

Observations and Suggestions
观察与建议

NO. 2013-4

ADB

Addressing Beijing Air Pollution

治理北京空气污染

Asian Development Bank

© 2013 Asian Development Bank
© 亚洲开发银行 2013

All rights reserved. Published in 2013.
Printed in the People's Republic of China
版权所有。2013 年出版。
在中华人民共和国印刷。

The views expressed in this publication are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent. Accounts presented here are anecdotal and do not represent comprehensive impacts of projects or programs.

ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use.

By making any designation of or reference to a particular territory or geographic area, or by using the term "country" in this publication, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

ADB encourages printing or copying information exclusively for personal and noncommercial use with proper acknowledgment of ADB. Users are restricted from reselling, redistributing, or creating derivative works for commercial purposes without the express, written consent of ADB.

本出版物中所述为作者的观点，不一定代表亚洲开发银行（亚行）、亚行理事会或其代表的政府的观点和政策。在这里所阐述的事件是实际案例，不代表项目或规划的全面影响。

亚行不担保本出版物中所含数据的准确性，而且对使用这些数据所产生的后果不承担责任。

在此出版物中标明、参照某个版图或地理区域，或使用术语“国家”不代表亚行对任何地域实体的合法性或其它法律地位的任何判断。

亚行鼓励仅出于个人和非商业性目的对信息进行印刷或复制的行为，但须给予亚行适当的承认。未经申请并得到亚行书面同意，使用者严禁出于商业目的再出售、再发行、或创造衍生作品。

Note: In this publication, "\$" refers to US dollars.
注：在本出版物中，“\$”表示美元。

Disclaimer for Translated Documents 译文声明

This document has been translated from English in order to reach a wider audience. While the Asian Development Bank (ADB) has made efforts to verify the accuracy of the translation, English is the working language of ADB and the English original of this document is the only authentic (that is, official and authoritative) text. Any citations must refer to the English original of this document.

为扩大读者范围，特将本报告由英文翻译为中文。亚行尽力确保翻译的准确性。但英语是亚行的官方语言，因此，本报告的英文原版为唯一具有权威性的（即正式的和经授权的）文本。任何对本报告内容的引用，必须以其英文原版内容为准。

Abstract

摘要

- Recent episodes of severe air pollution in Beijing in the form of winter smog have led to heightened concerns over the implications for public health and environmental sustainability. Severe episodes arise when there is an interaction between air pollutants and weather conditions in the form of smog.

近日，以冬季雾霾形式出现的空气重污染事件在北京突发，其对公众健康和环境可持续性的影响日益加重了人们对空气污染问题的担忧。当空气污染物和气象条件相互作用时，就会出现雾霾形式的空气重污染现象。

- The main sources of air pollution in Beijing are motor vehicle emissions, burning coal for heating and electricity generation, construction dust, and air pollution being carried by wind from neighboring provinces.

北京主要的空气污染源来自机动车尾气排放、供暖和发电燃煤、建筑施工扬尘，以及来自周边省份的空气污染物。

- Successful experiences in other countries indicate that efforts to control air pollution in major cities should be based on the objective of protecting public health. In this process, it is critical to avail of comprehensive data to understand how air pollution is affecting human mortality and morbidity to formulate effective interventions.

成功的国际经验表明，治理大城市空气污染应该以保护公民健康为基本目标。在此过程中，有必要利用综合数据来了解环境污染如何影响人类的寿命和健康，从而制定有效的干预措施。

- This policy note identifies measures to curtail air pollution in Beijing. Policy recommendations are grouped into two categories. First, short-term actions to prevent further air pollution episodes that threaten human health. Second, longer term measures, including suitable investments and policy changes, to ensure air quality on a sustainable basis.

本政策建议提出了治理北京空气污染的若干措施建议。这些建议可以划分为两类：第一类是防止危害健康的空气污染进一步爆发的短期措施；第二类是有关投资、政策转变等可持续性地维持空气质量的中长期措施

I. INTRODUCTION

1. Recent episodes of severe air pollution in Beijing in the form of winter smog have led to heightened concerns over the implications for public health and environmental sustainability. Smog is caused by interaction between air pollutants and weather conditions, leading to sharp rises in pollutant concentration. In Beijing, smog is produced when primary and secondary gaseous, aerosol, and particle pollutants get trapped in the air when weather conditions block the dispersal of photochemical smog (mainly ozone) and particle matter pollution, forming a low-hanging shroud.
2. The primary air pollutants released directly into the atmosphere include carbon monoxide (CO), carbon dioxide (CO₂), sulfur dioxide, (SO₂), nitrogen oxides (NO_x), suspended particulate matter (PM_{2.5}), and volatile organic compounds (VOC). Secondary air pollutants are formed by reactions between primary pollutants and other naturally occurring constituents present in air from the action of sunlight, mainly nitrogen dioxide (NO₂) and ozone (O₃).
3. In Beijing, motor vehicle emissions are the main source of primary active pollutants in the creation of photochemical smog (especially NO_x, VOC). Other important sources of VOC are industrial facilities and power plants (especially from small factories in neighboring Hebei province), and chemical solvents. Most PM_{2.5} is derived from combustion.^[1] Dust from construction sites is also a major source of PM_{2.5}, mainly during periods of low rainfall. Drawing upon successful experiences in other countries, this policy note identifies measures to curtail air pollution in Beijing

II. MAIN ISSUES

4. Addressing air pollution in Beijing is a complex task due to the magnitude of the existing challenges. From the policy perspective, there has been a tendency to address air pollution through institutionally fragmented approaches without a common framework for monitoring. Air pollution objectives have often become subsidiary to other objectives that are mostly concerned with economic expansion and infrastructure delivery. Moreover, data on mortality and morbidity due to air pollution episodes is scarce as health issues have received less attention.

1. PM_{2.5} concentrations at Beijing air quality monitoring substations in January exceeded 700 micrograms per cubic meter (mcg/m³), and some reports referred to peaks exceeding 1,000 mcg/m³. There were multiple episodes lasting up to several days, extending over 26 days in January. The World Health Organization (WHO) estimates that, worldwide, PM_{2.5} causes about 3% of mortality from cardiopulmonary disease, 5% of mortality from cancer of the trachea, bronchus, and lung, and 1% of mortality from acute respiratory infections in children under 5 years. WHO considers 25 mcg/m³ an acceptable level of PM_{2.5}, but rates 300 mcg/m³ as bad, and 500 mcg/m³ as hazardous.

5. Urban transport is the largest, fastest growing contributor to air pollution. Beijing has developed a high reliance on using motor vehicles, and emissions from motor vehicles are higher than for other transport modes. Per capita vehicle ownership in Beijing is now twice the levels in Paris and New York. The effect on emissions is compounded by the higher average trip length in Beijing (1.5 times more than in London, and 2.4 times more than in Tokyo). Another factor is that the fuel sold in Beijing has a relatively high sulfur content that results in higher emissions of pollutants.
6. Various policies have been pursued without considering their effect on vehicle emissions. Pricing policies for purchases of vehicles and fuel have not reflected the costs of pollution and congestion. City investment policies prioritized urban road construction even though the additional roadway capacity was soon absorbed by further vehicle traffic growth, leading to renewed congestion. Beijing's land use planning policies have been vehicle-centered and discouraged walking, cycling and use of public transport. Although considerable resources have been invested in public transport and the mode share of public transport increased from 28% in 2003 to 39% in 2009, this is still less than half the mode share of Paris and New York.
7. Actions taken to reduce transport emissions have had limited success. Responsibility for improving urban transport is fragmented among various institutions. They have been pursuing a variety of objectives, not all compatible with air quality—including roadway expansion, congestion reduction, travel time shortening, and public transport improvement. Drawing on good practices in other countries and elsewhere in the PRC, a host of different schemes have been attempted (e.g., vehicle registration restrictions, truck driving hours restrictions, number plate bans, bus rapid transit services) but they were typically introduced without comprehensive prior assessment and without monitoring systems in place. They were often incomplete or on an insufficient scale, and tended to focus on narrow, short-term objectives rather than pursuing a sustainable reduction in pollution levels.
8. Emissions from coal-fired power plants are another major cause of Beijing's air pollution. In winter months the increased demand for heat leads to increased burning of coal and air pollution. Most of the heating network is old and relies on coal-based heat-only boilers without adequate emission reduction measures. The benefits of changing to use of combined heat and power plants, preferably based on natural gas, are well understood, but they have received less priority. Cities find it difficult to address air pollution due to resource constraints, limited willingness-to-pay by consumers, and a lack of interest from private investors.
9. Beijing also suffers from air pollution carried by wind from neighboring provinces. It has been estimated that between one third and two thirds of Beijing's air pollution is caused by emissions in the surrounding provinces. This implies that Beijing can only solve the problem jointly with neighboring jurisdictions, which in turn are also affected by air pollution originating in Beijing. In addition, dust from construction sites in Beijing and surrounding cities is a further major source of suspended particulate matter.

10. Efforts to tackle the various sources of air pollution are hampered by ineffective application and enforcement of laws, regulations and policies for air pollution control. This affects the application of emission standards at power stations and industrial plants, and the control of construction dust, and helps to explain the continuing use of high sulfur vehicle fuels in Beijing and the loopholes in charging of parking fees.

III. POLICY RECOMMENDATIONS

11. Experience from other countries suggests that once a threshold level of per capita income is attained, the rationale for controlling air pollution is based on protecting public health and saving lives.^[2] Public awareness of air pollution also creates pressure to act in order to retain public confidence in governance and public services. In Beijing there are also strong economic arguments for preventing episodes of severe air pollution. The costs of emergency measures to reduce air pollution on at-risk days by imposing temporary restrictions on production and transportation are likely to be outweighed by the savings in human lives and health costs, and less illness-related loss of production.

12. Solutions will require concerted efforts by the general public, including behavior change, and regularly sharing factual information on air pollution, its causes, and its effects on public health, to build popular support for the substantial changes and financing needed. Policy recommendations are grouped into two categories. First, short-term actions to prevent further air pollution episodes that threaten human health. Second, longer term measures, including suitable investments and policy changes, to ensure air quality on a sustainable basis.

A. Short-Term Policy Actions

13. **Document the impact of air pollution on public health.** Reliable data and analysis that link mortality and morbidity with air pollution and its causes should be the starting point for determining effective solutions. A study should be conducted to identify the impact of air pollution on health in Beijing and surrounding areas. The impact of severe air pollution episodes should be examined. This should identify the causes of mortality and morbidity, and how these are linked to the existing sources of air pollution. The findings will help to formulate a package of short and longer term measures to address air pollution. They will be useful for raising public awareness of the need for heat and power conservation, including sensitizing consumers to eventual future higher energy prices to cover the costs of cleaner energy supply.

2. Following the 1952 Great Smog of London, public health researchers examined mortality patterns around the time of the smog and discovered that it had caused thousands of deaths. When this information became public, it led to a comprehensive package of policy changes to protect public health from harmful emissions.

14. **Strengthen institutional coordination to fight air pollution.** The PRC authorities should review institutional coordination arrangements to ensure (i) coherence of objectives across sectors and jurisdictions, based on the overriding objective to protect and improve public health; (ii) a coordinated multisectoral approach to the reduction and control of air pollution, with an effective hierarchy of responsibilities; (iii) real-time monitoring of PM_{2.5} and other key air pollutants in Beijing and surrounding areas, with the results released to general public in a transparent manner; and (iv) improved forecasting and modeling capacity to contribute toward formulation of air pollution abatement strategies.
15. **Develop an early warning system and emergency response actions.** The PRC authorities should define levels of PM_{2.5} and other key air pollutants that constitute a threat to public health, taking into account the risks for key vulnerable groups such as young children and the elderly. This will allow the establishment of an early warning system to prevent the public being exposed to dangerous levels of air pollutants, and to promptly restore healthy pollutant levels when pollutant levels rise. This should be developed in tandem with a set of emergency response actions, such as suspension of school activities, and bans on industrial production, construction work, and motor vehicle operation.
16. **Improve urban transport.** Identify a comprehensive mix of urban transport schemes with the best prospects for success drawing on the main conclusions of the ongoing ADB citywide modeling study to examine the effectiveness of various schemes.^[3] In addition, actions are needed on vehicle fuel quality reforms to remove high sulfur fuel, and enforcement of vehicle roadworthiness testing in high polluting vehicle categories (including heavy diesel vehicles such as buses, goods vehicles, and taxis) to reduce emissions.
17. **Encourage passengers to switch to lower emission transport modes.** Reduce private vehicle use by (i) introducing stricter number plate restrictions (e.g., each vehicle banned on 2-3 weekdays); (ii) dedicating lanes to vehicles with high occupancy; and (iii) increasing prices for vehicle use (e.g., auction system for new registrations drawing on Shanghai's successful experience, tax/surcharge on fuel or vehicle purchase prices, higher parking fees, and additional charges for use of vehicles in central Beijing on weekdays). These measures should be implemented with simultaneous reforms to improve and expand public transport to offer people a reasonable alternative to private vehicle use.
18. **Minimize the impact of heating, industrial emissions and construction dust.** Introduce mandatory emission performance monitoring for all heat and power sources located in the northern PRC. A benchmarking exercise should be undertaken immediately. The regulator should then gradually enforce stricter emission levels so that only high efficiency plants with strict emission control systems

3. ADB. 2011. *Technical Assistance to the People's Republic of China for Beijing Sustainable Urban Transport*. Manila.

can be used for heat supplies in urban locations. To reduce industrial emissions it is imperative to enforce existing air pollution and energy efficiency standards strictly in all industries. Similarly, as in major cities in developed countries, Beijing needs effective regulations and enforcement for the prevention and containment of construction dust.

B. Longer Term Policy Actions

19. **Enhance institutional capacity for control of air pollution.** The capacity of the Ministry of Environmental Protection (MEP) and related agencies needs to be strengthened through further recruitment and training. For example, in the United States, the Environmental Protection Agency (USEPA) employs about 18,000 government officials, compared with about 300 in the MEP. Additional steps are needed for Beijing and neighboring provinces to establish sustainable systems for managing cross-boundary air pollution (e.g., the US-Mexico trading in cross-border power plant emissions).

20. **Strengthen environmental compliance and enforcement.** While the PRC has a substantial body of environmental laws, regulations, and rules, many of the penalties for non-compliance are too low to discourage the polluters. In addition, local governments can often arrange for local environmental protection bureaus (EPBs) to waive such penalties. It is recommended that (i) the level of penalties is increased to ensure they serve as an effective deterrent; (ii) the EPBs should be placed under the MEP administration independent of local governments; and (iii) EPB officials should be empowered to directly implement penalties rather than jointly with local government departments.

21. **Reflect full economic cost in pricing.** All externalities including costs of pollution and transport congestion should be reflected in the pricing of energy, transport, and construction, to encourage a shift to cleaner technologies and fuels. Corrective taxes (i.e., fuel tax, carbon tax), and tradable permits should be also considered. One successful international practice is the SO₂ allowance trading program for acid rain control implemented in the US since 1995. Drawing on lessons from Singapore, London and other major cities, electronic congestion pricing for private vehicles could also be considered.

22. **Align urban planning with environmental targets.** The authorities could reconsider elements of its urban planning approach that have contributed to over-reliance on private motor vehicles to the detriment of low emission modes (i.e., cycling, walking and public transport). City planning needs to be adjusted so that future land-use plans will limit the length of trips and enable more trips to be made using low emission modes. This implies revising the concept of having only one city center, the separation of residential areas from places of work and services, and the use of “superblocks” that necessitate vehicle use.

23. **Support comprehensive and sustainable transport projects.** Major investments will be needed to achieve at least a doubling of the mode share of public transport, and increase the role

of cycling and walking. This target is consistent with the successful experiences of major cities in developed countries. The investment program may include large-scale expansion of the subway system, other rail expansion, bus rapid transit services, development of multimodal passenger hubs, electronic ticketing and travel information systems, and establishment of seamless networks of safe lanes and pathways for cycling and walking.

24. Improved energy sources, vehicle standards and enforcement. Use of natural gas should be mandatory for heating in megacities such as Beijing and Tianjin. It is the cleanest fossil fuel. Compared with coal, it emits only one-third as much NO_x, and negligible particulate matters and SO_x. Fuel substitution programs supported by public initiatives would help to assist operators of energy and industrial plants to switch to low emission fuel alternatives. Finally, vehicle emission controls should encourage the adoption of newer, cleaner and more fuel-efficient vehicles and use of cleaner fuels, while removing high emission vehicles from use.

一、简介

1. 近日,以冬季雾霾形式出现的空气重污染事件在北京突发,其对公众健康和环境可持续性的影响使人们对空气污染问题的担忧日益加重。雾霾是空气污染物和气候条件相互作用的结果,会导致污染物急速积累。在北京,当一次及二次气态污染物、气溶胶、及颗粒污染物等因光化学烟雾(主要是臭氧)和颗粒物的污染扩散受气象条件影响而阻碍时,就会滞留在空中,形成笼罩在城市上空的雾霾。

2. 直接排入空气中的一次污染物有一氧化氮(CO)、二氧化碳(CO₂)、二氧化硫(SO₂)、氮氧化物(NO_x)、细颗粒物(PM_{2.5})以及挥发性有机化合物(VOC)。二次污染物由一次污染物和其他大气中自然生成的物质在日光照射下发生反应而形成,主要包括二氧化氮(NO₂)和臭氧(O₃)。

3. 在北京,机动车尾气是产生光化学烟雾的一次污染物主要的来源(以NO_x和VOC为主)。VOC的其他重要来源是工业设施、发电厂(尤指相邻河北省的小工厂)和化学溶剂。大部分PM_{2.5}源自燃料的燃烧^[1]。此外,建筑施工扬尘也是PM_{2.5}的一个重要来源,尤其是在少雨时期。本政策建议在借鉴国外成功经验的基础上,提出解决北京空气污染问题的若干措施。

二、主要问题

4. 解决北京空气污染问题面临重重困难,任重道远。从政策方面看,各个部门和机构往往各自制定解决空气污染问题的措施,没有形成统一的监督框架。治理空气污染的目标通常从属于其他与经济发展、基础设施建设密切相关的目标。此外,由于人们对健康问题的关注不够,有关空气污染导致死亡和发病情况的资料十分匮乏。

5. 城市交通是最主要、增长速度最快的空气污染源。北京对机动车的依赖程度极高,机动车排放的尾气高于其他交通工具。目前,北京的人均机动车保有量是巴黎和纽约的两倍(是伦敦的1.5倍以上,东京的2.4倍以上)。北京机动车的平均行驶里程数较高,进一步加剧了尾气排放。另一个因素是北京销售的燃油含硫量较高,从而增加了污染物的排放量。

6. 在制定各项政策过程中并未把对汽车尾气排放的影响考虑在内。车辆和燃油的定价政策不能反映污染和交通阻塞的成本。城市的投资政策偏重城市道路建设,但增加的道路容量很快被新增车

1. 1月,北京空气质量监测站的PM_{2.5}指数为700(每立方米含700个细颗粒物),有些报道称该指数最高时超过1,000。1月份有26天以上都出现雾霾现象,最长持续时间长达数天。世界卫生组织估计,在世界范围内,由PM_{2.5}引起的心肺病死亡率达3%,气管、支气管和肺部癌症死亡率达5%,5岁以下的儿童急性呼吸道感染死亡率达1%。世界卫生组织认定PM_{2.5}日均指数不应超过25,超过300则为重度污染日,超过500为危险日。

辆所占据,再度出现交通拥堵。北京的道路使用规划政策以车辆为中心,对步行、自行车和公共交通工具等出行方式不够重视。尽管北京在公共交通方面投入了大量资源,将公交分担率由2003年的28%提升至2009年的39%,但这一比率依然低于巴黎和纽约。

7. 减少尾气排放的举措收效甚微。改善城市交通的责任分散在多个部门,这些部门各自制定目标,并非所有目标都有助于改善空气质量——包括道路扩建、减少交通拥堵、缩短出行时间、改善公共交通等。在借鉴国内外其他地方的成功经验的基础上,北京实施了一系列方案(如限制机动车登记、规定货车限行时间、推出尾号限行措施、提供公交快速换乘服务等),但是,这些方案在实施之前并没有经过综合预评估,相关监督机制也不到位,它们通常都是不完整、不充分的,与持续降低污染水平相比,它们更注重狭隘的短期目标的实现。

8. 北京主要的空气污染源还包括燃煤电厂的排放。冬季供暖需求上涨,导致燃煤量增加,从而加剧了空气污染。许多供热管网老化,单纯依靠燃煤锅炉,缺乏完善的减排措施。天然气热电厂供暖虽然有诸多益处,但这一模式并未受到青睐。此外,由于资源短缺、消费者消费意愿不高、私人投资者缺乏积极性,城市空气污染问题仍难以解决。

9. 北京的空气还受到周边省份外来污染物的影响。北京约有1/3~2/3的空气污染是由周边省份的排放造成的,而周边省份也同样受到北京空气污染的影响。也就是说,北京唯有与周边地区通力合作才能解决空气污染问题。除此之外,北京和周边城市的建筑施工扬尘也是悬浮颗粒物的一大来源。

10. 相关法律法规和政策的落实和执行不力,各种空气污染源无法得到有效控制。这不但会影响发电站和工厂执行排放标准的落实,也不利于控制建筑施工扬尘,同时还说明了为何北京持续使用含硫量高的汽车燃油以及为何停车费的收取漏洞百出。

三、政策建议

11. 国际经验表明,当人均收入达到一定水平之后,控制空气污染就要以保护公众健康和生命为基础^[2]。公众对空气污染的关注会促使政府尽快采取行动,以使公众保持对国家治理和公共服务的信心。在北京,很多人从经济角度探讨突发空气重污染的防治问题。相比在危险日采用紧急措施、通过对生产和交通采取临时管制来降低空气污染所消耗的成本,保护人民生命和健康、减少引发疾病的生产所节约的成本更多。

2. 1952年伦敦烟雾事件发生后,公共健康研究人员对当时的死亡情况进行了研究,结果发现该事件造成了数千人死亡。此消息一经公布,英国便全面进行政策调整,确保公众健康免受有害排放物的影响。

12. 空气污染问题的解决需要全社会的共同努力,包括改变日常行为、定期分享有关空气污染及其原因以及对健康的危害等信息,以此来构建公众对实际变化和所需资金的支持。政策建议可分为两类。一类为短期措施,防止空气进一步污染,危及健康;另一类是长期措施,包括投资和政策转变,可持续地保证空气质量。

(一) 短期措施

13. **记录空气污染对大众健康的影响。**要制定有效的应对措施,首先要获得可靠的数据,分析死亡及发病现象与空气污染及其成因的关联。因此,有必要研究北京及其周边地区的空气污染对健康的影响,查找死亡和发病原因及其与现有空气污染源之间的联系。此类研究将有助于制定解决空气污染的短期和中长期措施,提高公众对节约热能和电能需求的意识,让消费者意识到供应清洁能源的成本将意味着未来能源价格的上涨。

14. **应对空气污染需要加强机构协调。**中国主管部门应审查机构协调安排,以确保(1)在保护和促进大众健康这一压倒一切的目标基础上,保持各部门目标的一致性;(2)开展多部门合作,明确责任层级,以减少并控制空气污染;(3)对北京及其周边地区的PM_{2.5}和其他主要污染物进行实时监测,公开透明地向公众发布结果;(4)提高预测和建模能力,以更好地制定降低空气污染的策略。

15. **建立早期预警系统,制定紧急对策。**中国当局应该对PM_{2.5}和其他危害人体健康的主要空气污染物进行等级划分,同时考虑到儿童和老年人等重点易感人群面临的风险。这就需要建立预警系统,防止人们在空气污染严重时外出,当污染程度加重时及时采取行动,使其恢复至安全水平。预警系统还需要有配套的应急措施,如学校停课、工厂停产、停止施工和机动车限行等。

16. **改善城市交通。**根据亚行为检验各种方案有效性而持续进行的全市建模研究的结果^[3],确立一套最有可能获得成功的综合性城市交通方案。此外,还需提高油品,弃用含硫燃油、对高污染车辆(包括公交车、货车和出租车等重型柴油车)实行强制性能检测,以减少排放量。

17. **鼓励人们选择低排放的出行方式。**可以通过以下几种方式减少私家车的使用:(1)推行更严格的牌号限行制度(例如,每辆车每周限行2~3个工作日);(2)为高载客率车辆提供专用车道;(3)增加车辆使用的成本(例如,上海成功采用牌照拍卖制度,对燃油和车辆购买征税或收取附加费,上调停车费,工作日在北京市中心使用车辆收取额外费用)。这些措施要与提升发展公共交通的改革措施同步,让人们除了私家车外还有其他便利的出行方式。

3. 亚行,2011,“中国北京城市可持续交通技术援助”,马尼拉。

18. **最大程度降低供暖、工业排放和建筑施工扬尘的影响。**对中国北方所有的供热和发电厂采取强制性排放监督措施,并尽快采用标杆管理手段。逐渐推行更加严格的排放标准,在市内只留下能效高、排放标准严格的工厂来供热。要降低工业排放,所有工厂都必须严格执行现有的空气污染和能效标准。同发达国家的主要城市一样,北京也需要采用有效的管理和执行手段来防治建筑施工扬尘。

(二) 长期措施

19. **提高机构能力,控制空气污染。**环境保护部(MEP)和相关机构应增加人员,加强培训,提高自身能力。例如,美国环境保护局(EPA)的政府工作人员有近18,000人,而中国环保部仅有约300人。北京及其周边省份还需进一步采取措施,建立可持续的跨区域空气污染防治系统(例如美国和墨西哥建立的跨境发电厂排放交易)。

20. **加强与环境相关的合规管理和执行力度。**尽管中国出台了許多有关环境的法律法规,但是,对于违规行为的处罚通常较轻,达不到有效的惩治效果。此外,地方政府常常会要求当地环保局袒护违规者,使其免受处罚。针对这些情况,本文提出以下几条建议:(1)加大处罚力度,使其真正起到威慑作用;(2)地方环保局不再由地方政府管辖,改由环保部垂直领导;(3)环保局应有直接处罚违规现象的权力,无须同地方政府部门共同行使权力。

21. **定价要反映全部经济成本。**能源、交通和建筑行业的定价应考虑环境污染、交通拥堵等外部性,以鼓励人们选择更加清洁的技术和燃料。此外,还可考虑征收矫正税(如燃油税和碳税)和实行碳排放交易机制。自1995年,美国采用了旨在控制酸雨的二氧化硫排放交易方案,这是国际上一个成功案例。也可借鉴新加坡、伦敦等主要城市的经验,对私家车实行“拥堵电子收费”。

22. **城市规划同环境目标相结合。**有关主管单位应该重新审视城市规划,探究城市过度依靠私家车出行、低排放出行模式(如自行车、步行和公共交通工具)受限的原因。在城市规划方面,还应该考量未来土地使用规划,以尽量缩减出行里程,鼓励人们选择低排放的出行方式。这就要求人们转变观念,改变那种把工作和服务区同住宅区分割开来的、单一城市中心的观念,不再建设那种必须使用机动车的“超大街区”。

23. **支持全面的和可持续的交通项目。**大力投资公共交通,使公交分担率至少提升一倍,同时鼓励自行车和步行出行。发达国家的主要城市都已成功采取了类似的措施。投资项目包括大规模建设地铁和铁路系统、提供公交快速换乘服务、建设多式联运客运枢纽、电子售票和交通信息查询系统,以及为骑车人和步行者提供完善的安全路网等。

24. **发展能源资源、完善车辆标准,强化执行力度。**北京和天津等大城市应强制使用天然气。天然气是最洁净的化石燃料。与煤相比,天然气燃烧排放的 NO_x 仅是前者的1/3,微粒和 SO_x 更是微乎其

Observations and Suggestions

观察与建议

微。公众支持的燃料替代方案将会推动能源经营商和工厂选择低排放的燃料。最后,对尾气排放的限制措施应促使人们购买更清洁节能的新型车辆,使用更加清洁的燃料,杜绝使用高排放量的机动车。

About the Asian Development Bank 关于亚洲开发银行

ADB's vision is an Asia and Pacific region free of poverty. Its mission is to help its developing member countries substantially reduce poverty and improve the quality of life of their people. Despite the region's many successes, it remains home to two-thirds of the world's poor: 1.8 billion people who live on less than \$2 a day, with 903 million struggling on less than \$1.25 a day. ADB is committed to reducing poverty through inclusive economic growth, environmentally sustainable growth, and regional integration.

Based in Manila, ADB is owned by 67 members, including 48 from the region. Its main instruments for helping its developing member countries are policy dialogue, loans, equity investments, guarantees, grants, and technical assistance.

亚行的远景目标是实现没有贫困的亚洲和太平洋地区。亚行的工作旨在帮助其发展中成员体彻底减少贫困，改善亚太地区人民的福祉。尽管亚太地区发展迅速，但该地区的贫困人口仍然占全世界贫困人口总数的三分之二：18亿人口日均生活费用低于2美元，9.03亿人口挣扎在日均生活费1.25美元的贫困线以下。亚行致力于通过共享式经济增长、环境可持续发展和区域一体化减少亚太地区的贫困。

亚行是一家多边开发金融机构，总部设在菲律宾首都马尼拉，现有67个成员体，其中亚太地区成员48个。它主要通过政策对话、贷款、股本投资、担保、赠款以及技术援助等工具向成员体国家提供帮助。

亚洲开发银行

Asian Development Bank
6 ADB Avenue, Mandaluyong City
1550 Metro Manila, Philippines (菲律宾马尼拉)
www.adb.org

亚洲开发银行驻中国代表处

北京朝阳区建国门外大街1号
国贸大厦（三期）17层
邮编：100004
www.adb.org/prc
cn.adb.org

Produced in the PRC
在中国印制