

A CLEAN AIR TOOL FOR CITIES

A Centre for Science and Environment (CSE) report



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Why this study?

Air pollution is a scary public health story unfolding in India. A vast majority of cities are caught in toxic web as air quality fails to meet the health-based standards. Not only the mega cities, but also the smaller cities are emerging as pollution hotspots. The global burden of disease estimates have shown that air pollution-related diseases have already emerged as fifth largest killer in India. If deaths from indoor air pollution are also added, then air pollution is the top killer. Global air quality databases continue to claim that some of the worst polluted cities in the world are in India.

India is poised for a significant epidemiological transition that will enhance the health burden enormously. Even if air pollution does not get worse but remains just as it is today, the number of lives lost will continue to grow as the population grows and ages. Pollution and health risk would need to decline significantly over the next 15 years to offset health impacts from growing numbers, exposures and ageing.

It is not that air pollution mitigation has not started in our cities. In fact air quality management has taken roots with several cities moving ahead with their strategies. But this action is not uniform, comprehensive, or equally stringent and effective across the country. Cities where several actors – civil society, judiciary and media have come together to inform and sharpen public opinion and push policy have moved ahead of the curve. But this also shows that knowledge and public awareness are not equally distributed.

This represents a challenge of governance. Even as cities are trying to put in place control measures, the problem of pollution is overwhelming the gains. Cities need capacity for air quality management and compliance for consistent, stringent, and effective action to meet clean air targets. The powers to govern air quality are divided between the Central and the state governments. While the Central government sets standards and guidelines for regulating and monitoring pollution sources and air quality, the state governments are responsible for implementation. But increasingly, it has become clear that cities do not have adequate legal and institutional strength as well as management and technical capability across sectors to interconnect strategies and roll out comprehensive and integrated action plans.

Tooling for measuring capability and progress

Change is possible only if there is deeper understanding of the gaps in current action and in the mechanism for compliance. To address this concern, Centre for Science and Environment (CSE) has developed a comprehensive but simple set of indicators for assessment of baseline action and to plan next steps that will not only enable air quality regulators to plan and enforce to improve air quality, but also help citizens to understand progress in their respective cities. To demonstrate this idea, the top 10 most populous and major cities of India – representing about a quarter of the country's urban population -- have been selected.

This helps to identify the strategic gaps in action *vis-a-vis* the desired goals of progress in cities. The most basic criterion for selection of the 10 cities has been the capacity to carry out real-time online monitoring of air pollution to inform

policymaking. This has been taken as the primary requirement for selection of cities to inform action and to respond. The 10 cities include mega cities and key state capitals of Delhi, Chennai, Bengaluru, Mumbai, Hyderabad, Kolkata, Ahmedabad, Lucknow, Pune, and Jaipur. Even though there are few more cities in the same states with limited capacity to do real-time monitoring, the focus has largely been on state capitals where most of the decision making happens. Only Pune has been taken as a non-capital city.

In this first phase of assessment, a simple tool has been designed to help establish the baseline for each city. This tool indicates where cities stand in terms of (a) action in the areas of air quality monitoring and assessment and (b) their capacity to develop and implement clean air action plans in key sectors including transport, city-based power plants and industry, local dust sources including roads and construction, and trash burning. It has also considered availability of data in the public domain. For this first phase of assessment, institutional and financial capabilities have not been considered for city-level progress. Instead, it has been analysed as a macro and crosscutting issue for all cities. These criteria can be included for city-level assessment in the second phase as the air quality governance matures. These aspects will be progressively added as the tool begins to get applied to track progress.

The idea is to keep the tool dynamic so that it can be adapted to newer challenges and changes. Air quality management framework in cities is still so weak that a tool with very complex set of indicators can lead to regulatory overkill. Indicators have been designed in such a way that it guides the air quality regulators in cities in setting of milestones for quantitative and qualitative change in each sector of interventions. It helps to demystify the nature of change that is needed within an integrated framework to meet the clean air targets.

The tool will help to understand the baseline of action as well as track progress in action in stages. Progress in action has been divided into five stages with stage one being the common minimum performance and stage five being the desired and aspirational goals. Key indicators have been developed for each stage and each sector to indicate the desired level of action and degree of difference in stringency of action among cities. The tool of assessment is based on a simple logic that stage five is the desired goal defined as even better than the known best practices to secure public health and reduce energy guzzling. Selection of indicators is not an academic exercise but a way to chart the guiding path for the direction of progress desired in a city.

This is not a ranking of any one agency or government. This is an assessment of action and progress in cities. Several actors in the city including the government, judiciary, civil society, media and other stakeholders catalyse change in the city.

The tool documented in this Report is intended principally for air quality regulators, viz. State Pollution Control Boards (SPCBs) and environment departments in cities, who are expected to take the lead in the urban air quality management process. While it is expected that SPCBs will coordinate with other public agencies, different line agencies managing various air pollution sources may also use this framework to take requisite steps for mitigation.

This is a dynamic tool that can be used to refine action plan according to the indicators and also track progress over time. It is possible to institutionalize its application for overall management of urban air quality.

Attempt has also been made to apply the tool to the current baseline data and evidences that exist in the 10 cities. But this is only diagnostic and not a full blown assessment of all sectors. This has been used to draw up a learning curve for action. Information is not available in equal strength for all sectors and all cities. This makes inter-city comparison nearly impossible. Only in few cities like Delhi, involvement of public and judiciary in pushing clean air action has brought out a lot more information into the public domain. But in other cities, the departmental work is more opaque with very poor documentation process. In most cities, there is no organized database that is needed to track some of the critical indicators of the tool. In fact, most cities perform poorly on transparency and access to information.

Therefore, the application of the tool so far is more of a demonstration of application for policymaking rather than rating of cities. This shows that no one has yet reached stage 5; some may have reached stage 4 only for a few indicators but not as an overall advancement in clean air management action.

Air quality management has matured considerably globally. Sophisticated governance tools have been developed for rigorous planning and implementation. There is a need to improve governance and institutional capacity in Indian cities to take on the new pollution and public health challenge in India.

Guidance principle for clean air tool

Development and application of clean air tool for planning and monitoring is possible if cities are clear about the guiding principles that should set the terms for future action. Air quality monitoring and management, which began way back in the 1980s, now has to address many newer issues and concerns. It will have to be reinvented to address those challenges for public health and environmental protection.

Performance based compliance management: The new generation air quality monitoring and management will have to focus on performance and compliance based management. The air quality regulatory agencies – the Central Pollution Control Board, the apex monitoring body and the state pollution control boards for ground-level enforcement – will have to not only strengthen their standard setting role but also strengthen implementation framework to ensure compliance with standards and targets.

The critical question is – are cities setting time-bound clean air targets linked to air quality standards to decide the stringency of action? Air quality monitoring in cities gives a fair amount of idea about non-compliance with air quality standards. It is expected that based on this knowledge, the city will set a time-bound clean air target to be able to meet the standards.

India has set ambient air quality standards and notified them under the Air (Prevention and Control of Pollution) Act, 1981, hereinafter the “Air Act”. These indicate the maximum concentration that can be allowed for each pollutant and reduce the number of exceedence over an assigned time period – annual average, daily average, hourly averages etc. The shorter duration targets – daily and hourly averages -- are more important from public health point of view. These targets vary across pollutants. Under the Air Act, the daily and hourly standards for pollutants must be met 98 per cent of the time in a year and they should not exceed the standards on two consecutive days.

Indian standards are largely patterned along the WHO standards. While for

gaseous pollutants India nearly aligns with the WHO standards, for particulate matter it is at the intermediate stage. Indian particulate matter standards are based on local circumstances and on technological feasibility.

Thus, standards are always not health based but require periodic revision and tightening to become health based. It may be noted that the air quality index that India has adopted for public information system classifies air quality as good only when it is 50 per cent below the standards.

Based on air quality monitoring, city governments will have to assess the margin of exceedance from the standards and set a timeframe by which the city will become compliant. Performance oriented compliance regime will require leapfrog solutions to save time, and inventive solutions including adoption of polluter pays principle to meet the cost of transition. Air quality regulators face the unique challenge of taking early action to prevent worsening of pollution.

Reduce integrated exposure to air pollution from all sources to protect public health: Air pollution control efforts need to identify and control public health burden caused by integrated exposure to air pollution from all sources. This demands pollution source-wise action plan to monitor and track progress in each sector.

Moreover, instead of keeping exclusive focus on either ambient or household exposures, action is needed on all sources to control exposure of people to air pollution. This has been underscored by the 2015 report of the Union Ministry of Health and Family Welfare. All solutions across sectors will have to be interlinked. It has also been advised that the current distinction between urban and rural pollution or outdoor and indoor pollution should be done away with. In fact, the Global Burden of Disease Estimate of 2013 states that indoor air quality contributes up to 25 per cent of outdoor air pollution. Even urban air quality targets cannot be met if large numbers of poor households continue to use biomass-based cook stoves. Protection of public health should be at the centre of air pollution control measures. This is a unique challenge of the developing world.

Need ambient concentration management as well as exposure management to protect health:

Traditionally, air pollution control measures have aimed at controlling emissions to reduce outdoor ambient concentrations to meet specified levels or standards. These standards have been established by the WHO and further customized by countries on the basis of health criteria. This assumes that this can reduce exposure of the entire population. But the emerging science has also established that the actual exposures to air pollution can be higher and vary for different pollutants depending on the local circumstances and time spent close to the pollution sources. This also demands pollution mapping in micro environment to inform control measures. Several pollution sources contribute to human exposures in a greater proportion than they do to general ambient pollution. Exposure has stronger linkage with health. Exposure assessment can change the ranking of local pollution sources in micro environment like road side pollution from vehicles, trash burning, household pollution, in addition to the large-scale industrial sources in the region. Exposure to vehicular pollution can be very high while traveling and residing close to the road side. Power plants with high stacks will be a significant contributor to overall ambient levels in the region. Control pollution where the people are.

Need regional air quality planning to reduce transboundary movement of pollution: Air pollution does not follow political boundaries. Its dispersion can have larger regional impacts and undermine the local efforts to control local pollution. For instance, the entire Indo-Gangetic plain of North India which is land locked is vulnerable to widespread winter inversion and trapping of pollution. Adverse weather conditions can worsen this. This will therefore require area-wide assessment of pollution, forecasting and action. Air quality monitoring and assessment needs to account for it. International experience shows as in Beijing as much as quarter of air pollution can come from the surrounding provinces. Also in developing country situation, monitoring air pollution in urban, rural and urban periphery can be of relevance from public health standpoint.

Achieve diverse benefits of public health, climate mitigation and energy security: While in any city in a developing country, public health will remain the primary driver of air pollution control efforts, the action must also be calibrated against the indicators of greenhouse gas reduction and mitigation of short-lived climate forcers like black carbon that not only harm public health but also trap heat. The other welfare gains include energy savings, and reduction of road safety risks. This will tiptoe on to the agenda of air quality regulators very soon. Already, the Central Pollution Control Board is gearing up to support the international environmental treaties including those on climate change.

Control measures to address equity, affordability, inventiveness, compliance and transparency: These are the key elements of good air quality management practices. This is particularly important in developing country where urban poverty is high and welfare gains have to ensure health risk reduction across all income strata. Even before the cities of Africa and Asia could fully address the traditional health risks, they have fallen into the pincer grip of emerging toxic risk associated with rising pollution. The pollution situation is also very different. While pollution levels are rising, prevalence of urban poverty, poor nourishment, and underlying diseases in the population further enhance the health risk. This demands quick transition.

Need a framework for clean air action plan

In India, judicial intervention over the years in response to public interest litigations (PILs) in different cities has catalysed policy action. In 2003-04, the Supreme Court had expanded the ambit of PILs on air pollution in Delhi to include other cities—Bengaluru, Hyderabad, Chennai, Ahmedabad, Kanpur, and Sholapur. Similar cases were initiated in Mumbai and Kolkata by their respective High Courts. The judiciary has consistently invoked the constitutional provision of right to life and precautionary principle to push action. This has started the process of action plans for clean air in these cities that set rolling a common minimum programme. However, these plans have not been designed on an aggressive and urgent scale. Further, some cities that had prepared clean air action plans to comply with the court orders have not updated them regularly. There has been some follow-up, but it is minimal.

Following the court's intervention, the Union Ministry of Environment and Forest began to coordinate with the state governments to prepare action plans. During the early part of the last decade, about 52 cities were brought within the ambit of this planning. But the initiative lost steam soon. The matter of an action plan to meet clean air standards was subsequently taken up during the 11th Five Year Plan by the Union government. A provision for city clean air

action plans was made in the 11th Plan document. Both the 11th Plan and the ongoing 12th Plan have asked for compliance with national ambient air quality standards in major cities by the end of the plan period. But the legal mechanism for compliance has not been specified to ensure implementation.

The clean air tool reflects these guiding principles and helps to create a framework for clean air action plan in cities.

This report is divided in two parts. Part one defines the tool and highlights some of the key learning from selective application of this tool in a few sectors across cities. Part two analyses the larger legal framework for air pollution management and compliance in cities and the overall institutional capacity that will have to be addressed across cities and at the central level for effective clean air action.

SECTION 1: What defines the clean air tool?

The ability of a city to manage and improve its ambient air quality is contingent on the collective and coordinated action by all agencies responsible for managing and regulating these sources. Improving air quality in cities, thus, goes beyond isolated interventions. A shared understanding of a comprehensive picture of air quality management is necessary, which in turn can lead to a multipronged approach.

For the purposes of this study, air quality management has been trifurcated into three inter-related cyclical “aspects”. Every city needs to take adequate steps to measure and record air pollutant concentrations, their sources and the apportionment thereof. This in turn informs the requisite action that they need to adopt for mitigation. Taking appropriate steps in turn produces impacts that again need to be measured and recorded, thereby completing the cycle. This definition, thus, recommends that a city needs to improve on all three aspects – measurement, mitigation and impact -- in order to improve upon its air quality management capabilities.

Each indicator has been formulated in the form of a question with a limited set of values. In order to score positively for any given indicator, a city must have a pre-fixed desirable value out of the set of provided values. This desirable value may vary for different stages. While some are quantitative others are qualitative. Qualitative indicators have been derived from the global evidences on best practices and the principles of sustainability filtered from literature and expert opinion. However, qualitative indicators may still have elements of subjectivity.

The tool documented in this Report is intended principally for air quality regulators, viz. State Pollution Control Boards (SPCBs) who can use it to take a lead in the urban air quality management process. While it is expected that SPCBs will coordinate with other public agencies, different line agencies with the remit of regulating and managing various air pollution sources may also use this framework to take requisite steps for mitigation.

Figure 1: Three aspects of urban air quality management capability



Consistent with the definition adopted for AQM, a framework has been developed for benchmarking air quality management and action (AQM) in cities. Each city will be assessed and categorised as being between Stage 1 to Stage 5, with Stage 1 indicating cities performing at a very basic level while Stage 5 indicating cities performing at a highly advanced level vis-à-vis managing their air quality. Stages 2-4 indicate progressive stages leading from basic to the advanced.

Each of the three aspects has been divided into various factors (*see Figure 1*) that are in turn defined collectively by various indicators.

All indicators represent three aspects of capability – ability to measure and monitor, mitigation action and impact of action. Indicators for each stage get added cumulatively from stage 1 to stage 5. The numbers of mandatory and optional indicators change as one moves from Stage 1 towards Stage 5, with Stage 5 having only mandatory indicators. For each stage, the indicators under each of the three aspects have been classified as “mandatory” and “desirable”. The fulfillment of mandatory indicators defines various stages for each factor, while a combination of fulfillment of all mandatory indicators and a part of all desirable indicators of all factors defines the stages for each of the three aspects of measurement, mitigation and impact.

Each indicator has been formulated in the form of a question with a limited set of values that the indicator can have for any city. In order to score positively for any given indicator, a city must have a pre-fixed desirable value out of the set of provided values. This desirable value may for different stages. The number of mandatory and optional indicators increase and decrease respectively as one moves from Stage 1 towards Stage 5, with Stage 5 having only mandatory indicators. The assessment framework for assigning stages to any city has been explained in the next section.

This is a dynamic tool. With the help of this, the Central Pollution Control Board and State Pollution Control Boards can plan and monitor progress annually in each sector of pollution control in cities. As action progresses according to the indicators, the tool will reflect the improvement and how the city is graduating from one state to the other – on each indicator and in each sector -- and it will also reflect overall progress towards meeting the clean air target.

While the SPCBs and the state Departments of Environment are expected to take the lead in coordinating with all concerned state departments to inform and track action according to the relevant indicators, the implementing agencies and departments are also expected to internalise these indicators for their sectoral planning. Only such an approach will give the effective results. Indicators are designed to point to the desired direction of change in all relevant sectors of pollution control.

This section lays out the list of indicators along with desirable values for each of the five stages for the three aspects classified on the basis of their respective factors. The indicators in orange indicate that they are desirable for that particular stage, while those in red are mandatory.

Measurement and assessment

In order to manage its air quality, a city first needs to be able to properly measure and record air pollutant concentrations, their sources and the apportionment thereof and have the right systems in place to disseminate the data to public.

Thus, this aspect of air quality management can be divided into three factors:

- Capacity to monitor and record air pollutant concentrations
- Capacity to assess contribution to air pollution by various sources
- Data dissemination
- Capacity to record air pollutant concentrations

A city’s capacity to record air pollutant concentrations depends upon the monitoring infrastructure it has in place, their type and spread over the city’s geography and compliance with prevailing norms for monitoring. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage (see Table 1: Indicators for “capacity to record air pollutant concentrations”).

As can be seen from Table 1, the numbers of air quality monitoring stations, continuous air quality monitoring stations, kerb-side monitoring stations, and the type of pollutants being recorded increase as one moves from Stage 1 to Stage 5. In addition, towards later stages, it is necessary to ensure that there is full compliance with prevailing NAAQMS norms with regard to frequency and duration of monitoring as well as to ensure that the monitoring stations are geographically dispersed throughout the city to capture air quality in different areas having varied land uses (industrial, residential, commercial, etc).

Table 1: Indicators for “capacity to record air pollutant concentrations”

Capacity to record air pollutant concentrations	Air quality monitoring sites dispersed to capture different land uses in the city	Air quality monitoring sites dispersed to capture different land uses in the city	Air quality monitoring sites dispersed to capture different land uses in the city	Air quality monitoring sites dispersed to capture different land uses in the city	Air quality monitoring sites dispersed to capture different land uses in the city
	Compliance with NAAQMS norms of frequency and duration of monitoring	Compliance with NAAQMS norms of frequency and duration of monitoring	Compliance with NAAQMS norms of frequency and duration of monitoring	Compliance with NAAQMS norms of frequency and duration of monitoring	Compliance with NAAQMS norms of frequency and duration of monitoring
	Air quality monitoring in at least 1 kerbside location	Air quality monitoring in at least 2 kerbside locations	Air quality monitoring in at least 3 kerbside locations	Air quality monitoring in at least 3-5 kerbside locations	Air quality monitoring in more than 5 kerbside locations
	1-5 Continuous air quality monitoring stations in the city	6-9 Continuous air quality monitoring stations in the city	10-12 Continuous air quality monitoring stations in the city	13-15 Continuous air quality monitoring stations in the city	>15 Continuous air quality monitoring stations in the city
	Annual mean values are available for PM ₁₀ , PM _{2.5} , NO ₂ and SO ₂	Annual mean values are available for PM ₁₀ , PM _{2.5} , NO ₂ , SO ₂ and CO	Annual mean values are available for PM ₁₀ , PM _{2.5} , NO ₂ , SO ₂ , CO and Ozone	Annual mean values are available for all 12 pollutants (PM ₁₀ , PM _{2.5} , NO ₂ , SO ₂ , CO, Ozone, Lead, Benzene, Benzo(a)Pyrene, Arsenic, Ammonia and Nickel)	Annual mean values are available for all 12 pollutants (PM ₁₀ , PM _{2.5} , NO ₂ , SO ₂ , CO, Ozone, Lead, Benzene, Benzo(a)Pyrene, Arsenic, Ammonia and Nickel) as well as for air toxins + Monitoring undertaken of impact on air quality of actions taken
	1-5 Air quality monitoring stations in the city	6-9 Air quality monitoring stations in the city	10-12 Air quality monitoring stations in the city	13-15 Air quality monitoring stations in the city	>15 Air quality monitoring stations in the city
STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V	

Capacity to assess contribution to air pollution by various sources

While it is critical to record air pollutant concentrations, it is equally important to assess where the sources from where the pollutants are being contributed and in what measure. These sources range from transport, industries, to power plants and other human activities linked to daily lifestyle in cities. For each such category, it is important to record relevant data for measuring the contribution of each source. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 2: Indicators for “capacity to assess contribution of various sources to air pollution”).

The requirement of keeping data on various air pollution sources as well as for conducting direct studies on apportionment of various sources to air pollution increases as we move from Stage 1 towards Stage 5. Towards the later stages, the cities are expected to keep a thorough inventory of all air pollution sources (such as in terms of vehicle numbers, vehicle kilometers, power plant and industry emissions, etc.)

Table 2: Indicators for “capacity to assess contribution of various sources to air pollution

Capacity to assess contribution to air pollution by various sources	Data is available on mode-wise Vehicle Kilometers Traveled (VKT)	Data is available on mode-wise Vehicle Kilometers Traveled (VKT)	Data is available on mode-wise Vehicle Kilometers Traveled (VKT)	Data is available on mode-wise Vehicle Kilometers Traveled (VKT)	Data is available on mode-wise Vehicle Kilometers Traveled (VKT)
	Study on health impacts of air pollution in the city has been undertaken in the past 5 years	Study on health impacts of air pollution in the city has been undertaken in the past 5 years	Study on health impacts of air pollution in the city has been undertaken in the past 5 years	Study on health impacts of air pollution in the city has been undertaken in the past 5 years	Study on health impacts of air pollution in the city has been undertaken in the past 5 years
	Regular air quality forecasting is carried out for the city	Regular air quality forecasting is carried out for the city	Regular air quality forecasting is carried out for the city	Regular air quality forecasting is carried out for the city	Regular air quality forecasting is carried out for the city
	Data is available on total solid waste generated, collected and treated	Data is available on total solid waste generated, collected and treated	Data is available on total solid waste generated, collected and treated	Data is available on total solid waste generated, collected and treated	Data is available on total solid waste generated, collected and treated
	Data is available on total C&D waste generated, collected and treated	Data is available on total C&D waste generated, collected and treated	Data is available on total C&D waste generated, collected and treated	Data is available on total C&D waste generated, collected and treated	Data is available on total C&D waste generated, collected and treated
	Data is available on amount of biomass, kerosene and other solid fuels used in domestic sector	Data is available on amount of biomass, kerosene and other solid fuels used in domestic sector	Data is available on amount of biomass, kerosene and other solid fuels used in domestic sector	Data is available on amount of biomass, kerosene and other solid fuels used in domestic sector	Data is available on amount of biomass, kerosene and other solid fuels used in domestic sector
	Data is available on emissions from power plants located within city limits	Data is available on emissions from power plants located within city limits	Data is available on emissions from power plants located within city limits	Data is available on emissions from power plants located within city limits	Data is available on emissions from power plants located within city limits
	Data is available on total emissions from industries	Data is available on total emissions from industries	Data is available on total emissions from industries	Data is available on total emissions from industries	Data is available on total emissions from industries
	An inventory exists of contribution of vehicular and other sources to air pollution	An inventory exists of contribution of vehicular and other sources to air pollution	An inventory exists of contribution of vehicular and other sources to air pollution that's updated every 2 years	An inventory exists of contribution of vehicular and other sources to air pollution that's updated every 2 years	An inventory exists of contribution of vehicular and other sources to air pollution that's updated every 2 years
	An assessment has been done in the past 5 years of the contribution of urban transport to air pollution	An assessment has been done in the past 5 years of the contribution of urban transport to air pollution	An assessment has been done in the past 5 years of the contribution of urban transport to air pollution	An assessment has been done in the past 5 years of the contribution of urban transport to air pollution	An assessment has been done in the past 5 years of the contribution of urban transport to air pollution
	Data is available on age profile of vehicles	Data is available on age profile of vehicles	Data is available on age profile of vehicles	Data is available on age profile of vehicles	Data is available on age profile of vehicles
	Data is available on vehicles classified by type of fuel including NMT and private buses	Data is available on vehicles classified by type of fuel including NMT and private buses	Data is available on vehicles classified by type of fuel including NMT and private buses	Data is available on vehicles classified by type of fuel including NMT and private buses	Data is available on vehicles classified by type of fuel including NMT and private buses
	PM from Power Plants is monitored by SPCBs	PM+SOx+NOx from Power Plants is monitored by SPCBs	PM+SOx+NOx from Power Plants is monitored by SPCBs	PM+SOx+NOx+Hg from Power Plants are monitored by SPCBs	All pollutants from Power Plants are monitored by SPCBs
	CMP / CITS been prepared for the city in the past 5 years	CMP / CITS been prepared for the city in the past 5 years	CMP / CITS been prepared for the city in the past 5 years	CMP / CITS been prepared for the city in the past 5 years	CMP / CITS been prepared for the city in the past 5 years
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

Table 3: Indicators for “data dissemination”

Data dissemination	Daily health advisory is being issued	Daily health advisory is being issued	Daily health advisory is being issued	Daily health advisory is being issued	Daily health advisory is being issued
	Daily calculation carried out of Air Quality Index (AQI) or any such composite indicator	Daily calculation carried out of Air Quality Index (AQI) or any such composite indicator	Daily calculation carried out of Air Quality Index (AQI) or any such composite indicator	Daily calculation carried out of Air Quality Index (AQI) or any such composite indicator	Daily calculation carried out of Air Quality Index (AQI) or any such composite indicator
	Studies conducted on air pollution in the city (if any) publicly available on the internet	Studies conducted on air pollution in the city (if any) publicly available on the internet	Studies conducted on air pollution in the city (if any) publicly available on the internet	Studies conducted on air pollution in the city (if any) publicly available on the internet	Studies conducted on air pollution in the city (if any) publicly available on the internet
	Real time air pollutant concentrations as well as daily archival data is publicly available on the internet	Real time air pollutant concentrations as well as daily archival data is publicly available on the internet	Real time air pollutant concentrations as well as daily archival data is publicly available on the internet	Real time air pollutant concentrations as well as daily archival data is publicly available on the internet	Real time air pollutant concentrations as well as daily archival data is publicly available on the internet
	1 public display board disseminating recorded measurements of air pollutant concentrations	2 public display boards disseminating recorded measurements of air pollutant concentrations	3-5 public display boards disseminating recorded measurements of air pollutant concentrations	5-10 public display boards disseminating recorded measurements of air pollutant concentrations	>10 public display boards disseminating recorded measurements of air pollutant concentrations
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

Data dissemination

It is not just sufficient to measure air pollutant concentrations and assess their sources and their apportionment. It is equally important to disseminate that information to the public through various channels such as web / mobile application, information boards in public spaces as well sharing important studies conducted on air pollution with the public. This ensures public awareness of the issues and can help build ground up pressure on the concerned agents to address the problem. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 3: Indicators for “data dissemination”)

The requirement of having multiple public display boards for disseminating air pollutant concentrations information and the different categories of information that need to be made publicly available increase as we move from Stage 1 towards Stage 5.

Mitigation Initiatives

Having addressed the task of recording air pollutant concentrations and their sources, the most important task towards air quality management then becomes taking relevant initiatives towards alleviating the situation. Accordingly, this aspect has been described by various factors as below:

- Mitigation Planning
- Vehicular Emission Controls
- Implementation of clean fuel program
- Fiscal Measures for fuel technology
- Promotion of walking
- Promotion of non-motorized transport (NMT)
- Promotion of public transport
- Management of Intermediate Public Transport - IPT (auto rickshaws / shared auto rickshaws / taxis)
- Travel demand management
- Emissions reduction from non-transport sources (excluding industries and power plants)
- Emissions reduction from non-transport sources (industries and power plants)

Mitigation Planning

The first and foremost task towards air quality management is to have a plan for mitigation. This involves preparing a Clean Air Action Plan, its operationalization and monitoring, and preparation of emergency action plan. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 4: Indicators for “mitigation planning”)

As can be seen from Figure 8, while it is mandatory for cities to prepare a Clean Air Action Plan even to qualify for Stage 1, for the later stages, they must have an emergency action plan and also should have operationalised their Clean Air Action Plan and have processes in place to monitor results.

Vehicular emission controls

One of the primary and direct tasks towards reducing air pollution in cities is to impose various types of controls on vehicular emissions. These range from applying the prevailing emission norms on vehicles, restricting usage of

Table 4: Indicators for “mitigation planning”

	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V
Mitigation Planning	Clean Air Action Plan has been operationalised and mechanism exists for monitoring results	Clean Air Action Plan has been operationalised and mechanism exists for monitoring results	Clean Air Action Plan has been operationalised and mechanism exists for monitoring results	Clean Air Action Plan has been operationalised and mechanism exists for monitoring results	Clean Air Action Plan has been operationalised and mechanism exists for monitoring results
	Emergency action plan exists	Emergency action plan exists	Emergency action plan exists	Emergency action plan exists	Emergency action plan exists
	Clean Air Action Plan has been prepared for the city	Clean Air Action Plan has been prepared for the city	Clean Air Action Plan has been prepared for the city	Clean Air Action Plan has been prepared for the city	Clean Air Action Plan has been prepared for the city

Table 5: Indicators for vehicular emission controls

Vehicular Emission Controls	Visually smoking vehicles can be reported by anyone for fine	Visually smoking vehicles can be reported by anyone for fine	Visually smoking vehicles can be reported by anyone for fine	Visually smoking vehicles can be reported by anyone for fine	Visually smoking vehicles can be reported by anyone for fine
	Vehicle fitness program has been upgraded	Vehicle fitness program has been upgraded	Vehicle fitness program has been upgraded	Vehicle fitness program has been upgraded	Vehicle fitness program has been upgraded
	Vehicle fitness and road worthiness test are done for commercial vehicles	Vehicle fitness and road worthiness test are done for commercial vehicles	Vehicle fitness and road worthiness test are done for commercial and personal vehicles	Vehicle fitness and road worthiness test are done for commercial and personal vehicles	Vehicle fitness and road worthiness test are done for commercial and personal vehicles
	PUC Notification 2009 has been implemented in the city	PUC Notification 2009 has been implemented in the city	PUC Notification 2009 and On Board Diagnostics (OBD) have been implemented in the city	PUC Notification 2009 and On Board Diagnostics (OBD) have been implemented in the city	PUC Notification 2009 ,On Board Diagnostics (OBD) along with centralised vehicles inspection centre have been implemented in the city
	Complete restriction on plying of goods vehicles during day time inside the city	Complete restriction on plying of goods vehicles during day time inside the city	Complete restriction on plying of goods vehicles during day time inside the city	Complete restriction on plying of goods vehicles during day time inside the city, re-alignment of routes has been done to take transit truck traffic away along with imposition of environment cess	Complete restriction on plying of goods vehicles during day time inside the city, re-alignment of routes has been done to take transit truck traffic away along with imposition of environment cess
	Ban on plying of personal vehicles more than 15 year old	Ban on plying of personal vehicles more than 15 year old	Ban on plying of personal vehicles more than 15 year old	Ban on plying of personal vehicles more than 15 year old along with scrappage and recycling facilities	Ban on plying of personal vehicles more than 15 year old along with scrappage and recycling facilities
	Ban on plying of commercial vehicles more than 15 year old	Ban on plying of commercial vehicles more than 15 year old	Ban on plying of commercial vehicles more than 15 year old	Ban on plying of commercial vehicles more than 15 year old along with scrappage and recycling facilities	Ban on plying of commercial vehicles more than 15 year old along with scrappage and recycling facilities
	BS III and BS IV norms are applicable to new vehicles	BS IV norms are applicable to new vehicles	BS IV norms are applicable to new vehicles	BS IV norms are applicable to new vehicles	BS IV norms are applicable to new vehicles and efforts are being undertaken to go beyond norms along with a zero emission mandate
STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V	

various types of highly polluting vehicles and bringing in changes in vehicle technology to adapt to reduced emission requirements. The indicators selected to represent this factor have been shown stage-wise in Figure 9. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 5: Indicators for vehicular emission controls)

As can be seen from Figure 9, applying BS (Bharat Stage) 3 and 4 norms are the minimum mandatory norms for qualifying for any stage, while the requirements increase in terms of restricting various types of polluting vehicles (goods vehicles, old vehicles, etc.) and imposing stringent rules on polluting vehicles as we move from Stage 1 towards Stage 5.

Implementation of clean fuel program

A related step towards bringing down vehicular pollution involves bringing in usage of clean fuels (CNG / LPG / Low Sulphur Diesel). Over time, this can have a significant impact in lowering vehicular pollution. The indicators selected to represent this factor have been shown stage-wise in Figure 10. For each stage, those indicators shown in red indicate that they are mandatory to be met in

Table 6: Indicators for Implementation of clean fuel program

Implementation of clean fuel program	CNG/LPG specific safety inspection norms are included in vehicle fitness program	CNG/LPG specific safety inspection norms are included in vehicle fitness program	CNG/LPG specific safety inspection norms are included in vehicle fitness program	CNG/LPG specific safety inspection norms are included in vehicle fitness program	CNG/LPG specific safety inspection norms are included in vehicle fitness program
	Buses (STC / Private / PPP / School / Airport) in the city do not use retrofitted CNG/LPG vehicles (use only OEM vehicles)	Buses (STC / Private / PPP / School / Airport) in the city do not use retrofitted CNG/LPG vehicles (use only OEM vehicles)	Buses (STC / Private / PPP / School / Airport) in the city do not use retrofitted CNG/LPG vehicles (use only OEM vehicles)	Buses (STC / Private / PPP / School / Airport) in the city do not use retrofitted CNG/LPG vehicles (use only OEM vehicles)	Buses (STC / Private / PPP / School / Airport) in the city do not use retrofitted CNG/LPG vehicles (use only OEM vehicles)
	All Intermediate Public Transport vehicles (Auto rickshaws and Taxis) run on clean fuels	All Intermediate Public Transport vehicles (Auto rickshaws and Taxis) run on clean fuels	All Intermediate Public Transport vehicles (Auto rickshaws and Taxis) run on clean fuels	All Intermediate Public Transport vehicles (Auto rickshaws and Taxis) run on clean fuels	All Intermediate Public Transport vehicles (Auto rickshaws and Taxis) run on clean fuels
	All buses (STC / Private / PPP / School / Airport) in the city run only on clean fuels (LPG or CNG) or clean diesel (10 ppm sulphur + particulate trap)	All buses (STC / Private / PPP / School / Airport) in the city run only on clean fuels (LPG or CNG) or clean diesel (10 ppm sulphur + particulate trap)	All buses (STC / Private / PPP / School / Airport) in the city run only on clean fuels (LPG or CNG) or clean diesel (10 ppm sulphur + particulate trap)	All buses (STC / Private / PPP / School / Airport) in the city run only on clean fuels (LPG or CNG) or clean diesel (10 ppm sulphur + particulate trap)	All buses (STC / Private / PPP / School / Airport) in the city run only on clean fuels (LPG or CNG) or clean diesel (10 ppm sulphur + particulate trap)
	CNG/LPG is available in the city	CNG/LPG is available in the city	CNG/LPG is available in the city	CNG/LPG is available in the city	CNG/LPG is available in the city
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 6: Indicators for Implementation of clean fuel program).

As can be seen from Figure 10, cities are expected to start with making clean fuels available and then gradually coerce different vehicle categories (buses, taxis, auto rickshaws) in due time to make the transition to clean fuels.

Fiscal measures for fuel technology

In addition to implementation of clean fuel program, it is important to complement the measures through fiscal interventions that catalyze the adoption of cleaner fuels. The indicators selected to represent this factor have been shown stage-wise in Figure 11. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 7: Indicators for “fiscal measures for fuel technology)

As can be seen from Figure 11, while it is being considered a minimum requirement to impose additional tax on older vehicles, in order to move from Stage 1 to Stage 5, cities are expected to impose taxes on Diesel and other high

Table 7: Indicators for fiscal measures for fuel technology

Fiscal Measures for fuel technology	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V
	Revenue generated from additional taxes is used for air pollution control measures (polluter pays principle)	Revenue generated from additional taxes is used for air pollution control measures (polluter pays principle)	Revenue generated from additional taxes is used for air pollution control measures (polluter pays principle)	Revenue generated from additional taxes is used for air pollution control measures (polluter pays principle)	Revenue generated from additional taxes is used for air pollution control measures (polluter pays principle)
	Fuel pricing in the city promotes clean fuel such as CNG/LPG	Fuel pricing in the city promotes clean fuel such as CNG/LPG	Fuel pricing in the city promotes clean fuel such as CNG/LPG	Fuel pricing in the city promotes clean fuel such as CNG/LPG	Fuel pricing in the city promotes clean fuel such as CNG/LPG
	Additional tax is being levied on more polluting fuels (diesel, Euro II fuels)	Additional tax is being levied on more polluting fuels (diesel, Euro II fuels)	Additional tax is being levied on more polluting fuels (diesel, Euro II fuels)	Additional tax is being levied on more polluting fuels (diesel, Euro II fuels)	Additional tax is being levied on more polluting fuels (diesel, Euro II fuels)
	Additional tax is being levied on diesel vehicles	Additional tax is being levied on diesel vehicles	Additional tax is being levied on diesel vehicles	Additional tax is being levied on diesel vehicles	Additional tax is being levied on diesel vehicles
	Additional tax is being levied on older vehicles	Additional tax is being levied on older vehicles	Additional tax is being levied on older vehicles	Additional tax is being levied on older vehicles	Additional tax is being levied on older vehicles

polluting fuels along with the adoption of “polluter pays” principle whereby the revenue generated from such taxes is in turn used to fund other measures for reducing air pollution.

Promotion of walking

While implementation of strategies to directly reduce pollution from vehicles are extremely important, it is equally important to reduce the overall usage of vehicles by influencing travel behavior of commuters towards less or zero polluting modes such as walking, cycling, public transport and so on. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 8: Indicators for promotion of walking).

The selected indicators reflect the poor state of walking facilities in most Indian cities. For the initial stages, it is mandatory at the very minimum for cities to keep an inventory of footpath availability and safe pedestrian crossings to assess the magnitude of task required to make a walking friendly city. In order to move to further stages, cities need to adopt plans for phased development of safe walking facilities throughout the city along with setting up user feedback mechanisms.

Table 8: Indicators for promotion of walking

Promotion of walking	Set targets on zero road accidents for pedestrian and cyclists	Set targets on zero road accidents for pedestrian and cyclists	Set targets on zero road accidents for pedestrian and cyclists	Set targets on zero road accidents for pedestrian and cyclists	Set targets on zero road accidents for pedestrian and cyclists
	Grievance redressal mechanism exists for issues in pedestrian facilities	Grievance redressal mechanism exists for issues in pedestrian facilities	Grievance redressal mechanism exists for issues in pedestrian facilities	Grievance redressal mechanism exists for issues in pedestrian facilities	Grievance redressal mechanism exists for issues in pedestrian facilities
	Annual user satisfaction survey and street audits conducted for pedestrian facilities	Annual user satisfaction survey and street audits conducted for pedestrian facilities	Annual user satisfaction survey and street audits conducted for pedestrian facilities	Annual user satisfaction survey and street audits conducted for pedestrian facilities	Annual user satisfaction survey and street audits conducted for pedestrian facilities
	Pedestrian only zone exists in the city	Pedestrian only zone exists in the city	Pedestrian only zone exists in the city	Pedestrian only zone exists in the city	Pedestrian only zone exists in the city
	Dedicated budget allocation for NMT infrastructure exists	Dedicated budget allocation for NMT infrastructure exists	Dedicated budget allocation for NMT infrastructure exists	Dedicated budget allocation for NMT infrastructure exists	Dedicated budget allocation for NMT infrastructure exists
	Comprehensive NMT Policy exists that prioritises at-grade pedestrian crossings over grade separated crossings	Comprehensive NMT Policy exists that prioritises at-grade pedestrian crossings over grade separated crossings	Comprehensive NMT Policy exists that prioritises at-grade pedestrian crossings over grade separated crossings	Comprehensive NMT Policy exists that prioritises at-grade pedestrian crossings over grade separated crossings	Comprehensive NMT Policy exists that prioritises at-grade pedestrian crossings over grade separated crossings
	Guidelines / rules exist on universal accessibility for pedestrian facilities	Guidelines / rules exist on universal accessibility for pedestrian facilities	Guidelines / rules exist on universal accessibility for pedestrian facilities	Guidelines / rules exist on universal accessibility for pedestrian facilities	Guidelines / rules exist on universal accessibility for pedestrian facilities
	Phased plan exists to create safe pedestrian crossing facilities at PT stops / stations	Phased plan exists to create safe pedestrian crossing facilities at PT stops / stations	Phased plan exists to create safe pedestrian crossing facilities at PT stops / stations	Phased plan exists to create safe pedestrian crossing facilities at PT stops / stations	Phased plan exists to create safe pedestrian crossing facilities at PT stops / stations
	Phased plan exists to create safe pedestrian crossing facilities at all major intersections	Phased plan exists to create safe pedestrian crossing facilities at all major intersections	Phased plan exists to create safe pedestrian crossing facilities at all major intersections	Phased plan exists to create safe pedestrian crossing facilities at all major intersections	Phased plan exists to create safe pedestrian crossing facilities at all major intersections
	Phased plan exists to build footpaths on all city's roads	Phased plan exists to build footpaths on all city's roads	Phased plan exists to build footpaths on all city's roads	Phased plan exists to build footpaths on all city's roads	Phased plan exists to build footpaths on all city's roads
	Inventory exists of safe pedestrian crossing facilities at PT stops / stations	Inventory exists of safe pedestrian crossing facilities at PT stops / stations	Inventory exists of safe pedestrian crossing facilities at PT stops / stations	Inventory exists of safe pedestrian crossing facilities at PT stops / stations	Inventory exists of safe pedestrian crossing facilities at PT stops / stations
	Inventory exists of pedestrian crossing facilities at all major intersections	Inventory exists of pedestrian crossing facilities at all major intersections	Inventory exists of pedestrian crossing facilities at all major intersections	Inventory exists of pedestrian crossing facilities at all major intersections	Inventory exists of pedestrian crossing facilities at all major intersections
	Inventory exists of footpath availability on city's roads	Inventory exists of footpath availability on city's roads	Inventory exists of footpath availability on city's roads	Inventory exists of footpath availability on city's roads	Inventory exists of footpath availability on city's roads
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

Promotion of non-motorized transport

In addition to walking, bicycles and cycle rickshaws are the two other zero-emission modes and their usage needs to be promoted in Indian cities in order to improve the air quality. The indicators, therefore, selected to represent this factor have been shown stage-wise in Figure 13. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 9: Indicators for promotion of non-motorized transport)

It is mandatory for cities to have introduced bicycle lanes at the very least, but in order to move to further stages, they need to augment cycling infrastructure through suitable policy changes as required as well as organize their cycle rickshaw system so that it can serve as a vital component of the city's mobility system.

Promotion of public transport

Promoting and improving public transport systems is a crucial requirement for any city that aims to improve its air quality, as it enables people to switch from

Table 9: Indicators for promotion of non-motorized transport

Promotion of non-motorized transport (NMT)	Comprehensive phased plan exists for introducing traffic calming measures on all roads	Comprehensive phased plan exists for introducing traffic calming measures on all roads	Comprehensive phased plan exists for introducing traffic calming measures on all roads	Comprehensive phased plan exists for introducing traffic calming measures on all roads	Comprehensive phased plan exists for introducing traffic calming measures on all roads
	Any law mandating reservation of area for bicycle parking in off-street car parking facilities	Any law mandating reservation of area for bicycle parking in off-street car parking facilities	Any law mandating reservation of area for bicycle parking in off-street car parking facilities	Any law mandating reservation of area for bicycle parking in off-street car parking facilities	Any law mandating reservation of area for bicycle parking in off-street car parking facilities
	Any byelaws mandating bicycle parking facilities in commercial / institutional developments	Any byelaws mandating bicycle parking facilities in commercial / institutional developments	Any byelaws mandating bicycle parking facilities in commercial / institutional developments	Any byelaws mandating bicycle parking facilities in commercial / institutional developments	Any byelaws mandating bicycle parking facilities in commercial / institutional developments
	City has E-rickshaws	City has E-rickshaws	City has E-rickshaws	City has E-rickshaws	City has E-rickshaws
	Bicycle sharing schemes are introduced in the city	Bicycle sharing schemes are introduced in the city	Bicycle sharing schemes are introduced in the city	Bicycle sharing schemes are introduced in the city	Bicycle sharing schemes are introduced in the city
	Bicycle parking facilities are there at mass transit (BRT / Metro) stations	Bicycle parking facilities are there at mass transit (BRT / Metro) stations	Bicycle parking facilities are there at mass transit (BRT / Metro) stations	Bicycle parking facilities are there at mass transit (BRT / Metro) stations	Bicycle parking facilities are there at mass transit (BRT / Metro) stations
	Phased plan to implement bicycle lanes on major roads through out the city	Phased plan to implement bicycle lanes on major roads through out the city	Phased plan to implement bicycle lanes on major roads through out the city	Phased plan to implement bicycle lanes on major roads through out the city	Phased plan to implement bicycle lanes on major roads through out the city
	Designated spaces have been allocated for idling / parking of cycle rickshaws	Designated spaces have been allocated for idling / parking of cycle rickshaws	Designated spaces have been allocated for idling / parking of cycle rickshaws	Designated spaces have been allocated for idling / parking of cycle rickshaws	Designated spaces have been allocated for idling / parking of cycle rickshaws
	Bicycle parking facilities are there at bus stops	Bicycle parking facilities are there at bus stops	Bicycle parking facilities are there at bus stops	Bicycle parking facilities are there at bus stops	Bicycle parking facilities are there at bus stops
	Bicycle lanes exist in the city	Bicycle lanes exist in the city	Bicycle lanes exist in the city	Bicycle lanes exist in the city	Bicycle lanes exist in the city
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

polluting cars to buses that can ferry much larger number of persons for the same amount of fuel consumed. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage.(see Table 10: Indicators for promotion of public transport)

The basic service performance parameters are expected to improve as one moves from Stage 1 towards Stage 5. In addition, cities are expected to take steps to make the public transport systems usage a more smooth experience for the user through well designed interchange systems, suitable information systems and so on. Cities in the last stage are expected to also explore innovative models for operating their buses and revenue maximization.

Management of Intermediate Public Transport (IPT)

IPT systems often fill in a very important role in a city’s mobility system by acting as a bridge between the travel requirements of users that the conventional public transport system cannot fulfil such as last mile connectivity or point to point connectivity. However, their uncontrolled growth can also prove to be nuisance for a city’s traffic systems, thus warranting careful management of IPT

Table 10: Indicators for promotion of public transport

Promotion of public transport	Passenger satisfaction survey is carried out annually	Passenger satisfaction survey is carried out annually	Passenger satisfaction survey is carried out annually	Passenger satisfaction survey is carried out annually	Passenger satisfaction survey is carried out annually
	Innovative models for bus operations and revenue maximisation have been adopted	Innovative models for bus operations and revenue maximisation have been adopted	Innovative models for bus operations and revenue maximisation have been adopted	Innovative models for bus operations and revenue maximisation have been adopted	Innovative models for bus operations and revenue maximisation have been adopted
	Bus priority schemes such as bus lanes, BRT, signal priority, etc. have been implemented	Bus priority schemes such as bus lanes, BRT, signal priority, etc. have been implemented	Bus priority schemes such as bus lanes, BRT, signal priority, etc. have been implemented	Bus priority schemes such as bus lanes, BRT, signal priority, etc. have been implemented	Bus priority schemes such as bus lanes, BRT, signal priority, etc. have been implemented
	Integrated ticketing system exists for various public transport systems in the city	Integrated ticketing system exists for various public transport systems in the city	Integrated ticketing system exists for various public transport systems in the city	Integrated ticketing system exists for various public transport systems in the city	Integrated ticketing system exists for various public transport systems in the city
	City bus system adheres to a stated policy headway	City bus system adheres to a stated policy headway	City bus system adheres to a stated policy headway	City bus system adheres to a stated policy headway	City bus system adheres to a stated policy headway
	Phased plan exists to physically integrate the city's bus system with the BRT / Metro system	Phased plan exists to physically integrate the city's bus system with the BRT / Metro system	Phased plan exists to physically integrate the city's bus system with the BRT / Metro system	Phased plan exists to physically integrate the city's bus system with the BRT / Metro system	Phased plan exists to physically integrate the city's bus system with the BRT / Metro system
	City bus system routing and service plan has been revised during the past 3 years	City bus system routing and service plan has been revised during the past 3 years	City bus system routing and service plan has been revised during the past 3 years	City bus system routing and service plan has been revised during the past 3 years	City bus system routing and service plan has been revised during the past 3 years
	Real time information on bus schedules is available either through App or at bus stops	Real time information on bus schedules is available either through App or at bus stops	Real time information on bus schedules is available either through App or at bus stops	Real time information on bus schedules is available either through App or at bus stops	Real time information on bus schedules is available either through App or at bus stops
	Information on bus schedules for any bus stop is available online or at bus stops	Information on bus schedules for any bus stop is available online or at bus stops	Information on bus schedules for any bus stop is available online or at bus stops	Information on bus schedules for any bus stop is available online or at bus stops	Information on bus schedules for any bus stop is available online or at bus stops
	Operating Ratio is greater than 1.5	Operating Ratio is 1.3 - 1.5	Operating Ratio is greater than 1.0 - 1.3	Operating Ratio is greater than 0.9 - 1.0	Operating Ratio is greater than <0.9
	Fuel Efficiency is between 0-2 (kms/l)	Fuel Efficiency is between 2-3 (kms/l)	Fuel Efficiency is between 3-4 (kms/l)	Fuel Efficiency is between 4-5 (kms/l)	Fuel Efficiency is >5 (kms/l)
	Vehicle Utilisation is less than 100 (in km)	Vehicle Utilisation is less than 100-120 (in km)	Vehicle Utilisation is less than 120 - 150 (in km)	Vehicle Utilisation is less than 150-180 (in km)	Vehicle Utilisation is less than >180 (in km)
	Average age of fleet is >12 (years)	Average age of fleet is 10-12 (years)	Average age of fleet is 5-10 (years)	Average age of fleet is 3-5 (years)	Average age of fleet is 0-3 (years)
	Fleet Utilisation is less than 20 (%)	Fleet Utilisation is between 20 to 40 (%)	Fleet Utilisation is between 40 to 60 (%)	Fleet Utilisation is between 60 to 100 (%)	Fleet Utilisation is more than 100 (%)
	Ratio of existing fleet of city bus system + Metro to the city's population is less than 20	Ratio of existing fleet of city bus system + Metro to the city's population is between 20 to 40	Ratio of existing fleet of city bus system + Metro to the city's population is between 40 to 60	Ratio of existing fleet of city bus system + Metro to the city's population is between 60 to 100	Ratio of existing fleet of city bus system + Metro to the city's population is more than 100
STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V	

systems in cities. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 11: Indicators for management of Intermediate Public Transport)

As can be seen from Figure 15, cities are expected at the minimum to provide appropriate signage to allow IPT operators and passengers to know halting points without disturbing normal traffic flow. However, in order to move further to higher stages, cities are expected to take further steps towards organization such as enabling tracking of IPT vehicles, creating a policy for regulating taxi aggregators and adopting innovative operating models for managing taxis and auto rickshaws in the city.

Table 11: Indicators for management of Intermediate Public Transport

Management of Intermediate Public Transport - IPT (auto rickshaws / shared auto rickshaws / taxis)					
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V
Innovative models have been adopted to organise IPT services in the city	Innovative models have been adopted to organise IPT services in the city	Innovative models have been adopted to organise IPT services in the city	Innovative models have been adopted to organise IPT services in the city	Innovative models have been adopted to organise IPT services in the city	Innovative models have been adopted to organise IPT services in the city
City has a policy for regulating cab aggregators	City has a policy for regulating cab aggregators	City has a policy for regulating cab aggregators	City has a policy for regulating cab aggregators	City has a policy for regulating cab aggregators	City has a policy for regulating cab aggregators
All IPT vehicles fitted with a GPS device trackable by the State Transport Department	All IPT vehicles fitted with a GPS device trackable by the State Transport Department	All IPT vehicles fitted with a GPS device trackable by the State Transport Department	All IPT vehicles fitted with a GPS device trackable by the State Transport Department	All IPT vehicles fitted with a GPS device trackable by the State Transport Department	All IPT vehicles fitted with a GPS device trackable by the State Transport Department
Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers	Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers	Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers	Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers	Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers	Grievance redressal mechanism exists for errant behaviour of auto rickshaw drivers
Designated spaces are allocated for parking / idling of IPT vehicles	Designated spaces are allocated for parking / idling of IPT vehicles	Designated spaces are allocated for parking / idling of IPT vehicles	Designated spaces are allocated for parking / idling of IPT vehicles	Designated spaces are allocated for parking / idling of IPT vehicles	Designated spaces are allocated for parking / idling of IPT vehicles
Signage present at designated IPT stops throughout the city	Signage present at designated IPT stops throughout the city	Signage present at designated IPT stops throughout the city	Signage present at designated IPT stops throughout the city	Signage present at designated IPT stops throughout the city	Signage present at designated IPT stops throughout the city

Travel Demand Management

While promotion of cleaner modes offers options to people to switch from usage of personal car, other direct measures are often needed to influence the switch and are often clubbed under the rubric of travel demand management. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (see Table 12: Indicators for travel demand management)

With most cities adopting for mass transit system, it is critical that they preemptively formulate a transit oriented development (TOD) policy that enables higher usage of the transit systems and place-making of areas around transit stations. In addition, cities are expected to take wide ranging steps in the realm of car parking such as pricing and supply curtailment to persuade car users to use other cleaner modes.

Emissions reduction from non-transport sources

While vehicular pollution comprises a significant component of the overall air pollution in the city, it is equally important to address other sources that include industries, power plants and daily life style activities like cooking and

Table 12: Indicators for travel demand management

Travel demand management	Traffic impact assessment included as a criteria for giving planning permission	Traffic impact assessment included as a criteria for giving planning permission	Traffic impact assessment included as a criteria for giving planning permission	Traffic impact assessment included as a criteria for giving planning permission	Traffic impact assessment included as a criteria for giving planning permission
	Road tax applied on cars at multiple times coupled with elimination or lowering of taxes on buses	Road tax applied on cars at multiple times coupled with elimination or lowering of taxes on buses	Road tax applied on cars at multiple times coupled with elimination or lowering of taxes on buses	Road tax applied on cars at multiple times coupled with elimination or lowering of taxes on buses	Road tax applied on cars at multiple times coupled with elimination or lowering of taxes on buses
	Real time parking availability information exists	Real time parking availability information exists	Real time parking availability information exists	Real time parking availability information exists	Real time parking availability information exists
	Commercial location with parking fee of Rs 100 or more for 30 minutes exists	Commercial location with parking fee of Rs 100 or more for 30 minutes exists	Commercial location with parking fee of Rs 100 or more for 30 minutes exists	Commercial location with parking fee of Rs 100 or more for 30 minutes exists	Commercial location with parking fee of Rs 100 or more for 30 minutes exists
	Car parking facility available at mass transit stations	Car parking facility available at mass transit stations	Car parking facility available at mass transit stations	Car parking facility available at mass transit stations	Car parking facility available at mass transit stations
	Ban on free parking facility on public land and residential parking permit has been enforced	Ban on free parking facility on public land and residential parking permit has been enforced	Ban on free parking facility on public land and residential parking permit has been enforced	Ban on free parking facility on public land and residential parking permit has been enforced	Ban on free parking facility on public land and residential parking permit has been enforced
	Approved Parking Policy exists as TDM tool including or otherwise policy and strategies on Parking Management District (priced parking, demarcated and limited parking, common parking, parking maximum caps, parking ban in green areas)	Approved Parking Policy exists as TDM tool including or otherwise policy and strategies on Parking Management District (priced parking, demarcated and limited parking, common parking, parking maximum caps, parking ban in green areas)	Approved Parking Policy exists as TDM tool including or otherwise policy and strategies on Parking Management District (priced parking, demarcated and limited parking, common parking, parking maximum caps, parking ban in green areas)	Approved Parking Policy exists as TDM tool including or otherwise policy and strategies on Parking Management District (priced parking, demarcated and limited parking, common parking, parking maximum caps, parking ban in green areas)	Approved Parking Policy exists as TDM tool including or otherwise policy and strategies on Parking Management District (priced parking, demarcated and limited parking, common parking, parking maximum caps, parking ban in green areas)
	TOD (transit oriented development) policy exists	TOD (transit oriented development) policy exists	TOD (transit oriented development) policy exists	TOD (transit oriented development) has been implemented	TOD (transit oriented development) has been implemented
STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V	

heating practices. The indicators selected to represent this factor have been shown stage-wise in Table 13 (excluding industries and power plants) and Table 14 (industries and power plants). For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage. (See Table 13: Indicators for “emissions reduction from non-transport sources (excluding industries and power plants) and Table 14: Indicators for “emissions reduction from non-transport sources (industries and power plants)

Cities are expected to increase their adoption of cleaner methods to dispose or

reuse their waste (solid waste, construction and demolition waste, etc.). Along with these steps, they need to gradually phase out use of polluting fuels and systems used in the city for cooking, lighting and heating purposes. Similarly, in case of industries and power plants, while relocating the polluting industries out of the cities is very important, it is equally important to ensure their compliance with prevailing pollution control norms and usage of clean fuel.

Table 13: Indicators for “emissions reduction from non-transport sources (excluding industries and power plants)”

Emissions reduction from non-transport sources (excluding industries and power plants)	Helpline contacts / or a mechanism exists to ensure accountability in reporting and action on waste burning	Helpline contacts / or a mechanism exists to ensure accountability in reporting and action on waste burning	Helpline contacts / or a mechanism exists to ensure accountability in reporting and action on waste burning	Helpline contacts / or a mechanism exists to ensure accountability in reporting and action on waste burning	Helpline contacts / or a mechanism exists to ensure accountability in reporting and action on waste burning
	C&D waste management rules have been enforced	C&D waste management rules have been enforced	C&D waste management rules have been enforced	C&D waste management rules have been enforced	C&D waste management rules have been enforced
	Information on C&D waste recyclers publicly available	Information on C&D waste recyclers publicly available	Information on C&D waste recyclers publicly available	Information on C&D waste recyclers publicly available	Information on C&D waste recyclers publicly available
	Byelaws have been introduced for segregation at source with penal provisions for non-segregation	Byelaws have been introduced for segregation at source with penal provisions for non-segregation	Byelaws have been introduced for segregation at source with penal provisions for non-segregation	Byelaws have been introduced for segregation at source with penal provisions for non-segregation	Byelaws have been introduced for segregation at source with penal provisions for non-segregation
	Usage of Diesel Generator Sets has reduced	Usage of Diesel Generator Sets has reduced	Usage of Diesel Generator Sets has reduced	Usage of Diesel Generator Sets has reduced	Usage of Diesel Generator Sets has reduced
	Open burning ban has been completely enforced	Open burning ban has been completely enforced	Open burning ban has been completely enforced	Open burning ban has been completely enforced	Open burning ban has been completely enforced
	A time-bound action plan has been adopted to provide cleaner fuel to urban poor to meet their cooking and heating needs	A time-bound action plan has been adopted to provide cleaner fuel to urban poor to meet their cooking and heating needs	A time-bound action plan has been adopted to provide cleaner fuel to urban poor to meet their cooking and heating needs	A time-bound action plan has been adopted to provide cleaner fuel to urban poor to meet their cooking and heating needs	A time-bound action plan has been adopted to provide cleaner fuel to urban poor to meet their cooking and heating needs
	City uses engineered landfill for disposing solid waste along with policy to eliminate landfills	City uses engineered landfill for disposing solid waste along with policy to eliminate landfills	City uses engineered landfill for disposing solid waste along with policy to eliminate landfills	City uses engineered landfill for disposing solid waste along with policy to eliminate landfills	City uses engineered landfill for disposing solid waste along with policy to eliminate landfills
	20% of solid waste generated is being scientifically treated	21-40% of solid waste generated is being scientifically treated	41-60% of solid waste generated is being scientifically treated	61-80% of solid waste generated is being scientifically treated	>80% of solid waste generated is being scientifically treated
	20% of C&D waste generated within the city is being scientifically treated and reused	21-40% of C&D waste generated within the city is being scientifically treated and reused	41-60% of C&D waste generated within the city is being scientifically treated and reused	61-80% of C&D waste generated within the city is being scientifically treated and reused	>80% of C&D waste generated within the city is being scientifically treated and reused

Table 14: Indicators for “emissions reduction from non-transport sources (industries and power plants)”

Emissions reduction from non-transport sources (industries and power plants)	100% fly ash utilization has been achieved	100% fly ash utilization has been achieved	100% fly ash utilization has been achieved	100% fly ash utilization has been achieved	100% fly ash utilization has been achieved
	Industries / Power plants use air-pollution monitoring devices (CEMS) and other in-situ emission reduction devices	Industries / Power plants use air-pollution monitoring devices (CEMS) and other in-situ emission reduction devices	Industries / Power plants use air-pollution monitoring devices (CEMS) and other in-situ emission reduction devices	Industries / Power plants use air-pollution monitoring devices (CEMS) and other in-situ emission reduction devices	Industries / Power plants use air-pollution monitoring devices (CEMS) and other in-situ emission reduction devices
	Industries have adopted stack emission norms beyond those prescribed by CPCB	Industries have adopted stack emission norms beyond those prescribed by CPCB	Industries have adopted stack emission norms beyond those prescribed by CPCB	Industries have adopted stack emission norms beyond those prescribed by CPCB	Industries have adopted stack emission norms beyond those prescribed by CPCB
	Full compliance of air pollution norms by industries	Full compliance of air pollution norms by industries	Full compliance of air pollution norms by industries	Full compliance of air pollution norms by industries	Full compliance of air pollution norms by industries
	Full compliance of new air pollution norms by power plants	Full compliance of new air pollution norms by power plants	Full compliance of new air pollution norms by power plants	Full compliance of new air pollution norms by power plants	Full compliance of new air pollution norms by power plants
	Furnace Oil has been banned	Furnace Oil has been banned	Furnace Oil has been banned	Furnace Oil has been banned	Furnace Oil has been banned
	Clean norms for all industrial fuels have been enforced	Clean norms for all industrial fuels have been enforced	Clean norms for all industrial fuels have been enforced	Clean norms for all industrial fuels have been enforced	Clean norms for all industrial fuels have been enforced
	Polluting industries are not allowed within city limits including unauthorized colonies	Polluting industries are not allowed within city limits including unauthorized colonies	Polluting industries are not allowed within city limits including unauthorized colonies	Polluting industries are not allowed within city limits including unauthorized colonies	Polluting industries are not allowed within city limits including unauthorized colonies
	Brick kilns use improved kiln technology	Brick kilns use improved kiln technology	Brick kilns use improved kiln technology	Brick kilns use improved kiln technology	Brick kilns use improved kiln technology
	Grossly polluting power plants been shut and thermal power plants converted to gas based	Grossly polluting power plants been shut and thermal power plants converted to gas based	Grossly polluting power plants been shut and thermal power plants converted to gas based	Grossly polluting power plants been shut and thermal power plants converted to gas based	Grossly polluting power plants been shut and thermal power plants converted to gas based
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

Impact on air quality

In order to close the loop on air quality management, it is important for a city to produce tangible and measurable impacts from the measures it adopts for mitigation. And here it connects back to the city’s ability to measure and record air pollutant concentrations as well as the sources that contribute to them. Thus, this aspect of air quality management can be divided into three factors:

- Air pollutant concentrations
- Emission sources
- Promotion of sustainable practices
- Air pollutant concentrations

The most direct and desirable impact of air quality management is the reduction in air pollutant concentrations. A gradual reduction in the concentration levels is expected as cities try to move to higher stages with the last stage having air pollutant concentrations below those prescribed by WHO (wherever applicable). The indicators selected to represent this factor have been shown stage-wise in Figure 19. For each stage, those indicators shown in red indicate that they are mandatory to be met in order to qualify for that particular stage, while those in orange indicate that they are desirable to be met for that particular stage.

Table 15: Indicators for “air pollutant concentrations”

Air Pollutant Concentrations (Annual Mean from last FY except for CO)	Moderate / Low / WHO – values of Benzene/VOCs	Moderate / Low / WHO – values of Benzene/VOCs	Moderate / Low / WHO – values of Benzene/VOCs	Low values of Benzene/VOCs	WHO values of Benzene/VOCs
	Moderate / Low / WHO – values of Benzo - a - pyrene	Moderate / Low / WHO – values of Benzo - a - pyrene	Moderate / Low / WHO – values of Benzo - a - pyrene	Low values of Benzo - a - pyrene	WHO values of Benzo - a - pyrene
	Moderate / Low / WHO – values of O3	Moderate / Low / WHO - values of O3	Moderate / Low / WHO - values of O3	Moderate / Low / WHO - values of O3	Moderate / Low / WHO - values of O3
	Moderate / Low / WHO - values of NO2	Moderate / Low / WHO - values of NO2	Moderate / Low / WHO - values of NO2	Low values of NO2	WHO values of NO2
	Moderate / Low / WHO - values of CO	Moderate / Low / WHO - values of CO	Moderate / Low / WHO - values of CO	Low values of CO	WHO values of SO2
	Moderate / Low / WHO - values of SO2	Moderate / Low / WHO - values of SO2	Moderate / Low / WHO - values of SO2	Low values of SO2	WHO values of SO2
	Moderate / Low / WHO - values of PM10	Moderate / Low / WHO - values of PM10	Moderate / Low / WHO - values of PM10	Low values of PM10	WHO values of PM10
	Moderate / Low / WHO - values of PM2.5	Moderate / Low / WHO - values of PM2.5	Moderate / Low / WHO - values of PM2.5	Low values of PM2.5	WHO values of PM2.5
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

Table 16: Pollutant concentration levels - Values corresponding to “moderate/ low / WHO” values of various air pollutant concentrations

Pollutant	Critical	High	Moderate	Low	WHO
a NO ₂	60+	41 to 60	21 to 40*	Less than 20	Not Applicable
b SO ₂	75+	51 to 75	26 to 50*	Less than 25	Not Applicable
c PM10	90+	61 to 90	31 to 60*	Less than 30	Less than 20
d PM2.5	60+	41 to 60	21 to 40*	Less than 20	Less than 10
e O3	+50% of days in a year exceeding the 8-hr avg standard	25 to 50% of days in a year exceeding the 8-hr avg standard	15 to 25 % of days in a year exceeding the 8-hr avg standard	Less than 15 % days in a year exceeding the 8-hr avg standard	Less than 15 % days in a year exceeding the 8-hr avg standard
f CO	+50% of days in a year exceeding the 8-hr avg standard	25 to 50% of days in a year exceeding the 8-hr avg standard	15 to 25 % of days in a year exceeding the 8-hr avg standard	Less than 15 % days in a year exceeding the 8-hr avg standard	Less than 15 % days in a year exceeding the 8-hr avg standard
g Benzene/ VOCs	7.5	5.1 to 7.5	2.6 to 5*	Less than 2.5	Not Applicable
h Benzo - a - pyrene	1.5	1.1 to 1.5	0.6 to 1*	Less than 0.5	Not Applicable

Emission sources

Two indicators have been selected to reflect a tangible effect of mitigation initiatives as shown in Figure 20. These pertain to sales of 2-Wheelers and Diesel cars and the cities are expected to record an impact in terms of a decrease in either direct quantum of sales or the annual growth in sales as shown in Figure 20.

Promotion of sustainable practices

In order to monitor the implementation of various steps taken to promote a more sustainable behavior from users in the city, a set of indicators have been selected as shown in Figure 21. These pertain to growth in public transport ridership and growth in infrastructure for cyclists and pedestrians and cities are expected to achieve higher targets along these indicators as they move from Stage 1 towards 5.

Table 17: Indicators for “emission sources”

Stage	Indicator 1: Diesel car sales	Indicator 2: Annual growth rate of 2W sales
STAGE I	Diesel car sales for last FY lower than the previous FY	Annual growth rate of 2W sales for last FY lower than the previous FY
STAGE II	Diesel car sales for last FY lowest in past 3 FY	Annual growth rate of 2W sales for last FY lowest in past 3 FY
STAGE III	Diesel car sales for last FY lowest in past 5 FY	Annual growth rate of 2W sales for last FY lowest in past 5 FY
STAGE IV	Diesel car sales for last FY lowest in past 10 FY	Annual growth rate of 2W sales for last FY lowest in past 10 FY
STAGE V	Diesel car sales for last FY lowest in past 15 FY	Annual growth rate of 2W sales for last FY lowest in past 15 FY

Table 18: Indicators for “promotion of sustainable practices”

Promotion of sustainable practices	0 to 20 kms of footpath built / contract tendered in last FY	21 to 50 kms of footpath built / contract tendered in last FY	51 to 100 kms of footpath built / contract tendered in last FY	101 to 200 kms of footpath built / contract tendered in last FY	> 200 kms of footpath built / contract tendered in last FY
	0 to 5 traffic intersections for which safe pedestrian crossings were created / project tendered in last FY	6 to 10 traffic intersections for which safe pedestrian crossings were created / project tendered in last FY	11 to 20 traffic intersections for which safe pedestrian crossings were created / project tendered in last FY	21 to 30 traffic intersections for which safe pedestrian crossings were created / project tendered in last FY	> 30 traffic intersections for which safe pedestrian crossings were created / project tendered in last FY
	0 to 10 kms of bicycle lane created in last FY	11 to 20 kms of bicycle lane created in last FY	21 to 50 kms of bicycle lane created in last FY	51 to 100 kms of bicycle lane created in last FY	> 100 kms of bicycle lane created in last FY
	< 1 - Ratio of increase in public transport ridership to average annual growth of population during last FY	1 to 1.2 - Ratio of increase in public transport ridership to average annual growth of population during last FY	1.2 to 1.5 - Ratio of increase in public transport ridership to average annual growth of population during last FY	1.5 to 2.0 - Ratio of increase in public transport ridership to average annual growth of population during last FY	> 2 - Ratio of increase in public transport ridership to average annual growth of population during last FY
	STAGE I	STAGE II	STAGE III	STAGE IV	STAGE V

SECTION II: City action assessment: The learning curve

This is a rapid and diagnostic assessment of clean air action in top 10 populous cities – Delhi, Chennai, Bengaluru, Hyderabad, Mumbai, Pune, Ahmedabad, Kolkata and Lucknow, Jaipur. These cities represent about a quarter of urban population. Based on the indicators of the clean air tool that are related to air quality governance and compliance, available evidences and data for 10 cities have been assessed to establish base line and gaps in action in each city. Evidences have been assessed for air quality monitoring and planning, pollution source and health assessment; clean air action plan to address vehicles technology and fuels; public transport, walk and cycle, restraint on cars; industrial/ power plant sources; and dust control in construction and trash burning. However, this report has carried out relatively more detailed analysis of the vehicle and transport sector. Issues in other sectors have also been highlighted. But analysis is limited as information on air pollution action in several sectors especially sources of dust, waste burning and industrial and other area sources in cities is very limited.

This has broadly indicated the stages of progress in different sectors of interventions. It is clear, that as air quality management has not matured equally across sectors and cities, progressive action is not uniform. Cities may have done well in one sector while languishing in others.

National action on emissions standards are common to all and part of stage I development – unless proactive demand from states to improve. Data and information are not equally robust or exhaustive for all sectors. This creates bias in detailing. Data bases are not always directly comparable across cities. Benchmarking of stages puts great expectations on cities. This helps to understand direction of change in cities.

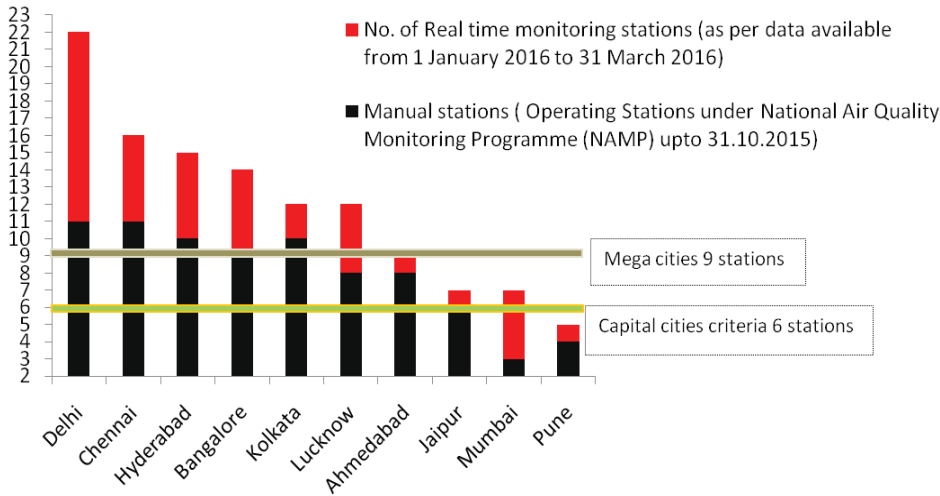
Here are a few highlights of the direction of change in cities that samples some of the progressive steps along the line of the clean air tool.

Air quality monitoring

All cities have a combination of manual and real time monitoring. According to the established protocol for monitoring of the Central Pollution Control Board, capital cities need to have 6 monitoring stations each and the mega cities about nine stations each. Delhi has maximum number of monitoring stations, followed by Chennai, Hyderabad and Bengaluru. The mega cities of Delhi, Chennai, Hyderabad, and Kolkata comply with this criterion, but not Mumbai. Both Delhi and Hyderabad have equal number of online realtime monitors. Capital cities of Ahmedabad and Jaipur also comply with this requirement (see Graph 1: Share of manual and real time stations).

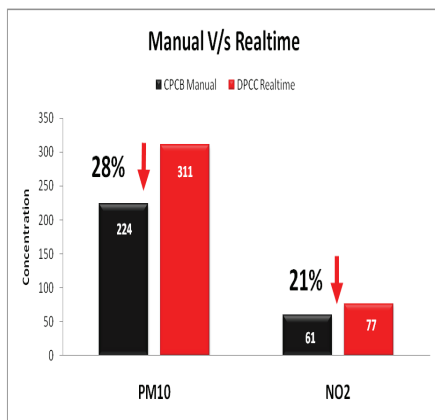
The monitoring grid needs to be designed to assess population exposures across the city, inform public about air quality, assess non-compliance status of cities, map out pollution hotspots and protect vulnerable eco system. Further expansion of the monitoring grid in these cities will certainly help to assess risk. In fact, cities in developed regions of the world have much higher density of monitors. But at this stage in India, focus on good quality monitoring, quality assurance of monitoring data, and representative values for land-uses and pollutants need to get priority over investments in too many monitors.

Graph 1: Share of manual and real time stations



Manual vs realtime monitoring: However, it may be noted that the cities need to expand real time monitoring as manual monitoring is inefficient and underestimates pollution. Even though overall real time monitoring has expanded across 32 cities, data for 22 cities are reported for daily air quality index. But for the reporting for annual national ambient air quality data the Central Pollution Control Board still reports data under National Ambient Air Quality Monitoring Programme from only manual monitoring. This underestimates pollution compared to real time monitoring. Comparison of data from real time and manual monitors for PM2.5 can be as much as 28 per cent and for NOx about 21 per cent (See Graph 2: Comparison of DPCC and CPCB data PM10 levels).

Graph 2: Comparison of DPCC and CPCB data PM10 levels (Average of 2011-2014)



Source: Centre for Science and Environment

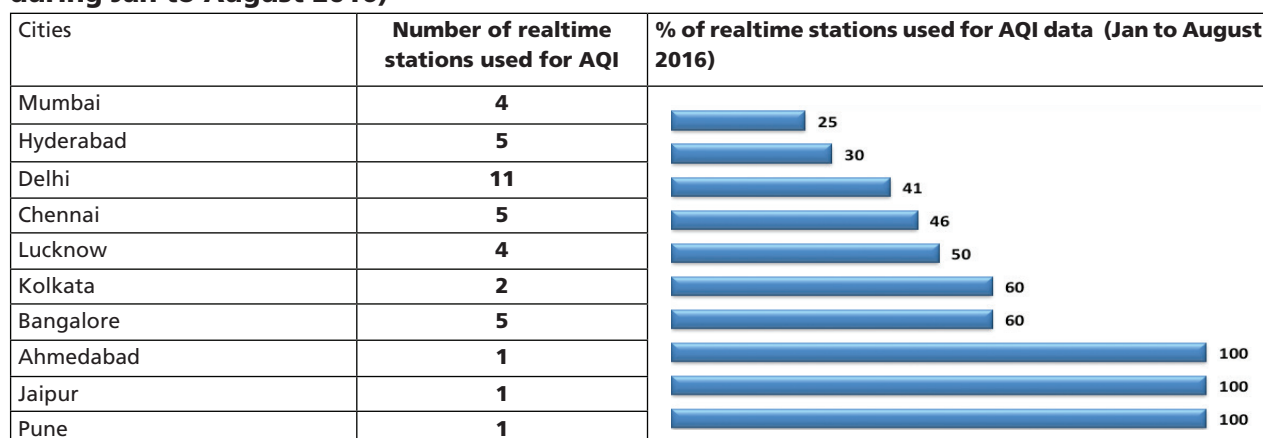
Underutilisation of air quality monitoring capacity

Cities will have to leverage investment in monitoring systems to maximize to inform action. The ten city review shows that not all realtime monitors are being utilized for data and air quality index (AQI) reporting.

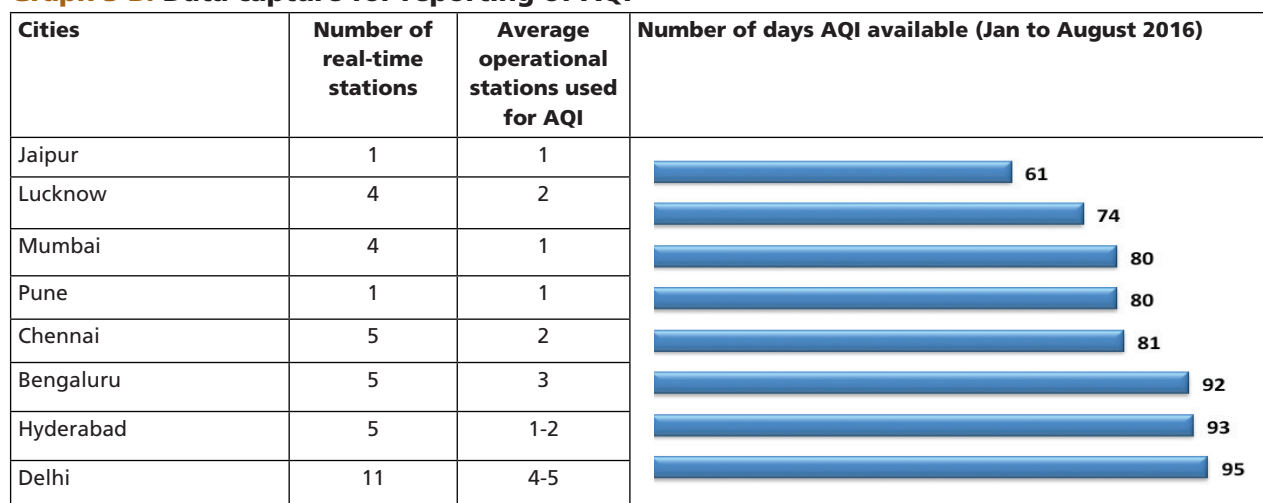
The percentage of real time stations used for AQI data between January and August 2016 was 25 per cent in Mumbai, 30 per cent in Hyderabad, 41 per cent in Delhi, 46 per cent in Chennai, 60 per cent in Kolkata and 50 per cent in Lucknow. The 100 per cent are those that have only one station. Though one may argue that the number of stations is unequal it is still important to underscore that if cities are investing to build capacity for real time monitoring, these should be fully utilized for policy making and action. (see Graph 3: Not all real time monitors utilised for reporting air quality index).

Some cities including Ahmedabad and Chennai, Ahmedabad and Hyderabad have taken the lead in introducing continuous Emissions Monitoring System to track industrial pollution.

Graph 3 A: Not all real time monitors utilised for reporting air quality index (assessed during Jan to August 2016)



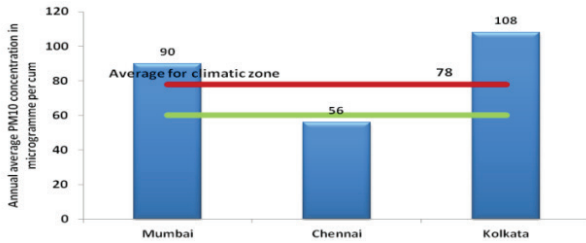
Graph 3 B: Data capture for reporting of AQI



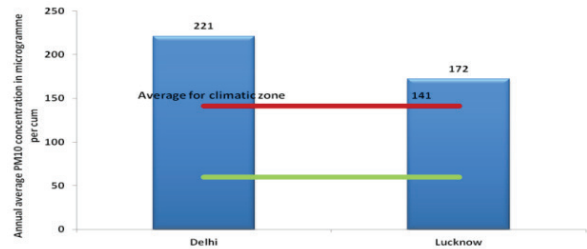
Source: Centre for Science and Environment: Based on data available in CPCB and state websites

Graph 4: Particulate level in selected cities in relation to average for different climatic zones

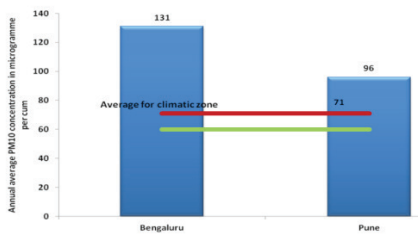
A. Warm and humid



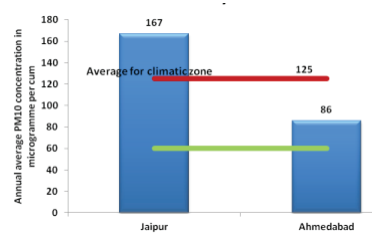
B. Composite (Indo-Gangetic plain)



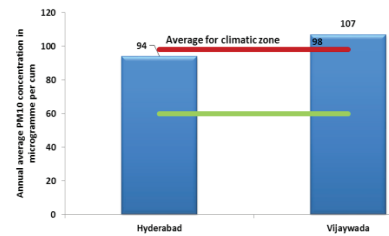
A. Moderate



B. Hot and dry North



C. Hot and dry South



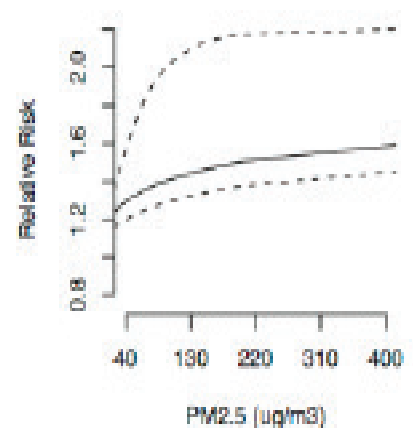
Where do cities stand in terms of air quality?

To begin clean air action plan, cities need to assess the baseline air pollution to set reduction target over time. The ten cities are distributed across different ecosystems and climatic zones – warm and humid climate, composite indo-Gangetic climate, moderate, hot and dry North and South (see Graph 4: Particulate level in selected cities in relation to average for different climatic zones A-E). Local weather patterns and climate do influence overall ambient concentration in different regions of the country. For instance, the land locked northern region with composite climate show higher trapping of pollution compared to the coastal areas that have the advantage of local sea breeze.

The climatic zone-wise analysis shows that Mumbai, Chennai and to some extent Kolkata have lower levels compared to compared to cities in composite and dry climates. But except Chennai the annual average in Mumbai and Kolkata far exceed the average for the climatic zone. Hyderabad and Ahmedabad also have levels a little lower than the average for the climatic zones. Other cities have levels much higher than not only the standards but also the average for the climatic regions.

Southern cities have comparatively lower pollution levels than Northern cities. This often breeds complacency. But such an air quality trend will have to be understood along with the evidences of health impacts. The global burden of disease estimates have shown that most of the health effects occur at much lower levels of particulate pollution – between 30 to 70 microgramme per cum, the levels that are normally seen in coastal region and hot and humid climate. This has been seen particularly in the case of ischemic heart disease. (Graph 5: Integrated Exposure-Response function for Ischemic Heart Disease)

Graph 5: Integrated Exposure-Response function for Ischemic Heart Disease



Source: Global Burden of Disease 2013

Mixed story of air quality gains and losses

All the ten cities show mixed trends over time. Overtime trend analysis shows that in some cities the PM10 levels have reduced to increase once again. These include Delhi, Jaipur, Chennai, Hyderabad, and Bengaluru. Air quality management has taken root in these cities and in response pollution levels have seen intermittent stabilisation. But the levels have worsened once again. This shows that action has to gather speed to sustain air quality gains.

Other cities have been able to stabilise the trend over time. These cities need to ramp up action to reduce pollution levels and meet clean air standards throughout the year. The pollution levels in these cities are exceeding the standard. These include Mumbai, Pune, Lucknow and Ahmedabad.

Only Kolkata shows a declining trend. But this will have to be understood with riders. This is a reflection of changes in location of monitoring stations and also the monitors that are being used for reporting data. (See Graph 6: Trend in PM10 levels in ten cities A-C).

Multi-pollutant crisis

In all the ten cities while particulate pollution remains the major threat, nitrogen dioxide, ozone and toxins are also rising in these cities. Nitrogen dioxide that is monitored more regularly shows its levels are rising in several cities (see Graph 7: Twin trouble: Nitrogen dioxides rising). These include Delhi, Bengaluru, Chennai, Pune and Vijaywada.

Evidence in Delhi also indicates that ozone levels are also a problem with frequent violation of standards especially during summer months. Limited monitoring shows high benzene levels have been reported in Bengaluru. These cities are in grip of multi-pollutant crisis. But such a risk mapping is becoming possible because cities are strengthening monitoring capacity to include more pollutants in the basket.

Setting clean air targets

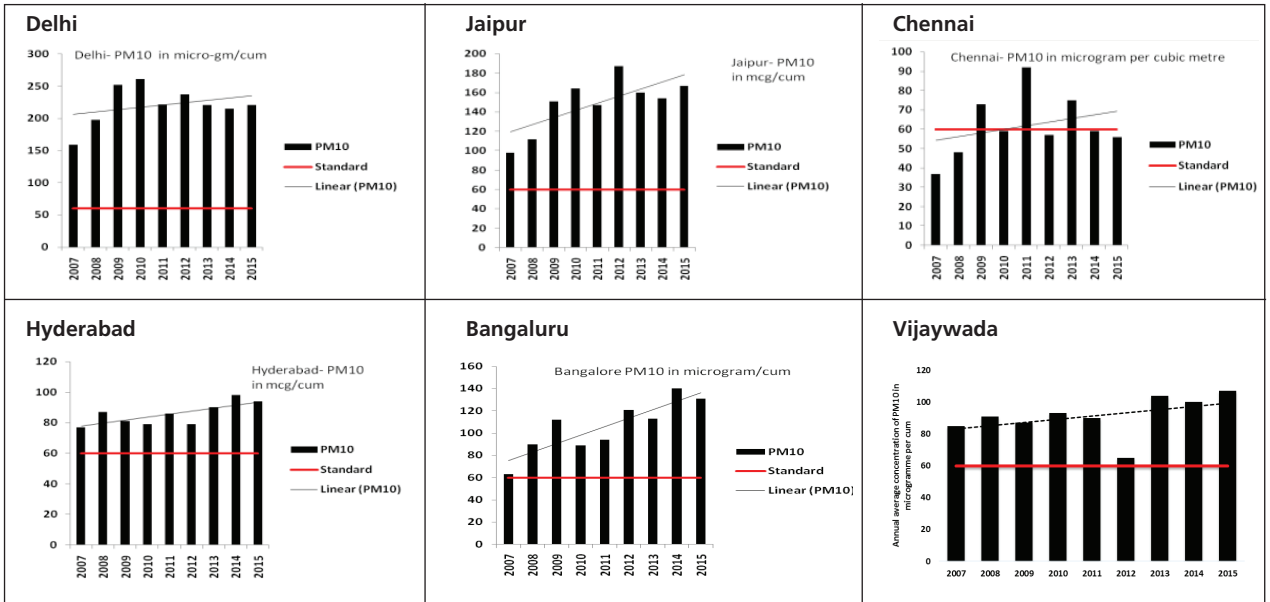
The objective of air quality monitoring and management is to meet clean air benchmark. According to the air quality index of the Central Pollution Control Board good air quality is 50 per cent below the standards. But to be able to achieve these cities need to set their goal posts to meet the standards within a given time frame. The national ambient air quality standards set time variable norms – 24-hourly, eight hourly, or one hourly monitored values for pollutants, and depending on the nature of the pollutants. Pollutants that have immediate impacts within short time horizon have short duration standards. The standards will have to be met for at least 98 per cent of the time in a year. Reduction targets will have to be set for each pollutant.

For this analysis the PM2.5 levels have been analysed for illustration. Currently, the PM2.5 standards in India are much lenient compared to the WHO guidelines. The national annual ambient air quality standard is 60 microgramme per cum as opposed to the WHO guideline of 15 microgramme per cum.

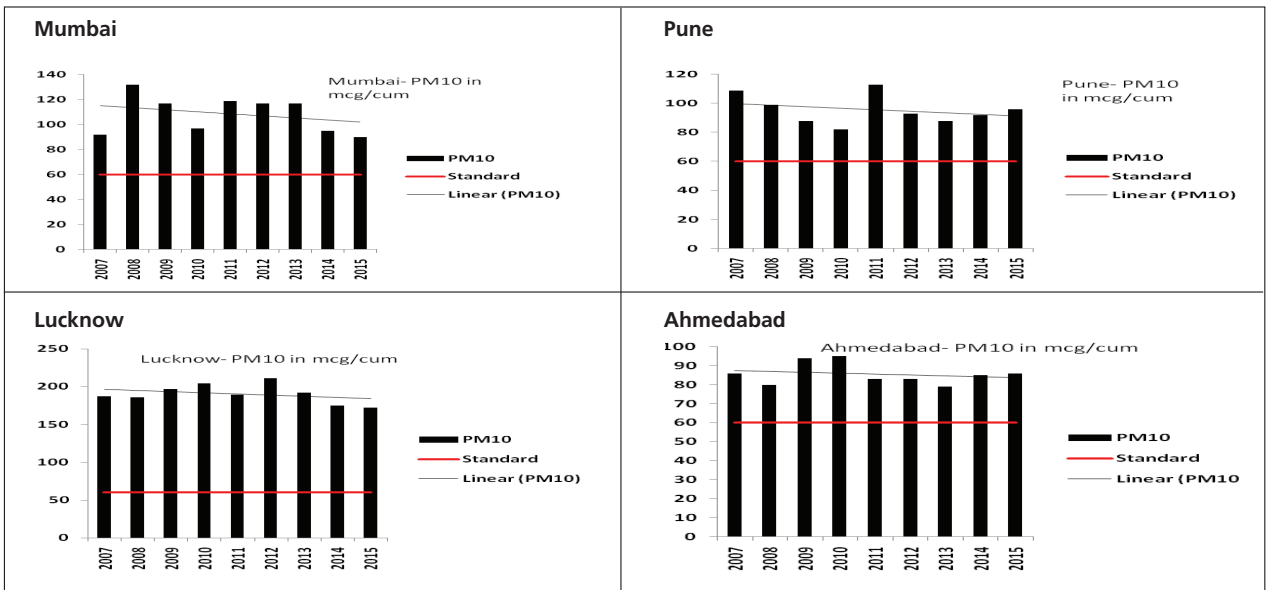
Pollution levels in ten cities indicate kind of reduction in particulate levels that is needed to meet the national annual ambient air quality standard (see Graph 8: Reduction target to meet particulate standard in ten cities A-J). This varies across cities – 30 per cent reduction in Ahmedabad; 54 per cent in Bengaluru; Chennai has to sustain the current level and further lower to the WHO guidelines of; 72 per cent reduction in Delhi; 36 per cent in Hyderabad;

Graph 6: Trend in PM10 levels in ten cities

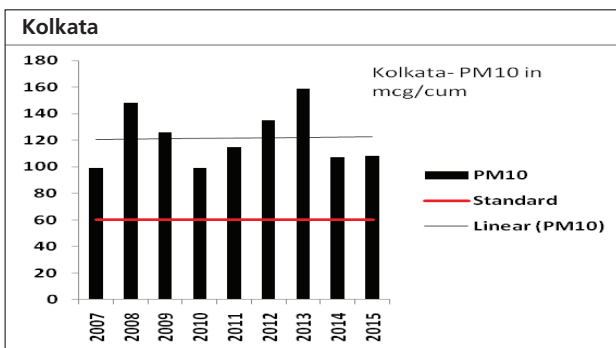
A. Lost gains



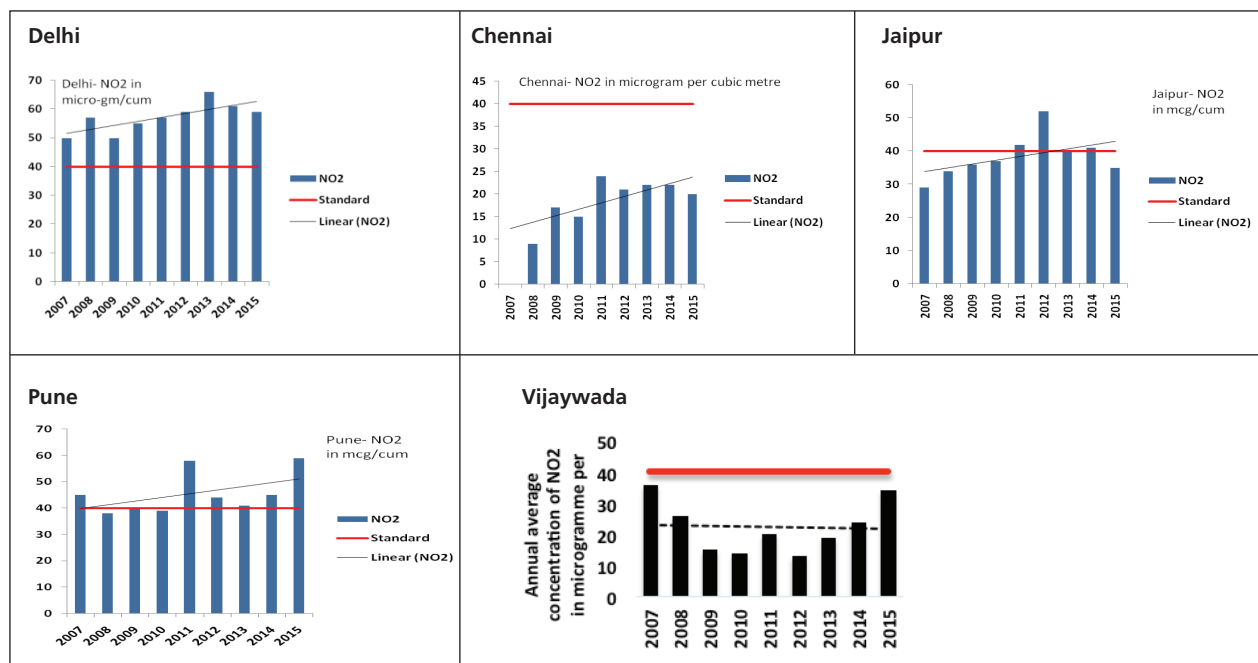
B. Stabilisation but exceeding standards



C. Stable and decline



Graph 7: Twin trouble: Nitrogen dioxides rising



Source: Centre for Science and Environment

44 per cent in Kolkata; 65 per cent in Lucknow; 33 per cent in Mumbai and 37 per cent in Pune.

These cities will have to set time bound reduction targets to meet the clean air standards. Such an exercise is not carried out in cities. However, the 12 Five Year Plan document has however stated that cities should meet clean air targets by 2017. But there is no city level process and mechanism to enable complying with targets. Even though central legislations require central Pollution Control Board to ensure clean air standards are met, there is no clear process and mechanism for compliance at ground level.

Are cities monitoring of impact of action?

Air quality monitoring also needs to get linked with assessment of impact of action taken. Very few cities have made such efforts to demonstrate the change.

The Karnataka State Pollution Control Board has assessed the impact of the monthly bus day scheme that was introduced by the Bangalore Metropolitan Transport Corporation (BMTC) in 2010. Monitoring is carried out on the stretch of Bus day route. (see Table 1: Bangaluru carries out special monitoring to assess impact of “Bus Day”).

Similarly, West Bengal Pollution Control Board has assessed the impact of phase out of old vehicles on PM2.5 in 2009. That shows significant drop in the levels as a result of this intervention. (See Graph 9: Impact of old vehicles on PM2.5 level).

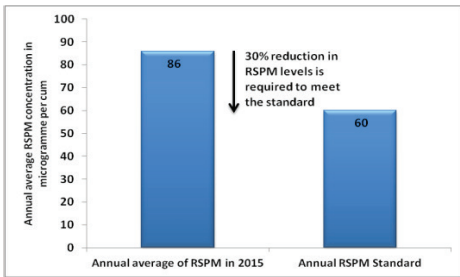
This is the maturity that is needed in air quality governance.

Ability to assess pollution sources

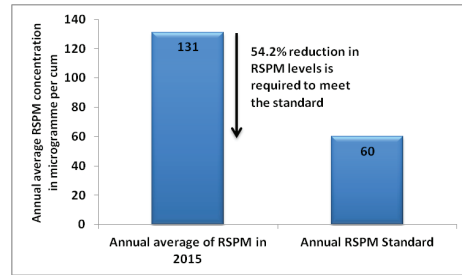
A critical step forward in air quality management is to strengthen capacity to

Graph 8: Reduction target to meet particulate standards in ten cities

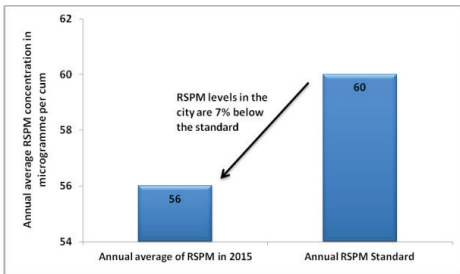
A. Ahmedabad



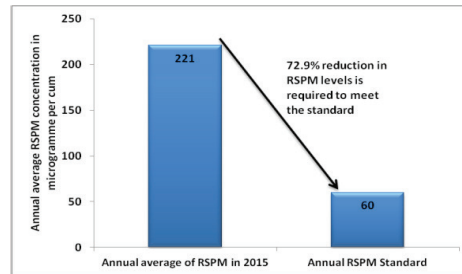
B. Bangalore



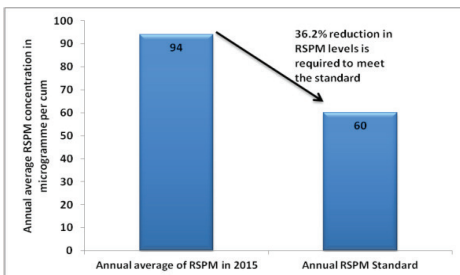
C. Chennai



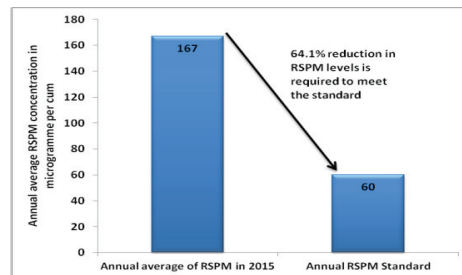
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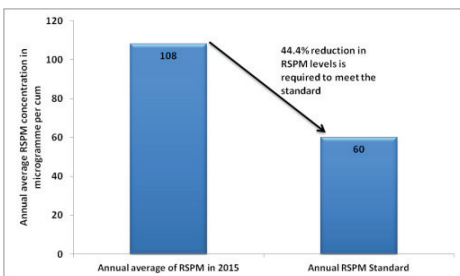
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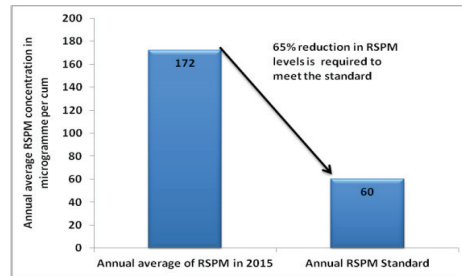
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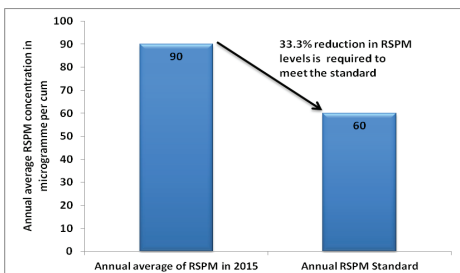
G. Kolkata



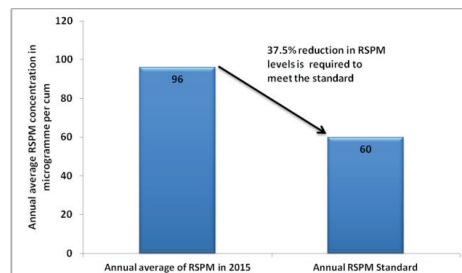
H. Lucknow



I. Mumbai



J. Pune



Source: Centre for Science and Environment – based on data from Central Pollution Control Board

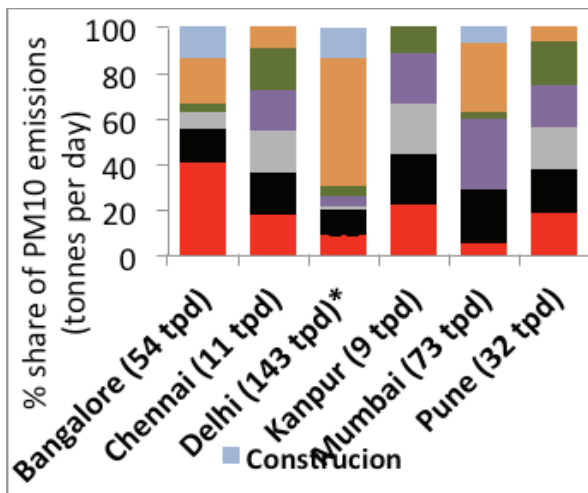
Table 1: Bengaluru carries out special monitoring to assess impact of “Bus Day”

Parameter	Standards	Before Bus Day (1.7.2011)	During Bus Day (4.7.2011)	Percentage decrease	After Bus Day (5.7.2011)	Percentage increase
Sulphur dioxide (microgramme per cum)	80	20.8	19.1	8.2	21.8	4.8
Nitrogen oxide (microgramme per cum)	80	48.4	46.1	4.8	51.5	6.4
PM10	100	111	107	3.6	108	2.7
Carbon monoxide (miligramme per cum)	2	1.7	1.5	11.7	1.5	11.7
Ozone (microgramme per cum)	100	5	4.8	4.0	5.1	2

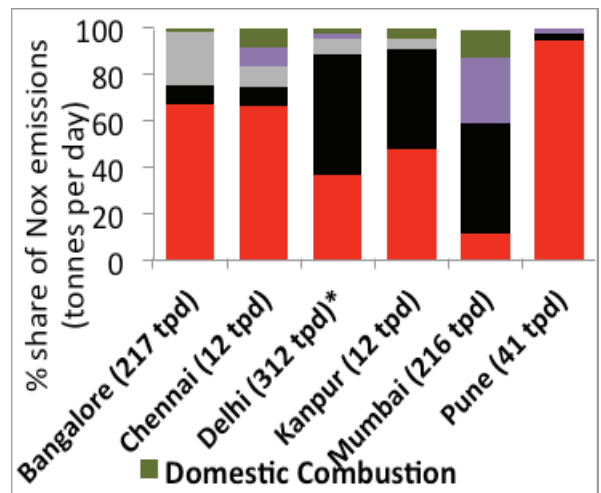
Source: Karnataka State Pollution Control Board

Graph 9 : Pollution source inventory in six cities of India

Sources of Particulate matter (PM10)



Sources of nitrogen dioxide



Source: Final emission inventory study, MOEF, 2011; * the Delhi study is conducted by the IIT Kanpur in 2015

assess the relative contribution of pollution sources, speed with which they are growing and impact of action. This is currently the weakest link in air quality management. So far only one centrally sponsored initiative is known in which source apportionment and inventory were carried out in 2009 in six cities including Delhi, Mumbai, Chennai, Bengaluru, Kanpur, and Pune (see Graph 10: Pollution source inventory in six cities of India). Hyderabad, Kolkata and Jaipur were not included in this study.

But this is not a dynamic process. This was not followed up with more central support for such studies. At the city level only Delhi government had commissioned another source apportionment and inventory study to Indian Institute of Kanpur that was published in 2015. Only this study was able to move some action in Delhi when the findings were submitted to the Supreme Court in October of 2015. That catalysed several measures on different sources of pollution in Delhi including trucks and diesel cars, , construction, waste burning etc. In fact, Delhi is now commissioning the second study to Indian Institute of Technology Madras.

Mumbai is yet another case where Maharashtra State Pollution Control Board has commissioned a study on pollution sources in Delhi. In case of other cities the limited inventory information has not been effective enough to guide action.

Are cities prepared for clean air action plan?

Review of ten cities show that air pollution action has taken roots and have evolved in stages but they are not composite and uneven in progress. Only a few cities under judicial scrutiny have framed clean air action plans and Task Force to monitor them – Delhi, Bengaluru, Hyderabad, Chennai, Lucknow-Kanpur and Ahmedabad. Within the ambit of ongoing public interest litigation in Delhi and National Capital region of Delhi has remained under consistent scrutiny. In case of other cities the Supreme Court in 2004 had directed them to frame action plans to control air pollution. Kolkata was left out as High Court was already listening to air pollution case. This did catalyse the process of action planning with a common minimum programme. Action plan limited in scope and not linked effectively with all sectors of mitigation for effective reduction. But this process in other cities could not maintain the momentum.

This process has advanced to some extent in Delhi where since the time of Commonwealth Games in 2010 several rounds of action planning process have been carried out. In addition to strategy specific decisions from time to time, a comprehensive process was put in place in 2012 when inter-departmental task force was created to develop source-wise action plan. But this process could not be institutionalised. But executive decisions and judicial interventions continued to push the envelope and city is evolving towards a more comprehensive approach of planning for different sources of pollution and monitoring of action.

A great part of it has been pushed by pollution emergency situation during winter. This has helped to align several venues of decision making and monitoring of action. Supreme Court led monitoring of clean air action, policy decisions by the Delhi government. Lt Governor of Delhi has initiated a process of monitoring action. This now needs to evolve towards a more robust and sustained executive process.

Assessment of city action in ten cities has brought out some typical trends in the baseline of action on different sources of pollution. This throws up an important learning curve for cities for the next phase of action.

Action on vehicle technology and fuels

In urban landscape clean air action on vehicles and mobility is the weakest. Even though vehicles are one of the most rapidly growing sources of pollution local action has remained the minimal. Emissions standards for vehicles and fuel quality are common across cities. Even though India follows two level of emissions standards – Bharat Stage IV in some cities and districts and Bharat Stage III in rest of the country. All ten cities follow Bharat Stage IV emissions standard which is therefore part of the common minimum programme. But these are vulnerable to pollution from highway truck traffic that has not moved to Bharat Stage IV yet. Bharat Stage IV emissions standards will be enforced nation-wide only in April 2017. As of April 2016 only 54 per cent of petrol and 51 per cent of diesel was compliant with Bharat Stage IV.

However, it is also important to know that the central government has issued notification to leap directly to Euro VI emissions standards in 2020. This has serious implications for the implementation and compliance strategies at city

level. Bharat Stage VI will bring in new genre of technology and fuel that will be subjected to a new compliance regime for the first time in the country.

For the first time monitoring of real world emissions with portable monitoring system along with in-service compliance regulations will be implemented to keep an eye on real world emissions. Real driving emissions (RDE) testing will be included as an additional requirement for vehicle certification. Emissions measurements will be carried out with the help of Portable Emission Measurement System (PEMS) and onwards in-service conformity factor will be applied to ensure that emissions from vehicles remain within the stated margin. This can prevent emissions cheating and use of sub standards emissions control or defeat devices as was done by Volkswagen. However, adoption of more advanced on-board diagnostic system has been delayed until 2023.

Cities will have to develop a compliance programme to integrate these emissions control approaches.

Action on diesel emissions

Growing use of diesel in transport sector especially in personal vehicle segment has been a cause of worry as poor quality of diesel fuel and technology enhance toxic risk in cities. Diesel emissions are class 1 carcinogen for its strong link with lung cancer. Moreover, emissions standards allow diesel cars are legally allowed to emit more particulate matter and nitrogen oxides. Studies have established that particulate emission from diesel combustion is more harmful. In view of this growing dieselization of cars and increased influx of commercial vehicles and trucks in cities is enhancing public health risk. Only at Bharat Stage VI that will be implemented in 2020 will witness narrowing down of gap between petrol and diesel emissions.

Only in Delhi, interventions from judiciary and strong public campaign have accelerated action on diesel emissions. Way back in 2005 the Supreme Court had directed bypassing trucks that have no business in Delhi. Since October 2015, environment compensation charge (ECC) has been slapped on each diesel truck that enters Delhi. The numbers dropped by close to half after its introduction. ECC revenue now goes to clean air fund. Moreover, entry of pre-2006 trucks has been banned. This opens up opportunity for improving freight modal share for railways.

Ultimatum has been issued to phase out all diesel taxis not only in Delhi but also in national capital region of Delhi (NCR). Even those operating under All India Tourist Permit are not allowed to do point to point service in Delhi and NCR.

Action is not limited to trucks and taxis alone. Supreme Court has also imposed pollution 1 per cent cess on 2000 cc diesel passenger cars. Delhi thus takes the lead in operationalising polluter pay principle to tax the dirty. In the meantime, National Green Tribunal has banned 10 year old diesel vehicles including cars in Delhi and NCR. The phase out process has started. Delhi transport department is in the process of identifying these vehicles for scrapping.

Bangaluru has restricted old, polluting vehicles and does not let them into the city. It has restricted two-stroke vehicles.

Kolkata is yet another city where a massive operation was launched a few years

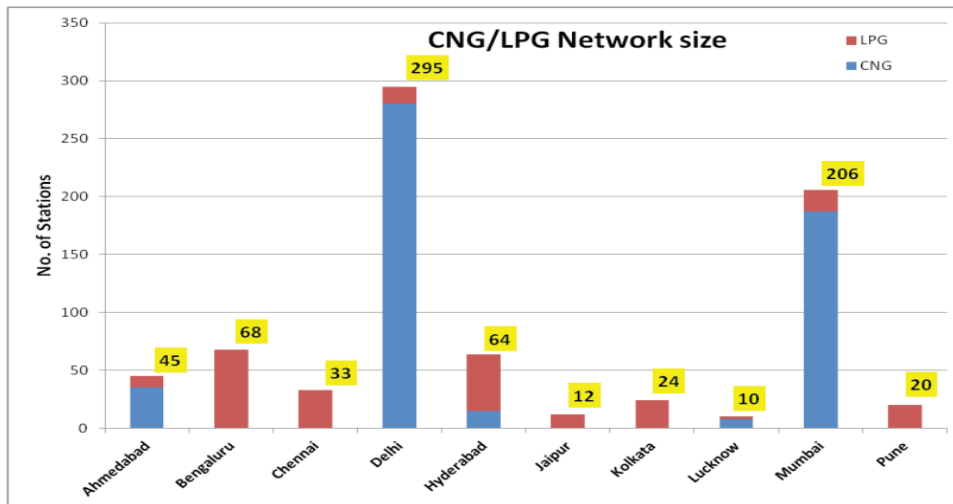
ago to weed out old commercial vehicles that have had appreciable impact on pollution level in the city.

Fuel substitution programme

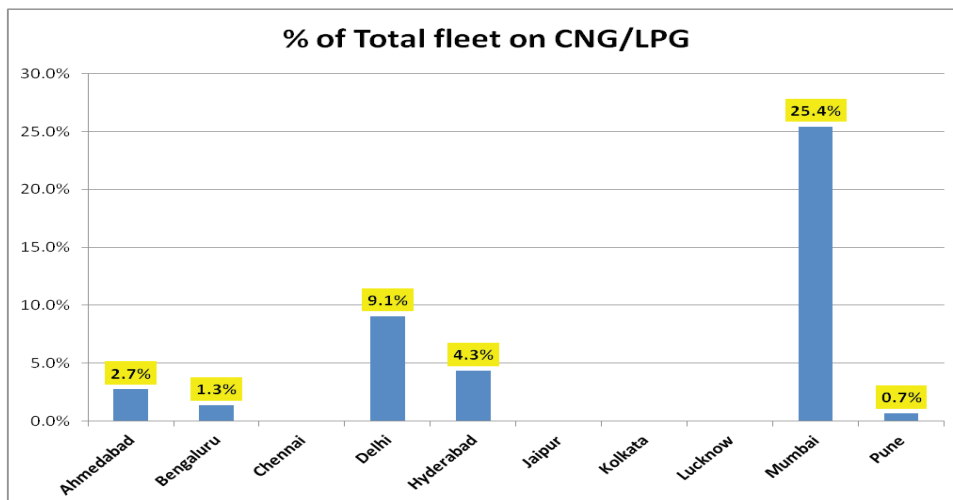
To overcome the problem of high pollution from diesel vehicles and two-stroke powered autorickshaws several among the ten cities have adopted fuel substitution strategy. Delhi, Mumbai followed by Lucknow and Hyderabad have implemented natural gas vehicle programme. Bengaluru, Chennai and also Hyderabad have implemented LPG programme for smaller vehicles

Delhi and Mumbai have taken the lead in establishing the largest natural gas vehicle fleet and network of refuelling stations (see Graph 11: Refuelling network for alternative fuels – CNG and LPG). All buses, local taxis and autos are on CNG in Delhi. Mumbai that has a programme even older than Delhi has large CNG bus and taxi fleet as well as large private vehicle fleet. The percentage share is highest in Mumbai – as much as 25 per cent (see Graph 12: Percentage fleet on CNG/LPG in ten cities).

Graph 10: Refuelling network for alternative fuels – CNG and LPG



Graph 11: Percentage fleet on CNG/LPG in ten cities



Management of in-use emissions

The common minimum and most basic action in this segment is the pollution under control (PUC) certificate that is extremely vulnerable to corruption and cheating. That makes this programme very ineffectual. All the ten cities have implemented the new PUC norms for the Bharat Stage IV compliant vehicles.

Delhi has taken the lead in advancing the emissions testing for petrol vehicles by introducing Lamda test that is needed to ensure that the conditions needed in the car for the optimum functioning of catalytic converters are in place.

West Bengal Pollution Control Board (WBPCB) and Transport Dept conduct joint inspections of the PUC Centres at the time of renewal of licenses by transport authorities. WBPCB sends its recommendations to the competent authorities for consideration of renewal of license of PUC Centres, on merit. WBPCB independently inspects PUC Centres in case new application is forwarded by the Transport Department.

Several cities including Delhi, Hyderabad, and Bangaluru have networked the PUC centres with central servers for automatic data transfer and minimise manual interference. However, these are not used for auditing of the system. None of these cities have taken steps to integrate on-board-diagnostic system with vehicle inspection programme.

Sign post on vehicle technology and fuel quality

Assessment of city level action on vehicle technology and fuels bear out that the emissions standards are top down and decided by the central government. Therefore, it is part of the common minimum programme. There is no bottom up pressure in cities to push the road map.

Fuel substitution strategy – CNG and LPG – have gathered momentum in cities and it is currently limited by the availability of the fuels in respective cities. CNG has allowed expansion of the programme to include both small and big vehicles, but LPG programme is largely confined to smaller vehicles of taxis and autos. This has helped to control diesel emissions especially from the bus and commercial vehicles and also emissions from two-stroke engines that empower three-wheelers.

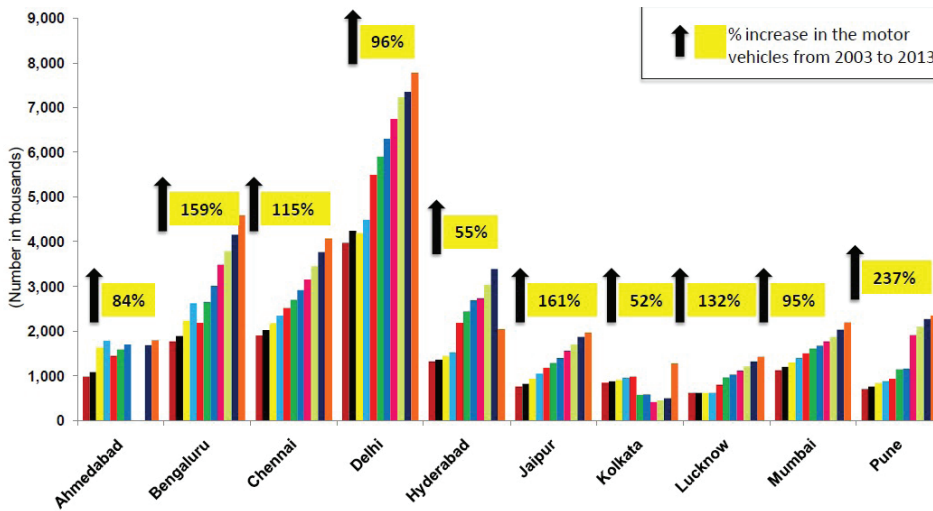
Most cities have found it difficult to control diesel cars. Strong public opinion and judicial interventions in Delhi and NCR have accelerated some action.

Most cities have adopted the strategies to regulate age of vehicles to control in-use emissions.

Vehicle inspection programme has remained the weakest programme in all cities. Corruption and cheating have undermined this programme. But there is no step forward to innovate and upgrade this regime.

Overall local action on vehicles in cities remains weak as the environmental authorities have no clear role in mitigating pollution from vehicles. As seen earlier in the legal section, even though action on vehicular pollution is possible under the Air Act and Environment Protection Act there is no convention by which environment authorities can take action on vehicular pollution which otherwise gets regulated under the Central Motor Vehicles Act. This weakens environmental action on vehicles which is the most rapidly growing source of pollution in cities.

Graph 12: Explosive vehicle numbers – Percentage increase in the motor vehicles from 2003 to 2013



Source: 2015, Ministry of Road Transport and Highways, Government of India

Reinventing mobility for clean air action

Action on mobility for clean air is a critical strategy to address air pollution but most difficult to track in cities. Rapid review of policy deliberation on air pollution control by the air quality regulators who at state level are primarily the state pollution control boards and department of environment barely include mobility strategies. What exists is more by default or at best a cursory reference to a generic strategy of improving public transportation.

The checklist of action drawn up by the agencies from time to time or their advisories to state governments are not explicitly nuanced or detailed for mobility action. In fact, discussion with the air quality regulators reveals very poor understanding of the range of interventions that are needed to reduce the total vehicle miles travelled with public transport, walking and cycling strategies as well as with restraint measures like parking and taxation.

As a result, in most cases mobility action in cities is very poor or is taking shape in isolation without a deliberate linkage with air pollution control. The organic link is not made. This also makes collection of data and information challenging. The air quality regulators do not source this information to track change in vehicular pollution.

It is therefore expected that the tool for planning and tracking action will help to facilitate the convergence as this clearly outlines the key intervention points that should be made a deliberate part of the clean air action plan.

Yet another barrier is the absence of state level of urban transport policy and legal back up to mobility action that slows down action considerably. Even though the city level Master Plan that are notified under an Act are expected to make explicit provision for mobility strategies are seldom revised to reflect the guiding principles or norms for urban and transportation design and strategies that can ensure compact city development and people friendly transport infrastructure.

How travel modes influence air quality in cities?

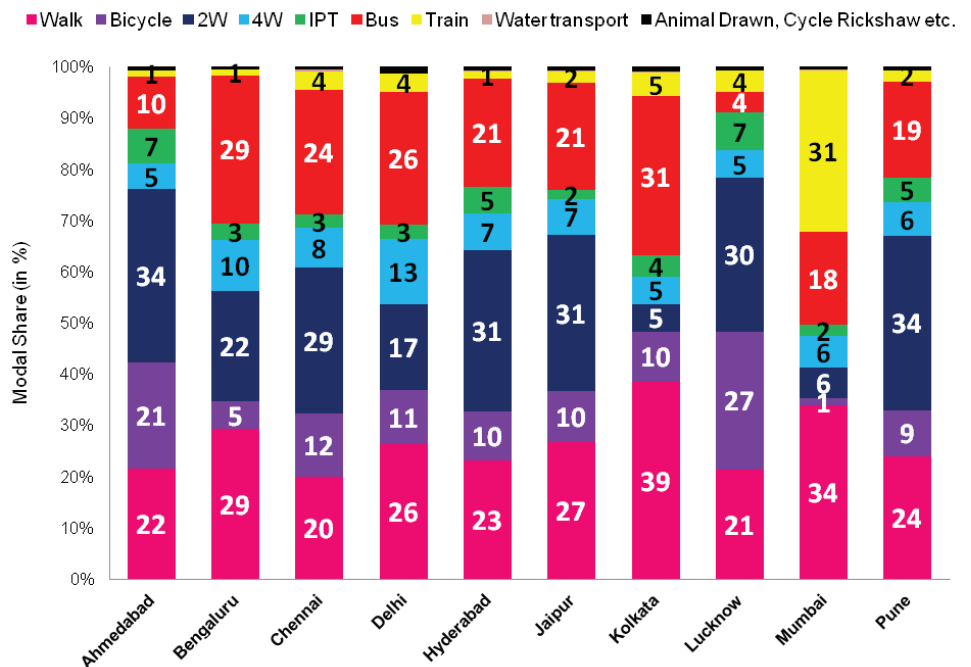
All the ten cities under study are experiencing explosive motorization largely due to growing dependence on personal vehicles – cars and two-wheelers. (Graph 12: Explosive vehicle numbers). Cars and two wheelers occupy maximum road space, carry much less people and emit more per person. They edge out sustainable modes and incur huge social and health cost. On the contrary, walking and cycling are zero emissions modes. Bus, metro, train etc carry more people but emit less per person. Auto and taxis are high frequency-low occupancy vehicles for connectivity.

The available data also shows that despite the growing dependence on personal vehicles, the majority in these cities still walk, cycle and use public transport (see Graph 13: How people travel in ten cities?). Share of cars varies between 4 to 10 per cent. Use of two-wheelers is more substantial and range between 17 to 30 per cent across these ten cities. Most people are too poor to even use public transport. Despite the expanding sprawl, most of these cities have inherited compact urban form that helps to keep distances short.

There is however very poor awareness among the air quality regulators about the merit of protecting this advantage of the current base line as an air pollution control measures. Data on modal share is not collected for tracking action either for congestion or pollution reduction.

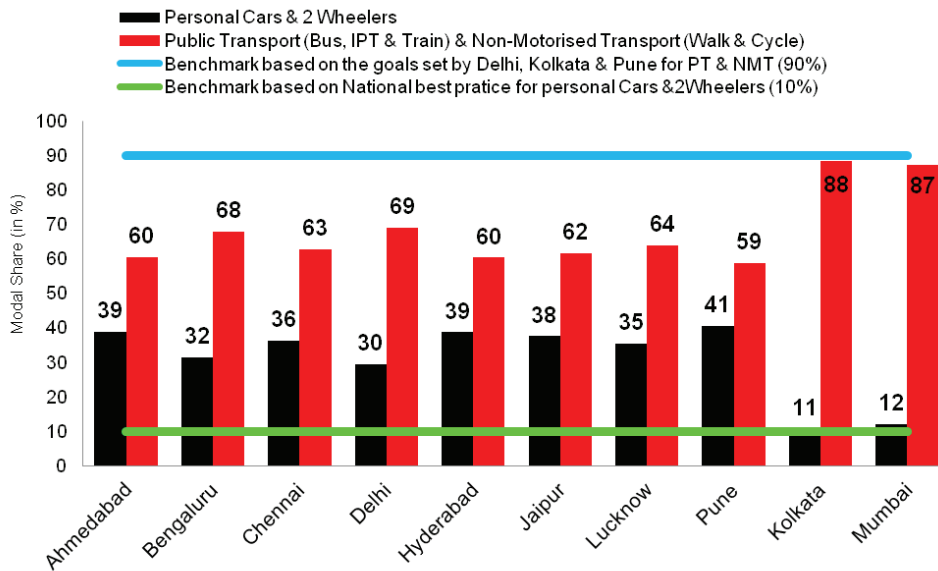
The 2011 census is the only source of data on modal share in cities. This shows that all the ten cities already have good baseline (see Graph 14: Clean air action plan to protect and improve public transport walk and cycling share). This in fact helps to establish an ambitious goal post for further improvement as a critical strategy to control air pollution. Majority among the ten cities have public transport, walking and cycling share between 60-88 per cent. Kolkata

Graph 13: How people travel in ten cities?



Source: 2011, Census of India

Graph 14: Clean air action plan to protect and improve public transport, walk and cycling share



Source: Census of India

and Mumbai are the leaders with one of the best global baseline at 88-87 per cent respectively. Share of personal vehicles is less than 10 per cent. With such baseline the cities should aspire for 90 per cent modal share for public transport to make it a game changer. In fact, the city mobility plans and Master Plan of Kolkata, Pune and Delhi, as the case may be, have set a target of 90 per cent.

Action on buses

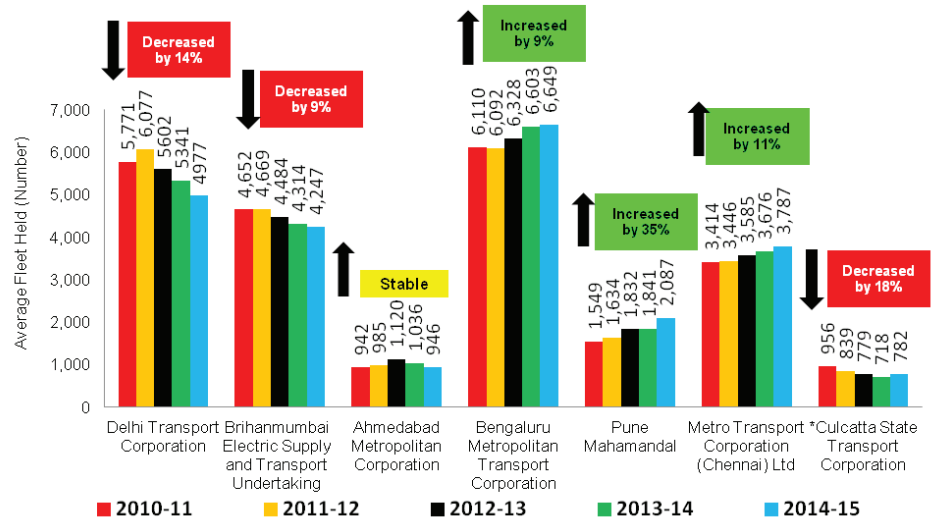
Buses are critical as spine of city mobility – 40-60 per cent of daily trips. These allow greater flexibility to allow more efficient geographical coverage and score high on space efficiency. Buses move people in most cost-effective way and emit a lot less per person.

Yet most cities have Inadequate and unreliable services, poor fleet utilisation, under-utilisation of passenger carrying capacity, no route rationalisation and poor geographical and population coverage, operated kilometer are much less than scheduled kilometer and no dedicated right of way for buses.

Bus numbers of the state transport corporations are extremely inadequate and dwindling over time. (Graph 14: Trend in bus fleet in ten cities (2010-2015)). According to the bus transport guidelines of the Ministry of Urban Development framed with support from Asian Development Bank states that a city should ideally have at least 60 buses per lakh of population. Estimating this number for cities is extremely difficult as in most cities public transport buses are operated by both state owned city transport corporations and private agencies.

While state owned agencies put out basic operational and financial statistics there is no information on private agencies. Cities like Mumbai, Bengaluru, Chennai have only state owned agencies to run buses. But others have a hybrid system. This makes tracking of bus transport performance extremely difficult. Available data in public domain shows that Jaipur, Lucknow and Ahmedabad have very few buses per lakh population which is about 13, 9, and

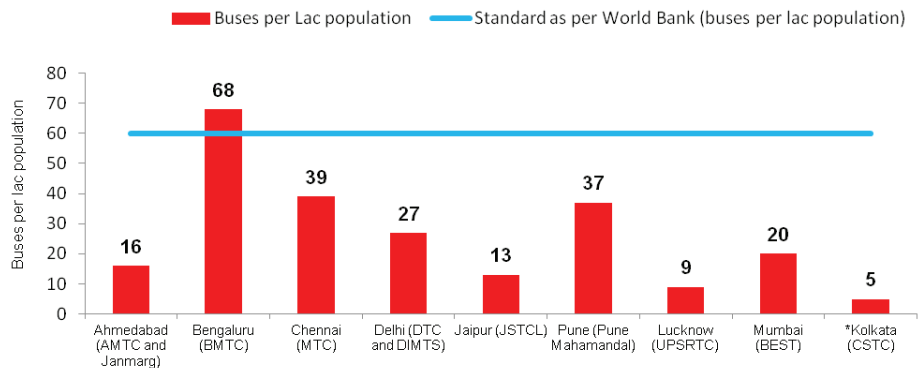
Graph 15: Trend in bus fleet in ten cities (2010-2015)



*Note: Data for Kolkata is only for one corporation among the five corporations that existed earlier. This does not reflect the total fleet in the city. This represents only the 10 per cent of the total buses

Source: Review of the performance of state road transport undertakings (Passenger Services) for April, 2014-March, 2015, MoRTH, GoI

Graph 16: How many buses per lakh of population?



Source: State Transport Corporations

16 respectively. Delhi with such large population has only 27 buses per lakh of population. Bengaluru has the best with 68 buses per lakh of population. Chennai and Pune have 39 and 37 buses respectively (see Graph 15: How many buses per lakh of population?)

Any clean air action plan should be able to push for and demonstrate substantial improvement in key operational parameters that include fleet utilisation; passenger carrying capacity; route rationalisation for efficient geographical and population coverage; increase in operated kilometer; bus lanes and dedicated right of way, and passenger information and ITS application

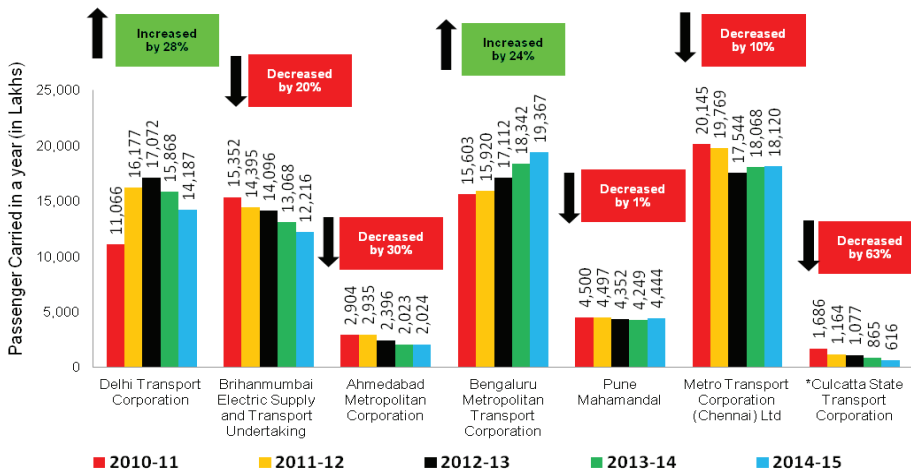
These reforms are needed so that bus service can be provided at a peak hour frequency of 3 minutes during peak hour and 5-7 minutes during non -peak hour. Buses should be able to serves entire population effectively and use advanced passenger information system for reliable services, quality service,

dedicated right of way, integration with other modes, remains affordable and runs on clean fuels.

In the absence of data for private bus agencies it is only possible to compare and assess the performance of the city transport corporations. This only gives a partial picture. Passenger carried by these agencies is steadily declining over time. Among all the ten cities only Bangalore Metropolitan Transport Corporation (BMTTC) has recorded increase in passenger carried over time. Delhi shows a mixed trend – initially an improvement and subsequent decline. Pune shows stable trend. But the rest shows steady decline (see Graph 16: Trend in passengers carried by city bus services (2010-2015)).

In fact, most bus operations are under utilizing their capacity to carry passengers. Bus fleet utilization varies across cities. Bangaluru is the highest with 90 per cent. Most operate between 76 to 86 per cent (see Graph 17: Bus fleet utilisation in ten cities).

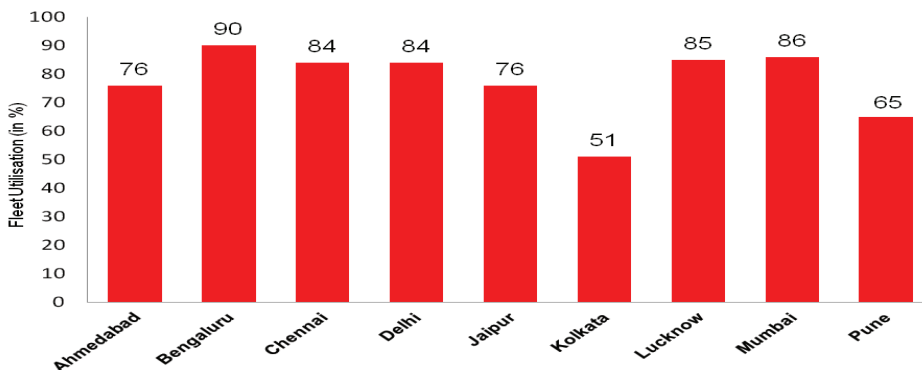
Graph 17: Trend in passengers carried by city bus services (2010-2015)



*Note: Data for Kolkata is only for one corporation among the five corporations that existed earlier. This does not reflect the total fleet in the city. This represents only the 10 per cent of the total buses

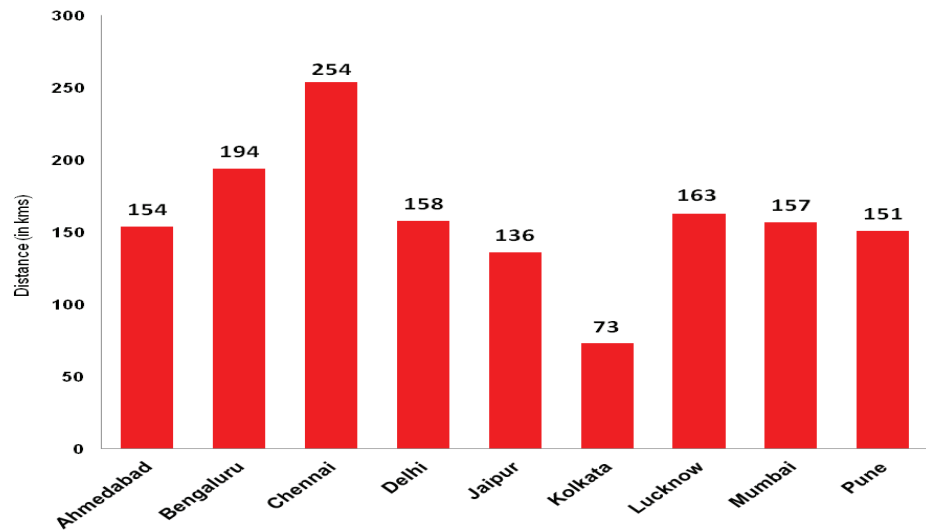
Source: Review of the performance of state road transport undertakings (Passenger Services) for April, 2014-March, 2015, MoRTH, GoI

Graph 18: Bus fleet utilisation in ten cities



Source: Review of the performance of state road transport undertakings (Passenger Services) for April, 2014-March, 2015, MoRTH, GoI

Graph 19: Distance travelled by buses per day



Source: Review of the performance of state road transport undertakings (Passenger Services) for April, 2014-March, 2015, MoRTH, GoI

There is also variance in the average distance traveled by buses in different cities. This also has bearing on the passenger carrying capacity of the bus system. The size of the city will also influence this parameter. The highest kilometer is clocked in Chennai at 254 kilometers followed by Bengaluru at 194 kilometers. The rest operate between 151—163 kilometers (see Graph 18: Distance travelled by buses per day).

Weak link between mobility interventions and clean air action

The basic review of bus transport in ten cities shows that in most cases the incremental changes that have been noticed in the bus sector have no explicit link with the clean air action. These are largely driven by the autonomous policies of the sector or catalysed by the central government funding under specific programmes like Jawaharlal Nehru National Urban Renewal Mission that is tied to the national urban transport policy. Evidence of such link is evident in Delhi and Bengaluru and on a limited scale in few other cities only in the matter of gaseous fuel programme for buses.

Bus transport in Delhi is to a great extent driven by the clean air action catalysed by the Supreme Court. It started initially with the 1998 Supreme court order when it had not only asked all buses to run on CNG but it had also asked the government to augment the bus fleet to 10,000. The second push came towards the end of the last decade when the Supreme Court had directed the Delhi government to submit its action plan to augment public transport system as part of the second generation action to control air pollution. This had led to the submission of integrated plan that included the metro and bus rapid transit system. Subsequently, in 2015, the Supreme Court while imposing the environment compensation charge on each truck entry into Delhi directed creation of clean air fund from this revenue and spend it to augment bus transport and infrastructure for walking for pollution control.

In addition to this, government of national capital territory of Delhi has included bus transport reforms in its clean air action plan. These are some evidences of

explicit link being made with bus transport reforms with air pollution control. Without such link the action on mobility strategies for clean air will remain sub optimal.

Similarly, in Bengaluru, the Bengaluru Metropolitan Transport Corporation (BMTC) has been following aggressive reforms for over a decade. It has scrapped old buses that covered 8.50 lakhs Kms or 10 years of age and replaced with BS-IV buses. It has planned CNG bus programme and stratified bus service according to affordability and has also worked out an elaborate revenue generation model. It organises bus Day to generate public awareness.

However, it is only very recently that the bus programme is being brought on the clean air agenda. In 2013 after a suo-moto public interest litigation the Karnataka State Pollution Control Board (CPCB) issued direction under Section 31(A) of the Air (Prevention and Control of Pollution) Act, 1981 to BBMP, Traffic Police, Transport Commissioner and Bangalore Development Authority to take steps to control air pollution and reduce noise levels in Bangalore. As part of this initiative it has directed the Traffic Police to introduce and enforce dedicated bus lanes.

In Hyderabad an explicit link was made between air pollution control and Multi Modal Transport System in the Supreme Court mandated clean air action planning process way back in 2003-4. This had proposed to strengthen of Public Transport (Hyderabad Metro Rail Project) as well as augment CNG supply for public transport.

This process needs to be scaled up in all cities and taken forward for more deliberate planning o bus transport for air pollution control.

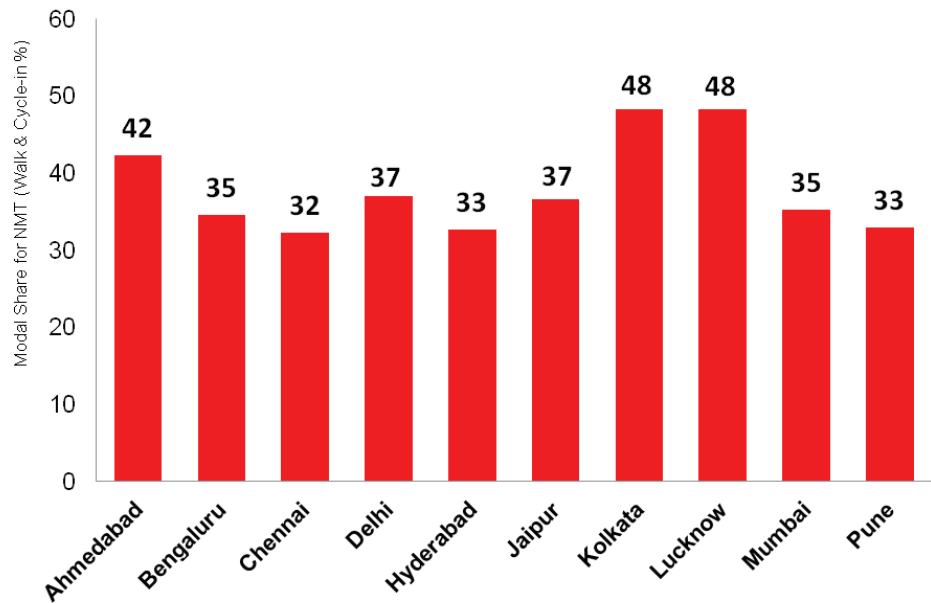
Are cities moving towards walking, cycling and compact urban design?

Walking and cycling and zero emissions modes and must rank as top priority in any check list for air pollution control. However, conversation with the air quality regulators exposed that this is not on the radar for extensive intervention. Yet again there is no established system or an official data protocol to even record and maintain data on walking and cycling in ciies. The Census data of 2011 indicates that the modal share of walking and cycling are already significant in the ten cities. The share is highest in Kolkata and Lucknow with 48 per cent followed by Ahmedabad at 42 per cent. Other cities vary between 32 to 37 per cent. (Graph 19: Modal share of walk and cycle in ten cities).

All cities should be able to provide safe and dedicated infrastructure for walking and cycling with zero pedestrian and cyclist fatalities and ensure that at least 50 per cent of the daily trips are by walking and cycling. The city should be able to create dedicated infrastructure and protect it to increase the modal share over the next 5 years. It needs dedicated policy and earmark budget for it. There should be zero tolerance for pedestrian and cyclist fatalities.

The urban local bodies deal with walking and cycling infrastructure but the institutional and policy processes to address this extremely weak in all cities. Rarely any demand is made to augment these modes as air pollution control strategy. Localised public campaigns on active transportation and congestion reduction measures for improved liveability are the only trigger for action in cities now. But these are not part of any unified frame to get prioritized as top measure for pollution control.

Graph 20: Modal share of walk and cycle in ten cities



Source: 2011, Census of India

Yet again in Delhi the air pollution control agenda of the Commonwealth Games in 2010 and the subsequent court directive followed by the Delhi Governments own strategy to redevelop roads have created a mandate for action. But this is still not strong enough. Delhi government has allocated funds for redevelopment of 10 roads of the public works department with walk and cycling facilities. Delhi’s ‘Green Bike’ initiative has been launched. Supreme Court directive has come to invest revenue from pollution tax on trucks on walking and cycling infrastructure. Delhi has already adopted street design guidelines.

The only city that has notified comprehensive non-motorised transport policy is Chennai. It has mandated a minimum of 60 per cent of Corporation’s transport budget to non motorized infrastructure. It has adopted Street Design Manual. Chennai city corporation has selected 448 bus routes (358 km) for improvement in its pedestrian access. With grants from the Tamil Nadu Road Infrastructure Funds, the corporation has begun work on footpaths of 71 bus routes, approximately over 49 km. It has reclaimed road space from carriageway and prohibiting encroachments on footpaths etc. It has also promoted car free streets. It is providing continuous pedestrian realm that is accessible to all.

Citizens movement and voluntary action has catalysed improvement in pedestrian infrastructure. City government with Bangalore City Connect Foundation has initiated a public-private initiative named Tender SURE that has redesigned footpaths. DULT organises Cycle Days in Bengaluru. But these once again have not found explicit mention in the checklist of air pollution action that has been developed by the Karnataka State Pollution Control Board (KSPCB) in response to the suo-moto public interest Litigation in 2013. The direction that the KSPCB has issued under Section 31(A) of the Air (Prevention and Control of Pollution) Act, 1981 to BBMP and Traffic Police to control air pollution only includes removal of encroachment from footpaths.

Kolkata is yet another city where the West Bengal Pollution Control Board in its checklist of air pollution action has included construction of pavements for all city streets to increase space for smooth traffic movement and provision of cycling and walk ways throughout the city. This also includes such projects as pedestrianising Humayun Place and Bertram Street.

In other cities such as Jaipur, some autonomous changes have started as part of the overall mobility planning. But the state Pollution Control Boards or the Environment Department are not connected to drive such initiatives to build to scale for an effective impact on air quality. Some of the steps forward include pedestrian development in Johari Bazaar and Chaura Rasta in Walled city. Walkable and shaded verandah is unique to the old city; The verandah is covered all along as a continuous and shaded space for walking. Shopkeepers display but keep clear width of 1-1.5 metre for walking. There is public-private partnership model for bike sharing for 1,000 cycles and 72 cycle stands. Footpath in several stretches is getting redesigned.

There is a nascent change but this drive will have to become part of the clean air and public health mandate.

Discussion with the air quality regulators has also revealed that while there is poor understanding of the walking and cycling strategies the pollution impact of car centric infrastructure – wide roads, flyovers, signal free corridors etc is also not well understood. In many cases while small steps are being taken to promote walking and cycling, the contrarian step of car centric infrastructure is also getting implemented at a much larger scale negating the benefits. Thus, Kolkata despite proposing to promote walking and cycling for air pollution control has in reality banned cycling on most roads. Similarly, Bengaluru has virtually turned into a one way traffic city that is impeding access to public transport. Mumbai has ignored to improve safe access at grade and instead has promoted sky walk and foot overbridges that make walking more difficult.

The air quality regulators will also have to be sensitized about the new policy approaches emerging to integrate land-use and transportation to allow people to live close to transit lines and have all key services within a short radius to reduce distances and car travel. Union Ministry of Urban Development is developing a national framework for transit oriented development policy to enable this development. But principles have not yet been rolled out for implementation at the city level.

Delhi has taken the lead to develop and integrate transit oriented development policy with the Master Plan revisions. But its implementation strategies are not yet focus of conscious policy making. This has also remained quite distant in the air quality planning process.

To address these concerns the clean air tool has therefore has included a range of parameters that can effectively guide on the nature of interventions needed in the area of non motorized transport and compact city design.

Are cities restraining vehicle numbers and usage to control air pollution?

Experience in cities so far has shown that while improvement in vehicle technology and fuel quality along with good maintenance practices and alternative fuels it is possible to cut emissions at source, ultimate control on sheer volume of traffic and vehicle numbers on roads is needed to control air pollution. Motorisation can negate gains from technology improvement.

Vehicle restraint measure has not yet found explicit mention in air pollution control measures in cities. Unlimited and free parking incites more car ownership and usage that cause more pollution. Parking takes away space from other important development, walkways from pedestrians, and green areas. The National Urban Transport Policy: 2006 has stated that urban land is valuable. Levy high parking fee that represents value of land occupied. Graded parking fee should recover the cost of the land. Make public transport more attractive. Public transport vehicles and non-motorised modes of transport be given preference in parking space allocation. Park and ride facilities for bicycle users with convenient interchange are a useful measure. In residential areas byelaws need changes to free the public carriageway.

From this perspective any clean air action plan in cities should ensure that the parking policy is designed as a vehicle restrained measure as opposed to parking supply measure. The parking policy has to ensure that the city provides limited legal parking with a cap on further supply and prices it effectively and variably to reduce demand for parking and thus car ridership and ownership. City allows legal parking caps and it is regulated and priced. Some parking restraint like proof of parking is available. There has to be high penalty for illegal parking.

Thus, the cities have to come out of the paradigm in which city provides unlimited parking and it is free or minimally priced to cater to increasing vehicular population and illegal parking is unregulated. A 100 sqm plot built to the full allowable FAR (315 sq m) needs 161 sq m of parking space by Law - more than half. This is equal to one and half storey or space of 4 EWS dwellings....

Delhi is the only city where the first move was made to ask for a parking policy as a demand management measure. In 2006 when the post CNG air pollution control action was under discussion in Delhi the Supreme Court had taken on board the recommendations of its committee – Environment Pollution (Prevention and Control) Authority that states Land is limited and there is a limit to the additional parking space that can be created in the city. This will also require pricing policy to control the demand for parking. The provision of parking for personal motorised vehicles cannot be considered as a matter of public good. The ‘user pays’ principle should govern the pricing of parking. Government should not subsidise this cost.

After long drawn policy deliberations on this matter especially in the context of revision of the Delhi Master Plan 2021 a comprehensive policy on parking district management plan with all the key elements of demand management have been integrated with the Master Plan. This has also been included in the Delhi Decongestion plan of the Union Ministry of Urban development. But its implementation has remained a serious concern. Only some partial revision has been carried out in parking charges in which hourly rates have been introduced. These developments have led to the inclusion of parking strategies in the clean air action plan. In fact the graded action plan that has been recently directed by the Supreme Court to respond to different levels of air pollution in Delhi and NCR has included increasing parking rates by 3-4 times during severe pollution episodes.

Bengaluru represents a deeper disconnect in this matter. As part of the JNNURM reforms it has already taken on board a parking policy as a demand management measures. This reflects several sustainability principles that are aligned with the National Urban Transport Policy. But this does not find mention nor is

there additional advice in the directives of the KSPCB to further tighten the policy to control personal vehicle usage.

KSPCB in response to the public interest litigation on air pollution in 2013 has also asked to plan comprehensive parking management programme.

Kolkata has been the first among all to introduce parking charges in residential areas and also restrict night time parking on narrow streets. While the urban local bodies is working with these strategies there is a disconnect when parking strategy is being conceptualized for air pollution control by the West Bengal Pollution Control Board. In its check list for action the Board has included parking as a supply strategy. It has asked for construction of multi-layered or underground car parking space and coupling of underground or multitier parking arrangement within the premises while sanctioning building plans for Malls etc.

Jaipur is the only city among the ten cities that has introduced proof of parking scheme for purchase of car. This was directed by the Jodhpur High Court for Rajasthan cities. The prospective car buyers have to submit an affidavit to the transport department as a proof of access to legal parking slot. But this is weakly enforced as there is no verification process and this is not linked with overall management of legal and illegal parking in the city.

The rest of the cities including Ahmedabad, Chennai, Delhi, Mumbai, Pune, Hyderabad & Lucknow have minimum parking standards and supply of unlimited and free parking that further aggravates and locks in pollution.

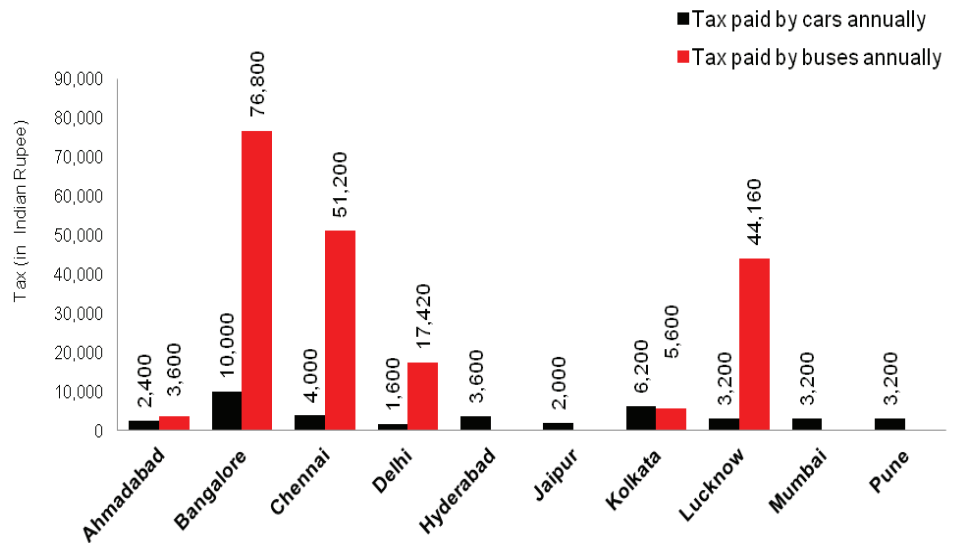
Are cities applying polluter pay principle?

Experience with air pollution control action has shown that Indian cities have not utilized the market based instruments of pricing and taxation adequately to discourage polluting activities and vehicles. These are normally not included in the check list of measures for pollution control by the air quality regulators. As air quality management matures in cities it would need to use fiscal instrument to change citizen behaviour and commuting choices and push demand towards cleaner technology. The city should be able to have advance fiscal system based on polluter pay principal and remove perverse incentive to dirty technologies. It should be able to introduce green tax on dirty vehicles, and fuels and create dedicated funds to incentivize cleaner technologies and modes of commute. But most cities have not yet made fiscal intervention. The steps so far are small and nascent.

The introduction of polluter pay principle has happened as a niche step in Delhi. In 2009 Delhi introduced pollution cess on each litre of diesel that is sold in Delhi under the Air Act and from its revenue created the Air Ambience Fund that is used for meeting costs of pollution control. This includes subsidy programme for electric vehicles. Subsequently, as mentioned earlier, pollution tax has been imposed on each truck entry and big diesel car. But this model of taxing dirtier fuel higher is yet to be expanded in other cities.

Some cities have introduced green tax on older vehicles. Hyderabad in its checklist of clean air action has included introduction of Green Tax to control movement of aged vehicles (G.O.Ms.No.238 Transport R&B (TR-I) dt:23.11.2006). In Mumbai also green tax has been levied under Bombay Motor Vehicles Tax (Amendment) Ordinance, 2010. Public and private vehicles over eight and 15 years old pay a green tax every year.

Graph 21: Tax on cars and buses in ten cities



Source: Source: 2015, Ministry of Road Transport and Highways, Government of India

The bigger challenge however lies in the distorted taxes that create disincentive for bus transport and incentive for car transport. The review of fiscal measures of 10 cities shows that in all of them cars are taxed much less than the buses (See Graph 20: Tax on cars and buses in ten cities). While the actual tax incidence varies across the cities, in relative terms in all cities there is a big gap between the annual tax that buses have to pay every year and on cars. Cars thus pay far less than buses. Only in Kolkata this gap is much narrower.

On a parallel track and as part of the transportation reform under the JNNURM programme some cities including Bengaluru and Jaipur took the initiative to create Urban Transport Fund.

Clearly, air quality regulators have not yet taken fiscal instrument on board for vehicular pollution control board.

Sign post on mobility intervention for clean air

The objective of this exercise is to ensure that action on key sources of pollution and key strategies in respective sectors are aligned in a unified framework for implementation of the clean air action plan to meet the goal post.

The review of action in cities however shows that in most cases the guiding principle air quality control in the respective sectors is not fully understood. This is particularly more glaring in the area of mobility management and urban planning and designing for air pollution control. The linkages between air pollution control and action on car restraint, walking cycling, city planning etc are not seen as part of the mandate. Action largely remain confined to tail pipe emissions control as the impact assessments do not account for the pollution load that gets locked into the infrastructure and travel modes.

Thus, the clean air tool to be used by the air quality regulators has to make explicit provision for detailing of these strategies for framing and monitoring of clean air action plan in a city. The indicators can guide and demystify action.

Action on other pollution sources

It is more complicated to track progress related to dispersed and non point sources including dust sources like construction and demolition waste, road dust, and also open burning of waste. There is virtually no record on the scale of these problems, level of enforcement and monitoring. Only fragmented and sparse information is available from cities.

Dust control from construction, demolition and roads

Fugitive dust from mismanaged construction and demolition (C&D) waste contribute to particulate air pollution. Most cities do not have a dedicated C&D waste policy or the infrastructure to effectively handle and utilize C&D waste. The clean air action plan will have to ensure that cities develop a circular economy for waste that minimises generation, effectively collects, recycles and uses all the generated waste. Cities need dedicated C&D waste management system and dedicated infrastructure to collect and recycle most of the waste generated. Very few cities have initiated a dedicated system of C&D waste collection and disposal.

Until 2016 there has not been any separate central rule and regulation for C&D waste. But on 29 March, 2016 MoEFCC has notified India's first ever rules construction and demolition waste management. The challenge now is to have these rules implemented and reduce generation of this waste to reduce fugitive dust in cities.

However, this review has found that very few cities have started to set up infrastructure for recycling of C&D waste. The assessment has considered quality of C&D waste quantification, city's existing and proposed C&D waste recycling capacity, qualitative assessment of the city's existing and proposed C&D waste policy, assessment of the city's C&D waste handling initiatives.

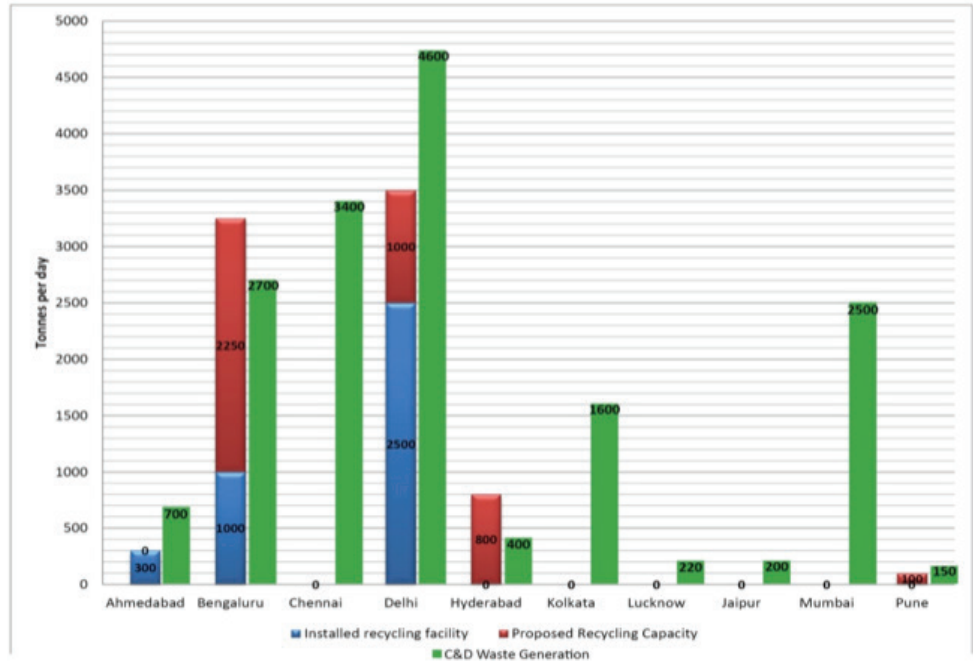
Only Delhi, Bengaluru and Ahmedabad have C&D recycling facilities. Data shows magnitude of waste and scale of recycling facilities are highest in Delhi followed by Bengaluru (see Graph 21: Estimated waste generation and installed and proposed C&D waste recycling capacity in ten cities). Delhi has installed capacity to recycle 50-60 per cent of 4,000-5,000 TDP of C&D waste. Ahmedabad has about 42 per cent and Bengaluru 37 per cent.

In Delhi the Municipal Corporations of North Delhi and East Delhi have a 2000 TDP and 500 TDP capacity C&D waste recycling plant respectively. Government mandates use of a minimum of two per cent recycled products from construction waste in all future contracts for building works and 10 per cent recycled products for road works undertaken by its agencies.

Also as part of the winter emergency action penalty of Rs 50,000 per is imposed on construction sites for violation of dust control measures. As part of the graded action plan linked to the pollution levels and air quality index in Delhi and NCR construction activities can be completely shut down when pollution levels hit the emergency levels. No other city has adopted such measures.

In Bengaluru Bruhut Bengaluru Mahanagara Palika (BBMP) notified Guidelines for Construction and Demolition Waste Management on 18 March 2016. Comprehensive guidelines linked the C&D waste management with the building construction permit system. BBMP notified six abandoned queries as designated C&D waste dump sites. City also plan to setup three C&D waste recycling plants with combined recycling capacity of 2,250 TPD. Private recycling facility with

Graph 22: Estimated waste generation and installed and proposed C&D waste recycling capacity in ten cities



1,000 TPD capacity run by Rock Crystals, a BBMP empanelled vendor.

Road dust and waste burning

Except Delhi where public and judicial intervention have built up pressure for action, nearly all key sources of pollution are now under scrutiny and monitoring. The Supreme Court, Environment Pollution (Prevention and Control) Authority and the Lt Governor office are regularly monitoring compliance with rules on waste burning and road dust. As a result, data base has started to shape up slowly that at least indicates the number of such incidents, penalty and conviction. This process has gathered momentum this winter of 2016 after Delhi government has announced its emergency action plan and the Supreme Court has asked for graded action plan. Local urban bodies are reporting the number of fire incidents and action on open fires in landfill sites.

Large scale fires plague Delhi’s three landfill sites—Bhalaswa, Okhla and Ghazipur— are burning round the year. These are “processing sites” of the entire waste of Delhi, -- about 10,000 tonnes a day. The unsegregated waste, which includes liquid, organic and food waste alongside materials decomposes, releasing highly combustible and global warming gas—methane.

In Delhi NCR the National Green Tribunal has ordered penalty of Rs. 5000/- for each violation. Supreme Court directed strict compliance with the order. Implementation process started. It is estimated that over Rs. 8,00,000 have been recovered in fines this winter. On the other hand, there are more dispersed and numerous fires lit by the homeless, pavement dwellers and security guards for warmth and light during winter nights.

Delhi government has also acquired vacuum cleaning machines to clean up road dust. This process has started. It is only a nascent beginning.

Such information on action on other sources is not easily available in other cities except generic statement. There is no clear documentation of action on these sources in other cities.

Power plants and industry

Information action by the state pollution control boards in point source pollution including industry and power plants is more organised. But most of these sources are not located either at the urban periphery or the outskirts of the city. These are all liable for monitoring and enforcement as these will have to comply with the stated pollution standards. SPCBs work with elaborate inspection and penalty system to ensure enforcement.

It is evident that most cities are beginning to relocate or shift polluting industries or power plants. But the bigger challenge lies in small scale polluting units using very dirty fuel like furnace oil or petcoke in the unauthorised colonies in cities. Units in unauthorised colonies are not recognised as these are not legal entities and therefore are not inspected. They are allowed to pollute. But from city assessment perspective action in these sectors are extremely difficult as there is no clear data.

Mumbai has done substantial cleaning up by shifting mills and industries. Delhi has also shifted all its polluting industry out. It has also shut down all its thermal power plants in Rajghat and Badarpur. It has shifted couple of thermal power plants to natural gas.

The clean air action tool is designed to enable air quality regulators in cities to work with critical and detailed indicators to track baseline of action and progress in all sources of pollution in urbanscape. The tool has been applied more as a diagnostic assessment. This exercise has also exposed weak data collection system on all the requisite indicators within the official system. Once this tool is institutionalized it is expected to create demand for the requisite information and information flow for air quality management and compliance.

This is only snapshot of issues and concerns that emerge from application of the tool to the current baseline of action in some critical sectors. Rigorous, regular and sustained application of the clean air tool based on the myriad of its indicators can inform decision making and help to establish compliance regime in cities.

SECTION III: Do air quality regulators have adequate power to act to meet air quality standards?

Effective application of clean air tool for baseline assessment and for measuring progress will require empowered decision making and implementation bodies. As air quality is worsening across the country and action to control it remains weak, the question that is being asked often is whether legal powers of the air quality regulatory institutions at both central and state levels are adequately defined to enable action. Before plunging into the assessment of clean air action in cities it is important to answer these questions.

The nodal agency for implementation of the Air (Prevention and Control of Pollution) Act, 1981, hereinafter the 'Air Act', at the Centre is the Ministry of Environment, Forest and Climate Change (MOEFCC). The Air Act provides for and empowers the Central Pollution Control Board (CPCB) and the state pollution control boards (SPCBs) to frame programmes to control the emission levels prescribed for industries and other sources.

There are clear provisions in the Act that create the mandate for the air quality regulators in these institutions. The Section 16 of the Air Act sets a mandate on CPCB to maintain the desired air quality in the country and empowers it to take all necessary measures to this end. The CPCB under the Air Act has the power to issue guidelines and promulgate programmes to monitor emission levels in India. The CPCB notified the revised National Ambient Air Quality Standards (NAAQS)¹ in November 2009, prescribing the emission levels of 12 pollutants. It has also established the National Ambient Air Quality Monitoring (NAMP) Network to assess the air quality in 248 cities. According to rules, the NAAQS should be met for at least 98 per cent of the days in a year. Only for 2 per cent of the time they may exceed the limit but not on two consecutive days of monitoring.

The SPCBs are bound by the directives of the CPCB to monitor and undertake necessary action against offenders. The data generated is transmitted to CPCB for scrutiny, analysis and compilation to inform action plans for the sources of pollution and take necessary actions. These can include relocation or withdrawal of consent of operation of pollution units. The Act also prescribes penal sanctions in failure to comply with the directions of the CPCB or SPCB under Section 37.

Under Section 18 of Air Act, the CPCB can issue specific directions to SPCBs to perform functions in consonance with the objectives as specified in the Act. Under Section 20 of the Act, the CPCB can give instructions for fixing permissible standards for emission from automobiles and issue restrictions on the use of certain industrial plants.

Once the consent to operate is given, the Board is empowered under the Section 31A to issue orders or directions to any person, company or public authorities and agencies to implement its directives. The Section states that any directions that the Central government or the Board may give in exercise of its

¹ http://www.cpcb.nic.in/National_Ambient_Air_Quality_Standards.php

powers, issue any directions in writing to, shall be binding and mandatorily to be complied with.

What slackens action?

The Air Act by itself has failed to address the gap between standards and enforcement and implementation. Despite having legislation, laws providing for judicial bodies with technical expertise and comprehensive laws supplemented with administrative guidelines, the objectives of the Air Act are not being realised or implemented.

The government is accountable for conducting inspection and monitoring pollution levels. It is, however, a different question whether the government can be held liable for not undertaking more pro-active policies to bring down emission levels and make the ambient air more suitable for cities and habitations. How will these institutions push for more proactive programmes to restore the quality of ambient air and introduce stringent measures for all sources to abate pollution in dense urban areas and regions?

It is often felt that without the guidelines for setting a clean air target, the SPCBs cannot be held liable for failure in compliance. There is no practice of setting time-bound targets to reduce pollution levels. Certain Action Plans, however, do have the stipulation of setting time targets for pollution sources, as in phasing out certain categories of vehicles and ban on the use of certain categories of fuels. They prescribe permissible emission levels and take action against such violators or polluters found in breach of these levels. The state governments through these approaches take action according to its discretion, with the most preferable method being to relocate polluting units and recommending alternative fuel initiatives. But such is not practiced for ambient levels.

The control measures are ad hoc in nature, although monitoring systems are not. While standards have been laid down for ambient air quality, actual enforcement relates mostly to source standards for individual polluters, factories, and vehicles and so on. While that is the action that is needed to meet the ambient targets, it is not adequate to calibrate action for stringency to ensure consistent reduction in pollution and meet ambient target in a time bound manner.

The ambient and source standards are laid down independently, and local action is planned unrelated to the volume of pollution-generating activities. Hence, it is quite conceivable that the quality of the environment could continue to deteriorate despite high degree of compliance among individual polluters.

While emissions control programmes imposes on the SPCBs the function of a monitoring and supervening agency, the guidelines remain silent about what is to become of this voluminous data and targets. It prescribes permissible levels of pollutants and monitoring parameter, but this by itself does not put the liability of achieving any ambient air standards on the state governments or Pollution Control Boards.

Further, the NAMP and NAAQS are guidelines, which by their very nature are prescriptive and open-ended and do not imply attraction of penal provision in case of failure to achieve air quality standards without express provisions for the same.

While the Act is observed to be vague in identifying the implementing agency

and scope of directions that the CPCB can issue, the judicial precedents of the Supreme Court and the National Green Tribunal have lent clarity and often directives to the government where needed.

The Court in *Damodaran Nair v. State of Kerala*² had accepted the position that, ‘ambient air quality standards are not standards which are to be enforced. They are only the objective or goal of pollution control. The standard which is to be enforced for Air Pollution Control is the emission standards which have already been set’.

There has been a marked shift in this stance, with more mandatory connotations being given to the CPCB guidelines and directives. In its 2007 order,³ the Karnataka High Court had stated that even if the State Board has not independently fixed the standards under the Clause (g) of (1) of Section 17 of the Air Act, the State Board is bound by the standards laid down by the Central Board. Under Section 18(1)(b) of the Air Act, every State Board shall be bound by the directions in writing as the central board may give to it. Thus, even if no separate notification is issued by the State Board laying down the standards for emission of air pollutants, the notification issued by the Central Pollution Control Board is deemed to be the notification issued by the State Board for all practical purposes in as much as the State Board shall have to follow the guidelines laid down by the Central Control Board.

The Court⁴ has held that the primary responsibility of controlling air pollution is on the State Board. Section 17(g) of the Air Act has entrusted the responsibility of framing emission standards on the State Board, which needs to be formulated considering the prevailing air quality as compared to the ambient air quality standards specified by the CPCB.

The Act further empowers the Board under Section 22-A to approach the Court in case of apprehension of pollution and also for filing of a complaint under Section 37. All these provisions provide sufficient legal powers that enable the State Board to effectively tackle the problem of air pollution.

Board has preventive, punitive and curative powers. While reading the object and reasons in conjunction with Sections 16 to 18 and Section 31A of the Air Act, it is clear that the powers of the Board to issue directions are to be exercised with the primary object of prevention, control and abatement of air pollution. The most fundamental aspect of environmental law is prevention and control of pollution and to provide clean and healthy environment and wholesome water to the society at large.

The provisions of Section 17(1)(a) casts upon the Board an obligation to do things and perform such acts as may be necessary for the proper discharge of its functions and generally for the purpose of carrying out the purposes of the Air Act. Upon analysis of the language of these provisions, it is evident that besides performing the specific acts and functions, the Board is entitled to do things or perform acts which may be in aid thereto and for carrying out effectively the purposes of the Air Act. Once it prepares a comprehensive programme for prevention, control and abatement of air pollution, and emission standards are prescribed, the Board then is required to issue the order of consent to various

2 V.S. Damodaran Nair v. State of Kerala. Dated 7 April 1995. Available at: <https://indiankanoon.org/doc/350523/>

3 Nitin Majumdar v. State of Karnataka (ILR 2007 KAR 2969)

4 Vinesh Madanyya Kalwal v. State of Maharashtra (ILR 2014 SC 1000) para 10. NGT. Dated 16 May 2014.

applicant-units to establish and operate their activities.

The matter is not put to rest at that stage but the Board is required to ensure implementation of the terms and conditions of the consent order. It may then do such acts and deeds as may be necessary to ensure effective implementation of the entire environmental programme. The powers vested in the Board are thus of a very generic nature and are not restricted in their scope and implementation. These powers have to be construed liberally and not so narrowly to the extent that it would defeat the very purpose of the Air Act. It will be appropriate to construe them in a manner that amplifies their scope to the fullest to the extent in line with the object of the Act.’

Accountability

The next critical question is how accountable are the air quality regulatory agencies for meeting the emissions and clean air targets. The provisions for accountability within the Air Act can be culled out by an implied reading of the provisions and with substantial support of judicial precedents in form of the NGT orders and a plethora of Supreme Court Judgements.

The Act contains provisions wherein the government can be made accountable if it fails to fulfil its duties. Mostly in cases of consent grant or withdrawal, or lapse in due process, all grounds for action under the Act, the government is made the necessary party. The Air Act contains specific sections⁵ under which penal action can be instituted against any person or company or authority found to be in non-compliance with the directives of the CPCB or SPCB. While these are the express penal provisions, the implied reading of the statutory provisions, along with the judicial precedents, is required to understand how to create a framework of accountability. There are available avenues for citizen action or accountability measures that can be taken against the government within the statute.

Citizen suit?

In the Air Act, while there are no express provisions for Citizen Suits. Action can lie against the government under Section 43 wherein any person, after giving a notice of 60 days can initiate a complaint to the Board or the Metropolitan Judge. Though the grounds for such action are limited to point-source pollution activity or blatant contempt of the directives so issued, the question of a legal action against the government for inaction or lapse in meeting its broader mandate, which may entail duties which are not specified in black and white, is left unanswered under the Air Act. Such an action though can be pursued in the National Green Tribunal, when we read the Air Act concurrently with the National Green Tribunal (NGT) Act.

The US Clean Air Act, 1963, following an amendment in 1970, had added the provision of Citizen suit,⁶ whereby citizens can bring a legal suit against violators or government agencies to enforce environmental laws and ensure compliance with the environmental laws. The section provides that such an action can lie against the government in case of injury to a legally protected interest, be it concrete or particularize or actual or imminent or must have a

5 Section 37: Failure to comply with the provisions of section 21 or section 22 or with directions issued under section 31A; Section 41: Offences by Government Departments

6 42 U.S Code: 7604-Citizen Suits:

(a) Authority to bring civil action; jurisdiction except as provided in subsection (b) of this section, any person may commence a civil action on his own behalf—

‘(2) against the Administrator where there is alleged a failure of the Administrator to perform any act or duty under this chapter which is not discretionary with the Administrator’

casual connection between the injury and the conduct.

Be it due to the appointment of the members or the funding, the boards are in clear control of the government, which delegates its powers to prevent, control and abate air pollution in the country to the Central and state boards. The Air Act clearly provides that wherever the government feels that a given board is not discharging its duties properly to achieve the objectives of the statute it can always step into its shoes. There are specific provisions such as Section 47 of the Air Act, 1981 which provide for it. The state governments also have the power to declare air pollution control areas to check air pollution. So there are ample provisions that provide for an accountability structure.

Action against Public Authority

Section 41 of the Act empowers a citizen to file a suit against the Municipal Authority or any polluting government authority if it is held to be guilty of polluting the environment. In *Paryavaran Mirta v. GPCB*,⁷ a case was filed in the NGT by a civil society organization to take action against the Municipal Corporation for the water pollution caused by the untreated solid waste leaking into the drinking water supply of the village. The GPCB had directed the Municipal Corporation to set up and operate the waste processing/disposal facility, which had been spilling waste onto the grazing land used by villagers. Despite repeated issuance of notice to the parties, the Municipal Corporation had failed to ensure the compliance or adaptation of adequate methods to control air pollution. The Court subsequently ordered the GPCB to take legal action against the Municipal Corporation and awarded the applicants the cost of the petition. It was held that 'every municipal authority within its territory is responsible for implementation of the provisions of these Rules. Every State Board or the committee is responsible for monitoring compliance of the standards regarding groundwater, ambient air quality and other standards as specified in the Schedule.'⁸

Whenever the CPCB has attempted to minimize its role in the matter of compliance, the tribunal has reiterated that the Central government has delegated powers of issuance of directions under Section 5 of the Environment (Protection) Act, 1986 to the Chairman of CPCB to issue directions to industry or any local authority. The CPCB cannot abdicate or be oblivious to its role and responsibility in such issues, though we agree that the primary role is of SPCB's.

Where it is apparent that any polluting activity of an industry has continued due to lapse in monitoring or enforcement on the part of the SPCB or any other monitoring agency, action can be instituted against them in the Court, as was the case in *SPCB, Odisha v. Swastik Ispat Pvt. Ltd.*⁹ The Court in most cases ends up setting up committees to see to the enforcement and compliance of such directives.

Suo motu action by the NGT

The state government and SPCBs are necessary parties to any action to be taken towards addressing environmental issues; suing the government for damages due to pollution is in the nature of torts. This is more or less through judicial redressal¹⁰.

7 Prayavaram Mitra (Janvikas) & Ors v. GSPCB, NGT, December 2013.

8 Rayons-Enlightening Humanity, Through its Secretary & Anr v. Ministry of Environment & Forests (MoEF) & Ors, (18-7-2013)

9 SPCB, Odishav. M/s Swastik Ispat Pvt Ltd & Ors, NGT. Dated: 09.01.14

10 The Supreme Court in *Subhas Kumar v. State of Bihar* (AIR 1991 SC 420) held that right to

Since 2010, the National Green Tribunal (NGT) has assumed the primary jurisdiction in all matters relating to environmental issues. The Tribunal has been given powers and jurisdiction in nature similar to the High Court, meaning that it has the power of a writ court, which includes suo moto jurisdiction to take up issues directly against the violating party.

The NGT, established under the NGT Act, 2010, has under Section 14 of the Act, jurisdiction on all civil matters where substantial questions relating to environment arising out of the scheduled act can be brought under it. Any violation pertaining only to these laws, or any grievance rising out any order or directions of the government under these laws, can be challenged before the NGT.

It has time and again pulled up government agencies for their recalcitrant attitude towards environmental issues. In *Dileep Nevatia v. Union of India & Ors*, the NGT, on a petition contending that the present regulatory framework is not being effectively implemented by the Ministry, Central government and state authorities, in terms of standards specified for noise limits for automobiles at the manufacturing stage, the Tribunal raised inter alia a very pertinent issue: Does the present enforcement of noise-related standards require specific directions from the Tribunal? While the standards had been issued in 2002, the MoEF has still to issue guidelines for enforcing such standards; they have not delegated any powers for enforcement of these standards to any local authority either.

In cases like these, the competent authority for prescribing the standards under the relevant section of Air Act was to be the enforcer of the standards too. Section 20 of the Act provides power to give instruction for ensuring standards for emission. The provision clearly implies that once the standard is prescribed by the State Board, under the Act, the state government is required to give such instructions, on recommendation of SPCBs, as may be deemed necessary; and such authority shall be bound to comply with such instructions. The NGT reprimanded the CPCB and the state government for passing the buck, and directed them to issue directions under Section 20 of the Air Act to the concerned Authorities of such standards for enforcement within a stipulated time period.

In the case of *Vinesh M Kalwal v. State of Maharashtra*,¹¹ the NGT emphasized on the urgent need for the MPCB to revisit its enforcement policy. ‘The enforcement strategy of MPCB seems to be restricted to a rounded and cyclic approach involving inspection, monitoring, directions and forfeiture of bank guarantees, which is invoked in the event of each observed non-compliance. It has been held by the Hon’ble High Courts and also this Tribunal in several cases that forfeiture of bank guarantee cannot be construed as penal action and can be done for specific purposes as elaborated in Judgements in Appeal No.43/2012 and Appeal No.10/2011 of this Tribunal.’

The Tribunal while setting time-bound directions for compliance was apprehensive about the effective implementation of the proposed directions intending to form monitoring committee of experts, comprising both

environment is a fundamental right of every citizen of India and is included in the ‘right to life’ guaranteed under Article 21 of the Constitution of India. A Public Interest Litigation (PIL) is maintainable in the High Court or Supreme Court at the instance of affected persons or even by a group of social workers or journalists for prevention of pollution.’

11 *Vinesh Madanyya Kalwal v. State of Maharashtra*. NGT 16 May 2014. Available at: <https://indiankanoon.org/doc/41339627/>

government officials and independent experts, for a particular duration, so that the directions of the Tribunal are implemented within a time frame and in an effective manner. There are several instances where the apex court and also various High Courts have formed such monitoring committees for effective implementation of directions.¹²

Where the Act has remained vague in defining the implementing and enforcement agencies, and streamlining the implementing procedure, the Courts have become the guiding force, lending clarity to regulating system and directing the government at all levels to move towards a more organized structure.

Measures such as these cannot be sustained for long. A more systematic approach has to be adopted. It is apparent from the cases taken up in the Tribunal, however, that the SPCBs should take more stringent measures in the form of penal action and power to arrest offenders as clearly the paltry fine amounts and revocation of consent to operate have not been enough of a deterrent. This can be done through the requisite amendment to the Air Act. Also,

The new enforcement policy of using bank guarantees as a measure against non-compliance has proved to be very effective. Maharashtra State PCB was among the first ones to enforce it. Similar exercises should be introduced in other states.

Legal loophole around vehicular pollution

Over a period of time vehicular emissions have more or less moved out of the practiced mandate of the air quality regulators. Emissions standards for vehicles and fuels are now regulated under the regulated under the Central Motor Vehicles Act that is administered by the Ministry of Road Transport and Highways. This stated objective of the Motor Vehicle Act is not supportive of the objectives of improving air quality to protect public health and environment. As vehicular emissions have strong bearing on air quality, its regulation needs to be aligned and made consistent with the objective of air quality regulations. The Central Motor Vehicle Act predates the Air Act. The Central Motor Vehicle Act of 1939 was amended in 1988 to regulate vehicular emission. Currently, vehicular emissions are regulated under the Central Motor Vehicles Act, not the Air Act.

But the provisions of the Air Act, 1981 empowers and enables the Ministry of Environment and Forests to regulate and legislate on vehicular emissions. Section 17 of 'Functions of the Board' states, 'lays down standards for emission of air pollutants into the atmosphere from industrial plants and automobiles. And, this is to be done in consultation with the Central Board and having regard to the standards for the quality of air laid down by the Central Board. Clause (g) of Sub-section (1) of Section 17 refers to standard to be set for automobiles and industrial units both.

The powers under Section 20 of the Air Act are very clear. This explicitly gives 'power to give instructions for ensuring standards for emission from automobiles'. But the form and particularity of this provision need to be defined. The Section 20 states, 'with a view to ensuring that the standards for emission of air pollutants from automobiles . . . are complied with, the State

12 Supra note

Government shall, in consultation with the State Board, give such instructions . . . to the concerned authority in charge of registration of motor vehicles under the Motor Vehicles Act, 1939 (Act 4 of 1939).’ It adds, that ‘such authority shall, notwithstanding anything contained in that Act or the rules made there under, be bound to comply with such instructions’. Despite these explicitly stated powers under the Air Act, the Ministry of Environment and Forests does not regulate vehicular pollution.

In the past, emissions standards for vehicles and fuels have been notified by the Ministry of Environment and Forests under yet another powerful environmental act—the Environment Protection Act 1986. Section 5 of this Act on power to give directions states that: ‘Notwithstanding anything contained in any other law but subject to the provisions of this Act, the Central Government may, in the exercise of its powers and performance of its functions under this Act, issue directions in writing to any person, officer or any authority and such person, officer or authority shall be bound to comply with such directions.’ This gives overriding powers over all else.

There is precedence of setting emissions standards for vehicles and fuel quality under the Environment Protection Act, 1986. The standards set under EPA Act are as follows:

Motor Vehicles: Environmental Standards 23.1 Vehicular Exhaust Emission Standards (effective for 1990–1996) Standards for emission of smoke, vapour etc. from motor vehicles Source: EPA Notification [GSR 55(E), Feb. 5, 1990]

Diesel Fuel: Specifications for Emission Related Parameters, Source: EPA Notification [GSR No. 176(E), April 2, 1996]

Motor Gasoline: Specifications for Emission Related Parameters, Source: EPA Notification [GSR No. 176(E), April 2, 1996]

Thus, precedence shows that the overriding authority of the Environment Protection Act 1986 has been exercised to notify standards for vehicles. This has superior authority to override the Central Motor Vehicles Act.

Rajeev Dhawan, senior advocate of Supreme Court has examined the matter for Centre or Science and Environment and through legal analysis has demonstrated how decisions on vehicular pollution control can be taken under the Air Act and the Environment Protection Action. (See box Air quality regulators can take overriding decisions on vehicular emissions). Nothing in the Central Motor Vehicles Act prevents Environment Protection Act and Air Act from creating an oversight body or from giving detailed instructions to any authority or agency. In such cases no state can protest.

It would be impractical for the Union to enforce the standard directly. The instruction would have to be given to the Ministry of Petroleum and Natural Gas, Ministry of Road Transport and Highways and State Pollution Control Boards. The real problem is therefore how to draft instructions. If loosely drafted—as no more than an objective—it would be left to the Ministry of Road Transport and Highways and other agencies to devise their own methods of acting out these objectives. If these instructions contain details—including how they are to be enforced, the answer would be in the letter and spirit of instruction.

Air quality regulators can take overriding decisions on vehicular emissions

Rajeev Dhawan, senior advocate of Supreme Court has examined this matter for the Centre for Science and Environment. According to him, Power of Union is enshrined in the EPA 1986 which was enacted under the Union's List-I Entry 13 and 14 read with Article 253 of the Constitution. This is self evident from the Statement of Objects and Reasons (SOR) to the Act).

It is equally true of the Air Act (Prevention and Control of Pollution Act (1981). The significance of this is that the powers of the Union Parliament and Union government are exclusive and overriding. The Motor Vehicles Act 1988 is enacted under the concurrent list. (List III, E 35) to give the Union's Act priority.

Superimpose on these the well-known principles of precautionary principle inter-generational equity and polluter pay (Vellore Citizens' Welfare Forum v. Union of India (1996) 5 SCC 647.

Sections 3 and 5 of the EPA 1986 provisions are wide and empower the Central government to empower inter alia,

'3(2)(i) coordination of actions by the State Governments, officers and other authorities—

(a) Under this Act, or rules made there under: or

(b) Under any other law for the time being in force which is reliable to the objects of this Act;'

Likewise Section 5 of the EPA has power to give directions. This states:

Notwithstanding anything contained in any other law but subject to the provisions of this Act, the Central Government may in exercise of its powers and performance of its functions under this Act issue directions in writing to any person officer or any such person, officer or authority shall be bound to comply with such direction.

Explanation: For the avoidance of doubts it is hereby declared that the power to issue directions under the section includes the power to direct—

(a) the closer prohibition or regulation of any industry, operation or process; or

(b) stoppage or regulation of the supply of electricity or water or any other service.

This has been widely interpreted. For the purposes of this instance, Section 6 may be noticed:

Section 6 (2)(a)(b)

6. Rules to Regulate Environmental Pollution—

(2) In particular and without per-justice to the generality of the foregoing power, such rule may provide for all or any of the following matters, namely:

(a) the standards of quality of air, water or soil for various areas and purposes;

(b) the maximum allowable limits of the concentration of various environmental pollutants and safeguards for the handling of hazardous substances;

Making of clean air action plan

It seems that no additional power or amendments in rules/acts are required; the SPCB/CPCB can achieve the desired air quality standards in cities and industrial areas, just by strict implementation of scientifically prepared action plans. SPCBs and pollution-control committees under the guidance of the CPCB can prepare city-specific air-quality improvement plans based on public consultation.

It is seen that SPCBs/state governments do not consider the directions given by the CPCB under Section 18(1)(b) to improve the air quality with adequate seriousness. On the contrary, CPCB and MOEF do not use their powers vested under the Acts and Rules to initiate punitive actions against the non-compliance of directions issued to SPCB/state governments.

Time has come for the CPCB and SPCBs to prepare dynamic clean air action plan to meet clean air targets. They need to set target date to achieve air-quality standard goals to be clearly specified in the plan document. Implement phase-wise plan with target date. The clean-air action plan should be supported by scientific study and inventory of polluting sources, air quality

This has been variously used for a vast array of subjects. I) Section 25 has a general rule-making power, including for air pollution. ii) Finally the EPA 1986 has overriding effect Section 24(1).

Section 24 (1) Effect of Other Laws. –(1) Subject to provision of Subsection (2), the provision of this Act and the rules or orders made therein shall have effect notwithstanding anything inconsistent therewith contained in any enactment other than this Act.

The Air Act 1981 was also enacted under Article 253 read with Seventh Schedule List I, Entry 13-14 of the Constitution. It is clear in its definition.

Sections 2 (a) and (b) state:

Section 2(a)(b)

2. Definitions—In this Act, unless the context otherwise requires,

(a) 'air pollutant' means any solid, liquid or gaseous substance 4 [(including noise)] present in the atmosphere in such concentration as may be or tend to be injurious to human beings or other living creatures or plants or property or environment;

(b) 'air pollution' means the presence in the atmosphere of any air pollutant

The of the Central Pollution Board in relation to the Central government is Advisory (Section 16 (2)(a)(b) and includes to plan and cause to be executed a nationwide programme.

Section 16(2)(a)(b)

16. Functions of Central Board—(2) In particular and without prejudice to the generality of the foregoing functions, the Central Board may

(b) plan and cause to be executed a nation-wide programme for the prevention, control or abatement of air pollution

Similar provisions exist for the State Governments (Section 17(1)(a)(b). The Central and State Government may give directions to the Central and State Board respectively.

Section 12(1)

12. Temporary association of persons with Board for particular purposes. – (1) A Board may associate, with itself in such manner, and for such purposes, as may be prescribed, any person whose assistance or advice it may desire to obtain in performing any of its functions under this Act.

1. Likewise, Section 217 of the Motor Vehicles Act 1988 repeals all Union and state statutes (Section 217).
2. This is the broad description of the statutory layout.
3. The Union has abundant powers to examine and implement enforcement in respect of air pollution. This power has to be moulded.

monitoring specially at breathing level, source apportionment study, chemical characterization of PM_{2.5}, meteorological data analysis (mixing height, wind speed, direction), long-range transport of air pollutants etc. should be an integral part of the clean-air action plan.

The framework of governance of air pollution should consider punitive action for failures or provides incentive to those achieving the targets. The action plans prepared for 17 Indian cities under the Supreme Court's directions are under implementation. Action plan prepared for the 70-odd industrial regions in India under CEPI are under implementation. But there is no time frame with punitive actions or incentives. The targets achieved, or not achieved, are not measured or quantified with respect to ambient air quality improvement, and human health benefits.

Add teeth to the regulatory agencies by giving them powers to impose civil penalties on the spot, cut short the process of appeals against such decisions, ensure financial independence and improve technical capabilities of such regulatory agencies. The quantum of these civil penalties should be such that it actually hurts the violators unlike right now where it makes more sense to pay

Public health objectives of Clean Air Act

Clean Air Act Sec 101 says, 'The Congress finds that the growth in the amount and complexity of air pollution brought about by urbanization, industrial development, and the increasing use of motor vehicles, has resulted in mounting dangers to the public health and welfare, including injury to agricultural crops and livestock, damage to and the deterioration of property, and hazards to air and ground transportation'¹

Standards to protect public health: EPA is directed to set primary standards that are requisite to protect public health, including the health of sensitive subpopulations, with an adequate margin of safety.

Standards to be science based not on the basis of cost incurred to meet the standard: The air quality standards must be set based on science without regard to costs of implementing pollution controls to achieve the standards. Costs are considered during implementation of the standards.

Implementation of standards: Implementing the air quality standards is a joint responsibility of states and EPA. In this partnership, states are responsible for developing enforceable state implementation plans to meet and maintain air quality that meets national standards.² Each state plan also must prohibit emissions that significantly contribute to air-quality problems in a downwind state.

Citizens can sue if standards are not met or in case of non-compliance: Any person⁷¹ can sue the EPA to compel the agency to perform mandatory duties under the Act or to seek judicial review of final agency actions, and also can file lawsuits to compel compliance by facilities that may be violating CAA requirements. Courts are authorized to impose civil penalties in lawsuits brought under the citizen suit provisions, and can direct up to \$100,000 to be used for mitigation projects that enhance public health and the environment.

Conduct health impact studies: Section 103 says, 'The [EPA] Administrator, in consultation with the Secretary of Health and Human Services, shall conduct a research program on the short-term and long-term effects of air pollutants . . . on human health . . . conduct studies, including epidemiological, clinical, and laboratory and field studies, as necessary to identify and evaluate exposure to and effects of air pollutants on human health; . . . develop methods and techniques necessary to identify and assess the risks to human health from both routine and accidental exposures to individual air pollutants and combinations thereof.

. . . examination, summary, and evaluation of available toxicological and epidemiological information for the pollutant to ascertain the levels of human exposure which pose a significant threat to human health and the associated acute, sub-acute, and chronic adverse health effects

. . . establish a national research and development program for the prevention and control of air pollution and as part of such program shall . . . conduct, and promote the coordination and acceleration of, research, investigations, experiments, demonstrations, surveys, and studies relating to the causes, effects (including health and welfare effects), extent, prevention, and control of air pollution;

Conduct a comprehensive analysis of the impact of Act on the public health, economy, and environment of the United States . . .

In describing the benefits of a standard . . . consider all of the economic, public health, and environmental benefits of efforts to comply with such standard . . . assess how benefits are measured in order to assure that damage to human health and the environment is more accurately measured and taken into account . . .

finer (if at all imposed) and get away with it as the quantum of the fines has not been revised in ages. Simply disincentivize violations.

The institutional and funding mechanism needs to be devised by MOEF in consultation with CPCB and SPCBs. Clean energy fund, diesel cess fund and water cess fund available could be utilized to fund the project. CPCB and SPCBs

have the required legal power to enforce the clean-air action plans to achieve the NAAQS in time-bound manner.

Need autonomy

It is however, clear that the air quality regulators will require more functional autonomy to be effectively empowered to utilize the provisions of the law and exercise the power more effectively.

Authority to set mobile source standards

The Act gives EPA authority to set and revise standards for all types of new vehicles and their engines, commonly called ‘mobile sources’. These include on-road vehicles such as cars, trucks, and buses; non-road engines and equipment such as farm and construction equipment, offroad motorcycles, recreational equipment, lawn and garden equipment, locomotives, and marine vessels; and aircraft. EPA rules under these provisions often help states attain and maintain air quality standards for common pollutants, as well as reduce toxic emissions. Recently, the EPA has also used this authority to limit greenhouse gas pollution from motor vehicles. The Clean Air Act generally preempts state authority to adopt or enforce emissions standards for new motor vehicles.

Health based targets

EPA has classified six criteria pollutants (ozone, nitrogen oxide, particulate matter, carbon monoxide, sulphur dioxide and lead) and, based on the latest research and threats that these pollutants pose, laid down national ambient air quality standards (NAAQS). The states are required to follow these standards and comply with them by adopting stringent enforceable plans. The states also need to take action to prevent and control pollution that drifts across state lines.

The CAA requires EPA to establish health-based air quality index for common pollutants. The EPA sets primary standards for pollutants based on their health impacts. CAA also requires EPA to look into the standards and revise them every five years based on advice and information provided by an independent scientific advisory committee. These standards are set based on science, not costs. Costs are only taken into account while implementing the standards.

CAA also provides for controlling hazardous air pollutants, protecting visibility in national parks, controlling acid rains, protecting stratospheric ozone layer, reducing pollution that causes climate change and enforcement of stringent standards.

Implementation plans

The US EPA and states work together to ensure that national ambient air quality standards (NAAQS) are met and complied with. Every state is required by the CAA to maintain and develop general plans to follow NAAQS and specific plans are needed for specific designated areas. These plans are called State Implementation Plans (SIP) that are developed and formulated by local and state air-quality management agencies and submitted to EPA.

The EPA designates areas as ‘meeting/attainment’ or ‘non meeting/non-attainment’ areas based on their compliance with SIPs. Non-attainment areas are areas that fail to meet air-quality standards. An area may be attainment for one pollutant but non-attainment for another pollutant. State plans for these non-attainment areas are due within three years once a new or revised air-quality standard comes up. States need to match the standards and attain them within five years of designation. In some cases it can go up to 10 years if the EPA determines additional time is needed based on severity of pollution.

SIPs take into account pollution emissions and compliance from stationary sources such as factories and industries. But based on the type of pollutant, SIPs may also include measures for a state to reduce emissions from existing vehicles to tune up their emissions and control the pollution. The states are also required to go through a ‘non-attainment new-source review’ to ensure that their stationary sources do not degrade their air quality any further.

As per the amendment in 1990, there are additional requirements from non-attainment areas especially those exceeding ozone levels, particulate matter (PM 10) and carbon monoxide. Areas with higher levels of pollution are granted more time but they are also required to include more congressionally specified control measures in their pollution control plans.

There are also provisions in the act to ensure that a state implements a plan and submits it on time. In case an agency figures that a state has failed to carry out an adequate SIP or EPA rejects a submitted plan, the state is required to overcome this deficiency with 18 months of this disapproval. If this deficiency is not overcome in two years of EPA’s finding or disapproval, restrictions are applied on the use of highway funds by states. In case of failure to meet the state implementation plans, EPA issues a federal implementation plan to the state.¹³

Enforcement of clean air action and ensuring compliance

Congress gives EPA the authority to take legal actions in case of noncompliance with CAA. In case a state finds a violator, it has the authority to take action against the violator. If the EPA decides to take an action, it informs the state so as to avoid duplication of effort. If EPA finds a violation, it can take administrative compliance order, administration penalty order or criminal/civil enforcement action. The administrative penalties may go as high as \$37,500 per day of violation or maximum of \$290,000. The amount may be set higher depending on the decision of administrator and attorney general. There are separate provisions for motor and mobile sources similar in nature to non mobile sources.

13 http://www.epa.gov/air/caa/pdfs/CAA_Nutshell.pdf

SECTION IV: Need empowered institutions

While it is clear from the assessment of legal framework for air quality management that legal powers are adequate to empower regulatory institutions for action, it is also clear that without adequate institutional capacity, delivery on clean air targets will remain weak and ineffective.

Institutional strength and capacity are important criteria to ensure strong regulatory and compliance regime to deliver on clean air targets. However, in this first round of city level assessment, institutional strength and reforms have not been considered as separate criteria for assessment of action in each city. Instead, the focus has been on identifying common institutional challenges at the central and state level that will require more systemic response at the macro level to improve air quality governance.

Institutional framework for air quality management

There is a federal arrangement in air quality management. The Water Act 1974 enacted under Article 252 of the Constitution provided for the establishment of Pollution Control Boards in the Centre and at the State levels, Central Pollution Control Board (CPCB) was created under Section 3 of the Water Act. More functions were given to CPCB under the Environment Protection Act of 1986 to cover any gaps between Water and Air Act. Article 252 of the Constitution of the India, 1949, provides the Parliament with power to legislate for two or more states by creating a machinery at both Central and State level. The power to amend or repeal such legislation lies only with the Parliament. This serves to highlight the tilt of balance of power in the favor of the Centre.

The CPCB is empowered under the Air Act, 1981 to declare plan and execute nationwide programmes, declare restricted-critically-polluted area and coordinate the activities of the State boards. The State boards are empowered to oversee the implementation of the ground objectives as directed (Section.18-19) under the Act by the CPCB.

Over and above this the Central Government is given the power to issue binding directions to the Central Boards and the State Boards. The Central Board is further authorised to set standards to be promulgated across the country on emission from industries, approve fuels, inspect industrial plant or any place to obtain information (Section.24), impose penalty on offenders found in violation of emission limits (Section.37- 46), power to order closure, prohibition or regulation of any industry (Section. 31A).

Institutional limitations

Despite having extensive power the CPCB has not been effective enough in the fight against air pollution. While the CPCB is an autonomous authority at the centre, it has not been able to exercise its autonomy. The Ministry of Environment and Forests and Climate Change (MoEFCC) is the nodal agency for decision making at the central level for planning, promoting and co-ordinating environmental programmes.

The MoEFCC formulates legislation to mitigate and control environmental pollution. The CPCB's genesis lies legislation promulgated by the MoEFCC and, is depended on it for funds and legislative-cum-administrative wherewithal. It

has been highlighted time and again that the MoEFCC is the authority which takes the final decision on environmental matters. This has led to jurisdictional conflicts with multiple authorities governing on the same matter, to rampant non-compliance and opaque structure which has allowed authorities to dodge responsibilities. For example, through the Amendment Act of 1987, the problem of noise pollution was covered within the definition of air pollutants under the Air Act, under which the CPCB can issue standards on noise pollution. On the other hand under the Environment (Protection) Act, 1986 and Environment (Protection) Rules, 1986, the Central Government can also make rules providing for “the maximum allowable limits of concentration of various environmental pollutants (including noise) pollution in different areas.

The Regulatory Structure for enforcement comprises of Central Government, MoEFCC and CPCB at the centre and; State Government, State Department of Environment, state pollution control boards (SPCB) and regional or zonal offices at state level. The coordination between the two is primary through regional/zonal offices. These regional offices are symptomatic of the outdated and non-committed system. There are six zonal offices in the country, each coordinating with multiple state pollution control boards. While these offices are under the CPCB, the officials are often deputed by the state government. This leads to an uncoordinated system, with little clarity of chain of command, from the authority at central level to the state authorities. It is said that the pollution control authorities prioritise the directions of their respective governments – sometime vulnerable to political influence at the state level.

Autonomy undermined

The CPCB and SPCBs are depended on the Centre and State Government, respectively, for funds. Any decision on recruitment is also subject to sanction of the respective governments. This power of the Government to appoint the Chairman of the Authority has left the Authority crippled. The post of Chairman of CPCB has remained vacant for several years, filled in the interim by bureaucrats deputed from the government. An Authority which has to withstand the pressure from government agenda, external politics and various interest lobbies, raises question about the autonomy of action that is needed to take on the challenge of environmental governance.

While the CPCB has the power to ask the state government to set Action Plans under the Air Act, it is only the judicial arm that catalyses the state to come up with a tangible programme to combat air pollution. In Delhi, while the requirement of an action plan is already mandated under the Air Act this has been put in place through a Supreme Court precedent in the ongoing public interest litigation on air pollution- M.C. Mehta vs. Union of India & Ors.

The orders of CPCB and SPCB issued to the state governments and state enterprises are often not binding in nature and that they are dependent on the state enforcement machinery to ensure compliance with their orders or directives. Take for example “Approved fuels¹⁴” which are so declared by the State boards, the decision to take action on any polluting fuel is left with the State government under the section 19, wherein if the State Government if it so feel, with consultation of the SPCB can ban the use/burning of any kind of fuel through official gazette notification. The SPCB needs the state machinery to promulgate such an action even when it is given express powers to take action on any fuel in a critically polluted area.

14 As defined under the Section.2 of the Air Act, 1981.

There are some directions that are legal and statutory in nature. These include performing function as per the Section 16 of the Air Act; Directions to SPCBs under Section 18; and can take over functions of any SPCB in a given area for a specified time; issuance of direction to industries under Section 5 of EPA; Issue of closure and withdrawal of consent to operate to industries.

However, CPCB and SPCB play an advisory role to the Central Government and to the judiciary on matters pertaining to abatement of pollution. They also play an advisory role in coordination under bilateral and multilateral agreements.

In certain administrative and technical matters, SPCBs are responsible to State Government, CPCB and MoEFCC. In critical matters, it is bound to go by the directions given by the State Government, CPCB or MoEFCC as the case may be, which largely implies that in most crucial matters it is subservient to the order of the government machinery.

The case in point is MoFCC reconstituting the CPCB through a notification dated March 23rd, 2015, completely disregarding the recommendations of the Parliamentary Standing Committee on Science and Technology, Environment and Forests and the High Powered Committee of the Supreme Court. The

Parliamentary Committee observed that composition of “CPCB is dominated by Government representatives and constituted by central government”, in such a situation””CPCB cannot be expected to act as a watchdog of environmental protection.” The key posts in CPCB and SPCB are occupied by officers from the ministry and state government on deputation. Most of them being drawn from the bureaucratic pool, neither possess the necessary capabilities and expertise in technical planning of pollution control activities, and under the pressure of the parent organization.

The report of the Parliamentary Standing Committee reads: “The Committee’ expresses its anguish over the fact that the Central Board created for the purpose of control and abatement of pollution is being given such a raw deal so much so that it has virtually been reduced as a near defunct body. If all the powers and functions were to be concentrated into the hands of the Central Government/ Ministry of Environment & Forests the very need to have such an apex body is untenable.

The selection committee at the cabinet secretariat rejected candidates shortlisted by the environment ministry for the post of chairperson of the CPCB. The post of a full-time CPCB chairperson has been lying vacant for several years. Since then, various officers of the ministry have been handling the additional charge of CPCB chairperson. The Act does not prescribe any time limit within which the vacancy of Chairman or other members has to be filled up. This is allowing for a situation where the Apex body from environmental regulation lies vacant for three years and more, and is held in the interim by the officials of the MoEFCC. This inadvertently leads to a conflict of interest and lays the CPCB’s agenda subservient to that of the ministry.

Moreover, according to the Report of the Supreme Court Monitoring Committee on Hazardous Waste in 2004, about 77 per cent of chairperson in different state pollution control boards were not qualified enough to hold the post while 55 per cent of the member secretary were not qualified enough.¹⁵

15 Supreme Court Monitoring Committee on Hazardous Waste, pp 106-108

Human resource capacity

Current human power in CPCB 2012-13 according to annual report 2014-15 shows that out of 539 sanctioned posts about 433 has been filled and 106 or 19.7 per cent are lying vacant. But CPCB has only 168 technical staff to take on extremely diverse pollution control mandate. Even zonal offices of CPCB that deal with several states face serious human resource crunch. For instance, the zonal office in Shillong that deals with 8 states has only 3 scientists. Often the technical capacity of the SPCBs in these states is so poor that the zonal office has to double up to take on their responsibility of issuing clearance etc. The southern zone has very limited staff – just about 5. It is not possible to have dedicated staff for different types of function. They also need upgraded staff to be able to command authority in the system.

India has a massive environmental agenda and this requires proportional increase in the institutional capacity to address these issues. In the past few years, new programmes have been introduced under the Environment Protection Act that have significant start-up needs and have added to the existing resource burdens without a comparable increase in resources.

The percentage of vacant posts has gone down over the years. It is now more at the lower administrative level. But CPCB needs sanction of additional technical staff. Board is unable to attract good manpower due to low salary and poor professional growth.

One of the key factors responsible for the poor institutional framework of the institution is the poor level of satisfaction among the employees. Professional growth of employees is limited as it takes lot of time to reach senior level.

Moreover, new generation environmental governance demands significant upgrade in laboratory, instrumentation and more advanced scientific applications. This is impossible without proper technical staff planning.

In fact, often it is not clear how research agenda of CPCB or SPCBs are planned and how they are linked with strategic policy and implementation plan. Often these decisions are adhoc sometime dictated and led by clients rather than by clear policy agenda of the government.

Way back in 2004-05 the Centre for Science and Environment had analysed the staff strength data of CPCB and found that total manpower strength was 445¹⁶ including non-sanctioned hiring. Of this, 23 per cent staff (102 staff) was employed by the institution without getting required sanctions of the Ministry of Finance. This is so because the institution is facing tremendous manpower crunch and government was not keen to give it permanent staff. There has been limited or marginal increase in the manpower. Between 1998-99 and 2004-05 (7 years), there has been an increase of only 19 per cent. In comparison, just the number of industries in 17 categories of industries has gone up by 72 per cent between 1999-00 and 2006. Moreover, the institution is also grappling with problems in hiring.

Majority of the manpower hired by the institution was for administrative posts. Technical staff comprised of only 48 per cent of total staff in 2004-05.¹⁷ The situation is similar in various SPCBs. CSE tried to study the number of days

¹⁶ Annual Report of Central Pollution Control Board, 2004-05

¹⁷ Annual Report of Central Pollution Control Board, 2004-05

a technical, scientific and technical staff working together gave to an industry for its monitoring, inspection, analysis, travelling and preparation of report. In GPCB, a technical person gets only 1.77 days to take care of one industry in a year while in Karnataka, a technical person gets 1.72 days. Maharashtra board's technical person gets only 1.23 days. This time also includes time spent in transportation while commuting to and back. The scene is not good in the case of scientific officers also. However, when the technical and scientific staffs are taken together, the situation is slightly better.

The issue of pay parity and post retirement benefits has also remained an issue of contention between the CPCB and the Central Government. In 1986 the Fourth Central Pay Commission recommended that the employees of Central Government, governed by the Contributory Provident Fund should be deemed to have come to the GPF-cum-Pension Scheme. The Ministry of Finance withheld pension benefits to the CPCB employees, refused to implement the Pension Scheme in CPCB stating that it will cause extra financial burden.

Separately, the Planning Commission had consented for such a Scheme and even agreed to provide funds to the extent of Rs.30 crores for its implementation. On June 30,2009 the Ministry of Finance issued an order by which it permitted employees of autonomous body to avail of the New Pension Scheme, if they so desired. The CPCB continued to press for introduction of Old Pension Scheme and on September 8, 2010 even provided a list of organizations which were governed by the same. The Ministry of Finance held at no point of time they were covered under the GPF-cum-Pension Scheme of the Central Government and have refused to issue notice to assimilate the CPCB employees under the scheme, despite the Court order it so.

The Central Administrative Tribunal, in Pradeep Mathur v. CPCB¹⁸, directed the Ministry of Finance to accord necessary financial sanction for the introduction of the GPF-cum-Pension Scheme to all the employees of the CPCB who have been appointed prior to January 1, 2004 as in the case of employees of Autonomous Bodies like National council of Educational Research & Training, Kendriya Vidyalaya Sangathan, Indian Council of Social Science Research, The National Institute of Health and Family Welfare, ICUs under the UGC etc.,

Every time, when Revised Pay Rules in respect of Central Government Employees are used, the Government used to issue separate orders regarding the extension of those benefits to the employees of Autonomous Organisations etc. whose pattern of emolument structure are identical to those of the Central government employees. This time even though the Revised Pay Rules are issued on July 25, 2016, till this day i.e. orders regarding Autonomous bodies is yet to be issued.

Concerns around financial autonomy

Standing Committee on Science and Technology, Environment & Forests-Rajya Sabha¹⁹, in its report highlights the issue of inadequate and delayed funding. The findings of the Committee are damning: while the physical targets relating to Ambient Air Quality Monitoring Station and New Noise Monitoring Stations have not been achieved, other targets set have been stated to be under process.

18 OA-2805/2012. Found at: <https://indiankanoon.org/doc/125315986/>

19 Report no: 283. Found at: <http://164.100.47.5/newcommittee/reports/EnglishCommittees/Committee%20on%20S%20and%20T,%20Env.%20and%20Forests/283.pdf>

The ministry informed the committee that the lower utilization in 2015-2016 is mainly on account of general administrative and procedural reasons. The Committee notes that time lag in release of funds by the Ministry and actual availability of funds to such implementing agencies also impacts on the performance of these schemes. The Committee was of the view that the very purpose of formulation of schemes/programme during the Five Year Plans is defeated if adequate financial allocations are not made for them in time.

The scheme of Assistance for Abatement of Pollution, conceptualized in 1992 to strengthen the CPCB and SPCC and PCCs for enforcing statutory provision for pollution abatement is a part of a centrally sponsored umbrella scheme of 'Pollution Abatement'. Lack of financial autonomy is also a barrier.

Nothing as compliance management

The compliance management is the duty of the state pollution control boards with CPCB acting as the guiding body. The SPCBs undertakes it through inspection, vigilance and sampling. There is nothing called compliance management in the country. Environmental pollution is growing, rivers are getting polluted, and air is getting dirty. CPCB has failed to come out with a specific compliance management plan or programme to make sure that industries are operating under condition specified in consent order.

The guidelines given by CPCB on minimum inspection frequency is not enough to ensure good compliance and performance. For example, the CPCB guideline puts the inspection frequency every 3 months for large-medium sized red category industry. The SPCBs are reported to do the minimum benchmark or sometime less.

However, it is evident that Karnataka state pollution control board and Maharashtra state pollution control board are not able to inspect industries even once in a year. The average inspection per industry per year for Maharashtra is 0.3 while for Karnataka it is 0.63 times. Even for Gujarat state pollution control board, which is able to inspect all industries twice every year, it is unlikely that these two inspections enough to ensure compliance through all the years. Clearly, the guidelines framed by CPCB and those adopted by the state PCBs are grossly inadequate.

Though SPCBs and CPCBs are expected to monitor compliance, there is no information on the overall compliance status in the country. Data is limited on how many industries are complying or defaulting or the pollution load from industries, number of defaulting industries, or the number of industries against which action has been initiated by board.

This is because CPCB has not established a national minimum data requirement, which the state boards, must collect and provide to it. Currently, CPCB depends for most of the environmental data on SPCBs quarterly and annual reports. However, many of the boards do not submit this information in a consistent format. Neither do they address all the data requests. Many of the smaller boards do not even have the expertise or resources to collect and present the data.

CPCB has no ability to take action against SPCBs if it does not provide the requested information. Neither has it taken any initiative to develop national guidance to standardise the content and format of periodic reports.

Analysis of the submitted compliance and enforcement data is also minimal

by CPCB. For example, they do not do adequate analyse of the information to determine whether the states are meeting inspection frequencies, conducting quality inspections, or identifying and addressing violations in timely manner. One of the biggest responsibilities of the CPCB is to frame standards for different industrial operations and pollution sources. But this process is slow and intermittent and not linked to the best available process technology concept. Therefore, industries with obsolete technology are pushed to upgrade their technology to comply with the standards. Clearly, no thought has gone into framing of the regulatory standards, which happens to be the major task of CPCB.

Reform liability and punishment rules

As mentioned, most of compliance monitoring and enforcement is done by SPCBs. CPCB is only authorised to enforce against violators in Union Territories and where the SPCB has been declared by MoEFCC to have defaulted on its responsibilities. The few direct enforcement actions taken by the CPCB are generally done by the zonal offices.

Under the Water Act, the Air Act and the EPA, the pollution control boards have the authority to issue and revoke consents to operate, require self-monitoring and reporting, conduct sampling, inspect facilities, require corrective action and prescribe compliance schedules. The enforcement powers include emergency measures of disconnecting water or power supply and facility closure, which are widely used in some states.

However, according to the Hazardous Wastes (Management and Handling) Rules of 1989, SPCBs can, with CPCB approval, impose administrative fines for any violation of those rules. Maharashtra is one of the very few states, which have used this provision to impose penalties for unauthorized storage of hazardous waste.

Other sanctions (fines and imprisonment) must be pursued under the criminal authority of the courts. The Environment Protection Act stipulates steeper penalties than the Water Act and the Air Act but at the same time defers to them (Section 24 of the EPA) in cases where the same type of violations is covered under the EPA and the other law. In addition, criminal cases brought by SPCBs are difficult to prosecute, have a low conviction rate (although that varies greatly between the states), and consume precious government resources and time.

SPCBs find it difficult to impose these punishments. Only 7357 cases were filed by the government against defaulting industries as of 31st March 2003. Out of this, 977 cases were dismissed by the courts or ultimately withdrawn by the government. The courts have ruled in favour of the government in 56 per cent of the cases. This situation may vary from state to state. In Gujarat, the court has ruled in favour of GPCB only in 19 per cent of cases while it has ruled in favour of Andhra Pradesh SPCB 100 per cent of the time.²⁰ The courts have also been unwilling to impose penalties or imprisonment in most cases. Of the total 2319 cases ruled in favour of the government, only 293 included fines and only 248 included imprisonments. This is 13 per cent and 11 per cent respectively.

Moreover, it takes extremely long period to resolve cases brought by the

²⁰ Report on Environmental compliance and enforcement in Indian, The United States Environmental Protection Agency, December 2005, pp 65

government. The per cent of cases pending versus all cases filed under Air and Water Acts is greater than 50 per cent.

It also discourages the boards from taking legal actions against the companies. For example, in Gujarat, there were 1335 cases of non-compliance including for air, water and hazardous waste management in 2005-06. However, the PCB filed cases against only 314 industries in between 2001-02 and 2005-06.

Similar is the case with Maharashtra. There were 8109 cases of non-compliance in 2005-06 but the PCB filed cases against only 42 units in between 2001-02 and 2005-06.²¹

The lack of civil administrative authority (particularly, to impose administrative fines) limits the effectiveness of PCBs' enforcement efforts and leads to over-reliance on the judiciary for enforcement. Filing criminal cases against violators in trial courts or reacting to PILs is a time-consuming, unpredictable and ineffective enforcement mechanism. Therefore, the best mechanism is to empower institutions to impose fines.

Time to act

Central Pollution Control Board needs to be given adequate statutory and legal support to make it effective and functional and for this purpose its constitution under Water (Prevention and Control of Pollution) Act, 1974 needs to be urgently reviewed. That environment protection should be included as an item in the seventh schedule to the constitution in the concurrent list and CPCB be brought under its ambit with all necessary powers and functions to meet the challenges that pollution and its after-effects pose before us without disturbing the federal character of our constitution.

This new body should be given functional as well as financial autonomy so that it can discharge its duties without influence. The procedure of appointing the Chairman must be reviewed, with a limitation on time within which the appointment must be made and also a system which insulate the procedure from undue political influence.

The organisation should be autonomous in lines with US Environmental Protection Agency and DEFRA in the UK. This will ensure limited political and bureaucratic interferences and also fix accountability. The institution also needs to develop a public interface. Right now, there is limited trust of the people. It is viewed as ineffectual organisation.

The CPCB needs to actively advocate for more positions for environmental compliance and enforcement programs at both CPCB and SPCBs. It would also need to reassess the balance between administrative and technical staff and fill vacancies with more technically competent individuals. To attract good technical staff, it should also provide good working environment and good salary packages.

CPCB in association with the states should develop national guidance on the training requirements for its manpower. It should assess the training needs of its own and state PCB's staff, identify its priorities and then select appropriate institutions to develop and deliver the training programmes. All technical staff should be given minimum training. In addition, annual capacity

21 Data provided by SPCB for the Regulator's Programme

building programmes should be conducted to regularly enhance the technical competence.

The legislation should be reformed and a civil administrative penalty authority should be developed to address violations instead of taking the long legal route. This would ensure that violations are dealt in more timely and cost effective manner. Also it would create a fear among the non-complying industries. At the same time, such authority would also reduce the environmental workload of the courts. This could be done through financial penalties, bank guarantees, which is a common practise abroad.

Polluter's pay principle should be adopted. This could also become an additional source of income. One way of regulating industries could be to ask for bank guarantees for meeting compliance schedules. Thus, the board will have an assurance that the industries would meet the stipulated norms in the required time frame. The amount of bank guarantee should be high enough so as to ensure compliance and act as deterrent for defaulting against agreement.

The CPCB must develop uniform system for collection (computerised), maintaining and utilising compliance and enforcement data at national and state level. It should formulate guidance to define national minimum data requirements, what information has to be provided, time frame for submitting the information and provide standardised formats. So far the CPCB is only monitoring the environmental quality, its role should be expanded to include compliance and enforcement. It is also extremely important that the information collected by CPCB should be made public and the operations of the board completely transparent. It is also the role of the CPCB to ensure that proper communication is maintained with different SPCBs.

Already information technology is being deployed rapidly for more online ambient air quality monitoring, continuous emissions monitoring of industrial stacks etc. This has opened up enormous opportunities to leapfrog compliance monitoring to a new genre of air quality management. Thus managerial and technical capabilities will have to be aligned for better results.

Move forward

Change is possible. Cities can leapfrog to clean air. But cities need institutions that can act and speak for public agenda. The challenge is to find ways of rebuilding the institutions to take on greater responsibility with accountability. They should be able to leverage the legal mandate and enhance technical capability to take on new environmental challenge. Public will work its institutions for public good.

1 THE CLEAN AIR ACT, USEPA, TITLE I—AIR POLLUTION PREVENTION AND CONTROL PART A—AIR QUALITY AND EMISSION LIMITATIONS, FINDINGS AND PURPOSES, SEC. 101.

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