REPORT

Renewing India's Air Quality Management strategy in the shadow of COVID-19

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Santosh Harish
Fellow, Centre for Policy Research

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Correspondence: santosh@cprindia.org

Summary

As large parts of India experience hazardous levels of air pollution for most of the year, the regulatory and policy response is inadequate to the scale and urgency of this public health crisis. Public and political engagement with the issue has been growing, although it still remains episodic and Delhi-centric. While the judiciary continues to play an important role in nudging and steering policy action, long-term policy efforts have to be strategically planned, and be undertaken outside courtrooms. Crucially, design and implementation processes have to seriously consider institutional capacity, capability and constraints. Aiding and driving the policy process has to be a virtuous cycle of greater public awareness and engagement, leading to increased political commitment and executive action, resulting in a few early wins that invigorate public demand.

Recent years witnessed some promising developments before the COVID-19 pandemic arrested the momentum. The National Clean Air Programme (NCAP) coupled with the 15th Finance Commission (FC) grants to urban local bodies have slowly institutionalised planning and scientific input, and provided greater resources to state and local governments beyond Delhi. While there have been some sectoral advances like the Bharat Stage VI transition, there have also been significant slippages: repeated compliance delays with power plant emission standards, and removal of government subsidies for cooking gas.

With COVID-19 response placing state capacity and finances under unprecedented pressure, air quality management needs a renewed push. Funders can play a critical role here by prioritising some strategic efforts.

- Continue supporting technical assistance to ensure effective use of funds from the NCAP and the 15th FC grants in cities across India, while increasing accountability through civil society participation.
- Deepen policy research and practice by integrating researchers from the social sciences.
- Advance research and dialogue on airshed level governance, and legislative reform for stronger institutions.
- Complement government efforts with independent tracking of fund flows, and year-on-year changes in pollution levels.
- Develop ideas and initiatives to resolve sectoral roadblocks such as affordability con-straints in the regular use of LPG, entrenched incentives for unsustainable paddy cultivation in north-west India, and opacity in industrial emissions monitoring.

1.Introduction

This framing paper aims to provide an overview of the current state of knowledge and the governance framework on air quality management in India. Air pollution is the second largest risk factor for public health in India, behind only child and maternal malnutrition[i]. Although there has been an increase in the visibility of the issue in the media, public concern and government response, a coherent national policy strategy remains in its nascent stages. How could the ecosystem of actors engaging with air quality in India work towards a collective strategy that leads to sustained improvements throughout the country?

I attempt to outline the contours of such a strategy here based on three premises. One, there is no substitute for the government's role to bring air pollution to safer levels. Two, government efforts will become proportionate to the crisis in urgency and scale only if the issue becomes, and remains, politically salient. Three, political salience requires sustained public demand with focused policy asks.

Air quality management, especially in India, could be thought of as a post-normal science, where "facts are uncertain, values in dispute, stakes high and decisions urgent".[ii] Knowledge gaps often become an excuse for delaying action, while the contested values seldom get platforms to be aired and resolved. We need a collective strategy that is informed by cross-disciplinary evidence, is cognisant of but not overwhelmed by uncertainty, and responds at a scale and urgency proportionate to the crisis. Given that any pollution mitigation effort will create winners and losers, it is important that the urgency 'to do something' does not result in short circuiting consultative processes and leave vulnerable groups worse off. Transparent, responsive governance in managing air quality is a useful collective goal to work towards.

Who is this for?

This paper has been written keeping a diverse audience in mind: researchers, practitioners, advocacy groups and funders, but with pointed suggestions targeted towards domestic and global philanthropies working on air quality in India. Philanthropies can take on risks that government agencies cannot. They can be more nimble, and do not have the same compulsions and constraints that influence the choices of government agencies. Furthermore, unlike government and development agencies, they also need not restrict themselves to 'official' narratives: in terms of problem definitions, priorities, or claims of success. Instead, they can play a significant role in testing innovative ideas, growing the ecosystem to include new actors bringing knowledge and perspectives, and broadening the discourse. While there are certainly opportunities to be harnessed by engaging with government priorities, getting restricted to the specificities of government programmes, like the National Clean Air Programme, limits the extent to which philanthropic funds can generate new ideas.

What is the timeline for the suggestions in this document?

This paper lays out an overarching long-term objective: creating a responsive governance structure to achieve sustained reductions in pollution levels in India. But the suggestions outlined here are primarily for the next one-three years.

2. Background

Air pollution levels are unsafe across India, year round. While pollution levels spike to dangerously high levels during the winter in north India, pollution levels in several parts of the country are poor or worse, for large parts of the year. High pollution levels are not restricted to cities: several industrial areas and rural areas across the country are also highly polluted. While there are several pollutants in the air such as particulate matter (coarse PM10 and fine PM2.5), carbon monoxide, ozone, oxides of nitrogen and sulphur, fine particles form a useful proxy indicator for air pollution in India. The population-weighted annual average concentration of PM2.5 across the country was estimated to be 83 microgram/m^3 in 2019 – more than twice the national standards for clean air.[iii] Another analysis finds that 83% of Indians had to breathe air more polluted than the national standards, capturing the geographical spread of the crisis. [iv]

The health impacts of poor air quality are staggeringly high, and growing as we discover the full range and magnitude of impacts with new research. Air pollution is estimated to reduce average life expectancy of a child born in India by at least 1.5 years,[v] and in 2019, to have contributed to 18% of the total deaths in the country. [vi] Cardio-respiratory diseases and lung cancer in adults, and acute lower respiratory infections in children are the more commonly known impacts of air pollution. In addition, new research indicates a much wider range of health impacts of air pollution such as on birthweight, child growth, obesity and bladder cancer, and even on cognitive abilities in children.

In India, multiple sources contribute to the problem: industries, power plants, vehicles, waste burning, road and construction dust, and household sources (such as cooking, lighting and space heating). At a national level, household burning of polluting fuels form the single largest contributor to average pollution exposure (in addition to the exposure within these households themselves).[vii] Industries and power plants that burn coal are the next largest sources of exposure at the national level.[viii] Within cities, transportation, road and construction dust and waste burning are significant contributors.

Two significant national legislations – the Air (Prevention and Control of Pollution) Act 1981, and the Environment (Protection) Act 1986 – empowering central and state governments to regulate most sources of air pollution have been in place for more than three decades. However, various challenges including weak monitoring and enforcement capacity, poorly designed regulatory standards, ineffective enforcement mechanisms, and lack of political and executive commitment have restricted the proper implementation of these legal instruments. Major policy initiatives like emission standards for power plants, and installation of Continuous Emissions Monitoring System (CEMS) for improved monitoring in certain sectors are either yet to be implemented fully, or have not yet achieved significant pollution reduction. Additionally, not enough has been invested into long term systemic measures like ramping up reliable public transport infrastructure and improving waste management processes.

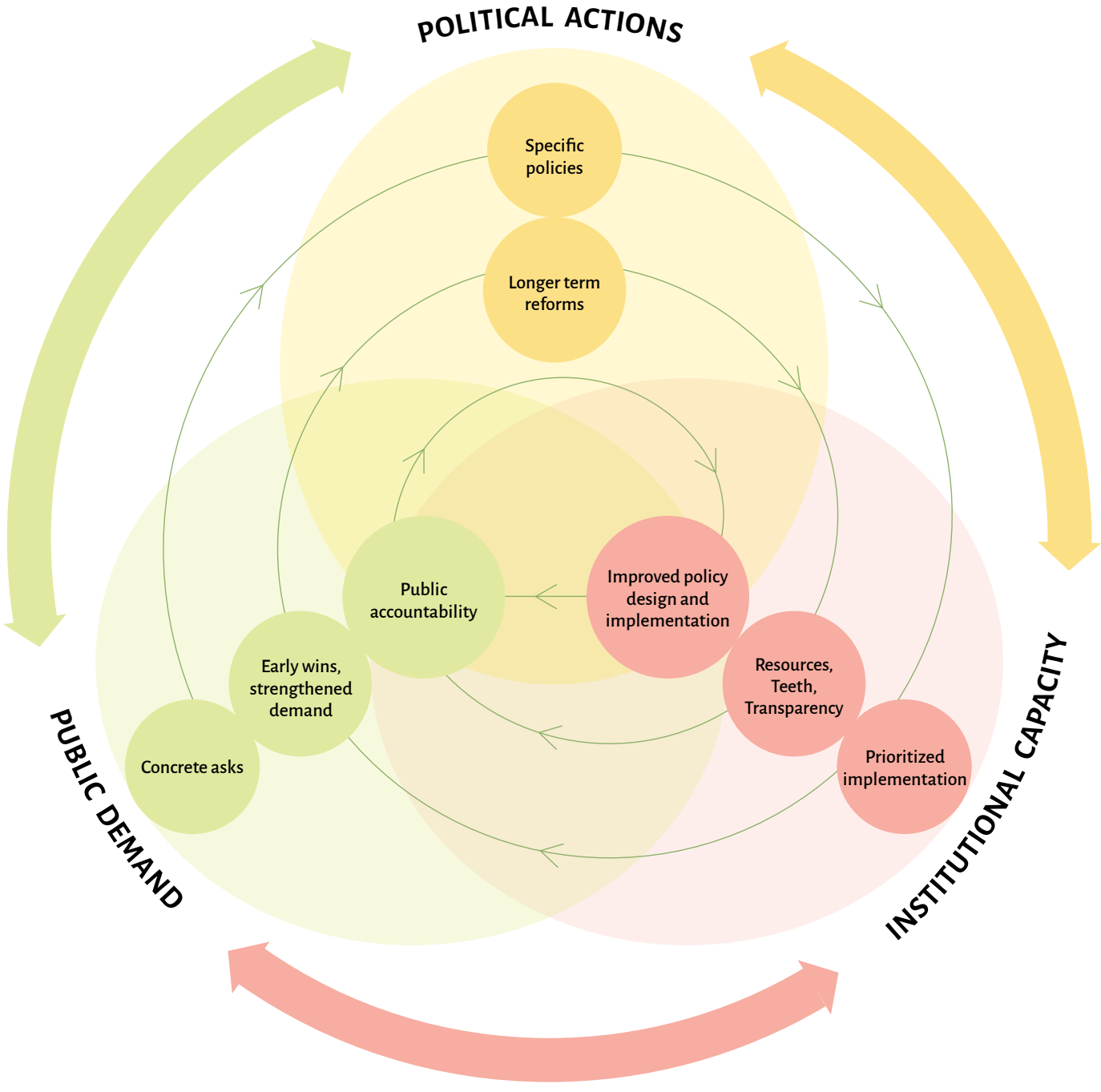
The National Clean Air Programme (NCAP), launched by the Ministry of Environment, Forest and Climate Change (MoEFCC) in January 2019, is the first comprehensive government policy document aiming to tackle air pollution across the country. Apart from sectoral goals, the NCAP identifies 102 (now, expanded to 132)[ix] non-attainment cities, which have particulate matter levels that exceed the annual standards. It has set a reduction target of 20-30% in PM2.5 and PM10 concentrations by 2024, compared to their 2017 levels.[x] The non-attainment cities are required to design and implement city action plans to combat air pollution. In its approach, the NCAP adheres to city-centric templates — consistent with the Delhi model.[xi] In addition to the NCAP, new air quality linked performance-based grants from the 15th Finance Commission (FC) to urban local bodies in large cities have significantly increased incentives to make sustained year-on-year improvements.

Many significant actions aimed at reducing air pollution have been at the behest of the judiciary: the switch from diesel to compressed natural gas in Delhi's public transport, the relocation of polluting industries outside Delhi's city limits, introduction of the Bharat Stage VI standards, development of emission standards for several categories of industries, and restricting the use of highly polluting fuel like pet coke.[xii] However, the predominant role played by the courts so far is not sustainable. Regulators and the executive need to make decisions in a scientifically sound, and democratically accountable way. Especially as air pollution reduction efforts are expanded to regions beyond the national capital, local consultation and planning need to replace central mandates from the Supreme Court and the National Green Tribunal. The advocacy community needs to help reduce the over-reliance on courts for expedient action, approaching them for redressal in exceptional circumstances, and perhaps for a few strategic pushes.

3. Setting A Virtuous Cycle In Motion

For a sustained, systematic response to air pollution in India, a virtuous cycle needs to play out successfully with political leadership playing a critical role (see **Figure 1**). First, policy asks identified by researchers, practitioners, and civil society groups get amplified by an informed public. These demands arise from a shared understanding of which actions need to be strategically prioritised. Second, as the political class sees air pollution and the actions needed to mitigate it becoming vital to its voters, it champions policies addressing governance issues and collective action problems — with impacts seen over different timescales. Third, political backing strengthens institutions implementing or enforcing these policies resulting in a few early wins. These early wins further invigorate public demand, making more difficult policy decisions and longerterm reform efforts politically attractive, slowly making way towards better environment governance.

FIGURE 1: Building a virtuous spiral towards a capable, accountable regulatory structure



Unless we successfully develop and support such a virtuous cycle, we run the risk of all the public awareness and pressure that has been building over the past few years against air pollution dissipating, and people being disheartened and disillusioned by a non-responsive political class. As the public pressure eases up, the political class will breathe easy, as it would no longer be expected to make difficult decisions, with unclear benefits in the short-term.

From the standpoint of civil society engagement, operationalising this theory of change would have three important components.

Developing a shared agenda and public narrative

As the public discourse around air quality builds, the community needs to coalesce around a clear and consistent narrative to ensure sustained progress. Cross-narratives and contradictory claims, without reasonable attempts at context setting and reconciliation, could create confusion in a public still coming to grips with the relative importance of the issue, and among policy makers wary of making tough decisions in the face of uncertainties. A shared common agenda needs to be developed which frames and channels the public discourse, and is based on a common understanding of the various facets of the air pollution – its nature, sources, impacts and ways to combat it. The process of developing such an agenda would also better integrate the community of researchers and practitioners in India. There are promising signs in this regard. The Clean Air Collective, coordinated by Asar, has developed as an important initiative in coordinating action, dissemination of new analysis and research, and increasing collaborations among the members of the air quality ecosystem in India. Awareness campaigns, especially on public health impacts, has seen a visible upswing in recent years especially through the efforts of groups like Doctors for Clean Air. As these campaigns get amplified, it is essential to ensure that all claims made on health impacts are backed by scientific evidence. While these messages need to be potent and emotive, funders and advocacy groups have an important role to play in verifying that they are also accurate. The narrative in English media on air pollu-tion has become increasingly sophisticated with environmental journalists becoming both better trained, and better acquainted with researchers and practitioners in this ar-ea. Air quality coverage in Indian languages, on the other hand, remains limited, and requires attention from funders and civil society.

Prioritising mitigation efforts at the national, state and local levels

Focusing public demand to a few concrete asks, along with making a broad-based demand for clean air, can guide (and apply pressure on) the political class and regulatory institutions to focus their limited resources in fully implementing these select measures. The city action plans under the NCAP and the 15th FC grants present a ready opportunity to engage with agencies and civil society groups in this regard, and deepen the discourse on air quality outside the Delhi-NCR. So far, most city action plans have been drafted with little public input, and follow a common template.[xiii] State action plans, that should have also been drafted under NCAP, seem to have been neglected entirely. [xiv]

Mitigation efforts need to tackle each of the major source categories (such as transport, biomass burning, dust, industries and power plants) in parallel. However, among each of these broad categories, actions to mitigate pollution need to be prioritised better. In ad-dition to knowing how much a particular polluting activity contributes, prioritisation will need to account for the potential for a given intervention to cut emissions, the costs involved, the state capacity for implementing intervention effectively, and who the winners and losers will be.[xv] Arguably, gaps in our understanding of the effectiveness of interventions, their costs, and implementation challenges might be the principal barrier for prioritising actions today.

Who gets included in these deliberations also matter

greatly. Ensuring that planning processes, and especially the city action plans, receive public input is crucial. Historically disadvantaged groups have disproportionately higher exposures, due to factors such as siting of neighbourhoods, working conditions, fuels used for cooking and heating at home, and ability to adopt defensive measures. Civil society actors and funders have an important role to play in ensuring that these fora for voicing concerns and inclusive deliberation get created and are accessible.

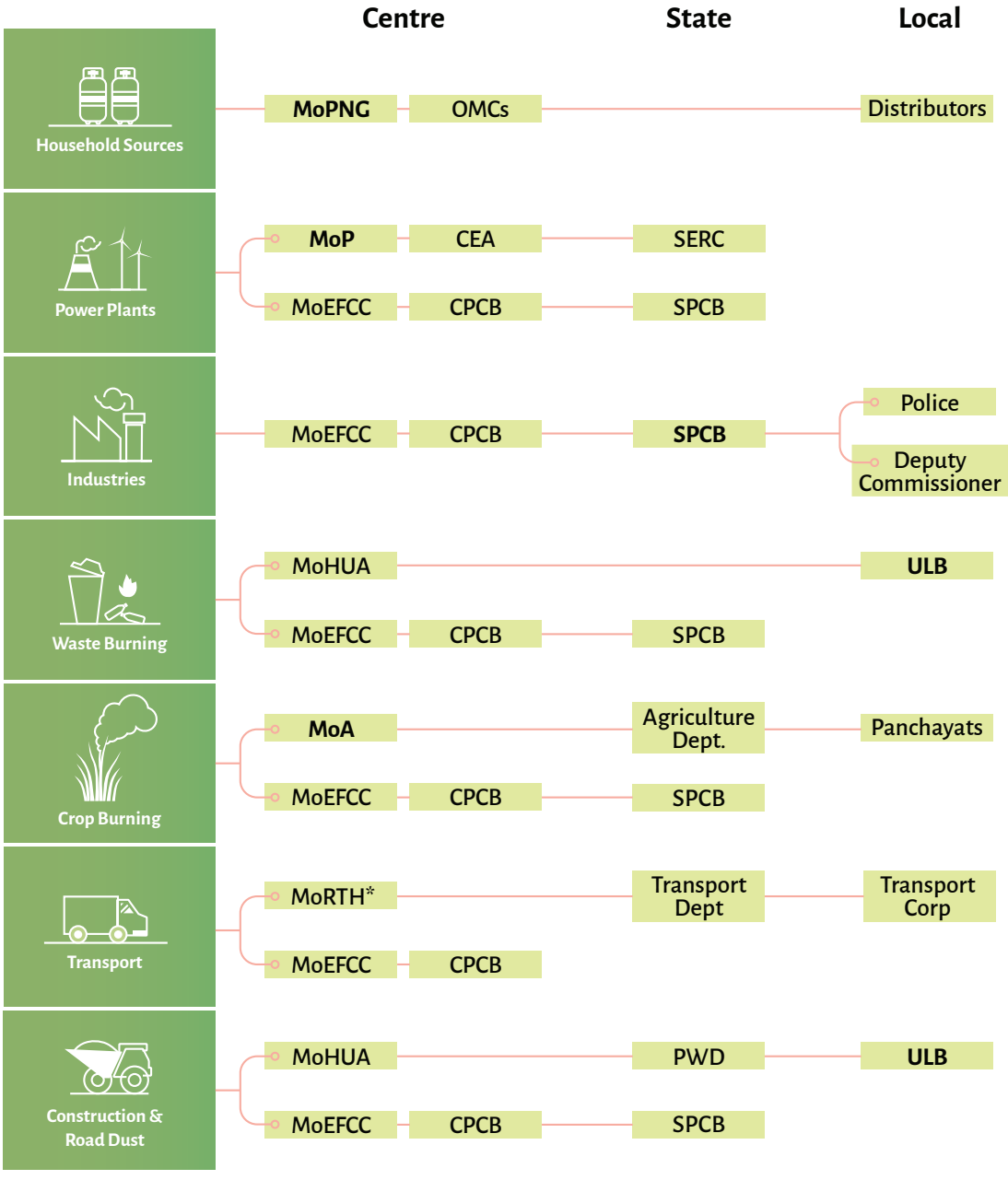
Strengthening institutions

Pollution Control Boards (PCBs) are the frontline regulatory agencies responsible for designing, implementing, and enforcing pollution regulation in the country. The institutional capacity of these boards to achieve their legislative mandate is constrained due to a variety of reasons: limited monetary resources and staff capacity, and an absence of political backing to enforce regulatory standards. In the near term, providing technical assistance could help in augmenting government capacity. Over the longer term, though, enhancing the capacity and ability of these boards to function effectively requires concerted public demand and a determined political push in that direction. In turn, well-functioning regulators could result in improved policy design and implementation, and their responsiveness could reassure the public.

That said, air quality management in India needs a ***regulation-plus*** approach. As **Figure 2** shows, the different sources of pollution fall under the jurisdictions of multiple agencies at the central, state and local levels. Modern economy sources like power plants, industries and certain classes of vehicles (like trucks) certainly lend themselves to more traditional regulatory instruments such as emission standards and periodic testing. For other important sectors, however, air pollution is a direct outcome of governance gaps; conversely, mitigation depends on improvements in public service delivery. These include better waste management, public transport planning, or road design and maintenance. Mainstreaming air quality objectives and strengthening capacity in other institutions like the state transport departments and municipal corporations thus becomes essential. Household sources of pollution— arguably the largest source of pollution exposure and health impacts in India— need policies that enable households to access and use cleaner fuels like liquefied petroleum gas (LPG) and electricity regularly.

Viewing air quality management in India through the lens of regulation alone would tend to rely excessively on instruments like bans, mandates, and penalties; managing air quality then becomes a question of setting rules and enforcing them. A regulation-plus approach acknowledges the need for a wider variety of instruments, reflecting the variety of sources, the large number of agencies responsible, and the underlying governance gaps.

FIGURE 2: The (simplified) institutional thicket managing the various sources of air pollution



Agencies in bold are responsible for priority actions in the near term.

* While MoRTH is arguably the most important agency for transport-related emissions, mitigation requires a more integrated approach across all three levels of government.

Glossary

CEA: Central Electricity Authority
OMCs: Oil Marketing Companies
MoP: Ministry of Power
ULB: Urban Local Body
PWD: Public Works Department
SPCB: State Pollution Control Board
MoEFCC: Ministry of Environment, Forest and Climate Change
CPCB: Central Pollution Control Board
MoA: Ministry of Agriculture and Farmers Welfare
MoHUA: Ministry of Housing and Urban Affairs
MoRTH: Ministry of Road Transport and Highways
SERC: State Electricity Regulatory Commission
MoPNG: Ministry of Petroleum and Natural Gas

4. Policy Landscape

The NCAP has become the overarching policy to address air pollution in India. It has been primarily operationalised through the city action plans so far. Although several sectoral policies were included in the NCAP document, subsequent budgets and other policy announcements from the centre suggest that air quality has not quite been mainstreamed into these other policies as yet. Swachh Bharat (urban) and Smart Cities Mission are possible exceptions.

The 15th FC grants represent an important effort at mainstreaming air quality goals in the functioning of urban local bodies (ULBs). These were first introduced in 2020-21. The grants are allocated to ULBs in 42 'million-plus' urban agglomerations across the country. Despite the fiscal pressures amid the pandemic, the 15th FC grants have been persisted with and will be provided annually between 2021-26; the annual outlay of Rs. 2,217 crores for 2021-22 is roughly half of what had been allocated for 2020-21.[xvi] The grant volumes in subsequent years are explicitly linked to AQM performance, with the MoEFCC responsible for developing the performance framework.

SPCBs have had persistent challenges with staffing that remain unaddressed by these funds, and the ULBs have little prior familiarity with the issue. Disruptions created by the COVID-19 pandemic and the government response to it has led to some new challenges, including on government capacity and budget allocations. While in the early months of the lockdown, it seemed like the pandemic had created both opportunities and challenges,[xvii] the latter seem to have dominated in hindsight (see **Box**).

Policy research in air quality management has been relatively neglected. The social sciences are under-represented in government committees, regulatory bodies, and in initiatives like the National Knowledge Network. Drawing on knowledge in areas like regulatory institutions, environmental law, economics, and urban political ecology could help root scientific advice to governments, advocacy efforts and policy practice better in their historical, social and political settings.[xviii] Several sectoral actions require deep, contextual knowledge that would similarly benefit from relevant research in the social sciences. Funders have an important role to play in growing the air quality ecosystem in India by integrating researchers from these disciplines.

A few thematic priorities for policy research and practice in the next few years are outlined below that could inform longer term reforms.

BOX

IMPLICATIONS OF COVID-19 ON GOVERNMENT PRIORITIES

As with everything else, the pandemic has been deeply disruptive for air quality management in India. The pandemic also impeded the growing mobilisation around city action plans under the NCAP, due to restrictions on travel and in-person events.

There were some windows of opportunity that seemed to have opened up after the first set of lockdowns in 2020. However, except for perhaps the vehicle scrappage policy and budget outlay on public transport infrastructure, there has been limited progress and some steps backward. COVID-19 response slowed down pollution mitigation efforts: capacity became more scarce especially with local governments that have been directly involved in leading the response. Some decisions, presumably to boost the economy or control government spending, are clearly counterproductive. One prominent example is of LPG subsidies being discontinued. Industrial regulation has also been weakened through automatic permit renewals.

From a public demand standpoint, some hooks were created. Visibly cleaner skies during the 2020 lockdowns demonstrated how much emissions from activities like industries, vehicles and construction (which were suspended then) contribute to air pollution. However, there could also be a problematic counter-narrative advanced that all economic activities need to stop for cleaner air. The salience of air pollution as a risk factor that compromises immunity and worsens the severity of infections like COVID-19 could be another hook for messaging, especially with a perceptible surge in infections coinciding with the spike in pollution levels in north India in November 2020. However, it is unclear how high public recall will be to utilise these hooks in the future.

4.1 Airshed management

There is now a consensus within the country that air pollution needs to be managed at a regional or airshed level. Indeed, the central government promulgated an ordinance in October 2020 to create the Commission for Air Quality Management in the National Capital Region and Adjoining Areas (CAQM) citing the need for airshed management. [xix] The ordinance lapsed in the Parliament, and was then re-promulgated with a few, significant tweaks. One important change allows for levying environmental compensation on farmers burning stubble but with no threat of criminal prosecution. In the Monsoon Session of 2021, a bill to replace the second ordinance was tabled in the Parliament and passed. The CAQM is an important new agency for civil society in the National Capital Region to engage with, and it could offer important lessons for developing airshed management elsewhere in the country.

However, the design of the CAQM follows only one, almost extreme, template of airshed management. This template involves setting up an entirely new agency with overriding powers, effectively controlled by the central government, and with multiple responsibilities that span planning, coordination, rule-making, implementation, and enforcement. Would such an all-powerful agency truly be more effective than a 'softer' committee-template with few direct powers but providing a platform for deeper and broader deliberation? How will state and local agencies cooperate with a central government-led agency entering areas previously under their sole jurisdiction? If not the CAQM-template, what institutional models have been tried in other countries that could work in India? How should airshed boundaries be arrived at, considering both science and political economy? Several such questions remain to be asked and studied.

Opportunities for funders

- Engaging with the CAQM in its early stages: technical assistance, research inputs on mitigation efforts to prioritise, and supporting complementary advocacy and research.
- Building a knowledge base on airshed management: forms of institutional coordination, regulatory instruments available, defining airshed boundaries, and identifying other airshed candidates in India.

4.2 Institutions and legislative frameworks

The Air Act, 1981 is a product of its era both in terms of its approach to governance, and its understanding of the underlying causes. It is primarily designed for regulating point sources. Even with industrial pollution, it puts several restrictions on both emissions monitoring and enforcement of compliance. This does not necessarily imply that we need outright legislation overhaul, however. Many of the powers it provides have remained underutilised, and its clauses have been interpreted broadly by the judiciary. Serious deliberation on the legislations, the need for reform, and the extent to which improved legislative foundations will result in improved governance is urgently needed.

Opportunities for funders

- Research on the functioning of regulatory institutions and governance gaps, and the extent to which these gaps are attributable to the underlying legislation vis-a-vis other likely factors such as constraints in staffing and funds.

4.3 Tracking improvements and establishing causal chains

The NCAP has targets framed in terms of reductions in PM10 and PM2.5 concentrations by 2024, compared to their 2017 levels. The 15th FC grants go further and link incentives with air quality improvements. With monitoring networks still being expanded in most of the non attainment cities, tracking year on year improvements could be challenging.[xx] Furthermore, there is the difficult question of being able to attribute the reasons behind improvements (or further deterioration) in air quality levels to specific policy efforts and emission sources. Impact evaluation studies are rarely definitive due to the many sources, and there are often contested claims.

Opportunities for funders

- Developing alternative methods for long-term tracking of air quality and engagement with MoEFCC and the Central PCB.
- Independent initiatives to transparently track and report changes in pollution statistics over time.
- Evaluation of the impact of prominent mitigation actions on emissions and concentrations, including careful analysis of implementation challenges.

4.4 Tracking fund flow and understanding costs of interventions

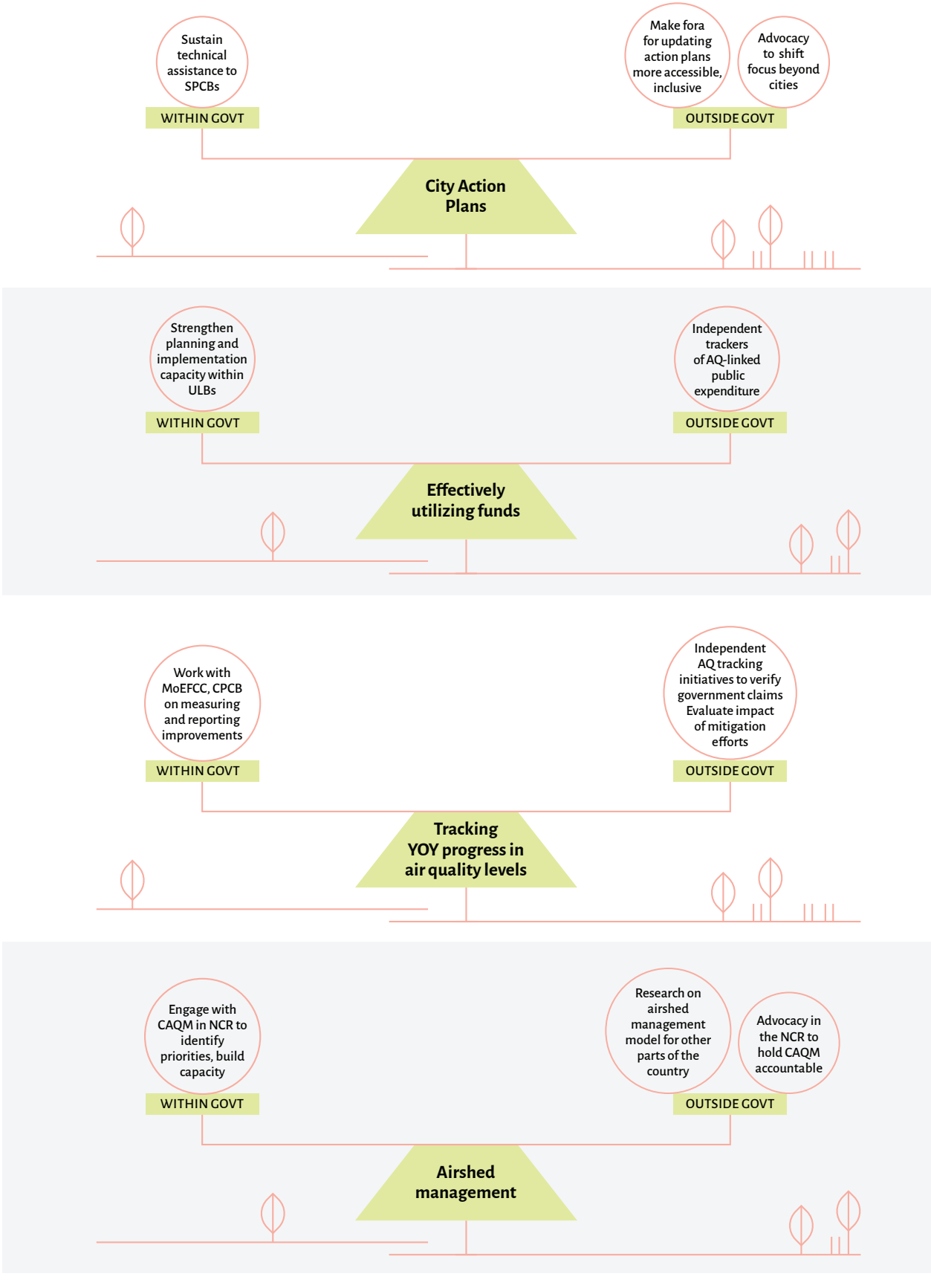
There is a significant lacuna in the existing literature on the costs of mitigation actions. Relatedly, tracking government expenditures on sectoral actions that may not be specifically earmarked against air quality management can be challenging. With the multitude of agencies involved, this task becomes complex and requires collaborative work together with sectoral and governance specialists.

Opportunities for funders

- Technical support to State PCBs and municipal corporations in assessing the costs of interventions, and developing plans for budget allocation under NCAP and the 15th FC grants.
- Research and independent tracking of previous budget allocations and expenditure on pollution mitigation interventions (identified explicitly, or related).

In summary, funders could aim to strike a fine balance between supporting efforts to strengthen institutional capacity through direct engagement, and research and advocacy to hold agencies accountable and expand the scope of pollution mitigation in India. **Figure 3** outlines four key areas for supporting initiatives working within and outside government.

FIGURE 3: Striking a fine balance while engaging with government agencies on policy priorities



5. Foundational Scientific Inputs

5.1 Health impacts

The Indian government has been traditionally skeptical of the large body of global literature on public health impacts of air pollution, and insisted on indigenous work. Efforts to catalogue the impact of long and short-term exposures to pollution levels on a range of health outcomes go some way towards addressing any genuine gaps in the evidence base and provide the basis for future policy.

There are two important other ways in which epidemiological work can guide policy more directly going forward. First, through the conduct of accountability research examining the efficacy of existing and future policies on health outcomes. The availability and use of registry data on births, deaths, and health conditions that has become more common through the pandemic can facilitate this work and lend it an added sense of credibility.

Second, by advocating for the establishment of a formal process through which advances in science (including epidemiology) are factored into decision-making around policy. At this point, it is unclear how frequently various standards including the National Ambient Air Quality Standards are to be reviewed, or what evidence if any is considered in the decision to set certain standards.

However, the public narrative should remain unambiguous that health impacts are known with sufficient certainty and large in magnitude to justify urgent action. Advocacy efforts would benefit from large-scale perception surveys and focus group discussions to identify ways to communicate health risks most effectively.

5.2 Monitoring

Expansion of the monitoring network has benefited from both government and philanthropic funding in recent years. The regulatory ambient air quality monitoring network, outside Delhi, continues to have significant gaps despite these improvements. Where resources are available, i.e. in non-attainment cities and those with access to the 15th FC grants, regulatory monitors are likely to expand quickly. Rural areas remain neglected and require urgent attention. Communities living in and around industrial clusters also languish from the absence of reliable, accessible air quality monitoring. Supporting citizen science initiatives in rural and industrial areas could enable local communities to demand recognition of heightened pollution levels and redressal.

Along with the need to widen the regulatory monitoring net to cover rural areas and smaller towns, we also need to make the net finer to be able to identify hotspots better in large metropolitan cities. These seemingly contradictory objectives are difficult (and likely inefficient) to achieve through the conventional, expensive, regulatory monitors alone. Application of hybrid monitoring approaches is inevitable.[xxi] Encouragingly, PCBs have become more comfortable with the use of satellite data-derived estimates, and low cost sensors. Notable recent initiatives have included government collaboration to colocate sensors with regulatory grade monitors [xxii], and senior Central PCB officials co-authoring a paper on changes in pollution levels in India using satellite data-based methods.[xxiii]

5.3 Source apportionment

As with the expansion in the monitoring network, source apportionment studies are now being commissioned across the country by state and local governments. In particular, with the tripartite MoUs between SPCBs, urban local bodies and technical institutes, local plans and scientific inputs are expected to be better integrated. Developing an official national emissions inventory is an important effort to prioritise in the near and medium term to provide a consistent base for planning and tracking purposes.

Translating the findings of the source apportionment studies to identifying and prioritising mitigation actions is not a linear process, however. The technical institutes also need to engage with social science researchers and local civil society groups to ensure that the plans consider aspects of state capacity and social justice adequately. Funders could play an important role in establishing platforms for these deliberations.

Monitoring networks and source apportionment studies are foundational for understanding and managing pollution levels. Developing this knowledge base across the country is important, and the last few years have seen considerable improvements. That said, investments in these should not be mistaken for mitigation actions.[xxiv]

5.4 Linkages between air pollution and climate change

Air pollution and climate change have several common sources. Considering the intricate atmospheric interactions among the pollutants emitted from these sources, these two crises need to be tackled through an integrated strategy.[xxv] Impact on health outcomes in the near term deserve to be prioritised. Where possible, opportunities for co-benefits — e.g. interventions reducing black carbon emissions (household sources, stubble burning, waste burning) — should be harnessed.[xxvi] In the case of mitigation actions that result in near-term warming (such as sulphate removal) these effects should be acknowledged and compensated by simultaneously prioritising actions to mitigate short lived climate pollutants like methane.[xxvii]

Given how much of the air quality funding in India remains tied to climate objectives, these linkages have two key implications for funders. First, much remains unknown still about the mechanisms through which different constituents of fine particles affect temperatures, and precipitation in India; supporting scientific research here could be valuable.[xxviii] Second, multi-criteria assessments on the implications of mitigation actions on air pollution and climate change could help decision makers in devising integrated strategies.[xxix]

6. Sectoral Initiatives

Despite a consensus in the scientific literature on the outsized impact of household sources on pollution levels both indoors and outdoors, they are still not central to the public discourse or government efforts on air pollution. Similarly, industrial pollution gets treated as distinct from urban air pollution. Consequently, their impacts on air quality in the rural areas and at the regional levels get neglected in the mainstream discourse.

Table 1 provides a snapshot of the current state of play in different sectors, and a perspective on the possible path forward. Based on these, suggested priorities for policy asks, and associated activities for funders to support in the near term are outlined below.

- **Household sources:** With government subsides for LPG removed, there is a real risk of regression towards reliance on traditional solid fuels, undoing some of the positive gains of Ujjwala. Supporting research, and possibly large scale experiments, on willingness to pay for LPG, targeting mechanisms, and the design of awareness campaigns could help the central government reinstate subsidies, while keeping budgetary outlay in check.[xxx] The substantial improvements in health outcomes expected from improved use of cleaner fuels may significantly exceed these subsidy costs though; cost benefit assessments of alternative subsidy design approaches could help clarify this point. Supporting advocacy, in parallel, is essential to make household burning of solid fuels more visible as a source, and strengthen the public demand for the reintroduction of subsidies for the poor.

- **Power plants:** Compliance towards the gaseous pollutant standards notified in 2015 have been repeatedly delayed, and a new proposal by the Central Electricity Authority (CEA) suggests extensions up to 2034. [xxxi] Oddly, the CEA proposal does not acknowledge the impact of sulphur and nitrogen oxides' emissions on fine particles at all. Without civil society pressure, these regulations may never see timely compliance. Furthermore, there seem to be parallel dialogues currently within the communities working on climate change, electricity, and air quality on the compliance towards these standards and phase-out of coal power plants. Reconciling the multiple objectives of air quality improvements, national energy security, and just transitions could help the wider civil society find some consensus on an integrated strategy for the sector.

- **Industries:** All units belonging to the 17 categories of most polluting industries have already installed Continuous Emissions Monitoring Systems (CEMS). While CEMS data cannot be used directly for regulatory enforcement under the Air Act, they may be viewed as a useful instrument for industries to self-report emissions, and raising red flags for closer scrutiny. If basic information from the environmental consents (to establish and operate) on all industries are available in the public domain along with the CEMS data, local communities and the media can more ably hold polluters and regulators accountable. Persuading and supporting pollution control boards in embarking on such transparency initiatives could potentially drive a virtuous cycle in mitigating industrial emissions, although staffing challenges and pressures to improve the 'ease of doing business' persist. More broadly, industrial pollution, sidelined under NCAP's city-centric focus, needs to become central again to the air quality discourse.

TABLE 1: Current status and main areas of focus by sector

Sources	State of play	Path forward
 Household sources	Increased recognition of the role played by household sources in civil society. Ujjwala gains risk getting dissipated as LPG subsidies have been discontinued, and prices are currently unaffordable to many.	LPG needs to made affordable among the poor with substantial subsidy outlay coupled with behavior campaigns: clear mitigation approach, favourable political economy, but high fiscal costs. Research on willingness to pay and design of nudges vital as policy inputs. Advocacy on health impacts key to keep up pressure.
 Industries	Large, formal: Need effective regulation by the PCBs. CEMS installed in the 17 categories of most polluting industries, but their use for routine regulation remains limited. Enforcement challenges persist. Informal and SMEs: Ongoing efforts at fuel substitution towards natural gas being pushed, especially in the NCR. Consensus on zig-zag technology for brick kilns.	Ultimately needs a capable SPCB to deal with individual sub-sectoral issues. From a research standpoint, more empirical work on regulatory functioning and challenges needed. Transparency of regulatory data needs to be amplified as a foundational ask, as it can facilitate subsequent mobilisation and increase accountability of both polluters and regulators.
 Power Plants	SO_2, NOx standards announced by the MoEFCC in 2015, but low compliance, and repeated extensions since. Deadlines have now been pushed further to 2024, and proposal from Central Electricity Authority in 2021 to further extend timelines upto 2034.	Clear intervention, unfavourable political economy. Emphasis remains on advocacy to increase political backing for ensuring compliance. Expectations on climate action, and stranded/ underutilised assets could help build the case for phaseout of old plants.
 Waste Burning	Formal rules on waste handling exist, but inhibited by governance challenges. Nascent efforts at curbing burning, but needs push on better management. On their own, bans are unlikely to be effective.	Need both behaviour change among citizens, and greater political will for waste segregation and handling— requiring significant, systemic changes. Requires mobilisation, aggressive communication campaigns and greater amplification of successful case studies.
 Construction & Road Dust	Formal rules in place, but weak implementation. Discourse currently dominated by mechanical road sweepers and plantation drives, and more recently 'anti-smog guns'. Relatively nascent discussion.	Need greater public sensitisation, and increased capacity for enforcing construction dust handling and improved road design and maintenance. More scientific roadside greening approaches necessary.
 Transport	BSVI transition has been a major victory in recent years. In addition, EVs seem to be at cusp of dramatic growth. 18,000 crores allocated in Union Budget '21-'22 for public transport infrastructure. Vehicular scrappage policy announced, creating incentives for retiring old, polluting vehicles.	Technically well-developed field with many engaged research and advocacy groups. Freight is a major contributor to vehicular emissions, and needs to be prioritised more. State level EV policies and increased take-up provide another active area for engagement. Continued support for the planning and research of public transport infra essential in Indian cities, despite EV transition.
 Stubble burning	Farm fires increased in winter 2020. Punjab state elections in 2022 could adversely impact enforcement drives in winter 2021 as well. Public visibility and political posturing have likely become counterproductive.	Needs urgent renewal of efforts towards farmer cooperation. Cropping choices are deeply entrenched due to government incentives over many decades through input subsidies and price guarantees. Long term transition away from paddy needs extensive engagement and deliberation with the farming community.

- **Agricultural sources:** For better or worse, stubble burning has become the most visible source of pollution in the public imagination. As a result, years of stalemate and little progress could be particularly frustrating. Given this context, the investments on in situ and ex situ methods of managing stubble could be helpful if they yield short term gains; however, they deserve more scrutiny about their relevance in the longer term. Stubble burning in north India in the winters is only one manifestation of a multi-faceted agricultural crisis, which has also resulted in crises in groundwater levels, and electricity distribution. Excessive fertilizer use is another agricultural practice with significant implications for air pollution resulting in emissions of ammonia. Philanthropic funds could aim to open up a long term dialogue on more sustainable agricultural practices and crop choices involving the farming community.

- **Waste management:** Significant resources are being allocated towards improving waste management, including through the air quality-linked grants from the 15th FC. Rather than responding to waste burning through the lens of bans and enforcement, mainstreaming air quality objectives — minimising disposal of waste through burning, landfills and waste-to-energy plants — into the functioning and incentive structures of the municipal bodies could be a more effective strategy. A recent assessment suggests that more waste is burned in India than gets treated, recycled or landfilled, but acknowledges large uncertainties in the underlying data.[xxxii] Improving data on waste generation, collection and subsequent treatment could therefore be another priority for funders.

7. Concluding Remarks

- COVID-19 has been a setback for the nascent but growing air quality discourse in India— whether this is temporary or not depends on us as a collective. Unsurprisingly, COVID-19 response results in reduced administrative capacity across the board. It has also resulted in added fiscal pressures on state and local governments that may continue to have ripple effects for years. The persistent uncertainty around future waves could result in start-stop waves of field work and in-person convenings among civil society groups as well. Together, these may result in undoing the gains in air quality mobilisation in recent years. Philanthropic funding should actively look to stem this tide with a renewed push in the short and medium term.

- 2021 promises to be a significant year for international climate negotiations. All countries, including India, are expected to up their climate ambitions, which in turn may create some opportunities with air pollution co-benefits. Viewing air pollution as a climate-adjacent issue does have its limitations though. If funding is channeled through a climate lens alone, air pollution mitigation measures that are climate-neutral or indeed may have near-term climate penalties may drop down the list of priorities, despite substantial impacts on health outcomes. Climate change and air pollution need to be addressed through an integrated strategy, with near term gains in public health prioritised.

- Substantial air quality improvements in India can result only through sustained, long-term efforts, which needs strong, capable institutions at all levels of government. These institutions will be well-resourced and empowered only if air pollution is politically salient. Widening the ecosystem to include more actors working towards improved governance, deepening the discourse in Indian languages, and focusing public demand on priorty asks could help set off a virtuous cycle towards transparent, responsive, air quality management in India.

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