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Challenges Associated with Air Pollution in Sustainable City Development: Case of New Delhi and New York

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Abstract Urbanization has advanced many lives but at the same time, it has degraded the natural environment in many layers be it air, water, or land. One such consequence has been air pollution. Air pollution has plagued the cities and has been one of the biggest obstacles to sustainability. Hence, it is crucial to understand, manage and mitigate the challenges associated with air Pollution in the development of sustainable cities. The study will begin by understanding air pollution, the correlation between the environment and sustainable development, and the current scenario of air pollution in India and the world. Further, it shall dig deeper into the challenges associated with air pollution along with Resource Planning and Mitigation and comprehend the case studies of New Delhi and New York. The paper shall later present the modes to improve the present and future scenarios of air pollution and conclude via an equitable solution for battling air pollution in India which shall involve both government reforms and the living style of people. This study stands valuable in perceiving the adversities of air pollution which affect sustainable city planning and development and will be helpful in suggesting mitigation strategies by the researchers.

Keywords: *air pollution, sustainable development, city planning, New Delhi, New York*

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1. Introduction

"Environmental pollution is an incurable disease. It can only be prevented."
-Barry Commoner

With the advent of modernization and urbanization, the natural environment of the earth has turned vulnerable to various adulterations in air, water and land. Out of these, the adulterations in air have had the most severe effects in the lives of people as air is directly utilized by them. Even though the air pollution is a nation-wide concern, it is majorly concentrated in urban settlements, turning cities unsustainable.

Air pollution is typically assessed by measuring the levels of Particulate Matter$_{2.5}$ ($PM_{2.5}$) which are small contaminants in air and have adverse effects on human health if the concentration is high. The two countries most affected by hazards of $PM_{2.5}$ are India and China as they together constitute approximately one-third of the total population of the world. Surprisingly, they account for three-fourths of lost life expectancy due to air pollution.

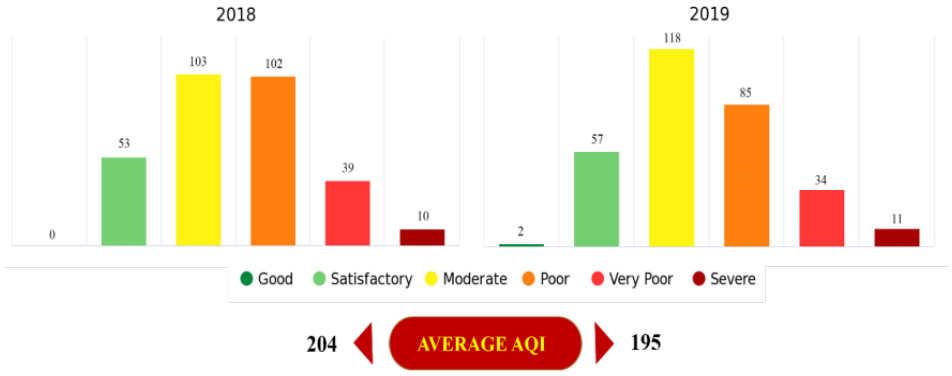

Figure 1. Delhi's Score of polluted days

Another mode of accessing the air pollution is Air Quality Index (AQI), which is considered good only if it is below 50. According to the Data Intelligence Unit of India Today, Delhi had only two days of good air in 2019.

Unexpectedly, out of the 30 most polluted cities in the world, 21 were in India in 2019. At least 140 million people in India breathe air that is 10 times over the safe limit prescribed by WHO [1].

2. Environment and Sustainable Development

Environmental Sustainability refers to the accountability of natural resource conservation and protection of ecosystems in order to support health and wellbeing in present and future. In other words, it can be understood as "meeting today's needs without compromising the ability of future generations to meet their needs" [2]

Multiple Strategies have been developed for sustainable development [3].

- o Use of Non-conventional Sources of Energy
- o LPG, Gobar Gas in Rural Areas
- o CNG in Urban Areas
- o Wind Power
- o Solar Power through Photovoltaic Cells
- o Traditional Knowledge and Practices
- o Mini-hydel Plants
- o Bio-composting
- o Bio-pest Control

Among these strategies, the use of LPG in rural areas and use of CNG in Urban Areas are directed towards decreasing the harmful emissions in air which shall promote clean air. Environmental sustainability stands as a major challenge in the development and policy for the country and shall be primary in the 12th Five Year Plan which is still being formulated.

3. Air Pollution: Global and Indian Scenario

Approximately 4.2 million people lose their lives due to outdoor air pollution globally. To minimize such adverse effects of air pollution, World Health Organization (WHO) prescribes an annual mean limit of 10 micrograms per cubic meter. Unfortunately, 91% of the people in world reside in places which exceed this limit. Some recent studies have even found out a harmful interrelation between PM2.5 levels and COVID-19. The intensity of infection is directly associated with higher PM2.5 levels. The virus spreads with a higher degree where there is more exposure to the particulate matter [4].

India's capital city tops the list of most polluted cities in the world. In May 2014, the PM2.5 concentrations were greater than 350 micrograms per cubic meter of air, the major cause of which was emissions from vehicles and industries in the cities [5].

In 2021 also, air pollution continued to magnify in India. According to the World Air Quality Report by Swiss Organisation IQAir, New Delhi continues to be on top in world capital cities pollution levels. 35 Indian cities were listed in the index for the tag of worst air quality in 2021. Many other cities in Uttar Pradesh were on the list which included Lucknow, Kanpur, Agra, Meerut, Amroha, Jaunpur, Ghaziabad, Varanasi and Noida.

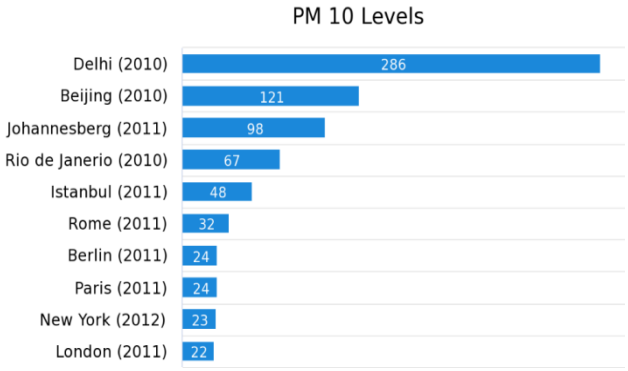

Figure 2. Air Pollution level comparison with major cities in the world

4. Challenges Associated with Air Pollution

The impactful sectors that are the main source of challenge in cleaning the air are: [6,7]

- ○ Vehicular emission
- ○ Industrial expansion
- ○ Power generation (thermal power plants)
- ○ Biomass burning
- ○ Strictness among the established laws

4.1. Vehicular Emission

Air pollution endangers human health, economic assets, and the environment as a whole. In the current Indian scenario, automobile emissions, industry, and thermal power plants damage metropolitan areas the most. According to surveys and research, automobile emissions are the primary cause of Delhi's rising pollution levels. According to previous studies, there is a dearth of India-specific emission factors for a number of air contaminants, which could be a serious concern in building realistic emission inventories for Indian cities. Furthermore, neither a ratio nor realistic figures for two-stroke and four-stroke two-wheelers, as well as light and large commercial vehicles, are available. This results in uncertainties in the estimated emissions of air pollutants.

4.2. Industrial Expansion

Over the last decades, industrialization has boomed and India ranks among the top 10 industrialized countries, global studies listed the improvements that could be made in the emission estimates from Indian cities by monitoring capacity, regular documentation of pollutant sources, fuel usage patterns, and receptor modelling studies.

4.3. Power Generation

To provide affordable electricity to its 1.3 billion people, the country is burning more coal, resulting in

filthy air across broad swaths of the country. This is resulting in the loss of life and decreases in the country's economic productivity, forcing a policy rethink [7].

4.4. Biomass Burning

The approaches for estimating emissions from biomass burning in India have some limitations. Several sources are excluded from estimation due to unreliable data sets on biogenic emissions. According to estimates, the burning of roadside garbage and landfill fires have a 50 percent uncertainty. The data on fuel used for cooking and heating in the household sector, according to the study, has a 25% uncertainty. For the year 2010, the fuel usage data for in-situ generators utilized in large institutions, hospitals, and hotels was 30% unknown [6].

4.5. Strictness among Established Laws

Irresponsible human behaviour is another key issue that makes it difficult to address the current challenges. The public's lack of interest in pollution control measures, as well as an inefficient traffic management system, are major roadblocks to achieving the aim of clean air. Due to a lack of public interest in some government actions, considerable investments in infrastructure facilities could be lost. Also, India's corrupt system encourages locals to break the government's rules, which is most likely the biggest factor that will lead to India's deception.

5. Mitigation and Resource Planning

5.1. Action Plan of India

- Union Government has launched the National Clean Air Programme (NCAP). The NCAP is a long-term, time-bound national-level strategy to report air pollution difficulties across the country holistically, with targets of attaining a 20% to 30% reduction in PM2.5 and PM10 concentrations by year 2024.
- A Graded Response Action Plan (GRAP) for air pollution prevention, control, and reduction in Delhi and the National Capital Region. It classifies graded measures and applies actions based on four Air Quality Index categories.
- The SAMEER application has been launched, giving the public access to air quality information as well as the ability to file complaints about air pollution-causing activities.
- Air quality data assortment and spread are done from a concentrated area. It gives ongoing air quality status.
- Data on air quality is collected and distributed from a central location. In real-time, it shows the present state of air quality.
- To provide access to air quality information, a dedicated media corner, as well as Twitter and Facebook accounts, have been established. The general public can also use these platforms to file complaints.
- The Environment Education, Awareness, and Training Scheme is being implemented by the Ministry of Environment with the goal of increasing environmental awareness.
- Approximately one lakh schools have been designated as Eco-clubs as part of the Ministry's National Green Corps (NGC) program, with approx. thirty lakh students actively contributing to various environmental protection and preservation activities, including problems related to air pollution.
- The Ministry encourages citizen participation and raises environmental awareness. Amongst other things, the ministry endorses cycling, saving water and electricity, planting trees, lane discipline, and reducing traffic congestion [8].

5.2. Role of Finance, Policy and Community

5.2.1. Policy

In India, various approaches and projects have been implemented to address the issue of air pollution. The success and viability of these projects, like that of other strategy measures, has been dependent on collaboration and coordination among various partners.

The National Clean Air Program (NCAP), which was launched in mid-2019, is possibly the most recent arrangement to deal with air pollution. The NCAP approaches 122 cities in India to develop city-level Clean Air Plans to implement moderation systems for surrounding PM fixations. It aims to reduce key air pollutants PM10 and PM2.5 by 20-30% by 2024, using 2017 as the baseline year. This five-year activity plan aims to establish a dish India air quality monitoring organization and to instill resident mindfulness.

There are also execution challenges, such as unacceptable information catch due to insufficient checking stations, a lack of fitting process to use ongoing information for detailing patterns, and a lack of information cleaning techniques to fill holes (missing/off base information) in the observing system. Moreover, there is still a shortage of information on the urban-rural difference in air quality. This implies that the vast majority of the country's population is being closely monitored for air pollution, with one monitoring station for every 6.8 million people [9].

5.2.2. Finance

The Indian economy suffers greatly as a result of air pollution. The scale, difficulty, and earnestness of the situation demand a strong, comprehensible, and synchronized financial reply from the government. Recent break and stimulus expenditure in response to the COVID-19 has affected the Indian budget and resulted in a huge upsurge in public debt. With limited fiscal leeway, the government faces a massive challenge in financing measures to improve air quality.

The urgent need is to develop a financial architecture capable of mobilizing private finance for clean-air solutions in India. Clean energy and e-mobility are likely to be the driving forces behind the development and implementation of tangible solutions to improve air

quality. An investment fund with a green focus could play a critical role in accelerating the growth of such green industries while also addressing the twin problems of air pollution and climate change. A Green SuperFund would combine a return-driven strategy with the need for sustainability, accelerating investment in green industries. The Triple Bottomline agenda will be at the heart of the SuperFund's performance management plan, with an emphasis on profit, people, and the planet. It would seek money from institutional investors such as multifaceted organizations, independent wealth funds, and development finance institutions. More than 40 environmental start-ups have been established in India since 2014 with the sole purpose of combating the air pollution crisis. The SuperFund would be dangerous in unlocking the economic and environmental potential of these start-ups as well as funding other high-impact schemes.

There are several other ways for the private sector to contribute to cleaner air and show that economic development and air pollution reduction are not mutually exclusive. The roadmap for catalyzing private-sector action to indorse clean air is divided into four main subsets.

Figure 3. Economic costs of air pollution from fossil fuels as a share of GDP in 2018

Figure 4. Catalyzing Action in the Private Sector to address air pollution

IKEA, a Swedish multinational corporation that specializes in furniture and home accessories, is a prime example. In 2019, IKEA introduced a collection that made use of rice straws (crop residue) as a raw material. Each year, farmers in Northwest India burn around 39 million tons of rice straw deposit on their farms to clear the field for the next produce—these doings contribute up to 45% of the poisonous smog that envelops Delhi during the stubble burning time. IKEA's innovative solution demonstrates the possibility of repurposing a waste product into a financially viable resource that reduces air pollution. Another innovative product for fighting air pollution is the 'Zephyr' air quality device, created by mobility Management Company Siemens Mobility and air quality experts at EarthSense. The sensor can make real-time quantities for a variety of pollutants, permitting local governments to make meaningful and timely interventions based on reliable pollution data [9].

5.2.3. Community

As previously stated, only a small proportion of the Indian population is monitored for health effects of air pollution; this number is also heavily skewed toward the urban population. It is critical to comprehend and work toward mitigating the extent to which air pollution affects marginalized and vulnerable communities. Women, children, indigenous peoples, and the elderly are among these groups. The extent of outdoor pollution can be detrimental to children's growth and development, particularly when they engage in outdoor activities. In 2016, children reported for 9% of all deaths caused by the mutual effects of domestic and ambient air pollution worldwide. Pollution exposure decreases lung capacity and inclines children to respiratory problems later in life. Air pollution causes more than half of all deaths from Acute Lower Respiratory Tract Infection (ALRI) in children under the age of five in Low- and Middle-Income Countries, making it one of the world's leading killers of children. Intrapartum-related complications, acute respiratory infection, prematurity and inherited anomalies are the five top causes of death in children below the age of five globally, as shown in figure below.

It is also critical to have women and tribal communities represented in decision-making bodies to ensure that their specific problems are brought to light and taken into account when developing and implementing development and industrial plans. Suitable representation of tribal and native communities in environmental policy and decision-making would avoid large-scale mining and other development missions from receiving approval without the necessary assessment.

Women in rural areas require role models who can engage in entrepreneurial projects such as selling clean cooking fuel and then build capacity in rural communities to use and switch to cleaner cooking methods. The community-based method of women actively participating in capacity-building initiatives to signify the value of pure cooking fuel to households can lure households to adopt this life and raise awareness of the important improvements in well-being that these changes would bring [9].

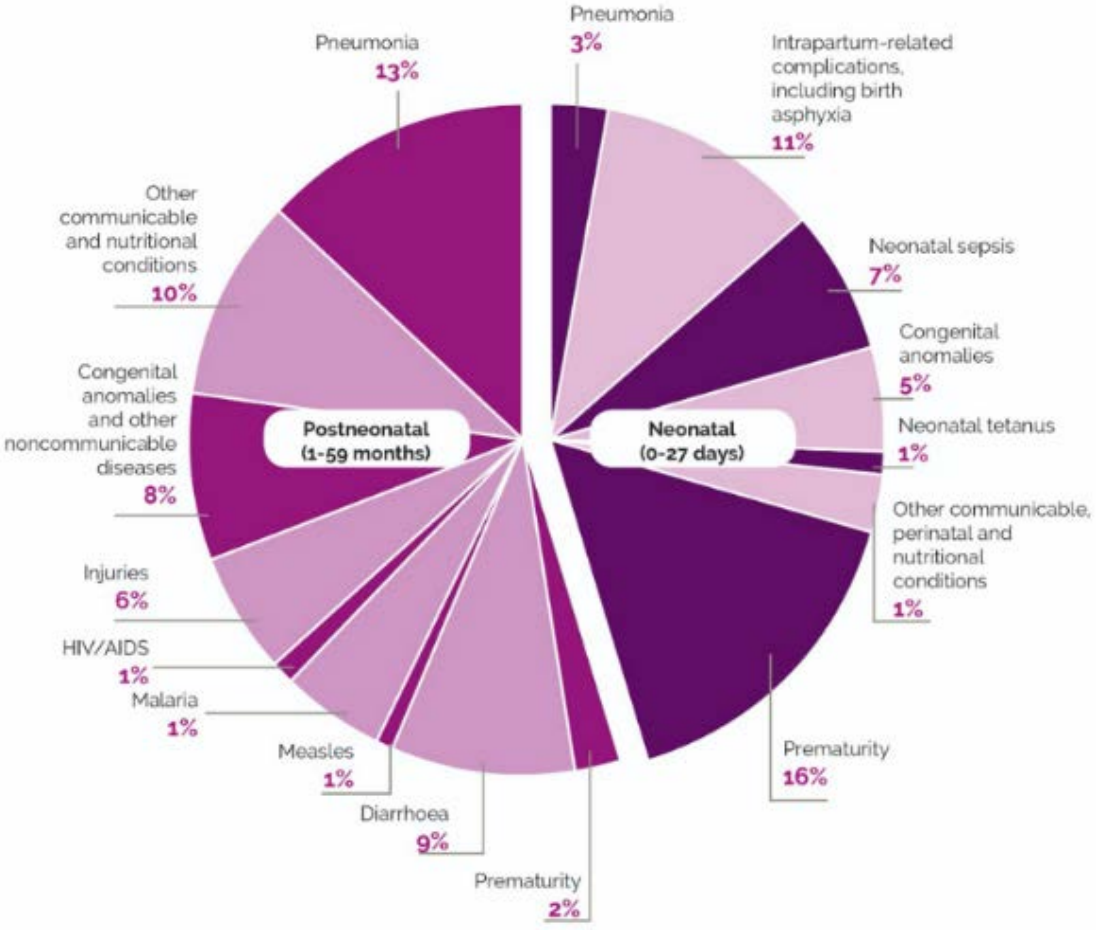

Figure 5. Causes of Death in Children below the age of five

6. Case Studies: Best Practices from India and USA

6.1. Environmental Pollution and Control: A Case of Mega City of Delhi

Delhi is one of the world's ten most polluted cities. Municipal services in Delhi, such as water supply and sanitation, storm water drainage, waste water treatment and disposal, solid and hazardous waste management, and the provision of enough and safe food and housing, are all unable to keep up with urban growth. As a result of all of this, pollution levels have risen [10].

Table 1. Sources of Air Pollution, Delhi 1970-2001

Category	1970-1971	1980-1991	1990-1991	2000-2001*
Industrial	56%	40%	29%	20%
Vehicular	23%	42%	63%	72%
Domestic	21%	18%	8%	8%

*The values for 2000-2001 is projected based on the given data.
Source: Central Pollution Control Board, Air Quality Status and Statistics, New Delhi, 1996-1997

6.1.1. Increase in Delhi's Pollution

According to preliminary Census of India 2001 statistics, the population of Delhi on March 1, 2001 was 13.78 million, with 7.57 million men and 6.21 million females, growing at a pace of 3.81 percent per year between 1991 and 2001 (Registrar General and Census Commissioner of 462 POPULATION AND ENVIRONMENT India, 2001). Table shows the population characteristics of the megacity of Delhi. According to the figures, the population of Delhi increased by 8.9 times between 1951 and 1991, from 1.44 million to 12.82 million. The population of the megacity of Delhi more than doubled between 1951 and 1971, as shown in the table. For the first time, the population of Delhi exceeded 5 million, making it India's third megacity.

6.1.2. Growth in Number of Vehicles

The demand for transportation has increased as a result of rising population, urbanisation, and industrialisation. In order to keep up with the required number of people, the number of vehicles has also increased. The total number of automobiles in Delhi has climbed from 37.4 thousand in 1961 to 2229.6 thousand in 1996, according to the data. From 12.1 thousand in 1961 to 1741.8 thousand in 1996, the number of two-wheelers has expanded dramatically. In Delhi's metropolitan cities, two-wheelers account for 66% of all vehicles, followed by cars and jeeps by 24%.

6.1.3. Delhi Air Pollution Effects on Health

Air pollution is defined by the World Health Organization (WHO, 1996) as "substances introduced into the air by human activity at quantities sufficient to cause detrimental effects on health, property, agricultural yield, or to interfere with enjoyment of property." Some of the most important air pollutants, according to Bhargava (1995), are suspended particulate matter (SPM), nitrogen oxides (NOx), carbon monoxide (CO), lead, sulphur dioxide (SO_2), and others.

Table 2. Population characteristics of Delhi Megacity, 1951-1991

Year	Population (In millions)	Average annual exponential growth rate (%)	Ratio of Population 1951 population (1951=100)
1951	1.44	7.26	100
1961	2.36	4.96	164
1971	3.65	4.36	254
1981	5.73	4.52	399
1991	8.47	3.85	586
2001	12.82	4.1	890

Source: Census of India, New Delhi, 2001.

Table 3. Industrial Progress in Delhi, 1990-96

Year	1991	1992	1993	1994	1995	1996	% Growth (1991-96)
Industrial Units (in '000')	85	89	93	97	101	126	55.65

Source: Statistical Handbook, NCT of Delhi, 1997.

Table 4. Percentage Distribution of total registered motor vehicles in Delhi during 1995 and 1996 (in thousands)

Year	Two-wheeler	Car/Jeep	Taxis	Buses	Goods Vehicles	Others	All Vehicles
1961	12.1	15.1	2.0	1.3	4.1	2.7	37.4
1971	109.1	61.5	4.1	3.3	15.3	10.8	204.1
1981	36.4	123.6	6.6	8.5	38.1	20.9	561.8
1995	1617.7	575.8	12.5	26.2	125.1	75.0	2432.3
1996	1741.8	633.8	13.7	27.9	133.5	59.0	2629.6

Source: Statistical Handbook, NCT of Delhi, 1997 and *Compendium of Environment Statistics, 1999.

Table 5. Major Sources and Health Effects of Pollutants

Pollutant	Main Source	Health Effects
SPM	Ceramic and glass, thermal power	Damage of lungs, may cause bronchitis and asthama,
SO_2	Thermal Power, Chemicals, Ceramics, Textiles	Acid Rain, damage to lungs, eyes, skin
NO_x	Diesel Engines, Ceramics	Form smog, damage to respiratory system and eye irritation
CO	Two Wheelers, engineering	Toxic causes blood poisoning
HC	Two wheelers, ceramics, chemicals	Cancer
Aldehydes	Chemicals	Cancer
Lead	Petrol engines, water pipes, food cans, batteries	Nervous system shows down and brain development is retarded, shows reaction time, reduces attention span
Chromium and Nickel	Alloys plating, electronics and fungicide	Cancer
Noise	Industry, traffic	Deafness, irritation and nervousness
Mosquitoes	Stagnant pools	Malaria
Bacteria, worms and Virus infections	Infected Water	Jaundice, Choleram Dysentry, Typhoid, Diarrhea, Polio, Worms

Source: Delhi Environmental Status Report: Pollution, Monitoring and technology Corporation Division, New Delhi, 1995.

6.1.4. Measures to Counter the Effects of Air Pollution

The Environment and the Prevention and Control of Pollution Act of 1981 (Protection Act, 1986). To reduce levels of suspended particulate matter (SPM), nitrogen oxides (NOx), carbon monoxide (CO), lead, sulphur dioxide (SO_2), and other pollutants, the Environment (Protection) Act 1986 is implemented by the Delhi government and other relevant agencies such as Pollution Control Boards and Factory Inspectorates [10]. The principal effects have been observed as a result of the government's efforts to reduce air pollution:

- Unleaded gasoline: A fatal pollutant from automotive exhaust has been removed thanks to the steady lowering of lead content in gasoline and the eventual delivery of unleaded gasoline for all vehicles in the capital city of Delhi beginning in September 1998. With this approach, the amount of lead in the air near Delhi's traffic crossings has decreased by more than 60%.
- Sulphur in diesel: To comply with EURO-II standards, the sulphur content in Delhi diesel was decreased from 0.5 percent in 1996 to 0.25 percent in 1997.
- Tightening of vehicle emission standards: Beginning in 1995, new passenger automobiles may only be registered if they were equipped with catalytic converters. Emission standards for such vehicles were strengthened by 50% in comparison to previous years.
- 2T oil for two-stroke engines: The low-smoke 2T oil became effective on 1.04.99, based on CPCB guidelines. Premixed 2T oil dispensers have been placed in all of Delhi's fuel filling stations to limit the usage of more 2T oil than is required. Since December 1998, the sale of loose 2T oil has been prohibited.
- Grossly polluting vehicle phasing: Based on CPCB guidelines, 20-year-old automobiles were banned from playing in December 1998, followed by 17-year-old vehicles being phased out in November 1998, and 15-year-old vehicles being phased out in December 1998.

Table 6. Ambient Air Quality in Delhi

Pollutant	1995	1998	% Reduction as compared to 1995
Industrial			
Sulphur Dioxide	24.1	20.2	16
Nitrogen Dioxide	35.5	34.7	4
SPM	420	36.7	13
Lead	110	105	5
Residential			
Sulphur Dioxide	16.5	15.8	4
Nitrogen Dioxide	32.5	28.6	13
SPM	409	341	17
Lead	155	95	39
Industrial			
Sulphur Dioxide	42	25	40
Nitrogen Dioxide	66	63	5
SPM	452	426	6
Lead	335	136	60
Carbon Monoxide	5587	5450	3

*All units are in micrograms/cubic meter except for lead, which is nanogram/cubic meter. Source: Central Pollution Board, Air Quality Status and Statistics, New Delhi, 1996-1997.

The implementation of emission norms and fuel quality specifications effective from 1996, as also phasing out of 15-year-old commercial vehicles and leaded petrol in the year 1998 and phasing out of 8-year-old commercial vehicles and 15-year-old two wheelers from 2000 onwards.

6.1.5. Latest Measures Taken to Reduce Air Pollution by the Government

- The Great Green Wall of Gujarat to Delhi, Aravalli Green ecological corridor, which is also connected to Shivalik hill, is proposed for a plantation of more than 1.30 billion native trees in the coming ten years. This long-term solution will increase the green around the territory and help the capital to fight pollution.
- In collaboration, IIT Bombay and McKelvey School of Engineering of Washington University in St. Louis launched the Air Quality Research Facility, enabling to study air quality and pollution in India [11].

- The odd-even programme was also launched by the Delhi Chief minister as a traffic rationing strategy in Delhi to relieve congestion on the city's roads, ensure a smooth commute, and reduce pollution. As a result, the streets were less congested, and hourly particle levels in the air decreased by 13%. It's not much of a relief, but it's always better than nothing.

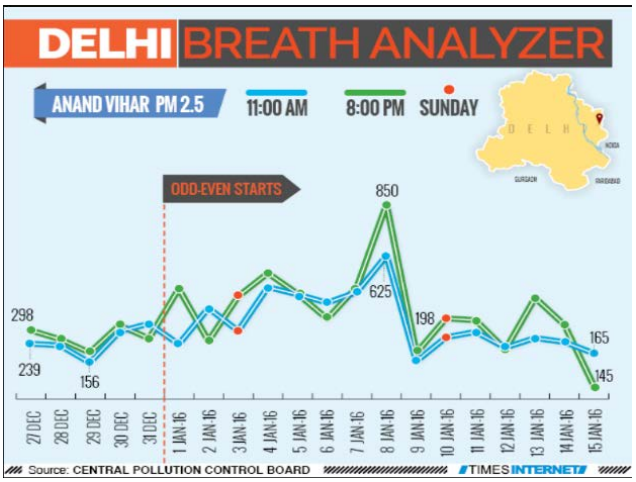

Figure 6. Significant Reduction in Pollution after the Odd-Even Programme

6.2. New York: Targeted Reforms in Residential and Commercial Heating

Despite the fact that New York City's air quality has been improving for decades, pollution is still a major concern. The levels of ozone and PM2.5 in 2007 exceeded the US Environmental Protection Agency's (EPA) guidelines. New York City created PlaNYC, its first long-term sustainability plan, the same year. The goal of PlaNYC was to make New York Metropolis's air the cleanest of any significant city in the US, as measured by PM2.5 levels [12].

PlaNYC has started an extensive air-quality monitoring programme. The first findings of that air quality programme revealed that not only were PM2.5 and ozone levels beyond national requirements, but that PM2.5 and SO2 levels were especially high in regions with a high density of buildings burning heavy fuel oil (Grades No. 4 or No. 6) for heat and/or power. The annual average PM2.5 levels in locations with more traffic or greater density buildings burning heavy fuel oil were 30 percent higher than in places with less traffic or fewer buildings burning same dirty fuels.

6.2.1. Measures to Counter the Effects of Air Pollution

To address this challenge, New York City initiated and supported a number of state and local regulatory reforms and incentive programs, including:

- Collaborating with other organisations to persuade the State of New York to cut the permitted sulphur content in No. 2 fuel oil to 15 parts per million (ppm), a 99 percent reduction.
- In 2010, a municipal law was passed requiring all heating oil to contain 2% renewable biodiesel by October 2012, reducing the sulphur content allowed in No. 4 heating oil from 3,000 ppm to 1,500 ppm.
- In 2011, the City issued regulations to phase out No. 4 and No. 6 heating oil, first requiring all boilers in the City to burn No. 4 oil (or cleaner) by 2015, and then requiring all boilers to transition to the cleanest available fuels (natural gas, ultra-low sulphur No. 2 oil, or equivalent) by 2030.
- Organizing a "Clean Heat" campaign that is entirely voluntary in 2011 to encourage early adoption of cleaner fuels by providing technical and financial assistance to building owners.

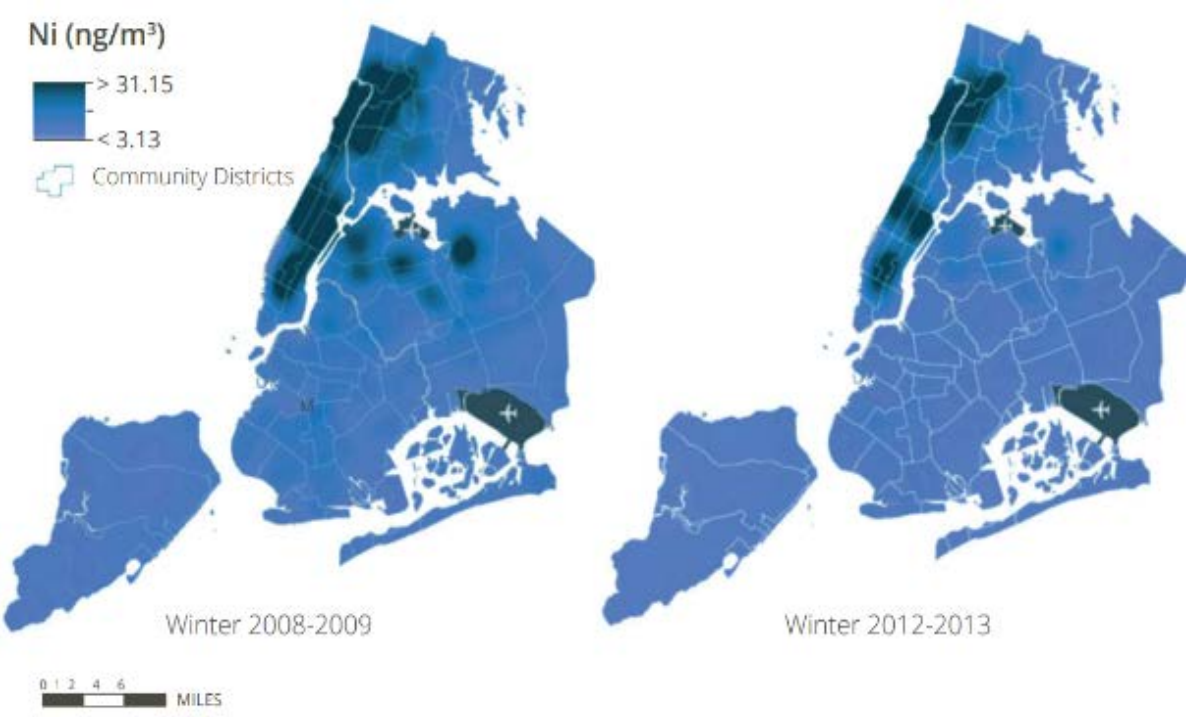

Figure 7. Comparison of Estimated Nickel Concentrations in $PM_{2.5}$

6.2.2. The Outcomes

As a result of these rules, nearly 30% of heavy fuel-burning buildings in New York City (2,700 out of 9,000) have changed to cleaner fuels by the fall of 2013. Approximately 75% of those who switched to natural gas or ultra-low Sulphur No. 2 oil did so successfully. Because of market considerations such as greater natural gas supplies to the New York area and cheaper pricing, the conversion to natural gas was particularly strong. 20 By mid-2015, all buildings had been converted to No. 2 heating oil or natural gas, and the phase-out of No. 6 fuel oil was complete.

According to a September 2013 air quality assessment, SO_x levels were down 69 percent in the winter of 2012-2013 compared to the winter of 2008-2009, while $PM_{2.5}$ levels from burning fuel oil were down 35 percent. 21 Because of their proximity to buildings burning heavy fuel oil, the benefits were greatest in locations with the highest concentrations of these pollutants.

7. Modes to Improve the Present and Future Scenario (Vision 2050)

Air pollution levels in several areas, particularly in Asia, are already considerably beyond WHO acceptable levels, and the situation is expected to worsen further by 2050. The number of premature deaths due to particulate matter (PM) exposure (which causes respiratory failures) is expected to more than double by 2050, from little over 1 million now to nearly 3.6 million per year, with China and India accounting for the majority of deaths. In the future decades, significant increases in Sulphur dioxide (SO_2) and nitrogen oxides (NO_x) emissions are predicted in the important growing economies. In 2050, SO_2 emissions are expected to be 90 percent higher and NOx emissions will be 50 percent greater than they were in the year 2000 [13].

India has made significant progress in seeking to address environmental issues. It has implemented strict environmental regulations and established agencies to oversee and enforce it. In June 2008, the Prime Minister's National Council on Climate Change announced India's first comprehensive National Action Plan in response to the threat of climate change [14].

7.1. National Clean Air Action Plan (NCAP)

India's flagship programme for enhancing air quality, the National Clean Air Programme (NCAP), was inaugurated in 2019. It covers 122 cities across the country. The 102 publicly available clean air action plans filed under NCAP are evaluated in terms of their scientific, regulatory, financial, and institutional framework [15].

7.1.1. Objectives

1. To ensure the strict application of mitigating measures for air pollution prevention, control, and abatement.

2. To ensure a complete and trustworthy database, enhance and evolve an effective and efficient ambient air quality monitoring network across the country.

3. To increase public awareness and capacity-building measures, such as data distribution and public outreach programmes, in order to ensure public engagement and to ensure skilled manpower and infrastructure in the area of air pollution.

7.1.2. Tenure

This will be a mid-term, five-year action plan, with 2019 as the starting point. However, international experiences and national studies show that significant results in terms of air pollution initiatives are only obvious over time, therefore the programme could be extended for another 20–25 years after a mid-term review of the results.

7.1.3. Approach

a. Collaborative, multi-scale, and cross-sectoral coordination among relevant federal ministries, state governments, and local authorities.
b. Integrating and mainstreaming current government policies and programmes, such as the National Action Plan on Climate Change (NAPCC) and other climate-related projects.
c. In terms of NAPCC, the main focus will be on mainstreaming the initiatives under NAPCC's five national missions: National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Mission for a Green India and National Mission for Sustainable Agriculture.
d. While many of these policies and programmes are already part of our present initiatives, they may require a shift in focus, increased breadth, and effectiveness, as well as the expedited implementation of time-bound plans.
e. Launch the NCAP in the 43 smart cities that are among the 102 non-attainment cities using the smart cities framework.
f. The NCAP will be dynamic and will continue to evolve in reaction to new scientific and technical information as it becomes available, as well as international best practises and experiences [16].

7.2. Support from the World Bank

The World Bank has also devised a multi-pronged strategy to address environmental concerns while also reducing its loan risks:

- A Sound Knowledge Products and Lending Program: This project aims to strengthen the knowledge basis for environmental solutions as well as pilot a number of projects to solve major environmental issues.
- Cross-Support Activities for Risk Management and Mainstreaming: A sound decision-making framework has been built thanks to the World Bank's safeguard measures. A variety of technologies have also been developed to facilitate the integration of environmental management into project design and to reduce the Bank's environmental footprint.
- National Systems and Capacity Building Initiatives assist in the development of institutional capacity and involve the testing of country (state) systems for managing World Bank risks [14].

7.2.1. Helping India Achieve Its National Clean Air Goals

- Through a multi-year technical assistance agreement with the Ministry of Environment, Forest and Climate Change, the World Bank is assisting in the implementation of the National Clean Air Program at the national, regional, and state levels (MoEF & CC).
- Bringing the most up-to-date worldwide expertise to bear on air quality issues.
- Mobilization of funds and development of relationships with governmental and private sector donors, as well as multilateral organizations.
- Leading and coordinating discussions on air quality policies and reforms, with an emphasis on areas with severe air pollution and addressing the needs of the poorest states.

7.2.2. World Bank India Air Quality Management Program

- The World Bank Group is helping a number of states and cities in prioritising Air Quality Management (AQM) action and investment plans, as well as supporting institutions in deepening understanding and building agreement for reforms that would result in better long-term air quality management planning.
- The World Bank Group is assisting the Government of India with technical assistance in three focal areas using an air shed approach through many programs.
- The Bank's assistance is focused on the Indo-Gangetic Plain, which has the highest population and pollution intensity, as well as the least developed ability and procedures to address the problem [17].

8. Conclusions

"Pollution should never be the price of Prosperity." said Al Gore. The air pollution's threats on mankind are indeed limitless and alarming and government reforms need to be implemented as soon as possible with full force. The government reforms are instantaneously required to carry away this serious matter of air pollution. The role of people is equally instrumental in tackling this situation. People as communities need to come together and bring about a change at the root level in order to make the government reforms successful. If each and every individual of the country pledges to act against the activities which promote air pollution, coupled with the government reforms, only then there can be a rectification in the current scenario and substantial prevention in further air pollution for the future generations as the humanity depends on their existence.

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