever possible, they should work with, and not against, the economic incentives of various actors; seek to reduce subsidies that result in environmental damage; press for reform that increases sector efficiency and reduces the cost of emission reduction; and begin with decisions that bring easy wins.

Several recommendations can be made.

- **Institutional framework.** Central governments should establish a predictable and consistent policy and regulatory framework for urban air quality management. A specific agency should be given responsibility for securing coordination in urban air quality

policy within each metropolitan authority. Establishing urban traffic management centers, and involving police in system design and training for traffic management, can be especially effective.

- **Air quality action plan.** Affected stakeholders—private sector participants, different levels of government, and civil society—should be engaged in developing an air quality action plan to the extent possible. The incentives to comply are likely to be more powerful if the stakeholders have been involved in policy formulation.
- **Fuel quality and vehicle emission standards.** Standards should be realistically set, progressively tightened over time, and stringently enforced. A targeted, well-designed, and adequately supervised emissions inspection program can foster a culture of proper vehicle maintenance. For two-stroke engines, it can be relatively low cost and effective to promote proper lubrication practices for existing vehicles and to require new two-stroke engines to meet the same emission standards as four-strokes.
- **Public transport.** Transit-oriented urban planning strategies and balanced land use should be developed to reduce trip lengths and concentrate movement on efficient public transport axial routes. Priority should be given to buses in the use of road infrastructure, and the creation of segregated busway systems should particularly be considered, in order to improve and sustain environmental standards for buses. Competition for the market can also play an effective role in efficiency improvement and creation of incentives for raising environmental performance.
- **Fiscal policies.** Taxes, import duties, and vehicle licensing can be designed to discourage purchase and continuing use of polluting vehicles and engines. In many countries, raising taxes on automotive diesel should be considered. Separate vehicle charges based on vehicle weight, axle loadings, and annual mileage may also be justified. Free on-street parking should not be provided in congested areas, and subsidies to public off-street parking should be eliminated.
- **Non-motorized transport.** Provision for safe and comfortable walking, bicycling, and other forms of non-motorized transport can benefit air quality. Careful differentiation of traffic by type of road can reduce accidents and promote non-motorized transport for short trips.