



LET'S CLEAR THE AIR ON AIR

An e-primer on air pollution for schools





ANIL AGARWAL 1947–2002

“Environmental literature being generated for schoolchildren is, with some exceptions, in the genre of nature education. It is very important to expose young children to the beauties and wonders of nature. But as they grow older, it is important they begin to understand how human beings and human societies interact with their environment for their survival and their growth, how these human-nature interactions become a part of a society’s culture, and why it is important to rationalise our relationship with our environment.”

Anil Agarwal

Founder-director, CSE



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**The Green Schools
Programme**



THE GREEN SCHOOLS PROGRAMME

ENVIRONMENT EDUCATION AND GSP

Environment education is caught in a fundamental contradiction. While the world loudly champions the importance of ‘learning to live sustainably’ in a climate-risked world, environmental education still sits on the sidelines of formal schooling. While schools have made efforts to build environmental awareness through eco clubs and extracurricular activities, environment education still holds little priority within the core curriculum, not just in India but in most countries around the world. At a time when our air, water, and climate are under growing pressure, and the world moves closer to an irreversible climate crisis, shouldn’t learning about the environment be as important as literature or math?



Timeline of Environmental Education in India's Formal School System*

1975

The Curriculum for the Ten-Year School:

An approach paper and a framework recommended focused attention on environmental education, along with nutrition, health, and population education for Grades VI–VIII to ensure science education remained meaningfully connected to life.



1986

The National Policy on Education was adopted, recognizing the "paramount need to create a consciousness of the environment" and advocating the integration of environmental education throughout schools, colleges, and 'the entire teaching process'.



1989

The Environmental Orientation to School Education Scheme, launched by the Ministry of Human Resource Development, aimed to raise environmental awareness by embedding it within school curricula and pedagogical approaches.



1991

In response to a Public Interest Litigation, the Supreme Court of India mandated that environmental awareness and pollution-related issues be taught as a compulsory subject across all levels of formal education.



2003

In compliance with the Supreme Court directive, NCERT developed a model syllabus for Environmental Education (EE), making its inclusion obligatory in all formal education programmes, from schools to universities.



2005

The National Curriculum Framework (NCF) strengthened EE integration by embedding themes like climate change, pollution, natural resource conservation, and renewable energy across subjects such as Environmental Studies (EVS), science, and social sciences.

2020

The National Education Policy (NEP) underscored the importance of equipping learners with the knowledge and skills to address environmental challenges, including climate change, and acknowledged the need to build professional capacity in climate science.

2023

The NCF recommended an interdisciplinary inclusion of EE at appropriate stages in the school curriculum and proposed a dedicated course on sustainability and climate change for secondary schools. This structured approach reflects India's commitment to fostering environmental consciousness and skills among its students.





This is the vacuum that CSE's **Green Schools Programme (GSP)** strives to fill. At its core, the programme helps students understand the vital connection between the environment and everyday life. What makes GSP stand out is its focus on 'learning by doing,' rather than relying only on theories and textbooks. Over the years, students who have been part of the programme have taken this hands-on learning beyond the classroom, driving real change and pushing the envelope in sustainable environmental practices, both within their schools and in the wider community.

THE GSP AUDIT AND OTHER INITIATIVES

A key feature of the programme is the GSP Audit—an online platform that guides students through task-based questions to assess and reflect on their school's resource consumption. Crucially, the Audit also benchmarks a school's performance to measure impact in the coming years and motivates participants to work towards change.

The Green Schools Programme (GSP) Audit begins with schools registering and logging into the GSP Audit portal. Once registered, schools can access and review previous audit reports, provided they have submitted audits in the past. The audit process involves schools engaging in various activities and filling in data related to their environmental practices on the audit portal. After submitting this data, it undergoes validation



and analysis to ensure accuracy. The results are then declared, categorising schools into ratings: Green (highest), Yellow, Orange, and Red, based on their environmental performance. An awards ceremony follows, celebrating the achievements of the schools. Schools can download their performance reports, which offer detailed feedback and recommendations for enhancing their environmental practices, promoting ongoing improvement and sustainability.

In addition to the Audits, the programme conducts regular workshops and orientation sessions to build capacity amongst teachers and master trainers. These sessions familiarise them with GSP and equip them to lead environmental activities with their students. Additionally, current information and updates on the state of India's environment are also shared with teachers for use in classroom teaching. CSE's rich content is adapted to create ready-to-use resource material for classroom teaching (factsheets, board games, comic books, manuals and other publications) that resonates with the school community and is shared with the participants of the workshops.

Forum of Schools that Segregate is an exclusive community of educational institutions dedicated to improving solid waste management on their premises. GSP's vision and aim are to help this community devise robust, long-term, and actionable plans for managing waste.

The GSP program helped us create a clean, healthy, and green school environment by conserving resources and encouraging sustainable practices. Students enjoyed being part of a larger network and learned to think before they "thrashed it." The audits gave us insights into areas needing improvement and fostered environmental sensitivity in daily life. Waste became wealth through composting, and concepts like rainwater harvesting and biodiversity became meaningful. Being called "Climate Warriors" gave students a sense of responsibility toward the planet.

RENY DANIEL

GSP Coordinator
SBOA Public Senior Secondary School,
Ernakulam, Cochin



WHAT IS A GREEN SCHOOL?

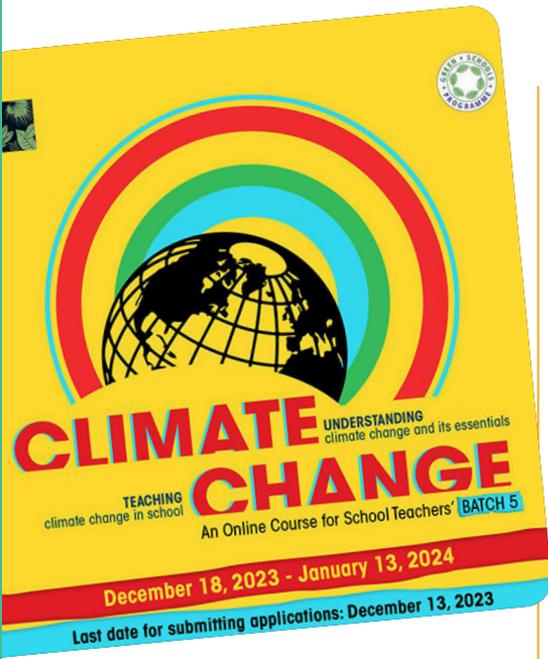
A Green School is a resource-efficient space that models sustainable, responsible living practices. What does that entail?

A school that has good ventilation in all classrooms; has a robust green cover; and provides healthier space for its occupants as compared to a conventional campus

A school that optimises energy efficiency; adopts renewable sources of energy; conserves, catches and recycles water; minimises waste generation and sustainably manages what is generated

A school that promotes consumption of locally produced food

A combination of all these practices, and most importantly, measurable change, is what makes a school a Green School.

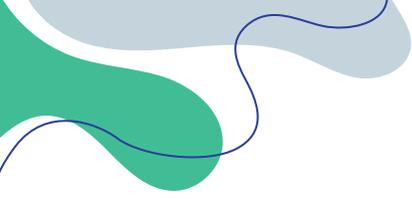


Climate Change Course for Teachers: This 4-week online course, open to teachers in the GSP network, covers the fundamentals of climate change, global negotiations, and how institutions and individuals can engage in climate action. It also guides teachers on incorporating climate change topics in their classrooms. Participants receive online content and attend weekly expert sessions. The course, run in multiple batches, concludes with an onsite climate convocation ceremony.

Solar 30 Initiative: In partnership with Himachal Pradesh Council for Science, Technology & Environment (HIMCOSTE), GSP launched the Solar 30 initiative

Birla Vidya Niketan (BVN) began its journey with CSE through the Green School Programme in 2019, achieving a Yellow grading, marking the start of a progressive path towards sustainability. BVN has maintained a Green grading for the past three years. The GSP Audit, covering Air, Energy, Water, Food, Land, and Waste sections, provided the Eco Club and Green Committee of the school with an opportunity to streamline activities aimed at fostering a culture of responsible consumption and optimal resource utilisation. The school's initiative of Home Waste Management during the COVID-19 pandemic and the ongoing 'Zero Waste Classrooms' are inspired and guided by various webinars organized by GSP. As the GSP coordinator, I thoroughly enjoy this journey of continuous improvement, aiming to transform our institution into a place where every individual is a conscientious member of planet Earth.

SEEMA DUTT
GSP Coordinator
Birla Vidya Niketan, New Delhi



The GSP audit holds a crucial place in our school's agenda, now integrated into our annual calendar for a comprehensive review of our environmental practices. This process not only raises awareness about our actions but also guides the creation of meaningful policies to minimise unintentional harm to the environment. The GSP audit journey serves as an engaging and enlightening experience in experiential learning. Collecting data from various school sections facilitates a smoother journey, with continuous policy upgrades in the years to come. GSP not only motivates but also sparks creativity in young minds, leading them to devise solutions for local issues. Our eco warriors developed an AI-based Water Wise App, aiding in estimating water wastage per family and promoting control through simple green steps. This transformative journey significantly influences the mindsets of those involved, and I express gratitude to the GSP team for their invaluable support.

NEERJA BHATNAGAR

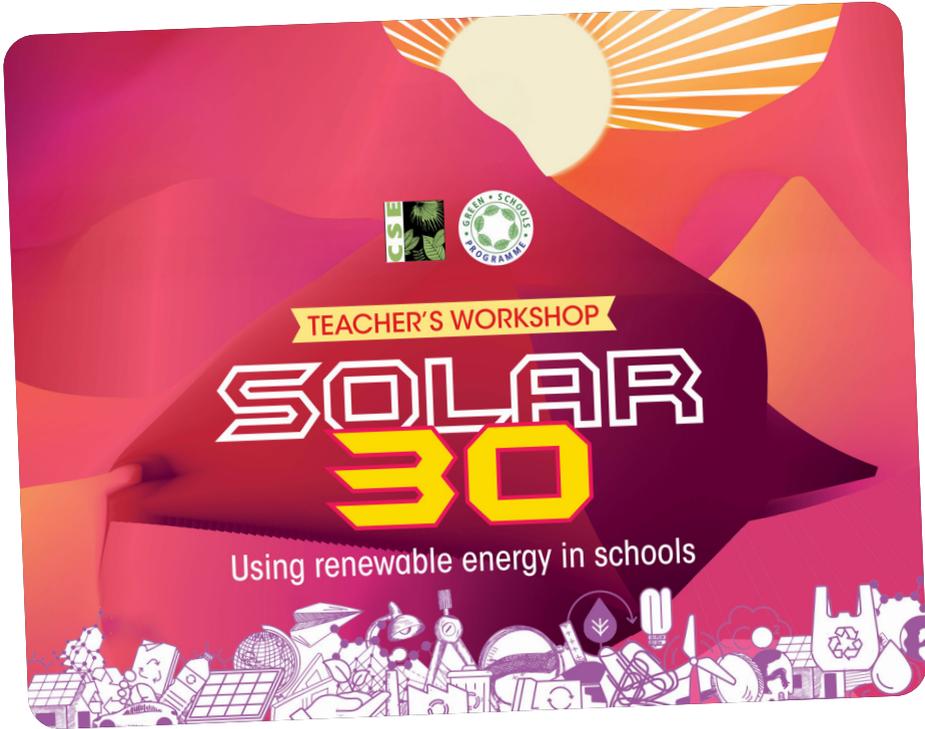
GSP Coordinator

Bal Bharti Public School, Noida, Uttar Pradesh

to help selected schools understand renewables, adopt solar energy, and manage its operation and maintenance. HIMCOSTE has funded rooftop solar installations in 30 schools, aiming to make them Zero Electricity Bill campuses. CSE is involved only as the knowledge partner under its 'Solar 30' programme and educate students and teachers on energy conservation and solar energy concepts, fostering a scientific temperament. Recently, GSP and other programme teams at CSE have joined hands to design and create another exclusive platform for teachers and their students – the **Young Environmentalist** website (<https://www.young.downtoearth.org.in>), and a digital version of the magazine, Gobar Times. This website is a growing virtual resource centre for the young and the curious, with interestingly packaged content on most of the key issues of environment and development, including solid waste management.

In a nutshell, CSE's Green Schools Programme aims high. It hopes to:

- Spur the growth of a more environmentally aware, conscious and responsible generation of citizens



- Equip resourceful teachers with tools to foster environmental literacy
- Help every member of the school community understand the scope and significance of his or her role in the sustainable use of natural resources within and outside the school campus
- Nudge everyone to get on with the job of making sustainability a lived practice

Adopting the programme does not mean that the most complex technological and scientific problems that our planet faces today will be fixed instantly. But what it will certainly do is create and nurture a space where our children, their teachers and their families can work towards driving change and building a better tomorrow.

To find out more about GSP and its Audit:
<http://www.greenschoolsprogramme.org/>



**UNDERSTANDING
AIR POLLUTION:
TYPES AND IMPACTS ON HEALTH**





UNDERSTANDING AIR POLLUTION

TYPES AND IMPACTS ON HEALTH

What is air pollution? Air pollution in history. How polluted are Indian cities? What are the different types of air pollution?

Air pollution occurs when the air we breathe is contaminated by harmful gases and toxic particulate matter in the air from vehicle exhaust, industrial emissions, power plants, diesel generators, dust, smoke from crop burning, and garbage dumps.

Breathing polluted air can cause serious health issues, including respiratory and cardiovascular diseases, cancer, and even death. Children, the elderly, and the poor are especially susceptible to air pollution, as are those with existing conditions like asthma or heart disease.

Besides impacting our health, carbon dioxide (CO₂) emissions from vehicles and industries also contribute to global warming—in India, road transport alone contributes up to 14 per cent of the nation's total CO₂ emissions.

It is important to note that air pollution is not a new phenomenon (see *Box: Air Pollution: From the Pages of History*); humankind has grappled with 'foul' air for centuries. What has changed is the sheer scale of the crisis. With millions of vehicles and thousands of industries releasing toxic emissions, polluted air now affects nearly every urban centre and billions of people worldwide.

Air pollution has largely been seen as an urban problem. Many cities in India, including Delhi, now feature among the world's most severely polluted urban centres. The 2024 World Air Quality Report reveals a grim picture: **Indian cities dominate the rankings with six in the top 10, 11 in the top 20, 35 in the top 50, and a staggering 74 in the top 100.** While metro cities have long been known as air pollution hotspots, smaller towns and cities are now increasingly joining the ranks of the world's worst-affected areas. (see *Table: The world's 'bad air' cities*).



AIR POLLUTION

FROM THE PAGES OF HISTORY

Air pollution has shadowed human civilisation for centuries. Long before factory chimneys defined city skylines, Roman philosopher Seneca complained of ancient Rome's smoke-filled air. In 1273, King Edward I banned sea coal in London for its health hazards. In 1905, colonial Bengal enacted the Smoke Nuisance Act to curb emissions in industrialising Calcutta.

But it was the 20th century that brought pollution disasters into sharp public focus exposing the deadly cost of unchecked emissions. Some notable ones are:

Meuse Valley Smog of 1930 occurred when a deadly smog caused by trapped industrial pollutants and a temperature inversion killed 60 people and sickened thousands in Belgium's industrial Meuse Valley.

The Los Angeles Smog of 1943, known as the 'gas attack', was triggered by industrial activity and automobile emissions. The smog, seemingly appearing out of nowhere, blanketed the city for over three days, causing widespread physical distress and panic, with many mistaking it for a wartime chemical attack.

The Donora Smog of 1948 blanketed the Pennsylvania mill town in a thick, yellowish haze as industrial emissions rich in sulfur dioxide and fluorides became trapped by a temperature inversion. The disaster sickened nearly half the town's 14,000 residents and claimed 20 lives, with many more dying in the following weeks.

The London Smog Incident of 1952, also known as the Great Smog, engulfed the city in a dense, toxic fog caused by coal smoke and a temperature inversion. Over several days, the smog led to widespread illness and an estimated 4,000 to 12,000 deaths, prompting sweeping reforms like the Clean Air Act of 1956.

The New York City Smog of 1966 struck in late November, as stagnant air trapped pollutants like sulfur dioxide and carbon monoxide over the city for four days. The toxic air prompted health warnings and is believed to have caused between 168 and 400 deaths. The incident spurred tougher air quality regulations and helped pave the way for the creation of the Environmental Protection Agency (EPA).

Thanksgiving 1966 Air Pollution Episode in the Eastern United States



THE WORLD'S 'BAD AIR' CITIES

Rank	City	PM2.5 Concentration 2024
1	Byrnihat, India	128.2
2	Delhi, India	108.3
3	Karaganda, Kazakhstan	104.8
4	Mullanpur, India	102.3
5	Lahore, Pakistan	102.1
6	Faridabad, India	101.2
7	Dera Ismail Khan, Pakistan	93
8	N'Djamena, Chad	91.8
9	Loni, India	91.7
10	New Delhi, India	91.6

Most polluted city ranking based on annual average PM2.5 concentration ($\mu\text{g}/\text{m}^3$)

VARIOUS TYPES OF AIR POLLUTION

Short-term air pollution refers to exposure to high pollutant levels over a period of a few hours or days, often caused by high traffic congestion, industrial accidents, wildfires, and construction sites, as well as from indoor sources like smoking and cooking. Weather conditions like temperature inversions can trap pollutants close to the ground, while public events and the burning of fossil fuels also contribute to elevated pollution levels. Short-term exposure can cause immediate health effects such as eye, nose, and throat irritation, headaches, dizziness and nausea. It can also aggravate pre-existing respiratory and cardiovascular conditions.





Long-term air pollution stems from sustained exposure to lower pollutant levels over months or years, driven by urbanisation, industrial activity, vehicle emissions, fossil fuel use, deforestation, and poor waste management. It can lead to chronic health issues—reduced lung function, respiratory and heart disease, lung cancer, and premature death—as well as environmental damage like acid rain and ozone depletion.

Outdoor air pollution is the presence of harmful substances like toxic gases, particulate matter, and dust in the air outside homes, schools, and workplaces. It is caused by vehicles, industries, waste burning, wildfires, and dust storms. Capable of travelling long distances, it can impact large populations and lead to both short- and long-term health effects.

Indoor air pollution is the presence of harmful substances inside homes, offices, and schools. Common sources include cooking and heating appliances, tobacco smoke, dust from building materials, and cleaning product fumes. It poses serious health



risks, especially for children, the elderly, and those with existing respiratory or heart conditions.

While outdoor air pollution is often more visible and receives more attention, indoor air pollution can actually be more harmful to human health due to the fact that most people spend a lot of time indoors. To protect both human health and the environment, it is critical to address both indoor and outdoor air pollution.

Winter air pollution is especially severe in cold, densely populated regions. It is driven by the increased burning of wood, coal, and oil for heating, higher vehicle emissions as engines struggle in low temperatures, and widespread crop residue burning.

Why do we say that air pollution is more severe sometimes in winters? This is because cold temperatures can cause the air to become stagnant, preventing it from rising. As a result, pollutants and toxic gases get trapped near the ground, right in our breathing zone. This concentrated exposure can lead to serious health risks, particularly for vulnerable groups like children, the elderly, and those with existing health conditions.





Summer air pollution: In India, air pollution is prevalent during the winter months due to inversion caused by cold and calm weather, which traps pollutants close to the ground. These meteorological conditions are generally absent in the summer, as warm air rises and disperses pollutants. However, hot, still, and dry summer air can occasionally lead to a build-up of pollutants, including dust, particulate matter, and ozone. When this stagnant air mass remains over the same area for several days, it creates a phenomenon known as stagnation, where light winds are unable to disperse the pollutants. Increased summer heat leads to more stagnant days. For example, a 2022 study by the CSE found high PM 2.5 (fine particulate matter) levels in various cities and regions of India from March to May. North India experienced the worst effects, with a 23 per cent rise in average summer pollution, while central India saw a 15.6 per cent increase.

DID YOU KNOW?

In 2019, pollution was responsible for approximately nine million premature deaths worldwide. Of these, air pollution alone accounted for about 6.7 million deaths. This global figure was reported by the Lancet Commission on Pollution and Health.



ACTIVITY

AIR DETECTIVES

INVESTIGATING THE INVISIBLE

1. Introduction (5 minutes)

Objective: To engage students in identifying, observing, and understanding air pollution through hands-on investigation and critical thinking.

Context: Discuss the sources (vehicles, factories, garbage burning, and construction dust) and types of air pollution (PM2.5, PM10, gases like CO₂, SO₂, NO_x).

Engage: “Have you ever noticed the air feeling different in different places? What do you think causes it?”

2. Preparation

(Before the Activity Starts)

Materials Needed:

- Notebook or worksheet (for observations)
- Pencils/pens (for note-taking)
- Colors (optional, for sketches)
- Device with camera (optional, for photos)

3. Activity Execution

(20-25 minutes)

Instructions:

- Observe at least two places—one indoor and one outdoor.
- In each location, describe how the air smells or feels (e.g., fresh, smoky, dusty, chemical, etc.).
- List any visible sources of pollution

(e.g., vehicles, construction, incense sticks, cooking smoke).

- Note the time of day and weather conditions.
- Interview teachers, staff, or classmates within school.
- Observe if there is any noticeable change in the weather pattern in the last few years?

4. Group Discussion

(10 minutes)

Discussion Points:

Share your findings with the class. Discuss what common sources of pollution were observed. Reflect on how your daily habits contribute to pollution.

5. Wrap-Up/Conclusion

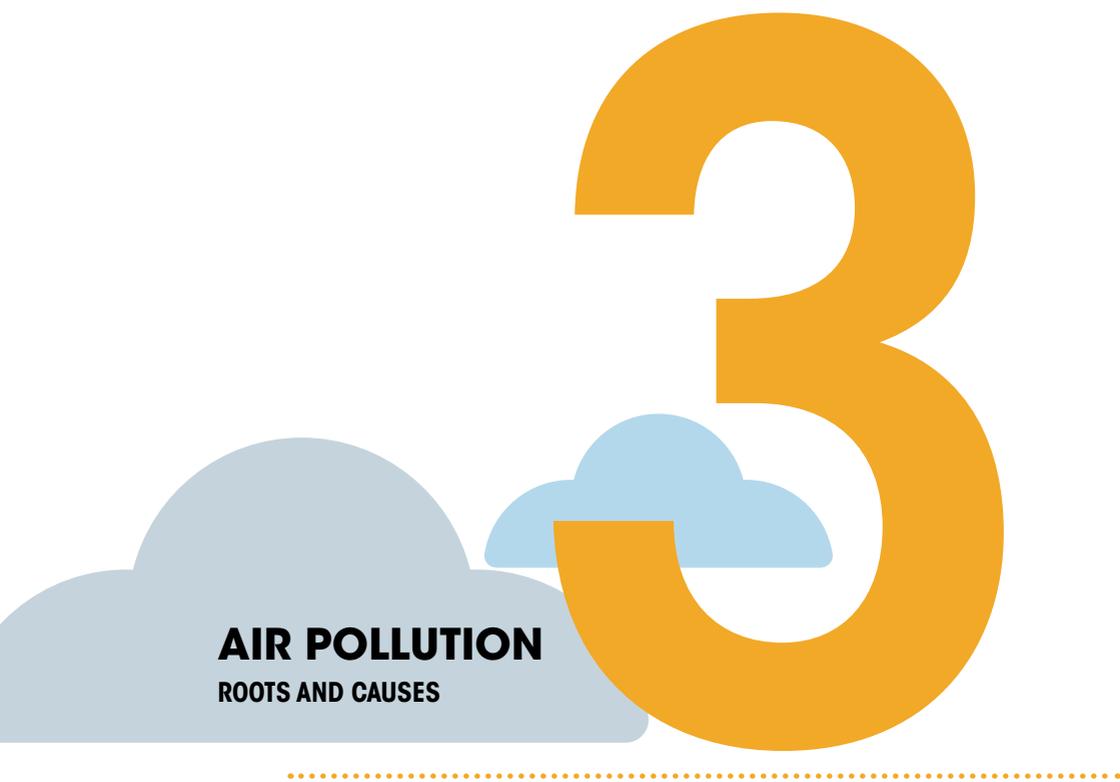
(5 minutes)

Key Takeaway: Students understand the sources and types of pollution and begin thinking about how they can reduce their impact.

Actionable Insight: “What simple changes can you make at home to reduce pollution?”

6. Extension (Optional)

Follow-Up Task: Students can design a poster or skit about pollution sources and solutions (e.g., cycling to school, planting trees).



AIR POLLUTION
ROOTS AND CAUSES



AIR POLLUTION ROOTS AND CAUSES

What causes air pollution? What are pollutants and particulate matter and their sources?

Considering the severe impacts of air pollution, the question naturally arises: why aren't we taking action to address this issue? To do so effectively, we must first identify the causes. A 2016 study by IIT Kanpur pinpointed five primary sources that contribute to air pollution: **vehicles, power plants and industries, garbage burning, dust, and burning of crop residues**. Among these, vehicles within the transportation sector stand out as one of the largest contributors. Road dust and industrial emissions also play significant roles. According to the IIT study, vehicles alone accounted for 20 per cent of all PM_{2.5} emissions and 36 per cent of all NO_x emissions.

Furthermore, in terms of climate change impact, the transportation sector consumes about 20 per cent of global energy, making it the largest consumer of oil worldwide. Modern travel is becoming increasingly energy-intensive and polluting. To address this, new vehicles must aim to emit as little pollution as possible, necessitating rapid technological advancements. However, technological solutions alone are insufficient. The rapid rise in vehicle use, particularly the growing number of two- and four-wheelers crowding the roads, is undermining recent gains in pollution control.

POLLUTANTS AND PARTICULATE MATTER

Pollutants are harmful substances that contaminate our air, water, and soil. They can originate from natural causes such as dust and volcanic eruptions, or human activities such as industrial operations and transportation. Exposure to these toxic pollutants can cause a variety of health problems, including respiratory and cardiovascular issues.

Particulate matter is a form of pollutant that is composed of minuscule particles that are so minute that we cannot see them with the naked eye. These irritants have the potential to harm our

AIR POLLUTION AND CLIMATE CHANGE

There is a strong connection between air pollution and climate change since many of the substances that cause air pollution also cause climate change. Climate change refers to long-term shifts in temperature, rainfall, and extreme weather patterns. At the heart of this crisis are greenhouse gases such as carbon dioxide, methane, and nitrous oxide. These gases trap heat in the atmosphere and are the primary force behind the Earth's changing climate.

Beyond greenhouse gases, air pollution can also have immediate climate effects. For instance, certain pollutants reduce the amount of sunlight reaching the Earth's surface, leading to atmospheric cooling that can partially offset the warming caused by greenhouse gases.

A comprehensive strategy is required to combat air pollution and climate change. It involves reducing dependence on fossil fuels and transitioning to cleaner energy sources. Such measures not only mitigate climate change but also significantly curb air pollution.

respiratory system by entering our lungs. They can originate from a variety of places, including industrial emissions, wildfires, and vehicle exhaust. Health issues including coughing, wheezing, and shortness of breath can result from exposure to particulate matter, especially in sensitive populations like children and the elderly.

Poisonous gases are another harmful form of pollution. Common examples include carbon monoxide, sulphur dioxide, nitrogen oxides, and ozone. Although they can be released by natural events such as volcanoes and wildfires, they are more commonly emitted through human activities like industry, transportation, and fossil fuel combustion. Exposure can lead to respiratory, cardiovascular, neurological, and developmental problems.

SOURCES OF AIR POLLUTION

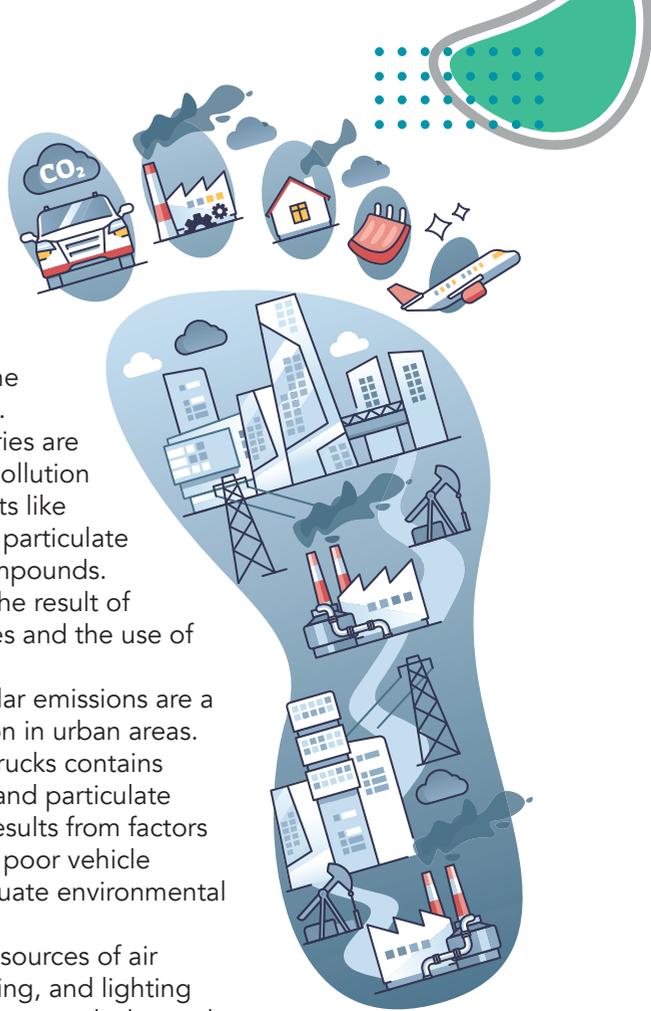
The sources of air pollution in India are complex and multifaceted, and addressing the problem will require a comprehensive

approach that involves reducing emissions from all sectors and sources in a symbiotic way. Let's discuss the different sources of air pollution and their impact on the environment and human health.

Industrial air pollution: Industries are a significant contributor to air pollution due to the emission of pollutants like sulfur dioxide, nitrogen oxides, particulate matter, and volatile organic compounds. Industrial air pollution is often the result of inefficient combustion processes and the use of fossil fuels.

Vehicular air pollution: Vehicular emissions are a major contributor to air pollution in urban areas. Exhaust from cars, buses, and trucks contains pollutants like nitrogen oxides and particulate matter. Vehicular air pollution results from factors such as burning fossil fuels and poor vehicle maintenance, as well as inadequate environmental regulations.

Domestic pollution: Domestic sources of air pollution include cooking, heating, and lighting using traditional methods such as wood, charcoal, and kerosene. These methods release harmful pollutants like carbon monoxide, nitrogen oxides, and particulate matter.



DID YOU KNOW?

A study conducted by System of Air Quality Weather Forecasting And Research (SAFAR) in 2018 reported that approximately 41 per cent of Delhi's pollutions (particularly particulate matters – 2.5 & 10) are sourced from the transport sector—the highest among all sources.



Domestic air pollution is especially common in rural areas and low-income communities due to the use of traditional fuels.

Garbage burning: The burning of garbage is a significant source of air pollution, releasing toxic pollutants like dioxins, furans, and polycyclic aromatic hydrocarbons into the air. This can cause respiratory problems and other health issues for surrounding communities. Garbage burning is often the result of inadequate waste management practices aided by a lack of awareness in the cities and rural areas as well.

Fuel quality: The quality of fuel used for combustion processes in industries, vehicles, and domestic settings can significantly impact air pollution levels. Poor quality fuels such as high-sulfur diesel can release harmful pollutants like sulfur dioxide and particulate matter, contributing to air pollution. The use of cleaner fuels like natural gas and low-sulfur diesel can help reduce air pollution levels.

Wild/farm fires: Wildfires and farm fires can release significant amounts of particulate matter and other pollutants into the air, causing respiratory problems and other health issues for nearby communities. These fires are often caused by natural factors like lightning strikes and extreme heat during dry conditions, as well as human activities such as land clearing or accidental ignition.

Dust and C&D waste: Dust from construction and demolition (C&D) activities contributes to air pollution, releasing fine particulate matter into the air. Dust can be reduced through proper waste management and the use of dust control measures like water spraying and covering materials.

Overall, reducing air pollution requires a combination of measures targeting various sources of pollution, including industrial emissions, vehicular emissions, domestic pollution, garbage burning, fuel quality, wildfires, and dust from C&D activities.



ACTIVITY

IDENTIFYING LOCAL AIR POLLUTION SOURCES USING GOOGLE MAPS

1. Introduction (5 minutes)

Objective: Students will learn to identify potential sources of air pollution in their local area using Google Maps.

Context: Discuss common outdoor sources of pollution (e.g., industries, landfill sites, railway tracks) and how to spot them using maps.

Engage: “What do you think could be polluting the air around your school?”

2. Preparation (Before the Activity Starts)

Materials Needed:

Computers or tablets with internet access

Google Maps or other map-based tools

Notebooks/pens (for recording observations)

3. Activity Execution

(20-25 minutes)

Instructions:

Step 1: Search for your school on Google Maps.

Step 2: Set the map to show a 3 km radius around the school.

Step 3: Identify and list potential sources of air pollution in this area (e.g., industries, landfill sites, railway tracks, monitoring stations).

Step 4: Record the number and types of sources identified in your notebook.

4. Group Discussion

(10 minutes)

Discussion Points:

Share your findings with the class.

Discuss what types of sources you identified and their potential impact on air quality.

Compare findings with others to look for any common sources.

5. Wrap-Up/Conclusion

(5 minutes)

Key Takeaway: Understanding how to use Google Maps to spot pollution sources and considering their impact on air quality.

Actionable Insight: “How can you help raise awareness about pollution sources in your local area?”

6. Extension (Optional)

Follow-Up Task: Students can research how local authorities monitor and manage pollution from identified sources.

4



**HOW IS POLLUTION
MEASURED?**





HOW IS POLLUTION MEASURED?

How is air quality monitored in India? Which agencies are responsible for regulating air pollution? What is the Air Quality Index (AQI) and how does it help us understand the air we breathe?

The World Health Organization’s Air Quality Guidelines (AQG) serve as a global benchmark for cleaner, healthier air. After 15 years, WHO has updated these guidelines to reflect current realities, encouraging governments everywhere to step up efforts to reduce pollution and protect public health.

WHO AIR QUALITY GUIDELINES: 2005 vs 2021

Pollutant	Averaging Time	2005 AQG	2021 AQG	Change
PM _{2.5}	Annual	10 µg/m ³	5 µg/m ³	↓50%
	24-hour	25 µg/m ³	15 µg/m ³	↓40%
PM ₁₀	Annual	20 µg/m ³	15 µg/m ³	↓25%
	24-hour	50 µg/m ³	45 µg/m ³	↓10%
O ₃	Peak season	–	60 µg/m ³	New
	8-hour	100 µg/m ³	100 µg/m ³	–
NO ₂	Annual	40 µg/m ³	10 µg/m ³	↓75%
	24-hour	–	25 µg/m ³	New
SO ₂	24-hour	20 µg/m ³	40 µg/m ³	↑100%
CO	24-hour	–	4 mg/m ³	New

We keep reading or hearing about air pollution and its deadly effect on our health and environment. More recently, we have also been hearing this new abbreviation being mentioned quite regularly: AQI or Air Quality Index. As the name suggests, AQI is essentially a report card on the quality of air in a specific location. It informs both the public and authorities about pollution levels, enabling timely action to control them.



In 2014, India's main pollution watchdog, the Central Pollution Control Board (CPCB), launched the National Air Quality Index (NAQI) to provide clear, daily updates on air quality across cities and towns. This system uses a 500-point scale to rank air quality from 'Good' to 'Severe.' To make it user-friendly, it follows a 'One Number–One Colour–One Description' format, helping people quickly interpret the air quality in their area. The rule is simple: the higher the AQI score, the more polluted the air and the greater the associated health risks.

THE AQI TABLE

AQI	Remark	Colour code	Possible health impacts
0-50	Good		Minimal impact
51-100	Satisfactory		Minor breathing discomfort to sensitive people
101-200	Moderate		Breathing discomfort to people with lungs, asthma and heart disease
201-300	Poor		Breathing discomfort to most people on prolonged exposure
301-400	Very poor		Respiratory illness on prolonged exposure
401-500	Severe		Affects healthy people and seriously impacts those with existing diseases

Source: CPCB

The CPCB monitors seven pollutants in our air: sulphur dioxide (SO₂), nitrogen dioxide (NO₂), respirable suspended particulate matter (RSPM/PM₁₀), fine particulate matter (PM_{2.5}), ozone, carbon dioxide (CO₂) and ammonia (NH₃).

There are numerous tools available for measuring air pollution.

These are a few examples:

Particulate Matter (PM) monitor: This device measures the concentration of PM, a significant source of air pollution. It can give information in real time on the amount of PM_{2.5} or PM₁₀ in the air.





Gas analyser: This device measures the levels of different gases in the atmosphere, including ozone, carbon monoxide, nitrogen dioxide, and sulphur dioxide. It can offer real-time information on the concentrations of these gases, which are significant contributors to air pollution.



The UV absorption analyser examines the amount of UV light absorbed by the air sample to determine the amount of ozone in the air.

Meteorological instruments: Instruments used to measure meteorological data include those that measure temperature, humidity, wind speed, and direction, as well as barometric pressure. These variables can be utilised to better comprehend how air contaminants spread out and migrate.



Passive sampling devices: Equipment known as passive sampling devices collect air pollutants over time, which may subsequently be tested in a lab to ascertain the number of contaminants in the air.



Just a few instruments that can be used to gauge air pollution are listed above. The particular pollutants being measured, the level of accuracy and precision needed, and the location of the monitoring site will all influence the instrumentation choice.

DID YOU KNOW?

According to the World Air Quality Report 2023, **35 out of the top 50** most polluted cities are located in India.





AQI MONITORING STATIONS ACROSS INDIA



Air quality monitoring stations in India are operated by the Central Pollution Control Board (CPCB) and various State Pollution Control Boards (SPCBs). These stations collect data on air pollutants and provide real-time information to the public. As of February 2026, there were a total of **1,537 monitoring stations** across the country, including both manual and continuous types. This includes **966 manual monitoring stations** in 419 cities and **571 continuous monitoring stations** in 299 cities. In parallel with the rise in real-time monitoring infrastructure, India's manual air quality monitoring network has more than doubled since 2010. According to the CPCB, as of 19 November 2024, there are 966 operational manual monitoring stations across 419 cities and towns, spanning 28 states and seven union territories. These stations monitor key pollutants, including **particulate matter (PM10 and PM2.5), sulfur dioxide (SO2), nitrogen oxides (NOx), carbon monoxide (CO), and ozone (O3)**. The data they gather is essential for assessing air quality and shaping related policies.

To ensure consistent reporting, the CPCB developed the National Air Quality Index (AQI), which provides a standardised measure of pollution levels. Based on the concentrations of the same core pollutants, the AQI scores range from 0 to 500, with higher values indicating poorer air quality.

Despite the size of the network, several challenges persist: equipment maintenance, data management, and insufficient resources affect data accuracy. Moreover, many rural and remote areas remain underserved by the current network, limiting the ability to fully gauge air quality across the country.





ACTIVITY

MEASURING AIR QUALITY USING INTERNET

1. Introduction (5 minutes)

Objective: Students will learn how to check the Air Quality Index (AQI) for their local area using various online resources and applications.

Context: Briefly explain AQI and its importance for health, outlining the different AQI levels and their significance.

Engage: “Why do you think it’s important to know the AQI before going outside?”

2. Preparation

(Before the Activity Starts)

Materials Needed:

Computers or smartphones with internet access

Access to the CPCB website (www.cpcb.nic.in) or AQI apps (e.g., Safar Air, Air Quality Index India)

Notebooks/pens (for recording AQI data)

Projector/screen (for teacher demonstration, optional)

3. Activity Execution

(20-25 minutes)

Instructions:

Step 1: Open the CPCB website or AQI apps and navigate to the AQI section.

Step 2: Find the AQI for your local area/hometown and two other areas of interest.

Step 3: Record the AQI and note down weather conditions for each location.

4. Group Discussion

(10 minutes)

Discussion Points:

What are the differences in AQI levels across different locations?

How do weather conditions affect AQI readings?

What health risks are associated with different AQI levels?

5. Wrap-Up/Conclusion

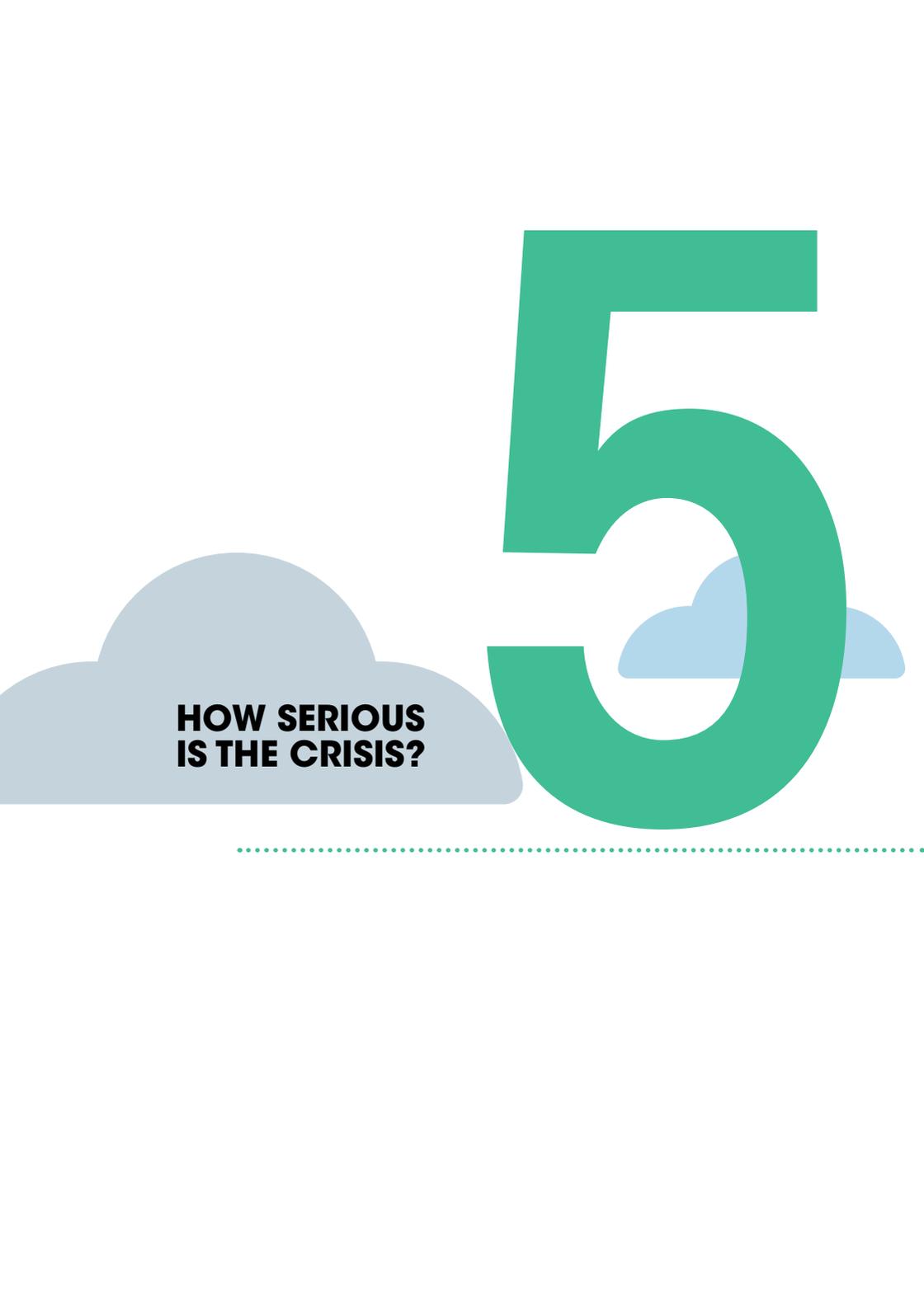
(5 minutes)

Key Takeaway: The importance of checking AQI regularly to stay informed and protect health.

Actionable Insight: “Start checking the AQI before your outdoor activities to ensure it’s safe.”

6. Extension (Optional)

Follow-Up Task: Schools can announce AQI levels during morning assembly and adjust outdoor activities accordingly.



**HOW SERIOUS
IS THE CRISIS?**

5



HOW SERIOUS IS THE CRISIS?

How does air pollution affect health and the economy? What drives rising pollution across India? Why is winter pollution worse, and how does it vary by region?

Air pollution, though often invisible, is one of India's most pressing environmental threats. Its effects are especially harsh on children and the elderly, making it harder to breathe in many cities across the country. The World Health Organization reports that 13 of the 20 most polluted cities globally are in India. The 2024 World Air Quality Report by IQAir ranked India the fifth most polluted nation, with average PM2.5 levels of 50.6 $\mu\text{g}/\text{m}^3$, which is more than ten times higher than the WHO's recommended annual limits of 5 $\mu\text{g}/\text{m}^3$.

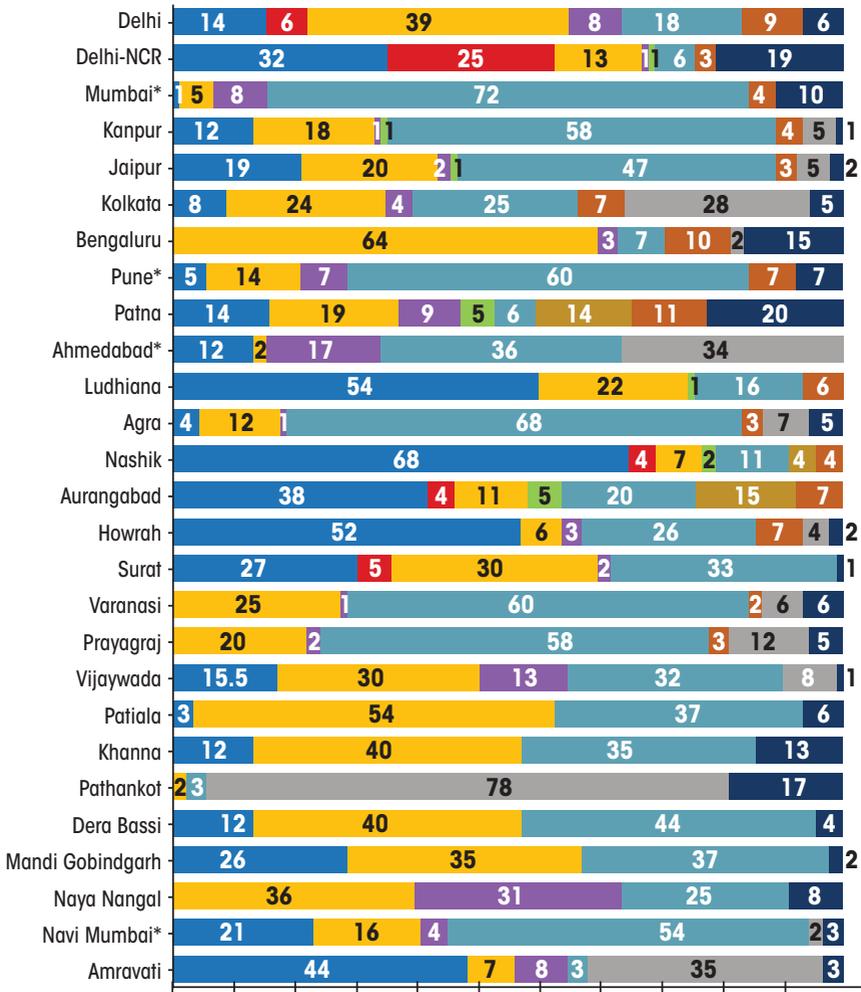
TOLL ON HUMAN HEALTH AND ECONOMIC IMPLICATIONS

The Global Burden of Disease Study 2019, conducted by Lancet Planet Health and the Indian Council of Medical Research (ICMR), found that air pollution accounted for 17.8 per cent of all deaths in India. Rajasthan reported the highest share at 21.2 per cent. Several other states with high percentages, including West Bengal (20.8 per cent), Jammu and Kashmir and Ladakh (20.2 per cent), and Uttar Pradesh (19.5 per cent). Other states that exceeded the national average were Tripura (19 per cent), Haryana (19 per cent), Gujarat (18.9 per cent), and both Bihar and Punjab at 18.8 per cent. The list concludes with Madhya Pradesh (18.7 per cent), Uttarakhand (18.6 per cent), Himachal Pradesh (18.5 per cent), and finally Delhi (18.2 per cent) with the lowest share among the group.

Beyond its severe health impact, air pollution has significant economic costs. In 2019 alone, India lost Rs 2.6 lakh crore (US \$36.8 billion) due to premature deaths and illness linked to polluted air. A more recent study, published in November 2023, highlighted that air pollution is the third leading risk factor for deaths among children under five and the second highest for those under fourteen.

EMISSION INVENTORY OF PM2.5 ACROSS DIFFERENT CITIES IN INDIA

■ Industry/Power plants ■ Residential ■ Transport exhaust ■ Construction/Hot Mix plants
■ DG Sets ■ Road dust ■ Brick kilns ■ Open waste/MSW burning ■ Household/Domestic
■ Others (in percentage)



Note- *Cities where emission load is given for PM and not specific to PM2.5
 Source: Based on recent emission inventory studies available



UNMASKING THE CULPRITS BEHIND THE RISING POLLUTION

Air pollution in India is driven by a range of pollutants, with PM2.5 levels exceeding national standards most of the time. This is followed by PM10, nitrogen dioxide (NO₂), carbon monoxide (CO), and ozone. Sulphur dioxide (SO₂) is the only pollutant that consistently remains within permissible limits. The sources of these pollutants are diverse and often overlapping.

Across Indian cities, the major contributors to air pollution are well-established. These include emissions from vehicles, heavy industries such as power plants, small-scale units like brick kilns, and resuspended dust from roads and construction sites. Open burning of waste and the use of solid fuels for cooking, heating, and lighting also play a significant role. On-site power generation from diesel generators is a significant source of pollution. This problem is further intensified by seasonal factors such as dust storms, forest fires, stubble burning, and sea salt carried inland in coastal regions.

In winter, air pollution from combustion sources like vehicles and industries increases, while dust-related pollution declines. This is due to greater fuel burning and the rise of secondary particulates formed from combustion gases. Thermal inversion traps these pollutants close to the ground, and lower mixing heights limit their dispersion, together causing a sharp drop in air quality.

The Centre for Science and Environment's End of Winter Report 2023–24 reveals that air quality deteriorated earlier than usual this winter, largely due to low rainfall in September–October and weak wind speeds—both crucial for dispersing pollutants. The report also emphasises that air pollution levels in India are far from uniform, showing significant regional variation.

In 2024, North India recorded worse air quality than the previous winter, while East India showed notable improvement. South India remained the least polluted, with consistently low PM2.5 levels. Still, pollution episodes were observed across all regions, underscoring that PM pollution is a regional-scale issue, with real-time monitoring showing synchronised fluctuations across geographies.



UNDERSTANDING REGIONAL VARIATIONS

City-level analysis reveals that smaller cities like Begusarai (Bihar) and Hanumangarh (Rajasthan) have pollution levels comparable to Delhi. Industrial hubs in southern India and the Himalayan region also show alarmingly high levels. In contrast, cities in the Northeast and Karnataka rank among the cleanest. However, even cities with low seasonal averages experience sharp daily pollution spikes, underscoring the need for region-wide action.

Winter pollution peaks mostly align with Diwali, except in the hills where January records the worst air quality. In 2023–24, peak PM_{2.5} nationwide was recorded on 13 November, the day after Diwali, with similar trends across most regions. The Himalayan states peaked on 13 January, and the Northeast on January 22. North India had the highest regional PM_{2.5} peaks, followed by the West Himalayas and East India. Compared to last winter, pollution worsened in the North and Northeast, dropped 29 per cent in the East, and declined about 10 per cent in the West and South. Delhi and Chandigarh were the most polluted UTs; Bihar and Haryana, the most polluted states. Karnataka and Kerala ranked cleanest, though data gaps in some states limit a full national assessment.

Mitigating air pollution offers a dual benefit: not only does it reduce public health risks, but it also curbs the warming effects caused by local air pollutants. These pollutants, while detrimental to public health, also act as heat traps, exacerbating global warming.



ACTIVITY

HOW DO WE COMMUTE? UNDERSTANDING OUR IMPACT

1. Introduction (5 minutes)

Objective: Students will identify the main sources of air pollution in their community and brainstorm ways to reduce them.

Context: Discuss how commuting, energy use, and waste habits contribute to pollution and how small changes can reduce the environmental impact.

Engage: “How does your commute to school affect the air around you?”

2. Preparation (Before the Activity Starts)

Materials Needed:

Survey sheets or digital survey forms (for collecting data)

Pen/pencil (for filling out surveys)

Graph paper or spreadsheets (for data analysis)

Computers or tablets (optional, for digital analysis)

3. Activity Execution (20-25 minutes)

Instructions:

Design a survey asking about transportation, energy use, and waste habits.

Example questions: “How do you commute to school? Do you use

energy-efficient appliances? Do you recycle?”

Distribute the survey to students and staff over 1-2 days.

After data collection, analyse the responses and create graphs to visualise the data.

4. Group Discussion

(10 minutes)

Discussion Points:

What were the most common transportation methods? What impact do they have on pollution?

What steps can individuals take to reduce their carbon footprint?

5. Wrap-Up/Conclusion (5 minutes)

Key Takeaway: Understanding the role of transportation, energy use, and waste in pollution, and how small lifestyle changes can make a big impact.

Actionable Insight: “How can we reduce pollution from commuting, energy, and waste in our daily lives?”

6. Extension (Optional)

Follow-Up Task: Create an action plan for the school or community to reduce pollution through eco-friendly commuting or waste management.



**India's Roadmap
for Cleaner Air**



INDIA'S ROADMAP FOR CLEANER AIR

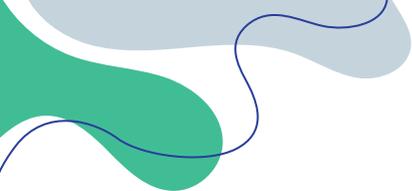
*What is India's national approach to air pollution since 2019?
What actions has Delhi-NCR taken across key sectors? How can
cities link clean air goals with climate benefits?*

India is implementing a multi-faceted approach to control air pollution, involving policy measures, technological advancements, and public awareness campaigns.

In January 2019, the Ministry of Environment, Forests and Climate Change (MoEF&CC) rolled out the country's first national framework to address air pollution—the National Clean Air Programme (NCAP). Designed as a comprehensive, pan-India strategy, the NCAP set an ambitious target: to reduce PM10 concentrations by 20 to 30 per cent by 2024, using 2017 levels as the benchmark. The deadline was later extended to 2026, with a revised target of reducing pollution levels by 40 per cent using 2019 as the baseline. As part of the NCAP, the Central Pollution Control Board (CPCB) identified 131 non-attainment cities—urban areas where particulate matter levels have persistently breached national air quality standards. For the first time, a dedicated funding mechanism was introduced to support these cities in implementing their clean air action plans.

All identified cities are required to submit quarterly progress reports, detailing achievements against sector-specific indicators laid out in their clean air action plans. These indicators cover various sectors, including air quality monitoring, pollution source assessment, public outreach, road dust, construction and demolition (C&D) waste, solid waste management, industrial and vehicular pollution (covering on-road and old vehicles), public transport, non-motorised transport, parking, and freight. In total, there are approximately 258 indicators.

The time-bound implementation of NCAP, aiming for a 40 per cent reduction in particulate pollution by 2026 (from 2019 levels), has the potential to catalyse coordinated multi-sector action, offering the co-benefit of lowering both air pollution and CO₂ emissions.



LAWS IN PLACE FOR AIR POLLUTION

In India, the primary law governing air pollution is the Air (Prevention and Control of Pollution) Act, 1981. This law was enacted to prevent and control air pollution by regulating pollutant emissions from industries, vehicles, and other sources.

Under this law, the Central Pollution Control Board (CPCB) and State Pollution Control Boards (SPCBs) are responsible for implementing and enforcing regulations to control air pollution. The CPCB sets national standards for air quality, while the SPCBs monitor and enforce these standards at the state level.

There are also other laws and regulations in India that address specific sources of air pollution, such as the Motor Vehicles Act, which regulates emissions from vehicles, and the Graded Response Action Plan (GRAP), which outlines measures to be taken during periods of high air pollution levels.



GOING BEYOND CITY LIMITS

Since the launch of NCAP in 2019, it has become evident that regional cooperation is essential for cities to meet clean air targets, given the challenge of transboundary pollution. Scientists have identified airsheds—geographical zones shaped by shared meteorology and topography—that influence how pollutants disperse. Strengthening state-level clean air action plans is therefore critical to tackling pollution at a regional scale.

For example, a 2018 study found that NCR contributes up to 70 per cent of Delhi's winter PM_{2.5} levels. The NCAP acknowledges the need for a regional approach and inter-state coordination, recommending comprehensive plans based on regional pollution sources.

The Delhi-NCR model, which brings together four states, has demonstrated the value of coordinated regional action, through steps like phasing out polluting fuels and scaling up the use of natural gas vehicles. The establishment of the Commission on Air Quality Management (CAQM) in 2019 has further enabled region-wide directives to streamline efforts. This integrated framework



offers a strong blueprint for shaping the next phase of NCAP.

The complex web of pollution sources, coupled with stark seasonal fluctuations, calls for unified and sustained action to curb emissions. The compounded effects of diverse pollutants make it imperative to adopt comprehensive, multi-sector strategies to safeguard air quality and protect public health.

SECTOR-WISE ACTION TO CURB AIR POLLUTION

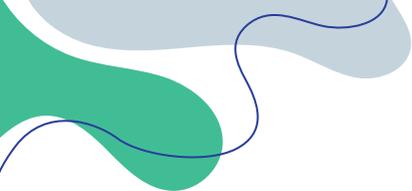
Vehicles

Vehicles remain a major and consistent contributor to air pollution, affecting both overall ambient levels and immediate human exposure. In 2020, India took a bold step by transitioning directly from BS-IV to BS-VI emission standards for new vehicles, a move that led to a dramatic reduction in vehicular emissions. Diesel cars saw an 82–93 per cent drop in particulate matter emissions and a 68 per cent cut in nitrogen oxides, while standards for trucks and buses became 50–67 per cent stricter, significantly reducing the disparity between petrol and diesel norms.

India is steadily shifting from internal combustion engines to electric vehicles (EVs), a critical change for decarbonising the transport sector. As of now, 29 states have adopted EV policies, and national EV penetration has grown significantly from less than 1 per cent in 2015–16 to around 7.8 per cent in the 2024–25 fiscal year. Leading this progress, Delhi has seen the share of its new vehicle registrations surpass 10 per cent. To sustain this momentum, states must implement comprehensive policies with clear targets, infrastructure for charging, and prioritised support for two-wheelers, public transport, and delivery fleets. Establishing battery recycling systems and measurable implementation milestones will be equally essential for long-term impact.

The electric vehicle programme under the central Faster Adoption and Manufacturing of (Hybrid &) Electric Vehicles (FAME 2) is helping to phase in zero emissions vehicles in cities.

To further support this transition, several state governments are linking clean air funding with electrification programmes. The national government has introduced the PM e-Bus Sewa, an initiative to deploy 10,000 electric buses across the nation in 169 cities, enhancing public transportation while reducing emissions.



These new policy measures underscore the commitment to a sustainable, zero-emissions future.

Industrial Emissions

India has implemented a multifaceted approach to control air pollution from the industrial sector. Stringent emission standards have been established, regulating the release of pollutants such as SO₂, NO_x, and PM. Additionally, several state governments have notified an approved fuel list by banning the use of highly polluting fuels like petcoke and furnace oil in key industrial areas, encouraging a shift to cleaner alternatives such as natural gas.

To promote cleaner technologies, initiatives such as the Perform, Achieve and Trade (PAT) scheme under the National Mission for Enhanced Energy Efficiency (NMEEE) incentivise industries to adopt energy-efficient practices, indirectly reducing emissions. Additionally, high-emission industries are mandated to install Continuous Emission Monitoring Systems (CEMS) to track and report emissions in real time, improving transparency and regulatory compliance. Together, these measures aim to reduce the industrial sector's impact on air quality in India.

Waste

The Swachh Bharat Mission 2.0 aims to make cities garbage-free by 2025, supported by performance-based funding. Key efforts include cleaning up old dumpsites through bio-mining and segregation, and boosting the capacity to treat, process, recycle, and recover municipal solid waste to reduce landfill usage.

Swachh Survekshan 2.0 emphasises performance-linked funding to achieve garbage-free cities by 2025. This includes bio-mining and segregating legacy dumpsites, expanding waste treatment and recycling facilities, and aiming to limit landfilling to 20 per cent by 2025. The mission also targets 100 per cent source segregation and door-to-door collection of waste, with scientific management and digital monitoring of all waste operations.

Additionally, NCAP funding focuses on improving infrastructure for recycling construction and demolition (C&D) waste in cities.

AIR QUALITY CHALLENGES IN DELHI-NCR

Delhi has seen an overall improvement of about 10 per cent in its

DELHI'S CLEAN AIR DRIVE

SECTOR-WISE ACTION SNAPSHOT

Vehicles

Delhi has led the way in controlling vehicular emissions:

- Delhi and NCR adopted BS-VI fuel, two years and six months ahead of national rollout, respectively.
- Phased out 10-year-old diesel and 15-year-old petrol vehicles.
- Imposed a cess on diesel sales, environmental pollution charge on large diesel engines, and taxed truck entries.
- Purchase incentives and subsidies for charging infrastructure under EV Policy.
- Establish an EV Cell to monitor supported by the creation of a dedicated EV cell to oversee progress and monitor implementation.
- Over 3,100 charging stations set up in NCT Delhi, 467 in the broader NCR.
- 100% fleet electrification for aggregators by 2030, under the Motor Vehicle Aggregator.
- Directions have been issued to phase out diesel autos and mandate the use of CNG or electric autos across Delhi-NCR.
- Intercity bus operations within NCR are now required to operate exclusively on electric, CNG, or BS-VI-compliant buses to curb emissions.
- As of September 2023, diesel generators must now be retrofitted, replaced with compliant models, or shifted to CNG.



Industrial

Delhi-NCR has implemented stringent measures to control industrial pollution from the thermal power sector:

- Banning use of dirty fuels like pet coke, furnace oil and coal. The ban on coal has been expanded to NCR towns.
- 96% industries have switched to approved fuels in industrial areas.
- Major industries shifted out of Delhi.
- So_x emissions standards imposed for 16 category of industries.
- Permanently shut all coal power plants in Delhi, while those in the NCR region face temporary closures during winter.





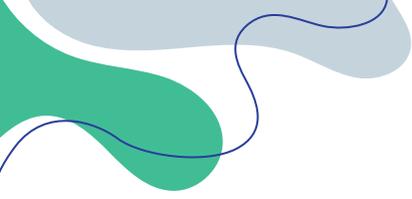
annual PM_{2.5} levels since 2018, when most monitoring stations became operational, with a temporary dip during the 2020–21 pandemic period. However, this progress has reversed in recent years: after 2021, levels increased, remained elevated, and the trend turned upward during 2023–24. Notably, the maximum concentrations recorded in 2024 are the highest in the past few years. Despite earlier gains, Delhi still requires an estimated 62 per cent reduction in its annual average PM_{2.5} levels to meet the national ambient air quality standard.

The Graded Response Action Plan, implemented since 2017, has been key in reducing pollution peaks in Delhi, especially in winter, through targeted measures and timely interventions based on forecasting models, leading to noticeable air quality improvements.

Delhi has made significant strides in improving air quality through targeted interventions across key sectors. While these actions have led to a general decline in pollution levels over time, recent data shows that progress is uneven, with challenges persisting—particularly in managing winter spikes and achieving national standards. Continued and sustained efforts will be essential to build on these gains and ensure long-term air quality improvements.

HOW WILL CITIES MEET THE AGENDA FOR CLEAN AIR WITH A CLIMATE CO-BENEFIT

To achieve cleaner air, cities must enhance air quality monitoring and scientific management, improve vehicle technology and fuel quality, manage on-road emissions, address old vehicles through scrappage policies, and expand electric vehicle fleets. Cities also need to develop integrated public transport, invest in walking and cycling infrastructure, and implement vehicle restraint measures like parking policies and tax adjustments. Clean energy adoption in industries and households, enforcing emissions standards, and effective waste management are crucial. Controlling dust pollution requires greening initiatives, soil stabilisation, afforestation, and forest conservation.



7

GLOBAL STRATEGIES FOR CLEANER AIR





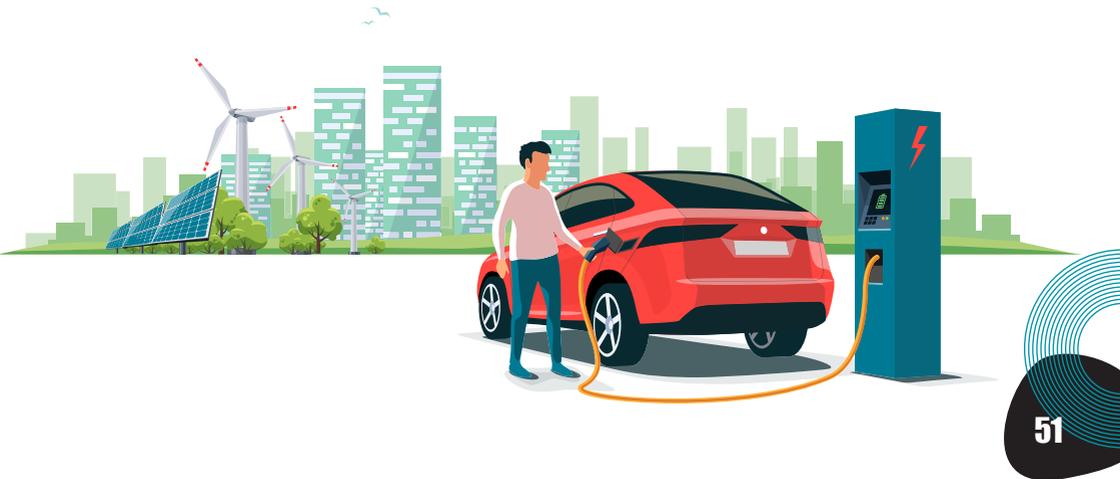
GLOBAL STRATEGIES FOR CLEANER AIR

What global strategies and technologies are countries using to tackle air pollution? How are laws, incentives, and urban planning shaping cleaner futures?

Countries worldwide are implementing various measures to combat air pollution, starting with electrifying public transportation systems, promoting biking, and encouraging the use of public transport over private vehicles. Additionally, governments are installing air quality sensors to monitor pollution levels locally, while also working towards reducing reliance on fossil fuels by phasing out coal and diesel-based vehicles and adopting renewable energy sources.

Germany and Iceland stand out for their significant strides in renewable energy adoption. Germany's Renewable Energy Sources Act incentivises the shift to wind, solar, and biomass energy, while Iceland generates nearly 100 per cent of its electricity from renewable sources (27 per cent from geothermal and 73 per cent from hydroelectric power), with 85 per cent of its total primary energy supply coming from domestically produced renewables.

Low-cost public transport options, bans on cars during mass gatherings, heavy penalties for polluters (e.g., in Australia), and promoting car and bike pooling are also part of the global efforts. Meanwhile, initiatives like the odd-even rule (e.g., in Delhi), electric





metros and buses, and planning bans on fossil fuels (e.g., in the Netherlands) are gaining traction.

The transition to electric vehicles (EVs) is also significant, with countries like Norway leading the charge. Incentives such as tax exemptions and toll waivers are offered to EV owners. The top five countries with the highest share of EV sales are Norway (all-electric vehicles made up 80 per cent of passenger vehicle sales in 2022), Iceland (41 per cent), Sweden (32 per cent), the Netherlands (24 per cent) and China (22 per cent). Cities like Amsterdam prioritise cycling infrastructure and pedestrian-friendly urban planning. Changes in laws and regulations, including penalties for pollution-related activities and the introduction of new vehicle emission standards, further underscore the global commitment to combat air pollution.

Moreover, regions like the European Union, Japan, and China have implemented stringent emissions standards and invested in pollution control technologies to address air quality challenges effectively. The EU's Euro standards for vehicle emissions, Japan's subsidies and tax breaks for low-emission vehicles, and China's strict emissions standards for industries are notable examples of these efforts.

Countries around the world are now transitioning toward electrifying their transport sectors. Let's understand how conventional internal combustion engine (ICE) vehicles differ from electric vehicles (EVs).

WHAT SETS THEM APART?

Electric Vehicles (EVs) may look similar to their internal combustion engine (ICE) counterparts, but under the hood, they're a whole new world.

Motor vs engine

EVs use electric motors with just two moving parts, no oil, no filters, no fuss. Compare that to an ICE vehicle's engine with 40+ parts needing regular maintenance.

Smarter power flow

EVs rely on power electronics that convert battery power (DC) into motor power (AC) and back again during braking—this helps recharge the battery using regenerative braking.

Cooler cooling

Both types use AC, but EVs power the compressor directly from the battery. In ICE cars, it draws from the engine, which is why the car sometimes slows down when the AC is on.

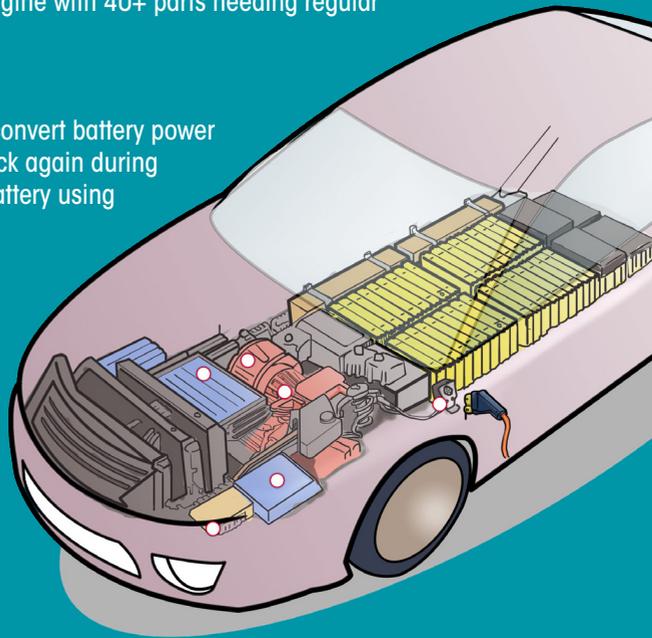
One-speed simplicity

EVs don't need complex gear systems; just one smooth-speed gearbox that delivers instant torque.

Brake and recharge

EVs slow down by using their motor to generate electricity—saving your brakes and topping up the battery. Hydraulic brakes only kick in when needed.

In short, EVs are simpler, cleaner, and smarter machines built for the future.





**WHAT CAN WE DO
FOR CLEANER AIR?**



WHAT CAN WE DO FOR CLEANER AIR?

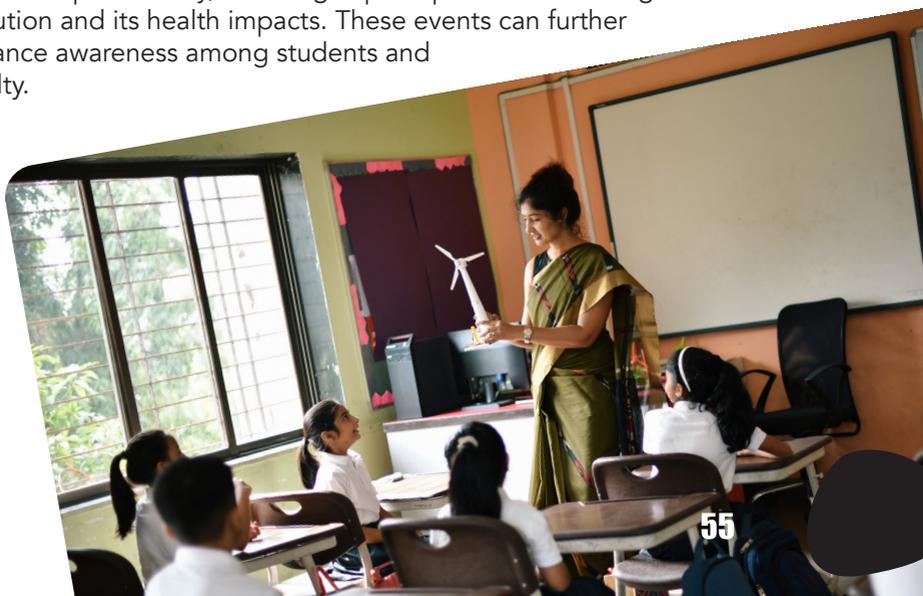
How can schools influence change in air pollution control? How do infrastructure and transport choices impact school air quality? How can students and teachers drive collective environmental action?

WHAT CAN SCHOOLS DO?

To combat air pollution, we need to act on multiple levels. Addressing this challenge requires concerted efforts from all sectors of society, including educational institutions. Schools play a pivotal role in shaping the future generation's understanding and response to environmental issues.

1. Educational initiatives and awareness building:

- Schools can install a permanent display board providing information on daily air quality sourced from reliable platforms like the Central Pollution Control Board (CPCB) website. This board can be managed by students and faculty, serving as a key tool for spreading awareness about air pollution issues.
- Assemblies, seminars, and health check-up camps can be organised periodically, featuring expert speakers discussing air pollution and its health impacts. These events can further enhance awareness among students and faculty.





2. Implementation of sustainable practices:

- Develop a protocol based on the Air Quality Index (AQI) to minimize outdoor exposure for students, avoiding unnecessary activities on days categorised as 'very poor', 'severe', or 'emergency' in terms of air quality.
- Introduce car-free days and restrict car-access areas around the school to promote non-motorised transport like walking and cycling. Invest in infrastructure such as signaling systems, junction crossings, and cycle stands to support these initiatives.

3. Advocacy and policy influence

- Encourage the use of school buses and public transport by implementing incentives for faculty and staff. Rationalise bus routes for maximum efficiency and enforce regular maintenance and compliance with pollution control measures for all school-owned vehicles.
- Advocate for stricter regulation of third-party service providers like taxis and auto-rickshaws, ensuring they meet safety and emissions standards set by the school.



4. Community collaboration and engagement

- Collaborate with local authorities and community organisations to create 'green barriers' through intensive plantation along entry points and boundaries to minimise dispersion of dust and pollutants.
- Organise waste disposal initiatives and provide electric heaters to replace personal fires, minimising emissions from burning waste and biomass.

5. Use of cleaner energy sources

- Transition to cleaner energy sources such as LPG and solar for all energy requirements within the school, including cooking.
- Minimise the use of diesel generator sets and ensure compliance with dust control norms for construction sites within the school premises.

WHAT CAN INDIVIDUALS DO?

- Encourage students and faculty to avoid using personal vehicles and instead utilise school buses, public transport, or non-motorised modes of travel.
- Advocate for clean fuel usage and adherence to traffic rules among family members and raise concerns about visible pollution sources in the community.
- Lead by example, with teachers promoting sustainable practices like cycling to school and supporting school initiatives to combat air pollution. Calculate personal carbon footprints to understand individual impacts on the environment.

By implementing these strategies, schools can play a vital role in reducing air pollution, promoting sustainable practices, and fostering a culture of environmental stewardship among students and the broader community.



AIR MANAGERS

TOP SCHOOLS IN THE GSP AIR CATEGORY





AIR MANAGERS **TOP SCHOOLS IN THE GSP AIR CATEGORY**



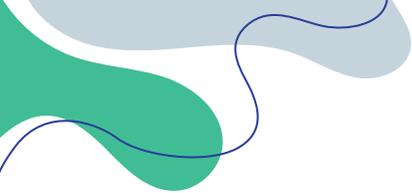
PM SHRI KENDRIYA VIDYALAYA, AFS AKkulam, GSP Air Manager Awardee

PM Shri Kendriya Vidyalaya, situated in Akkulam, Kerala, embodies a commitment to environmental stewardship and sustainable practices. With a student population of 1,537, this government-run co-educational institution has implemented various initiatives to reduce its environmental impact and promote eco-friendly behaviours among students and staff.

CONSOLIDATED POINTS:

Transportation and pollution reduction

The school initiated a campaign promoting non-polluting modes of transportation, resulting in a significant increase of 133 per cent in Non-Polluting Transport (NPT) usage. This campaign also led to a remarkable 85 per cent reduction in the usage of private transport within the school community.



Sustainable energy adoption

In alignment with its sustainability goals, the school introduced solar energy as a viable power source during the 2023–24 academic cycle, reducing reliance on non-renewable energy sources.

Comprehensive waste management

Implementing a comprehensive waste management strategy and 100 per cent recycling of both wet and dry waste, setting a commendable example in responsible waste management.

Environmental conservation initiatives

Prioritising environmental conservation, the school prohibits waste burning, maintains a significant 48 per cent green area coverage within the premises, and refrains from providing packaged food for school activities, fostering appreciation for nature among students.

Effective waste segregation and practices

Adopting two-bin (201) and three-bin (105) systems for waste segregation, the school ensures efficient resource utilisation and promotes a culture of environmental responsibility among students and staff.

PM Shri Kendriya Vidyalaya's commitment to environmental sustainability is evident through its proactive initiatives to reduce pollution, embrace renewable energy, and implement effective waste management practices. By fostering a culture of environmental responsibility, the school not only contributes to a cleaner and healthier environment but also empowers students to become agents of positive change in their communities.



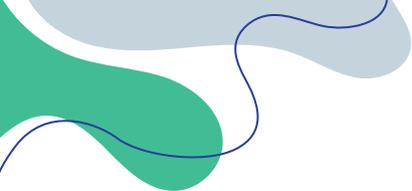
SUBODH PUBLIC SCHOOL AIRPORT, JAIPUR, RAJASTHAN

Pioneering Green Mobility and GSP Air Manager Awardee

Subodh Public School Airport, located in Jaipur, Rajasthan, is a Green-rated private co-educational school with 2,144 students. Since 2021, the school has taken significant steps toward sustainability by eliminating the use of diesel and petrol on its campus and promoting cleaner, renewable alternatives. Through consistent efforts, it has become a model for environmentally responsible transportation practices.

Change in mobility practices

The major milestone in the school's sustainability journey is the significant shift in transportation practices among students, staff, and the surrounding community. In 2021, only 25 per cent of the school population used non-polluting modes of travel. However, through continuous advocacy, targeted awareness campaigns, and the school's proactive approach, this number increased sharply to 89 per cent within just one year. Today, 98 per cent of the school community relies entirely on sustainable and non-polluting transportation options. By actively promoting walking, cycling, electric vehicles (EVs), and the use of public transport, the school has not only reduced its own carbon emissions but also played a key role in encouraging environmentally responsible behaviour



across the local community.

Green area

One of the notable achievements is the school's commendable dedication to nurturing the environment. Today, the campus boasts a lush green area covering an impressive 69 per cent of its total grounds. This deliberate focus on green spaces not only enhances the aesthetic appeal of the school but also fosters a sustainable ecosystem that supports biodiversity and natural conservation.

Renewable energy adoption

Subodh Public School also leads the way in harnessing renewable energy sources. By investing in solar infrastructure, the school now meets an impressive 50 per cent of its energy consumption through clean, sun-powered technologies. This significant step not only reduces the school's dependence on conventional power sources but also contributes positively to the environment.

Electric vehicle initiative

Moreover, the school took a pioneering initiative by introducing electric vehicles that are either purchased or hired by the institution. This move not only encourages the adoption of EVs among students and staff but also sets an inspiring example for other educational institutions and organisations to follow suit.

Recognition and awards

As a testament to its outstanding efforts, Subodh Public School Airport earned the prestigious Air Manager award in the GSP Programme of CSE (Centre for Science and Environment). This accolade is a recognition of the school's unwavering dedication to combating air pollution, promoting sustainable practices, and inspiring positive change within the community.

With Subodh Public School Airport leading the way towards a greener and more sustainable future, it stands as a beacon of hope, proving that even small changes and determined actions can bring about significant positive impacts on the environment and society as a whole. The school's journey is an inspiring tale that motivates others to take up the mantle of sustainability and collectively work towards a cleaner, healthier, and brighter world.

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This publication makes the issue of air pollution easy to understand and relevant to our daily lives, health, and future. Aimed at school students, teachers, and school communities, it explains what causes air pollution, how it is measured, and why it matters—especially in the Indian context. With simple language, real-world insights, and practical tips, it encourages students to think critically and take action. Teachers can use it as a tool to build awareness, while schools are inspired to lead the way in creating a cleaner, healthier environment.



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