BREATHE
India

**AN ACTION PLAN FOR
COMBATING AIR POLLUTION**

CONTENTS

INTRODUCTION

A recent WHO database (2018) has identified several of India's top cities with some of the highest levels of air pollution. Kanpur, Faridabad, Gaya, Varanasi and Patna are the top five most polluted cities in the world (see Table 1). The organization also highlights that almost nine out of 10 people worldwide breathe polluted air. Air pollution is one of the biggest killers, causing almost seven million deaths a year due to exposure to air pollution. This exposure leads to diseases such as stroke, heart disease, lung cancer, chronic obstructive pulmonary diseases and respiratory infections, including pneumonia. In fact, according to Health of the Nation's States, household air pollution was responsible for 5% of the total disease burden in India in 2016, and outdoor air pollution was responsible for 6% of the burden.

In this context, NITI Aayog has developed 15 Action Points across a range of industries and sectors. It calls for concerted action from all levels of governance, cutting across Ministries and Departments. In addition, the Action Plan covers all stakeholders without whose active participation and support the air pollution crisis cannot be tackled.
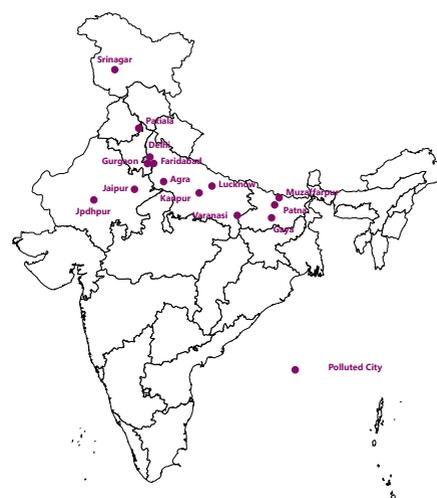
While a majority of these Action Points present immediate tasks that should be undertaken by the concerned authorities, they also include activities that are more long-term in nature. In addition, several Action Points begin with specific interventions that need to be undertaken by the most polluted cities in the country. Such a comprehensive approach will allow for more sustainable solutions in fighting air pollution.

TABLE 1:
Top 10 most polluted cities in India based on pm 2.5

CITY	PM 2.5 (Annual mean, ug/m^3)
Kanpur	173
Faridabad	172
Gaya	149
Varanasi	146
Patna	144
Delhi	143
Lucknow	138
Agra	131
Gurgaon	120
Muzaffarpur	120

Source: WHO Database, as on 21 May 2018.

14 of the world's 15 most polluted cities are in India. : WHO, 2018

OVERVIEW OF THE ACTION PLAN

REDUCTION IN AIR POLLUTION

- Control Industrial & Power Emissions
- Reform Regulatory Framework
- Implement Emissions Trading
- Utilize Crop Residue
- Implement Waste Management Policy
- Tackle City Dust & Construction
- Address clean cooking & forest fires
- Adopt Targets and Monitor
- Limit Vehicular Emissions

ACTION POINTS

1. Drive Mobility through ZEVs

Action Plan for Top 10 Most Polluted Cities in India
- Electrify last mile connectivity by 2022, including public transport, taxis and three-wheelers

Increase distribution of electric and hybrid vehicles: This should be carried out through necessary financial measures and infrastructural support. The procurement of electric vehicles (EVs) should be **mandatory** for vehicles for Central Government use and certain public facilities. **All Central Government offices should replace existing fleets older than 15 years to electric vehicles in the next 3 years i.e. by 2021 April.** Research and development activities should be enhanced in the areas of battery cell technologies, electric vehicle power train system integration, electric motors and power electronics. Availability of citywide support infrastructure for electric vehicles should be ensured.

Set up low-emission zones in Delhi and other similar cities by restricting private vehicle entry in highly polluted zones: this needs to be supported by clean public transportation, preferably based on electric vehicles.

Encourage electric 2 and 3 wheelers: A scheme to convert existing ICE autos into electric ones either by retrofitting or by discounting the residual value of the exiting auto from a new electric auto should be launched. Additional incentives like free registration and ease of getting permits for electric 2 wheelers and 3 wheelers should be immediately notified by MoRTH. In addition, all public transportation and 3 wheelers should adopt ZEVs by 2020

Boost Last Mile connectivity through clean/e-Rickshaws: Use of aggregators may be encouraged to provide further incentives to commuters to migrate to public transport.

2. Enact Strong Measures to Curb Vehicular Emissions

Action Plan for Top 10 Most Polluted Cities in India
- Prohibit transition traffic in these cities
- Phase out private diesel vehicles by 2022

Implement a large scale Feebate program from 2020 onwards: A feebate is a policy by which inefficient or polluting vehicles incur a surcharge (fee) while efficient ones receive a rebate (bate). Austria, Denmark, France, the Netherlands, Norway, Ontario (Canada) and Singapore have introduced variations of feebates. Its advantages include its market-based design; its potential to be revenue neutral, size neutral, and technology agnostic; and its alignment of private interests with societal interests and incentives. The CAFE norms in India's case can be suitably amended and a suitable feebate policy for India can be developed.

Issue guidelines for vehicle ownership and usage: Measures like congestion pricing, escalation of taxes and insurances, higher costs of parking, and implementing restrictions on certain areas and times need to be employed to reduce private vehicle usage. A congestion pricing scheme could be employed in big cities like Delhi to discourage private vehicle use. High congestion stretches in all major stretches for all major cities should be immediately identified and a congestion tax/charge should be imposed immediately. Enforcement can begin with manual processes, which can be later supported by electronic systems using ITS.

Switch to low Sulphur fuel (10 ppm) and implement Bharat VI (similar to Euro VI) standards for engine emissions: This will require tail-pipe controls like diesel particulate filters for PM and selective catalytic reduction for NOx.

- BS VI norms to be implemented in Delhi NCR by April 2019
- BS VII norms to be implemented all over India by April 2020

This will also call for engine optimization and technologies like exhaust gas recirculation. The Government of India has already announced these norms and timely implementation of these norms will be important. We further recommend that legacy vehicles that are still in use are retrofitted with these control technologies. This solution will cut down soot (black carbon) emissions by up to 90% and drastically reduce oxides of nitrogen (NOx which is a main precursor for ozone formation), carbon monoxide (CO), and hydrocarbon emissions.

Introduce a scrapping policy and ensure fleet modernisation: The Ministry of Road Transport and Highways, Government of India, is coming up with a voluntary fleet modernisation mechanism supported by financial incentives in the form of discounts from the manufacturers and lower excise duties. The programme should be strengthened through the **mandatory scrapping of very old vehicles.** Specific purpose grants could be used to motivate state transport companies and city bus operators to modernize their fleets. Retrofitting options can be explored for 'not so old' vehicles, which can be fitted with tail-pipe treatment technologies. There is a need for a research and development programme for low-cost, robust, easily maintained tail-pipe filters, and other treatment technologies. Commercial vehicles older than 15-20 years will be scrapped and a discount can be provided for new vehicle purchase.

3. Reduce Emissions by Optimizing the Power Sec

Action Plan for Top 10 Most Polluted Cities in India
- Survey and analyse power plants around the most polluted cities to prioritise their decommissioning in the next five years

Expedite strategic decommissioning of old and inefficient power plants: Power plants with inefficient power generation contribute heavily to air pollution. These inefficient power plants should be replaced by efficient super-thermal plants or with power generators that are based on renewable energy.

Upgrade efficient thermal power plants to meet the requirements of dynamic operation: Dynamic and flexible power plants will allow power generating companies to enter into flexible Power Purchase Agreements (PPAs) with DISCOMs/Captive-Loads to meet the dynamic power requirement. This will open a larger window of opportunities for the renewable power generators.

Push rooftop solar and distributed generation: Larger penetration of rooftop solar panels will increase the share of renewable power; hence it is a critical measure that needs to be adopted in order to reduce air pollution caused by power generation. Simplification of rules, regulations and leasing policy for operations and power distribution reforms will augment renewable's share in power mix.

Ensure high grade low polluting coal to the power plant: Availability and usage of high grade coal will allow power plants to operate at a high efficiency point. This will minimize the emission of polluting components for the same amount of power generated. Government should come forward with a comprehensive approach that links coal mines and imported coal with the thermal power plants.

Emphasis on improved power reliability in urban areas to eliminate the operation of DG sets: Ensure reliable power supply in urban areas at an affordable price that will demotivate the separate usage of Diesel Power Generators (DG Sets); this can be pushed forward by efficiently implementing Integrated Power Development Scheme (IPDS). Current installed capacity of DG sets is approximately 85 GW and it is a major cause of urban industrial pollution.

4. Reform Regulatory Framework for Industrial Air Pollution

To revamp the regulatory framework around industrial air pollution, a three-pronged approach needs to be taken:

Revise standards and practices: The ambient air quality standards of Central Pollution Control Board (CPCB) as well as individual categories of industrial emissions should be considered for revision. A revised regulatory framework for installation of devices like vortex separators, electrostatic precipitators, settling chambers etc. needs to be developed. The revised norms should also address strict implementation of stack height standards for all existing and new industries. Furthermore, formulation of a fuel substitution sub-action plan with the following measures should be explored.

1. Mandated increase in content of ash in coal used for powering boilers and thermal plants.
2. Mandatory use of beneficiated coal Promotion of clean coal technologies. (FBC, PFBC, IGCC, etc.)
3. Emission standards for DG sets.
4. Use of LDO/ Natural gas instead of coal in small boilers.
5. Nationwide ban on usage of highly polluting fuels such as coke and furnace oil

Improve audit process: Development of a right incentive structure for the environmental auditors will lead to an improved auditing process. The current practice of self-audit with the industry managing and paying the auditors should be changed. Introduction of measures such as random assignment of auditors to industrial plants, payment from a common pool, monitoring for accuracy and accuracy-based bonus payment system have proven to be effective in enhancing the compliance of industries.

Incentivise law enforcement: To improve law enforcement at the state level, stricter law enforcement against polluting industries is critical. Incentivising the performing states will be instrumental to speed up corrective action against air pollution. One of the measures being creation of a competitive 'Air Pollution Index' with sub-indices for corresponding sources of pollution can be used to rank the states and create competition. This 'name and shame' policy based on the index combined with performance-linked transfers from a common 'Clear Air Fund' (created with the support from the central government under MoEF&CC) can combat air pollution.

5. Implement a National Emissions Trading System

Introducing a market-based instruments within a regulatory framework based on the concept of 'polluters pay' should be implemented. It would entail capping the individual pollution levels of all industries to certain emission allowance. The currency of trade would be tonnage of pollutants produce such as 'CO_2, SOx and NOX units', which are inter-convertible. Similar trading units for particulate matter can also be introduced. This cap should be shrunk annually, leading to a faster adoption of cleaner fuel and stringent pollution curbing mechanisms. Similar models exist in the European Union (Emissions Trading System) and in India (Perform Achieve Trade) for combating greenhouse gas emissions (GHGs).

The emission allowances should be customized – division of industries into clusters, with respect to factors such as polluting intensity, scale, type etc. The firms operating at a deficit, i.e. emitting more than permitted, can purchase through the open trade exchange from the firms that are operating at a surplus. Additionally, firms that do not use their allowance can monetize their trading units.

To incentivise adoption of renewable energy sources like solar energy, wind energy, and to promote installation of efficient filtration equipment provisions such as accelerated depreciation lower GST rates or import duties should be explored.

EMISSION TRADING SYSTEM

SURPLUS ALLOWANCE   **DEFICIT ALLOWANCE**

CAP

Allowance

Money

EXCESS POLLUTANTS
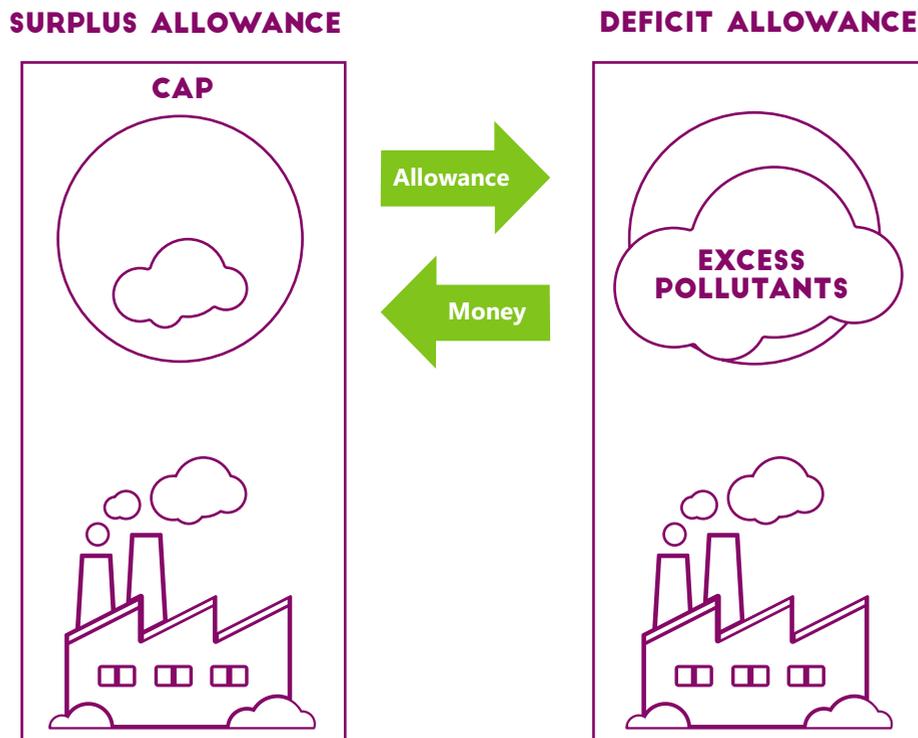
6. Adopt Cleaner Construction Practices

Action Plan for Top 10 Most Polluted Cities in India
• Establish smog-free towers at all major construction sites by 2019

Mandate Environmental Risk Assessment for construction projects: Similar to Environment Impact Assessment (EIA), which examines the likely environmental impacts of a proposed project or development activity, Environment Risk Assessment must be prepared for any cluster where large scale construction is going to take place.

Revise parameters of Green Building Ratings to include construction process: Expand the ambit of Green Building ratings to include adherence to construction process indicators that follow cleaner construction guidelines. Higher score on the Green Ratings can then be linked with subsidised financial support.

Set up smog free towers: It is an innovative technological solution deployed across Europe, which cleans the polluted air in an area around it. A 23-foot-tall air purification system at present with a cost of $54,000 will clean up 30,000 cubic meters of air per hour of ultra-fine smog to create smog-free bubbles in public spaces. These can be installed at the point sources of construction activities.

Enforce use of ready-made concrete: In view of the large environmental impacts, Ready Made Concrete usage should be mandated so as to eliminate the negative externalities of using Site Batch Concrete.

7. Implement a Business Model to Utilize Crop Residue

Action Plan for Top 10 Most Polluted Cities in India
• Incentivise procurement and utilization of crop residue

During the winter months, crop residue burning (CRB) accounts for 17% of PM10 and 16% of PM2.5 air pollution. The problem of crop burning is mainly observed in the major paddy producing states of Punjab, Haryana, Uttar Pradesh and some parts of Maharashtra, where CRB is practiced among the sugarcane farmers.

Direct procurement of crop residue by large agro-waste management companies: The agro-residues collected by major agro-waste management companies must be procured by large thermal units like NTPC at the standard market rate. At present NTPC has already brought out a tender issuing purchase at Rs 5,500 per tonne. The focus should be on promoting local level entrepreneurs to purchase crop residue directly from the farmers and then sell the residue to large thermal power plants. This can involve promotion of Farmer Producer Organizations (FPO) and active Self-Help Groups (SHG) to purchase paddy stubble at the per acre declared rate from the local farmers.

Encourage new markets for purchase of crop residues from farmers: The Government should provide subsidies (in term of incentives and tax rebates) to set up new plants of agro-waste management companies in major paddy and sugarcane farming States. State governments can utilize the Green Climate Fund (GCF) for this purpose. In India, NABARD has been accredited with a Direct Access Entity (DAE) to channelize the GCF for recommended projects related to environmental management.

Mandate an inter-State trading model: Centre must direct, on pilot basis, inter-state trading for paddy stubble. For instance, paddy straw collected from Punjab can be procured by other States for mushroom cultivation, ethanol production and various other purposes.

Reward PRIs with performance-based incentives: It is recommended that PRIs, where zero-burning incidences are observed, should be provided with performance-based non-monetary incentives. A single incidence of crop-burning should disqualify a village from receiving the incentive.

8. Implement an Integrated Waste Management Policy

> Action Plan for Top 10 Most Polluted Cities in India
> * Implement a policy on landfill taxes and incentivize waste processing over landfilling by 2019

An estimated 62 million tonnes of waste are generated annually in India, but only about 75-80% gets collected, of which only 22-28% is processed and treated. A bulk of allocated funds are spent on collection, leaving inadequate amounts for treatment, which means that even landfilled waste creates pollution. Reducing landfilled waste would also contribute to energy reductions in transporting massive quantities of waste.

In addition to the Solid Waste Management Policy 2016, the principles of circular economy for waste reduction and waste processing need to be implemented.

Enact Extended Producer Responsibility (EPR): These regulations, common in the EU and the United States, ensure a life cycle approach to products from the manufacturers themselves, holding them responsible for safe disposal of their products. It also encourages producers to use less polluting materials, and is particularly effective in areas like electronics, vehicles, plastic packaging etc.

Adopt landfill taxes and regulation: Charging extra fees at the gate for landfill entry can shift economic viability from more landfilling to treatment/processing methods. This will be a shift from prevailing policies that encourage landfilling by paying for even untreated and unsegregated waste by the tonne. The next step would be setting targets for percentage reduction in landfilled biodegradable waste, like in Sweden.

Incentivise waste to energy systems: Incentives like tax reduction for energy produced through biogas, consumer subsidies for biogas plants, or incentives for upgraded incineration with energy capture, will help make treatment more viable than dumping or burning. E.g.: Gramacho Landfill Gas to Energy System, Rio De Janeiro.

Decentralize waste processing: Alternatives to landfilling can be effectively implemented, as demonstrated by waste segregation in Bengaluru, pipe and aerobic composting in Alappuzha, recycling business models in Mysuru, municipal segregation models in Panaji, etc.

Pilot blockchain initiatives: Initiatives taken by the Government of Netherlands, Agora Tech Labs, Swachh Coin, Plastic Bank etc. are demonstrating the use of blockchain in waste management. For example, in return for items recycled, tokens are provided to people that can be exchanged for other services.

9. Tackle City Dust through ULBs

Action Plan for Top 10 Most Polluted Cities in India
• Mandate compulsory mechanized dust removal in the most polluted cities by 2019

City dust is one of the major problems affecting urban agglomerations in India. The high content of PM and pollen in the dust leads to air pollution, affecting health and visibility. In order to effectively tackle city dust, urban local bodies (ULBs) can adopt two broad approaches, namely mechanical dust removal and mitigation measures.

Undertake mechanical dust removal: Mechanical dust removal, by, for example, deploying dust absorbing and water spraying vehicles on roads, or mechanized road sweeping machines. This has resulted in significant reduction in road dust in Seoul, South Korea. ULBs should implement innovative solutions for disposal of collected dust, rather than dumping it into landfills. This can be done by converting the collected dust into bricks. This will ease pollution, solve the problem of dust dumping, reduce illegal sand mining, lower sand price and give a boost to the construction industry. In addition, ULBs should prioritize water spraying on roads where dust absorbing vehicles or mechanized road sweeping machines cannot be used. These tankers/sprinklers should be enabled with GPS to track their progress, and this data should be publicly available. In order to ensure the effectiveness and efficiency of these mechanisms, independent third-party evaluations and certification should be made mandatory.

DEFICIT ALLOWANCE

• Deployment of dust absorbing and water spraying vehicles

• Convert collected dust into bricks
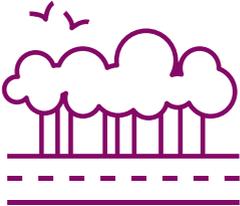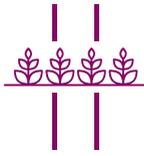
• Water spraying on roads

• GPS enabled vehicles for real time tacking

• Third party evaluation and certification

Mitigate city dust: ULBs should undertake the following measures in order to mitigate city dust:

a. Undertaking reforestation and afforestation drive along roadsides and medians.
b. Covering landfills with vegetation.
c. Planting vertical gardens using pollution absorbing plant varieties on the pillars of over-bridges/flyovers.
d. Identifying such over-bridges/flyovers where plantation drive in spaces below can be taken up.
e. Constructing footpaths and pavements alongside road by ULBs, PWD and NHAI.
f. Relocating brick kilns further away from cities.
g. Eliminating manual sweeping of roads and the side areas of roads.
h. Prioritizing identification of sites with silt and garbage on the side of the drains and its removal. Silt removed can be used in road embankments.

MITIGATION MEASURES BY ULBS

Greening along Roads	Cover landfills with vegetation	Vertical gardens on pillars	Construction of footpaths and pavements
Relocation of brick kilns	Desilting of drains	Discourage manual road sweeping	

10. Integrate Efforts to Tackle Forest Fires

As per State of Forests Report 2017, India has a forest cover of more than 7 Lakh sq km area that is 21.54% of the total geographical area of the country. Forest fires are a large source of PM. These fires can have a significant impact on local air quality, visibility and human health.

Forest fire emissions include:
1. Particulate matter
2. Carbon Monoxide
3. Atmospheric Mercury
4. Ozone-forming chemicals
5. Volatile organic compounds

While statistical data on fire loss are weak, it is estimated that the proportion of forest areas prone to forest fires annually ranges from 33% in some states to over 90% in other. About 90% of the forest fires in India are created by humans.

PREVENTIVE MEASURES		MITIGATION MEASURES	
	Comprehensive National Policy for Prevention and Control of Forest Fires		Mandatory provision of fire breaks and fire lines
	Pre-Warning Alarm System		Creation of water harvesting structures
	Separate cadre at State level for Forest Fire		Mandatory training and pre-fire season workshops
	Fire Danger Ratings		Procurement of fire-fighting equipment and field vehicles
	Controlled Early Burning		

Undertake measures to prevent forest fires: A comprehensive **National Policy for Prevention and Control of Forest Fires** being prepared by MoEFCC should be finalized urgently. In addition, FSI has developed an indigenous system for forest fires. Implementation and utilisation of this system should be made mandatory by all state forest departments. This should also cover the creation of an information network to instantly disseminate advisories. In all States, forest fire is dealt with by forest management staff who are either not trained or are not experts at dealing with forest fire. A separate cadre at state level is needed for this. Ire danger ratings should be mandatorily implemented to forecast the likelihood of occurrence of forest fire in a particular area and duration of time. These ratings should be colour coded as per severity. This will aid in increased vigilance by state forest department by deploying technological solutions like aerial monitoring and increased patrolling by forest staff in such areas. Finally, Controlled Early Burning should be undertaken by forest department before the onset of dry season. This will help in reducing fuel load.

Ensure mitigation of forest fires: Provision of fire breaks and fire lines that act as barriers in propagation of forest fire should be made mandatory. Countries in the EU like Spain and Cyprus have reported reduction in forest fire incidents by using this method. In addition, creation of water harvesting structures by involving local people near areas in the forests vulnerable to fire should be take on. This is required as large quantity of water is required to contain fire.

11. Encourage Clean Cooking Practices

Action Plan for Top 10 Most Polluted Cities in India
- Implement policy on mandatory use of cleaner forms of cooking to reduce indoor air pollution

According to WHO, an estimated 4.3 million people a year die from the exposure to household air pollution. Burning fuels such as dung, wood and coal in inefficient stoves or open hearths produces a variety of health-damaging pollutants, including particulate matter (PM), methane, carbon monoxide, polyaromatic hydrocarbons (PAH) and volatile organic compounds (VOC). Indoor air pollution can be more harmful than outdoor pollution as closed areas allow more build-up of pollutants as compared to open areas.

Encourage the use of cleaner fuels: This includes fuels such as LPG, biogas, solar energy and electricity. PMUY is a significant step in this case, but it is crucial to continue encouraging renewable sources of energy in order to minimise indoor air pollution.

Promote and distribute of fuel efficient chulhas: This is to be targeted towards households. Incomplete combustion of fuel (particularly solid fuel) is a major source of indoor air pollution. The concerned line ministries should encourage research and design of fuel efficient stoves and approve specific designs as has been done for bio-mass stoves. In addition, models of stoves that may be used with the cleaner forms of energy should be encouraged as well, such as solar and induction stoves.

Ensure well-ventilated homes: This can be done by formulating guidelines and provisions for building designs that define cooking and living area to maintain healthy air quality inside the house. This approach may be integrated with Pradhan Mantri Awas Yojana (PMAY). Retrofitting these designs into the already constructed houses should be considered as well.

12. Drive Public Ownership through Behavioural Change

Action Plan for Top 10 Most Polluted Cities in India
- Develop stakeholder-specific awareness campaigns in these cities to ensure that all participants are aware of the impacts of air pollution and repercussions of engaging in pollution-causing activities

A key strategy to tackle air pollution requires that the stakeholders are aware of the serious health impacts due to exposure to the various pollutants, how their practices may be exacerbating the situation, and what steps they can undertake to modify their practices and lifestyle in order to reduce emissions. This requires the Government to initiate a targeted, national-level IEC campaign that reaches out to the various stakeholders with relevant messaging. Below, target groups and the message to be conveyed to each have been identified for such a campaign.

Agricultural Pollution: Through the existing Krishi Vigyan Kendras (KVKs), dedicated and specifically-designed campaigns must be set-up to provide farmers with appropriate information tools such as in-situ mulching and on-farm management techniques. The centers should also be used to promote knowledge of alternatives to biomass burning such as: removal of the straw from the field, and its use for other economic activities like energy production, biogas generation, commercial feedstock for cattle, composting, conversion in biochar and raw material for industry.

Indoor Pollution: A culture of clean cooking among households by informing the public about the impact on health needs to be promoted. In addition to advertising campaigns, LPG Panchayats should be held regularly.

Forest Fires: The mechanism of Joint Forest Management Committees established at village level should be leveraged to sensitize traditional forest dwellers on causes and hazards of forest fires. Formulation of rewards policy and its dissemination may further help prevent and mitigate such incidents. Training must be provided to tourist guides and issuance of do's and don'ts guidelines for tourists in forest areas to prevent forest fires. This should be done in conjunction with promoting awareness regarding the harmful effects of littering and fires at major tourist spots along with steep fines for breaking rules.

City Dust: Construction companies for curbing generation of construction waste should be sensitized. IEC activities should encourage citizens to engage in tree plantation exercises at road sides and other uncovered non-vegetated areas.

Waste management: Awareness campaigns to accompany positive and negative policy incentivization for people to segregate household waste at source and encourage composting of wet waste and recycling of dry waste.

13. Develop Consistent and Quantified National, Sub-National and Sectoral Plans

Action Plan for Top 10 Most Polluted Cities in India
- Define city-level plans with clear timelines and emission targets across various sources of pollution (construction, vehicular, indoor) by the end of 2018

A comprehensive Action Plan at the national-level should be complemented with well-designed and well-researched State-level and city-level plans, with strong implementation and monitoring mechanisms to ensure achievement. All the sub-national plans should dovetail into one another and add up to clearly defined outcome targets with timelines, especially for a targeted level of PM2.5 and PM10. For example, the European Union aims at achieving a level of 25 μg/m^3 in annual PM2.5 levels by 2015, and 20 μg/m^3 by 2020. The ambitious National Clean Air Programme has announced a reduction in pollution levels in 100 cities by 35% in the next three years and 50% in the next five years. Along with defining a base year for this calculation, the plan must also ensure that the estimated benefits from each individual strategy or set of strategies are commensurate with the overall target.

The national plan should link and converge the sub-national plans, which should therefore also be consistent with the national targets. Along with governance-level plans, sectoral plans should also be developed in consistency with national targets.

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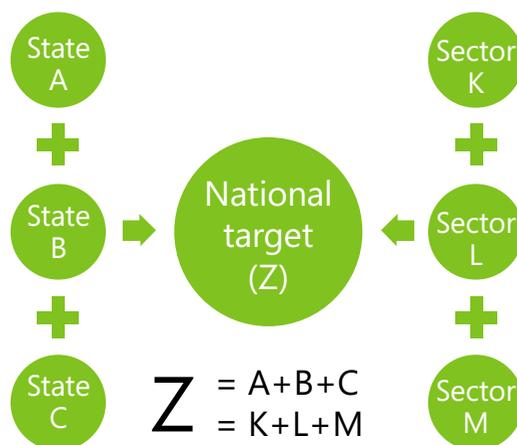
Along with these targets, the plans must contain strategies to incentivise the actors in the ecosystem both positively and negatively. Positive incentives include tax incentives, subsidies etc., while negative incentives are fines, penalties and fees - a combination of both must be outlined for non-achievement of outcome targets. A number of sector-specific examples are discussed in the points below, to also encourage the formulation of sector-specific plans.

To ensure effective implementation of these plans, including meeting sub-national, sector-specific and interim targets, three systemic features are important: close monitoring, regular reviews and transparent public reporting.

14. Improve Air Quality Monitoring Systems

Action Plan for Top 10 Most Polluted Cities in India
• Establish accurate and comprehensive air quality monitoring systems in the worst affected cities by 2019

India has 39 on-ground real-time air pollution monitoring systems spread across 23 cities as compared to China, which has 1,500 of such systems spread in over 900 cities. To enable interventions to combat air pollution, the numbers of such systems needs to be much higher.

Accurately and comprehensively monitor air pollution levels: An elaborate air pollution monitoring movement is vital to provide comprehensive data for interventions aimed at improving air quality. It can be accomplished by using the data captured via geostationary satellites – like the Sentinel 5-P launched by European Space Agency in 2017. The advanced high resolution Tropospheric Measuring Instruments atop such satellites can measure wide range of pollutants in air including PM, NOX, SO_2, CO etc. Additionally, these advanced instruments will aid the understanding of how the pollutants spread in the atmosphere, major sources of pollutants and accumulation hotspots. The usage of drones and UAVs can be explored for capturing air quality. The data can be displayed and linked to a pollution dashboard available to the citizens.

Develop air pollution abatement plans based on monitoring data: The data generated through the above systems coupled with geo-mapping of all point sources of pollution can lead to an effective monitoring of air pollution through source apportionment and its abatement. Development of models such as Plume rise models, dispersion models and metrological models is essential to control the dissipation of pollutants and take precautionary measures. The simulation of multiple scenarios using these models can help to develop a control and mitigation plan - Graded Contingency Action Plan that can serve as a response mechanism to the changing levels of pollution in an urban agglomeration.

NITI Aayog