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

Country Network Nepal
Clean Air Network-Nepal
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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 the People’s Republic of China (PRC), 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 (WHO) estimates that ambient air pollution causes over half a million premature deaths in Asia 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 the efforts and progress to improving air quality in Nepal, which also focuses on related areas, most importantly health, climate change, transport and energy management. This summary report was prepared by the Clean Air Network-Nepal (CAN-N) which is hosted by the Clean Energy Nepal. This report presents

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

You are invited to discuss with us the achievements and challenges of Nepal at the Roundtable for South Asian Countries 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 country webpage on www.cleanairnet.org/cann for more information, or contact us directly. We welcome your support to help improve air quality in Nepal!

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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

Although Nepal is not urbanizing evenly throughout the country, the main cities and urban centers are growing faster. According to the 2001 national census, the urban population is increasing at a rate of 6.65% whereas the annual national growth rate stands only at 2.3%. By 2050, 46.34% of people will be living in cities, compared to 8.85% in 1990. One of the main reasons for the rapid rate of urbanization is the migration of people from villages to the cities in search of better opportunities. The recent trend in Nepal indicates that when people migrate, they choose larger cities instead of small towns. Thus, bigger cities will continue to grow faster than small towns putting more pressure on available resources, including clean air.

![Urbanization Chart](Image)

**Figure 1. Urbanization increase between 1990 and 2005 and forecast for 2010 to 2050**

Nepal’s energy supply is based on three sources – traditional (biomass), commercial (coal, petroleum products and electricity) and alternative energy (biogas, solar, micro hydro, and so on). Although Nepal’s per capita energy consumption is very low as compared to other developed and developing countries, the energy consumption rate has increased in the recent years because of expanding economic activity and population growth. The rate for consumption of petroleum products is increasing day by day. The amount of energy consumed is an indicator of the level of development and standard of living. Hence, as the GDP of Nepal continues to rise, energy consumption will also show an increasing trend. Energy consumption increased from 0.018 quadrillion BTU in 1990 to 0.065 quadrillion BTU in 2005.
Being a landlocked and mountainous country, road transport dominates the transport sector in Nepal. Vehicles powered by fossil fuel are predominantly used for the transport of goods as well as people. Due to the rapid growth in urban areas, vehicle ownership is also growing rapidly in these areas. Much of the urban air pollution in Nepal, particularly in Kathmandu Valley, comes from vehicles. In 1990, the total number of registered vehicles was 76,276; in 2004, this increased almost six-fold to 428,285. The growth is highest in the case of private vehicles such as motorcycles and small cars. The share of two wheeler motorcycles is over half the total vehicle fleet.
1.2 Air Pollutants and Greenhouse Gas Emissions

In 2002, the then Ministry of Population and Environment established six permanent air quality monitoring stations in Kathmandu Valley. It is the only air quality monitoring system in Nepal. These stations monitor daily PM$_{10}$ concentrations; time series data on this parameter is easily available. Other key parameters such as SO$_2$, NO$_2$, benzene, lead, polycyclic aromatic hydrocarbons (PAH) are monitored through passive samplers and such monitoring is not carried out on a regular basis. For this reason, time series data on these other parameters are not presented here.

The main air pollutant in Kathmandu Valley is particulate matter. As shown in the figures below, average national levels of PM$_{10}$ in Kathmandu City has seen a decreasing trend from 2003 to 2006 and increased in the year 2007 again. Except for 2006, PM$_{10}$ levels are generally higher than the national standard (120µg/m$^3$), and consistently exceed WHO guidelines (20µg/m$^3$).

The concentration of NO$_2$ and SO$_2$ are generally within the national standards of 40 and 50 micrograms per cubic meter, respectively.

The benzene level also meets the national standard of 20 micrograms per cubic meter. PAH has been monitored at the monitoring stations on a campaign basis and the results indicate that PAH concentration in Kathmandu may be a concern.

Lead levels were found to be well within the National Ambient Air Quality Standards (NAAQS) value of 0.5 micrograms per cubic meter as measured during March to November 2006.

![Figure 4. Trends in PM$_{10}$ levels in cities in Kathmandu Valley between 2003 and 2007](image-url)
Figure 5. NO$_2$ levels in Kathmandu Valley in 2003/04 and 2004/05

Greenhouse gas emissions from fossil fuel combustion, expressed as Carbon dioxide (CO$_2$)-equivalents, are rapidly increasing. In 1990, GHG emissions were 213,964.10 thousand metric tons, in 2006 this was 378,250.11 thousand metric tons.

Figure 6. Trends in greenhouse gas emissions (CO$_2$-equivalents) for fossil fuel combustion in Nepal between 1993 and 2004
1.3 Impacts of Air Pollution

Air pollution leads to:

- Reduced health and quality of life
- Damage to agricultural productivity and forestry
- Reduced tourism potential
- Economic losses of about 2-4% of GDP

Some studies done in Kathmandu Valley clearly indicate that the health impacts of Kathmandu’s air pollution can be quite severe. In 1993, an analysis done with the records of all patients admitted to Patan Hospital found that in six years (1985 to 1991), the proportion of admissions for Chronic Obstructive Pulmonary Disease (COPD) as a percentage of the total number of medical patients had tripled. Estimates by the Ministry of Environment, Science and Technology in 2005 show that ambient air pollution is responsible for the premature deaths of 1600 people per year in Kathmandu Valley. The Clean Energy Nepal/Environment and Public Health Organization (CEN/ENPHO) (2003) estimated that about NRs 30 million of hospital costs every year could be saved by reducing Kathmandu’s PM\textsubscript{10} level to meet WHO guideline values.

Kathmandu Valley is the first arrival destination for tourists in Nepal. After arriving at Kathmandu either they observe the historic Kathmandu Valley or take a route to other tourist areas of the country. In this context, the deteriorating air quality of Kathmandu Valley is having negative impacts on tourism. In a tourist survey carried out in 2005 by the Kathmandu Electric Vehicle Alliance and the Kathmandu Environment Education Project, nearly 69% tourists rated Kathmandu’s air quality as poor. Similarly, 58% of tourists mentioned that they are facing problems during sightseeing trips due to poor visibility. The data from the Kathmandu Airport also confirms that the visibility in Kathmandu Valley has decreased substantially from 1970 onwards. A recent survey of 299 residents of Thamel, a famous tourist hub in the valley, found that 94% of the respondents felt that tourists shorten their stay in Thamel because of environmental problems such as air pollution.
2. CLEAN AIR NETWORK-NEPAL

2.1 Introducing the Clean Air Network-Nepal

The Clean Air Network Nepal (CAN-N) was formed in 2004 to forge collaboration and networking among all the relevant stakeholders to tackle the air pollution problem in Nepal.

The goal of the CAN-N is to increase the ability of professionals and other interested stakeholders to effectively address the problems of air pollution in Nepal by:

- Sharing knowledge and experiences on air quality management (AQM) on a regular basis
- Providing inputs to improve policies, plans and programs for AQM in Nepal
- Organizing activities to raise awareness on air quality related issues
- Building local capacity on AQM
- Promoting integrated AQM

The CAN-N is working as an informal network of individuals, experts, national and international nongovernmental organizations, governmental organizations and private sector engaged in clean air activities in Nepal. It is the country network of Clean Air Initiative for Asian Cities (CAI-Asia) in Nepal and is hosted by the Clean Energy Nepal.

The CAN-N keeps track of air quality drivers, trends, impacts and responses. In doing so, it works together with a wide range of stakeholders with an interest in better air quality in Nepal 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

During the period of 1991 to 2004, many steps were taken by the government, I/NGO, private sector in improving the air quality in Nepal. But it is sad to mention here that few clean air initiatives were taken since 2006. The then volatile political situation of the country and low investment in this sector by the government and donor agencies can be attributed as major reasons behind this.

Since 2006, the main achievements in improving air quality in Nepal are

- About 650 electric three wheelers are operating on the roads of Kathmandu Valley. More initiatives are being taken to diversify the usage of electric vehicles in terms of market and geographical segment.
- Vertical shaft brick kiln (VSBK) technology has been proven to be the best available technology for the brick industry in Nepal. VSBK reduces the pollution load by 80% compared to the traditional kilns and saves nearly 30-40% in energy consumption. At the moment nearly 6 VSBK plants (18 vertical shafts) are in operation in Nepal.
• Air Quality Monitoring system in Kathmandu Valley is continuously working in good condition and producing PM$_{10}$ data.

At the moment, Nepal is facing the following challenges
• High concentration of PM$_{10}$ in urban areas: The urban areas are facing the problem of high concentration of PM$_{10}$ mainly emitted by fossil fuel-run vehicles, poor roads, and industrial units.
• Rapid increase in vehicle numbers: Along with rapid urbanization, the number of vehicles is increasing fast. The cleaner vehicles that use alternative energy such as electricity, CNG and LPG make a very low share of the total population of vehicles. Nepal has a high potential for electric vehicles. While about 650 electric three wheelers are operating on the roads of Kathmandu Valley; this number is negligible compared to fossil fuel-run vehicles. The number of electric vehicles has not increased drastically nor has its usage been diversified in terms of market segment and geographical location.
• Weaknesses in the I&M system for vehicles: Nepal lacks an effective and systematic inspection and maintenance system for in-use vehicles. The present inspection system has many loopholes such that the intended results are not achieved.
• Transport planning and management: Poor transport planning and management has aggravated the air pollution problem. Poor road condition, insufficient infrastructure, congestion and ineffective public transport system are the major problems.
• Institutional weaknesses: Nepal lacks a champion institution which is solely responsible for policy formulation, planning, implementation, compliance and necessary coordination among relevant stakeholders. In the absence of a comprehensive Clean Air Act and action plan for AQM, much has yet to be achieved.
• There is no national system for AQM: Very little information exists on air quality outside Kathmandu. There is a need to improve the capacity of professionals on air quality assessment and management.
Figure 7. Clean Air Network of stakeholders in Nepal
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

Nepal 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:

<table>
<thead>
<tr>
<th>Policy /Legislation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>National Conservation Strategy 1987</td>
<td>It mentions the problem of air pollution in urban and industrial areas and highlights the need for Environmental Impact Assessment for proposed projects</td>
</tr>
<tr>
<td>Industrial Policy 1992</td>
<td>Calls for the formulation and implementation of guidelines to control pollution and tax benefits for investments in activities related to pollution control</td>
</tr>
<tr>
<td>Industrial Enterprises Act 1992</td>
<td>Provides tax rebates to manufacturing industries dealing with energy efficiency, conservation and pollution abatement</td>
</tr>
<tr>
<td>Vehicle and Transport Management Act 1993</td>
<td>Prescribes standards for emissions from in-use vehicles, sets parameters for roadworthiness certifications for vehicles</td>
</tr>
<tr>
<td>Nepal Environmental Policy and Action Plan (NEPAP) 1993</td>
<td>Highlights the need to address the urban and industrial pollution and calls for appropriate legal and institutional mechanism</td>
</tr>
<tr>
<td>Environment Protect Act 1996 and Environment Protection rule 1997</td>
<td>It is the main legislation to prevent and control the pollution in Nepal. It has various provisions for compliance, enforcement and formulation of bylaws and standards to control pollution including air pollution</td>
</tr>
<tr>
<td>National Transport Policy, 2001</td>
<td>Makes public transport system safe, reliable and easily accessible to the general public and promotes environment friendly transport system in Nepal</td>
</tr>
<tr>
<td>Sustainable Development Agenda for Nepal 2003</td>
<td>“Every Citizen has access to … clean air” is one of the broad goals of Nepal’s sustainable development agenda. Its objectives include compliance and enforcement of national standard of air and promote zero emission vehicles</td>
</tr>
<tr>
<td>Interim Constitution 2007</td>
<td>Recognizes a clean environment as a fundamental right</td>
</tr>
<tr>
<td>Fiscal Act 2008/09</td>
<td>Provided incentives to electric vehicles and imposed pollution tax on diesel and petrol to be sold in Kathmandu Valley.</td>
</tr>
<tr>
<td>Interim national plan (2008-2011)</td>
<td>Promotes environment friendly transport system such as electric railways, electric vehicles, give due consideration to vehicular emission control and continue to measuring air pollutants in Kathmandu Valley</td>
</tr>
</tbody>
</table>

The Nepal government is in the process of formulating the National Climate Change Policy. The proposed policy has provisions on reduction of greenhouse gases and pollution control giving due consideration to close relationship between air pollution and climate change. The policy also intends to mention local and national level AQM action plans.
The Ministry of Environment, Science and Technology has also commissioned a study to review the vehicle and emission standards for new and in-use vehicles. The Ministry has also set stack emission standard for brick kilns.

The Nepal government intends to devise a concrete action plan to develop Kathmandu Valley as clean, healthy and prosperous place to live in.

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 Nepal, 19 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

Cleaner Technology in Kathmandu’s brick industry

Brick kilns are one of the major emission sources in Kathmandu valley and other parts of the country. It is estimated that nearly 429 brick kilns are in operation throughout the country. The available technologies are moving chimney bull’s trench kilns, fixed chimneys and vertical shaft brick kilns (VSBK). In 2004, the Nepal government decided to ban moving chimney bull’s trench kilns (MCBTC) from Kathmandu valley because MCBTK is a more polluting and inefficient technology compared to fixed chimneys and VSBK technology. As a result, entrepreneurs are either opting for VSBK technology or fixed chimneys.

VSBK is the best available technology for the brick industry in Nepal. VSBK reduces the pollution load by 80% compared to the traditional kilns and saves nearly 30-40% in energy consumption. The VSBK Program Nepal project commenced in 2002 with support from DANIDA and SDC to demonstrate VSBK as a cleaner technology for the brick industry. The project supports capacity building, research and policy dialogue, public awareness, technical and partial financial input. To date, six VSBK plants are in operation in Nepal (3 in Kathmandu valley and 3 outside of the valley). Three more VSBK plants are under construction. The project aims to build more than 20 VSBK plants in Nepal by the end of 2011. There is an effort to also develop VSBK projects as CDM projects to bring carbon revenues into the country.

Promoting Electric Vehicles in Nepal

For the last ten years, battery operated electric three wheelers “Safa Tempos” have been the most successful electric vehicles but their numbers have stuck at 600 even though vehicle registration has increased by 13% every year. The primary reason for this is lack of market diversification in terms of market segment and geographic location.
In this connection, Shree Eco Visionary Pvt. Ltd. and CAN-N are implementing the project “Reducing Transport Sector CO₂ emissions through Market Segment and Geographical Diversification of Electric Vehicles (NEP/OP#/2/07/13)” with support from GEF/SGP since 2007.

The goal of this initiative is to reduce the transport sector’s contribution to net CO₂ emissions in Nepal by increasing the number of electric vehicles through effective market diversification by

- Reducing barriers to geographic and market segment diversification of electric vehicles
- Building capacity and partnerships for effective marketing
- Demonstrating new market feasibility
- Increasing investments through innovative financing mechanisms

The major activities of this project are:

- Policy research and advocacy
- Assessment of the technological fitness of electric vehicles to meet different market segment needs
- Conduct of stakeholder and partnership building workshops
- Training on marketing, driving and of technicians in cities where electric vehicles will be introduced for the first time
- Pilot operation of electric vehicles in Dharan, Waling and other cities with the involvement of market specific stakeholders
- Pilot operation of the Electro Bus, developed by HLF; and Tourism Tempos developed by SEV as tourist vehicles in tourism sector
- Marketing demonstration in schools, offices and for private use
- Design of innovative financial concepts and models to attract financial institutions for investment in electric vehicles

The intended outcomes are:

- Electric vehicles are diversified into at least four new market segments: (a) Tourist industry, (b) Schools, (c) Offices, and (d) Private use to test its market viability
- Electric vehicles will be geographically diversified into two locations: (a) Hetauda, and (b) Dharan
- Demonstrate performance, increase in demand and innovative financing mechanisms which catalyze the flow of finance into the electric vehicle sector