

Clean Air in Bangladesh: Summary of progress on improving air quality



November 2008

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About CAI-Asia

The Clean Air Initiative for Asian Cities (CAI-Asia) was established as a joint initiative by the Asian Development Bank, World Bank, and the United States – Asia Environmental Partnership (a project of USAID) in 2001.

CAI-Asia promotes innovative ways to improve air quality of Asian cities by sharing experiences and building partnerships. This multi-stakeholder initiative has three parts:

- The CAI-Asia Center, a regional, Philippines-based non-profit organization as the implementing arm of CAI-Asia
- The CAI-Asia Partnership, a United Nations Type II partnership, with over 120 member organizations
- CAI-Asia Country Networks in People’s Republic of China, India (2009), Indonesia, Nepal, Pakistan, Philippines, Sri Lanka, and Viet Nam.

FOREWORD

Air quality management (AQM) is still a major challenge in Asia. The fast growing Asian economies and continued urbanization have increased the demand for mobility and energy in the region, resulting in high levels of air pollution in cities from transport, industry and other sources. The World Health Organization estimates that ambient air pollution causes *over half a million* premature deaths per year, leaving the urban poor particularly vulnerable since they live in air pollution hotspots, have low respiratory resistance due to bad nutrition, and lack access to quality health care.

We are therefore pleased to present you with an update on efforts and progress to improving air quality in Bangladesh, which also focuses on related areas, most importantly health, climate change, transport and energy management. This summary report was prepared with inputs from the Department of Environment under Ministry of Environment and Forests, Government of the People's Republic of Bangladesh. This report presents:

- Trends in air quality and climate change
- The Clean Air Network including main achievements and challenges
- Responses to address air pollution including policies, programs/projects, training courses, and several case studies of concrete actions.

You are invited to discuss with us achievements and challenges of Bangladesh at the Country Roundtable on Thursday 13 November, 10:30 – 12:00, at the Better Air Quality (BAQ) workshop 2008 in Bangkok, under the theme “Air Quality and Climate Change: scaling up win-win solutions for Asia.”

You can visit our webpage at www.doe-bd.org for more information, or contact us directly. We welcome your support to help improve air quality in Bangladesh!

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1. TRENDS IN AIR QUALITY AND CLIMATE CHANGE

This chapter explains the drivers of air pollution and climate change, trends in air pollutant levels and greenhouse gas emissions, and impacts from air pollution.

1.1 Drivers of Air Pollution and Climate Change

Urbanization and Population growth

With rising population growth, the urbanization in Bangladesh is also taking place at a quick pace. The current population of the country stands at 140.5 million out of which 12.7 million people live in the capital, Dhaka. One estimate says by 2050, 57% of people will be living in cities, compared to 26% in 1990. By 2015, Dhaka may become one of the densest cities of the world. The unplanned urban development coupled with urban population growth will result in increased demands for transport, energy and other infrastructure that in turn will result in high emission levels.

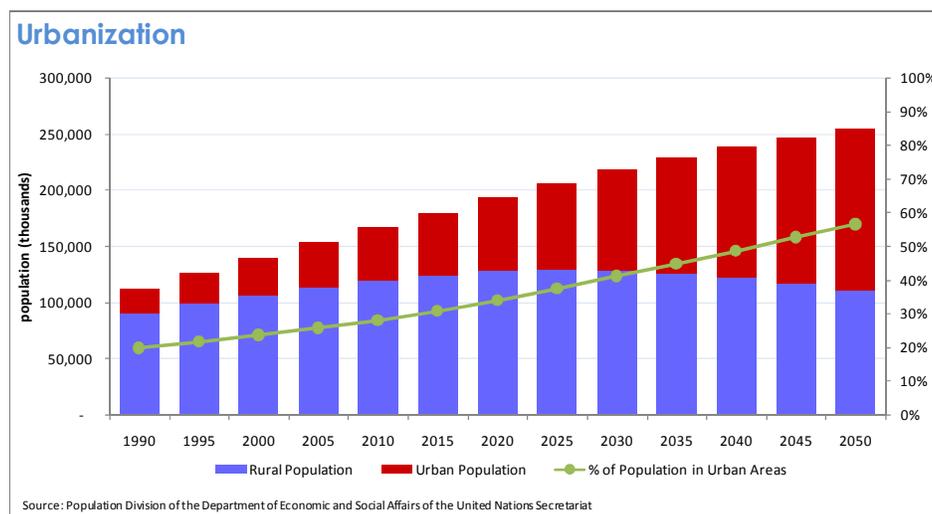


Figure 1. Urbanization increase between 1990 and 2005 and forecast for 2050

Energy

Oil and natural gas constitute the main energy sources in Bangladesh. The share of various energy sources in the commercial consumption of energy is shown in Figure 2. Apart from commercial energy, a large amount of traditional energy sources in the form of fuel wood, agricultural waste and animal residue are also used in the country. While the gas comes from its own reserve estimated to be 28.4 TCF, both refined and crude oil is imported from abroad. Given that Bangladesh has high quality (low sulfur and high calorific value) coal, it is being used now for power generation.

In Bangladesh, commercial energy consumption is around 66% natural gas, with the remainder mostly oil plus limited amount of hydropower and coal. Only 20% of the population, 25% in urban and 10% in rural areas,

has access to electricity. Consumption of coal in Bangladesh is steadily increasing and in 2007, coal consumption in the brick sector alone was 2.2 million tons. Major consumption of petroleum is in the transport sector (50%), followed by domestic (18%), agriculture (16%), power (10%) and industry (6%).

Natural gas is a major source of energy for Bangladesh meeting 70% fuel requirement of the country. For power generation, fertilizer production, commercial and domestic uses natural gas is the principal source of energy. The bulk of the natural gas is consumed in home cooking, electricity and as a fuel for CNG vehicles. The country in its northern part has an approximate coal reserve of 2127 million metric tons. In view rising demand for energy coal will replace the gas as a source of energy for power generation in the foreseeable future.

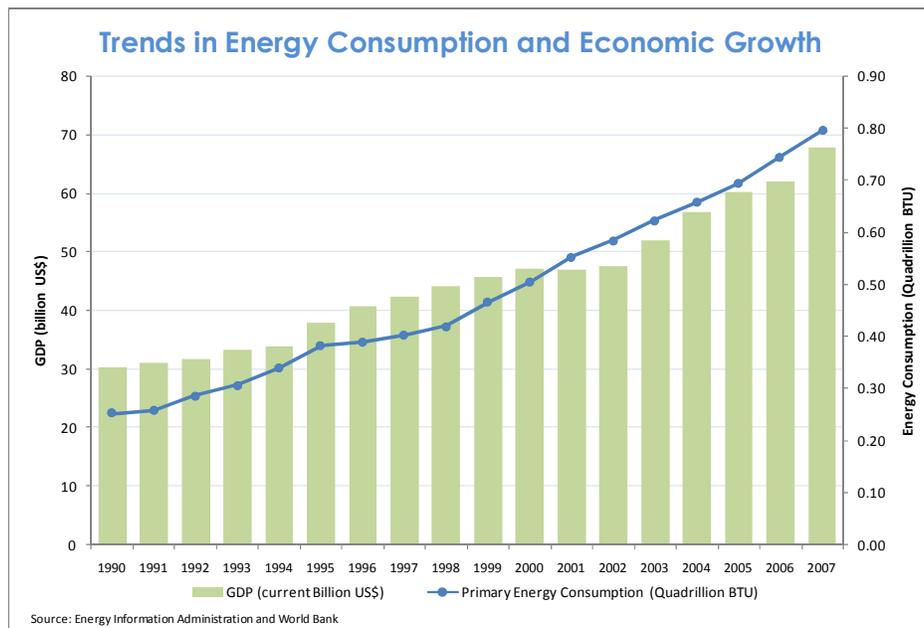


Figure 2. Energy Consumption Increase compared to GDP between 1990 and 2007

Transportation

Dhaka, the capital of Bangladesh, has seen phenomenal growth in motorization in recent years. During the last five years the vehicle population has grown by about 50% to 0.4 million plus, in step with population. The total number of registered vehicles in Bangladesh has increased from 0.07 million in 1970 to 0.46 million in 2006.

Dhaka has a fleet of 3000 plus of old minibuses which run on diesel fuel. A study conducted under the Air Quality Management Project found that 80% of these buses are unfit to ply on the city roads because of their high emissions. Even the huge fleet of aging trucks, invariably overloaded and over-fuelled, though not allowed to run during the day time, contribute significantly to worsening Dhaka’s air particularly during the dry winter months. Despite the phasing out of two-stroke three wheeler baby taxis in 2003, the air quality benefit could not be sustained because of the smoky diesel vehicles which came in huge numbers at a time

the city was badly suffering from the want of a mass rapid transit system like a Bus Rapid Transit (BRT) System.

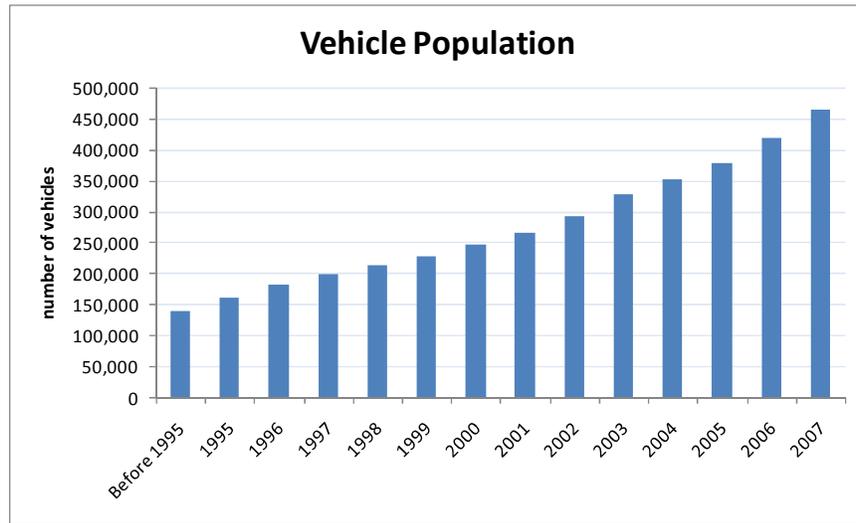


Figure 3. Vehicle Growth in Dhaka City between 1995 and 2007

The city has witnessed a tremendous growth of compressed natural gas (CNG)-run vehicles in the recent years (Figure 4). A sizeable number of gasoline-run vehicles have been converted to CNG. Some of the very old commercial vehicles are being converted to CNG in view of the lacunae in motor Vehicle Ordinance. The retrofit engines which run on dual fuel are posing a real threat to the already polluted city's air and the safety and security of commuters. The rising cost of auto fuel in the recent months also contributed to conversion of vehicle engines to CNG.

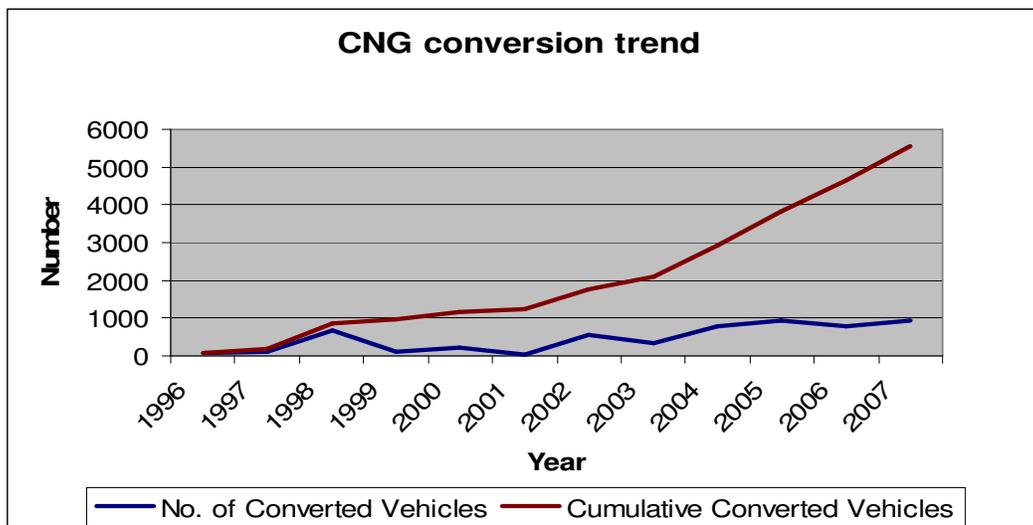


Figure 4: Year wise CNG conversion in Bangladesh since 1996 to 2007

1.2 Air Pollutants and Greenhouse Gas Emissions

The main air pollutants in two major cities of Bangladesh, Dhaka and Chittagong, are sulfur dioxide (SO₂), nitrogen oxides (NO_x), particulate matter (PM, usually expressed as PM with diameter of 10 microns or smaller, PM₁₀, or 2.5 microns or smaller, PM_{2.5}), carbon monoxide (CO), ozone, volatile organic compounds (VOCs), and lead. According to an emission inventory by World Bank it is predominantly the diesel-run vehicles and brick kilns that contribute most to air pollution. For Dhaka, emissions from coal burning traditional brick kilns are a source of air pollution. Hundreds of brick kilns operate during the dry months of November to April in the low lying agricultural land surrounding Dhaka city generate particulate emissions including SO₂, NO_x and hydrocarbons that contribute to worsening ambient air to the detriment of public health. These kilns are also a major source of greenhouse gas (GHG) emissions.

As shown in the figures below, average national levels of PM₁₀ in major cities are increasing since 1993, SO₂ levels are increasing and NO_x levels are increasing. It is important to note that in 2007 the average of both NO_x and SO₂ remained below Bangladesh national ambient air quality standards and World Health Organization (WHO) guideline values, but that PM₁₀ and PM_{2.5} levels continue to exceed both Bangladesh national ambient air quality standard and WHO guideline values.

For Bangladesh, monitoring of ambient air is a recent phenomenon. The journey to ambient air monitoring on a continuous basis just started from year 2002 with the installation of a continuous air monitoring station at the heart of the capital Dhaka. This is reflective of limited data on Dhaka's air quality.

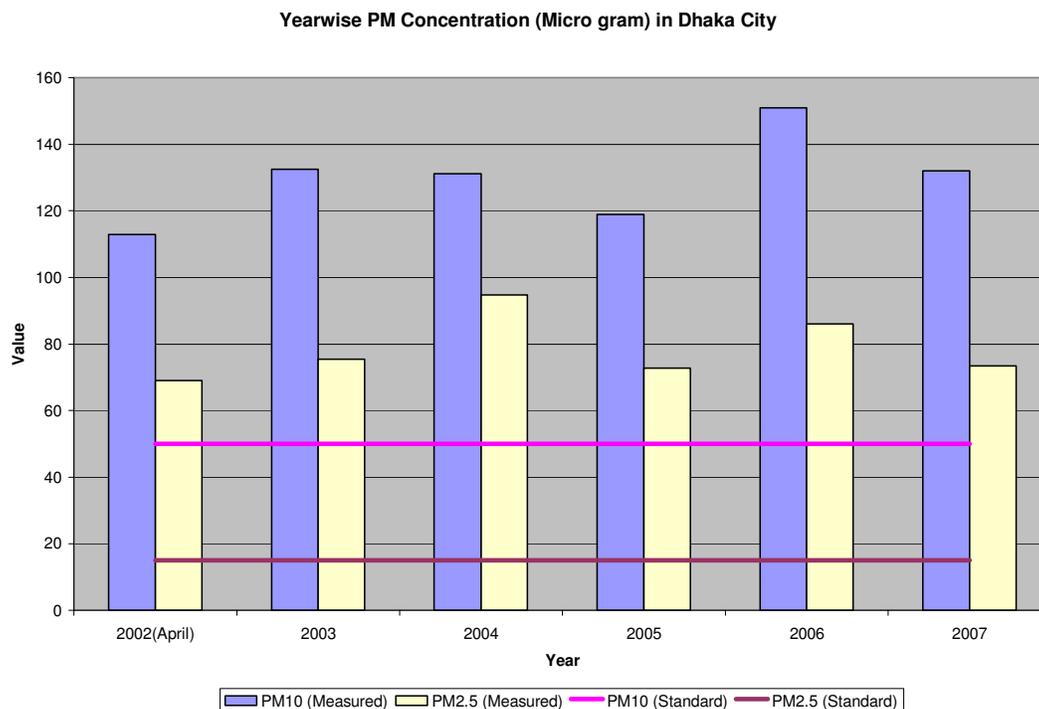


Figure 5. Trends in PM₁₀ and PM_{2.5} levels in Dhaka between 2002 and 2007

The transport, brick making industry and untreated wastes in municipal areas predominantly contribute to GHG emissions. A study by the Bangladesh University of Engineering and Technology says the brick sector alone contributes to GHG (CO₂) emissions to the tune of 8.75 million tons per annum. This could be attributed to use of high sulfur and low grade coal in the brick making industry. The brick sector alone consumes 2.2 million tons of coal. The forecast is that in the next 10 years there will be a 2-3% growth in the brick sector if the current trend of urbanization goes on.

A World Bank study says nearly 2×10^5 tons of air pollutants are emitted from motor vehicles alone. The lower GHG benefits could also be derived by improving industrial energy efficiency and improving solid waste management in the cities.

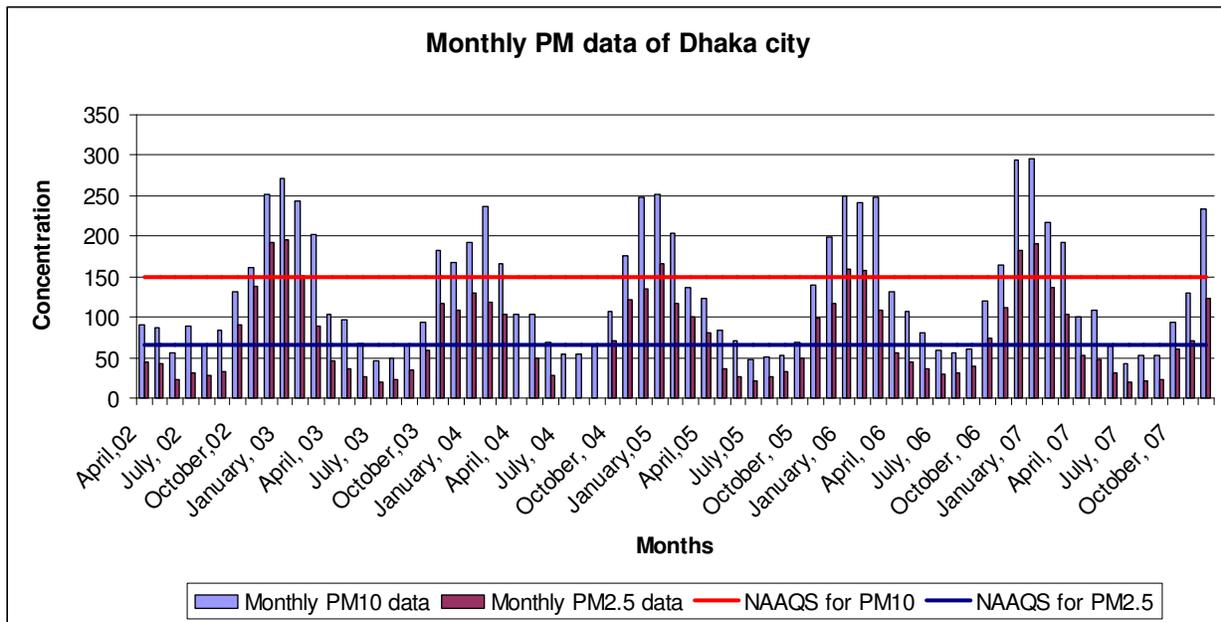


Figure 6: Monthly PM₁₀ and PM_{2.5} concentration of Dhaka city from 2002 to 2007

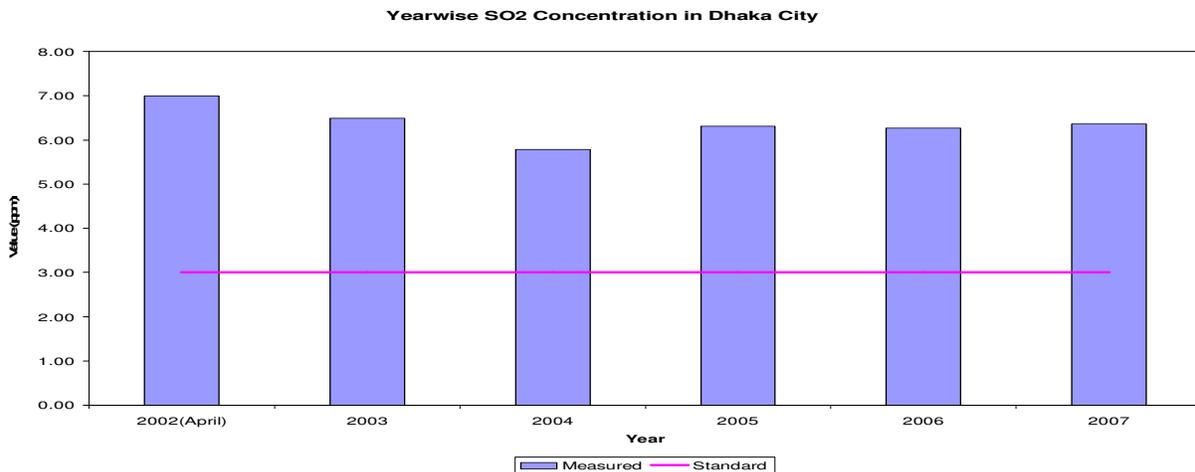


Figure 7. Trends in SO₂ levels in Dhaka between 2002 and 2007

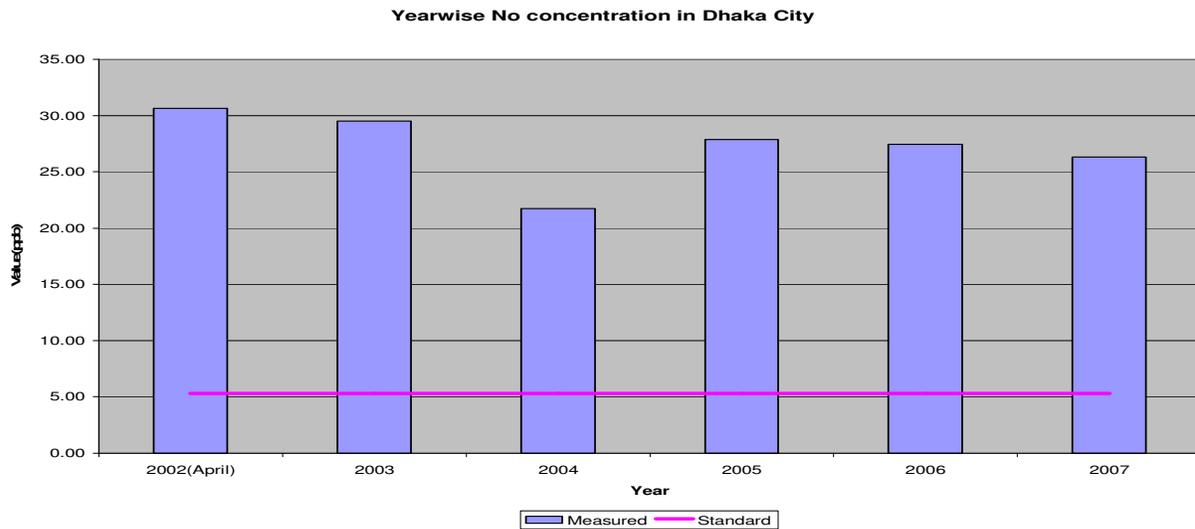


Figure 8. Trends in NO_x levels in cities in Bangladesh (national average) between 2002 and 2007

Greenhouse gas emissions, expressed as carbon dioxide (CO₂)-equivalents, are rapidly increasing. In 1990, GHG emissions were 0.15 million tons, in 2006 this was 0.25 million tons, and this will continue to grow. Increased energy consumption is the main reason for this steep increase.

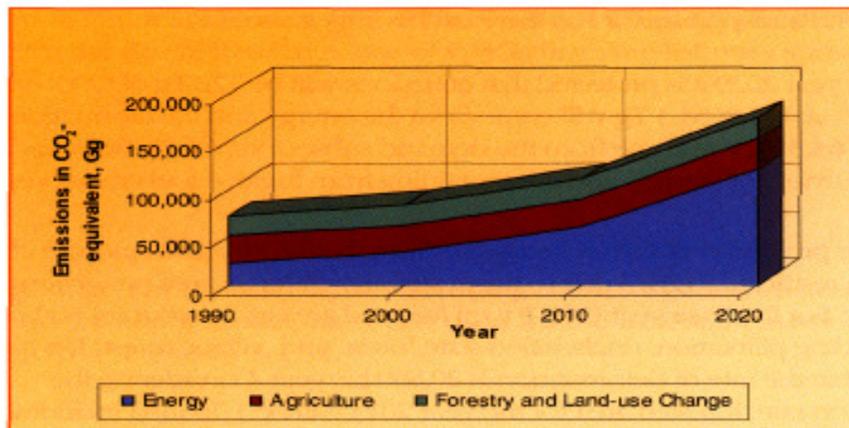


Figure 9: Trends in GHG emission in Bangladesh during 1990-2020

1.3 Impacts of Air Pollution

The most important pollutant from the health point of view in Dhaka and Chittagong is particulate matter (PM₁₀ and PM_{2.5}). The level of PM remains well above the National Ambient Air Quality Standards (NAAQS) and WHO guideline values especially during the dry winter months which last about 100 days per year. The levels of gaseous pollutants also remain well above the NAAQS during the dry winter months.

A study by the World Bank states that if particulate pollution levels in the four largest cities in Bangladesh were reduced to meet the standards in developed countries, as many as 15,000 deaths, 6.5 million cases of sickness requiring medical treatment, and 850 million minor illness could be avoided annually. The economic cost of this avoided sickness and death is estimated to be US\$200-800 million per year, or 0.7%-3.0% of GDP.

Another estimate by the bank says the number of cases of mortality and morbidity that can be avoided per year if the PM₁₀ pollution levels are reduced by a modest 20% of the current level, or to the NAAQS, are found to be between 1200-3500 and 80-235 million cases respectively. The costs involved are between US\$169-492 million per year, which corresponds to 0.34-1.0% of GNI in the WTP based estimates. A World Bank study says nearly 2×10^5 tons air pollutants are emitted from motor vehicles alone.

The impact of air pollution on visibility in Dhaka city has not yet been studied. The visibility worsens during winter months due to thermal inversion. The winter months 2007 saw a dense smog episode that contributed to flight delays and a virtual halt of steamer movement in the rivers surrounding Dhaka.

The damage to agricultural productivity and forestry and reduced tourism potential is expected to be studied under the Clean Air and Sustainable Environment project due to be commissioned starting 2009.

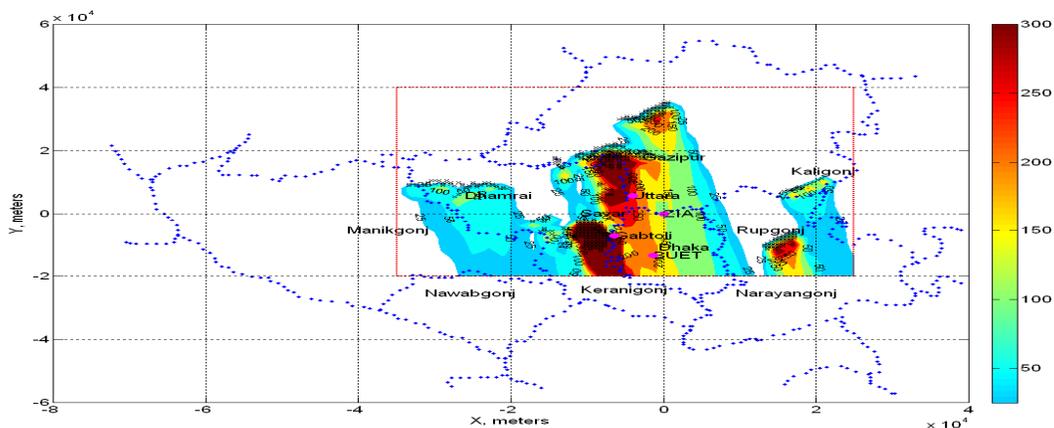


Figure 10. Four Months Seasonal average (December to March) for particulate pollution in Dhaka city from Dhaka North brick kiln clusters



Figure 11. Reduced visibility due to smog episode in Dhaka city during the winter months (picture on the right) compared to clear visibility during monsoon (picture on the left).

2. CLEAN AIR STAKEHOLDERS IN BANGLADESH

2.1 Introducing the Clean Air Stakeholders in Bangladesh

The stakeholders in Bangladesh keep track of air quality drivers, trends, impacts and responses. They work together with those who have an interest in better air quality in Bangladesh and who have a role to play in achieving this: government agencies, development partners (including donors, foundations, development agencies), civil society (including non-governmental organizations or NGOs, academia, research institutes) and the private sector. Stakeholder groups are shown on the next page.

2.2 Main Achievements and Challenges

2.2.1 Achievements

Though air pollution is a cross cutting issue, Bangladesh is poised to make significant stride in abating urban air pollution. Since 2006, four additional Continuous Air Monitoring Stations (CAMS) were set up in Chittagong, the second largest city in the country and home to 6 million people, Rajshahi and Khulna, with populations of more than one million each. Besides these hotspots, CAMS was set up along the busy street at the heart of Dhaka. The city-wide monitoring network has also been strengthened. The Air Quality Index of two populous cities including Dhaka is being regularly posted in the Department of Environment website for public information.

In order to strengthen the air quality monitoring capacity of the Department of Environment, the government has already created an “Air Quality Cell” within the DOE set up. This will pave the way for the future expansion of air quality management activities in Bangladesh. Based on the lessons learned and experience gathered from the just concluded Air Quality Management Project (AQMP), the government has already undertaken a US\$70 million IDA- financed Clean Air and Sustainable Environment (CASE) project under which necessary infrastructure like an Air Lab and new CAMS will be set up in populous cities. Under the project, CAMS already in place and additional six new ones will be brought under a network with a focus to regularly inform the public on the status of air pollution in cities in the AQI format. The formulation of a much-needed Clean Air Act is another milestone to be looked into under the CASE project.

The CASE project will address the pollution from motor vehicles in Dhaka city and emissions from brick kilns. To reap clean air benefits, the project will finance the feasibility studies and design of the BRT system for Dhaka in line with Strategic Transport Plan approved by the government for Dhaka city. To promote walking as a mode of transport, a good number of pedestrian-friendly foot overpasses will be constructed in the city. The project also plans to invest a sizeable allocation for efficient traffic management especially with a focus to improve the traffic signaling system in Dhaka city.

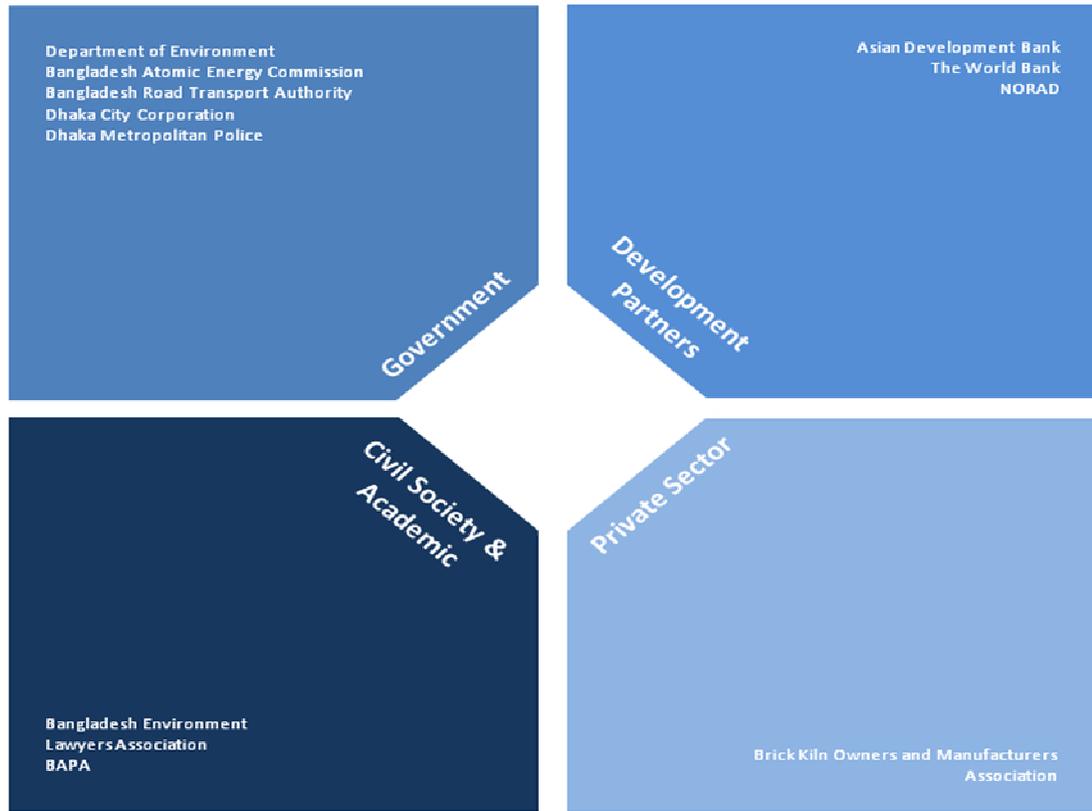
Bangladesh being the signatory to various international conventions and protocols relating to emission reduction particularly the GHG, so far established a two-tier Designated National Authority (DNA) in order to gain access funds from the Clean Development Mechanism under the Kyoto Protocol. The two tiers are the national CDM Board and the national CDM committee. The DNA so far has approved four projects in waste

and energy sectors in Bangladesh. The projects include: (a) landfill gas extraction and utilization at Matuail by Waste concern, (b) composting project at Gazipur and Kanchpur (700 tons/day) by Waste Concern, (c) installation of 30,000 Solar Home Systems (SHS) in rural households by Grameen Shakti and BCAS, and (d) promotion of energy efficient Compact Fluorescent Lamp (CFL) in rural Bangladesh. Under this particular project, to be jointly implemented by Grameen Shakti and BCAS, 0.1million incandescent is expected to be replaced by CFL.

2.2.2 Challenges

Despite the progresses made, several challenges remain. The most important ones being

- Marine and vehicular emissions and air pollution from industries particularly from the burgeoning steel and re-rolling mills surrounding the capital Dhaka and Chittagong city.
- The introduction of low-sulfur diesel is another issue that merits special attention. Given that the bulk of the imported diesel is used in the agriculture sector for dry season irrigation, the government is cautiously prodding the introduction of low-sulfur diesel.
- The introduction of cleaner technology in traditional brick making industries is another key area which is likely to be addressed under the CASE project. But a quick shift to alternative building materials in place of bricks would render hundreds of peoples jobless.
- Despite that there is a general ban in place on plying 20 years old vehicles on the city roads still a good number of very old technology vehicles are visible in capital Dhaka. The automated vehicle inspection centers set up under the Bangladesh Road Transport Authority with financial support from the ADB have yet to become operational. As a result, the annual fitness certificates are issued to vehicle users without any scientific basis. The laxity in issuing the fitness certificates based on visual inspection is seriously contributing to increased vehicular emissions at times 20,000 to 25,000 plus new vehicles are being added to city roads every year resulting in traffic congestion and air pollution.



Clean Air Network of Stakeholders in Bangladesh

3. RESPONSES TO IMPROVE AIR QUALITY

Countries and cities can address air pollution in several ways, such as, policies, programs, training courses, and on-the-ground measures.

3.1 Policies

Bangladesh has a range of policies relevant to air quality management. Policies can be directly aimed at improving air quality, or policies cover related areas (such as health, climate change, energy management, environment) or sectors (such as transport, industry, construction) that affect air pollution indirectly. The most important ones are:

- **Ban on Fix Chimney Kiln (FCK) technology.** In order to reduce emissions from brick kilns contributing to urban air pollution the government has already announced the ban on Fixed Chimney Kiln (FCK) technology effective from year 2010. This particular action was necessitated in view of rising pollution in the urban areas from brick kilns despite the effort to raise chimney heights to 120 feet in FCK. To make the brick making industry more energy efficient and less environmentally polluting, the government is actively considering imposing conditions like retrofitting of FCK with gravity settling chamber and use of internal fuel in the manufacture of green bricks. Apart from this, proven brick production technologies will be encouraged. In addition to this, dispersion modeling will be used in the issuance of permits to new brick kilns.
- **Revisit motor vehicle ordinance 1983.** The existing motor vehicle ordinance 1983 is being revisited in view of rising vehicular emission in the cities. Stringent measures have been proposed to stop black smoke from in-use vehicles. The import policy provides provisions for importation of minimum Euro II diesel vehicles.
- **Encouraging the use of CNG as auto fuel.** The government is encouraging to use of CNG as auto fuel in different types of vehicles. In the current fiscal year, the import duty on dedicated CNG vehicles and engines and their spare parts has been reduced.
- **Strategic Transport Plan for Dhaka City.** The Bangladesh government has approved the Strategic Transport Plan for Dhaka city. The approval comes with introduction of environment-friendly mass transit like BRT, LRT and metro system in Dhaka. This will ensure co-benefits of air quality management and climate change mitigation.
- **National Energy Policy.** In order to reduce air pollution in Dhaka and other cities, the government in its National Energy Policy emphasized the best possible use of CNG in the transport sector. It also provided fiscal incentives in the form of tax cuts on the import of equipment for compression and refueling of natural gas. This particular policy decision immensely contributed to growth of CNG as an auto fuel in Bangladesh.

3.2 Programs/projects and Training Courses

The CAI-Asia Center and country networks compiled a Compendium of air quality management (AQM) organizations, programs/projects, and training courses, which was published in January 2007. For Bangladesh, 20 programs and projects were identified. In Asia, 28 air quality training courses delivered on a regular basis were identified. For more information see www.cleanairnet.org/compendium.

3.3 Case Studies of Concrete Actions

Banning smoky baby taxis result in drastic reduction of harmful air pollutants

In order to get rid of high pollution levels in Dhaka city, two-stroke three wheeler baby taxis were phased out in January 2003. The objective of the ban was to abate air pollution and to safeguard public health.

The phasing out saw a host of activities that include: training of baby taxi drivers on the harmful health effects of adulterated lube oil and involvement of mass media and civil society to raise awareness of citizens against the smoky vehicles.

The phasing out of baby taxis contributed to 40% reduction in PM_{2.5}, 51% reduction in hydrocarbons and 35% reduction in CO. The phasing out was successful because of the people's participation in the campaign against smoky vehicles. The government maintained the consultation process with various stakeholders at every stage of the phase out decision. To continue the gains of the ban, an important next step is the promotion of four-stroke CNG baby taxis.

The Dhaka Urban Transport Project under the Ministry of Communications, Air Quality Management Project under the Department of Environment, Bangladesh Atomic Energy Commission, Bangladesh Road Transport Authority, Bangladesh Environment Lawyers Association, and Bangladesh Paribesh Andolon (BAPA) were among the organizations that supported the project.



The smoky two-stroke three wheeler baby taxis were phased out from the capital Dhaka in 2003.



A busy street in capital Dhaka with heterogeneous mix of vehicles



The New Airport Road leading to the capital Dhaka is heavily congested with vehicles stuck up on a flyover



The CNG vehicles that replaced the two stroke three wheeler baby taxis now visible on the city roads.



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