

# Cleaning City Skies

Our future is urban, yet air quality in cities is increasingly toxic, causing millions of premature deaths each year. In the wake of last year's Clean Air Cities Declaration, this Voices asks, how and where should we focus efforts to improve air quality in cities?

## Air Pollution Is Solvable



**Kurinji Selvaraj**  
Council on Energy, Environment, and Water

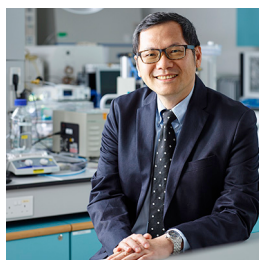
Air pollution is a severe health risk across many Asian cities. To make our cities livable once again, policymakers and civil society must together prioritize management of air pollution.

Firstly, the focus should be on concrete actions and policy measures that control source emissions. With dispersed sources of pollution—such as vehicles, households, waste burning, and dust—administrative solutions that require monitoring and enforcement are likely to fall short in the short term as a result of limited financial and human resources. Immediate policy focus must be on specific measures such as ensuring that power plants and industries comply with emission norms and switch to cleaner fuels and incentivizing auto manufacturers to meet the latest emission standards.

Secondly, the implementation of control measures calls for more significant government commitment, such as increasing accountability of the responsible agencies through the periodic disclosure of data on monitoring, inspections, and enforcement actions into the public domain. Further, the responsible agencies should be equipped to make targeted interventions by actively using enforcement tools such as the Continuous Emission Monitoring System, live tracking complaints received through grievance portals, and identifying pollution hotspots highlighted by citizen-owned low-cost sensors.

Finally, it is crucial to educate citizens about sustainable lifestyle choices and mobilize them to create a demand for clean air. This will make the issue politically salient and give the rallying cry for collective action to solve our air-pollution crisis.

## Tighter Control of Emissions from Restaurants Is Needed



**Chak Keung Chan**  
City University of Hong Kong

High-density urban environments are subject to large traffic flows and a high abundance of restaurants, especially in districts dominated by commercial and retail activities. Both vehicular and cooking emissions represent significant anthropogenic sources of gaseous and particulate air pollutants.

Common cooking methods and the use of spices can produce substantial amounts of volatile and particulate compounds. It's been estimated that 15%–30% of ambient organic particulate matter is attributable to cooking emissions. Volatile organic compounds, which represent the bulk of gas-phase cooking emissions, can form additional secondary organic particulate matter upon atmospheric oxidation. Such a post-emission process augments air pollution and could have substantial impacts on downwind areas.

In high-priced areas such as Hong Kong, restaurants are frequently located on lower-level floors of high-rise buildings, meaning a low release height for kitchen emissions. The combination of tall buildings and high density generates a street-canyon environment, impeding the dispersion of emissions. This greatly exacerbates the exposure to toxins.

Policy efforts have largely focused on abating traffic emissions through fuel switches, retrofitting vehicles with emission-control devices, and the promotion of hybrid and electric vehicles. However, far fewer measures have been taken to actively control cooking emissions. More stringent regulations on mitigating and reducing emissions from restaurants in dense urban environments are needed to address their adverse environmental and human health impacts.

## Urban Air Is a Sustainability Challenge



**Noelle Selin**  
Massachusetts Institute of Technology

Ensuring that cities are designed and built to protect and enhance the well-being of all of their inhabitants, present and future, will take both new knowledge and inclusive policy.

Air pollution leads to millions of deaths each year worldwide, and its impacts are felt by even more people, especially children and other vulnerable individuals who suffer from respiratory symptoms and have to limit time outdoors. Urban air quality is also linked to a broad range of other pressing sustainability challenges, including mitigating climate change, providing energy and food to a growing population, and ensuring economic opportunity for all.

Technologies that reduce emissions from sources such as power plants and cars exist, and their use can and should be increased through targeted policies. But it is also important that measures to address air quality reinforce rather than counteract efforts to address other environmental and societal problems. For example, efforts to mitigate climate change by moving from fossil fuel to renewable energy help mitigate air pollution. However, others—such as investing in natural gas—might reduce some urban pollution now but still contribute to climate change.

Policies, technology, and infrastructure affect not only air pollution but also people's health and well-being, both nearby and far away, in complex ways. Addressing air pollution with approaches that simultaneously support a sustainability transition thus requires new, targeted knowledge. Knowledge generation and policy action should also involve those most affected by pollution's impacts.

### “Urban” Air Pollution: A Regional Problem with a Long Tail



**Milind Kandlikar**  
University of British Columbia

Urban air pollution invokes images of automobiles on clogged highways and industrial smokestacks. In megacities of the developing world, especially those in South Asia, the reality is altogether more complex. Sources of pollution in these cities are numerous and go far beyond formally regulated sources such as cars and power plants. They include emissions from households, from informal local businesses, from small industrial operators, from construction, and from activities related to waste disposal, reuse, and recycling. Each city faces a unique “long tail” of pollutant sources from within its boundaries. Air pollution is also transboundary. New Delhi’s annual tryst with pollution from agricultural fires 100–200 km away has reached catastrophic proportions. Singapore’s otherwise clean air is routinely hit by fires from distant Indonesian oil palm plantations. Cities such as Tehran, Lahore, and New Delhi are particularly hard hit by annual winter inversions tied to the meteorology of their locations.

Cities are the primary engines for growth in the developing world. People come to cities in search of jobs, livelihoods, and better lives. Yet, the shadow of air pollution hangs over residents and threatens these vital centers. Cities cannot solve this problem alone because pollution, as the cliché goes, does not recognize boundaries. Solutions that work will need to involve monitoring, scientific assessment, and policymaking within cities, which will all crucially need to be negotiated across nearby jurisdictions. Most fundamentally, we will need to recognize that the experience of each city is unique, that each faces its own version of the long tail, and that no one approach fits all.

### Thinking Outside the Box to Clean the Air We Breathe



**Shonali Pachauri**  
International Institute for Applied Systems Analysis

Mounting air pollution is an urgent crisis affecting the well-being of city inhabitants around the globe. It is hazardous to people’s health and productivity and affects the most vulnerable populations disproportionately. Limited knowledge of causes still hampers efforts to address key sources in many cities.

Cities in the Global South are among the worst affected and face specific challenges. Sources of air pollution in these regions are more diverse, require a larger set of interventions, and need more coordination among sectors, actors, and jurisdictions. Paradoxically, these cities often have little capacity for such coordination. Even when policies and regulations to address pollution sources exist, implementation and enforcement remain weak.

Sources that often contribute more to air quality in some cities—such as household cooking and heating, open burning of agricultural residues and municipal waste, and fireworks—require changing people’s behaviors, and practices tend to be neglected. Typical measures to tackle pollution include technical fixes on large point sources, such as power plants and industry, or the transport sector. Effective strategies require coordinated and integrated approaches that go beyond technical fixes in specific sectors to also focus on spatial planning, raising awareness of pollution causes and impacts, and behavior-change interventions. Cities need to engage with stakeholders beyond their own borders to also address pollution arising in hinterlands. Radical and ambitious efforts are needed to protect the air we share and save lives.

### The Curse of the Kuznets Curve upon Air Quality?



**Roy Harrison**  
University of Birmingham

Poor outdoor air quality is associated with around four million premature deaths annually worldwide. The environmental Kuznets curve predicts that as countries undergo economic development, their environmental quality is degraded until a point is reached where public pressure and increasing prosperity lead to a cleanup and the environment steadily improves. Many of the premature deaths are occurring in highly populated countries such as India and China, which are close to the top of the curve of environmental degradation.

Is the degradation of air quality an inevitable consequence of economic growth? The answer has to be definitely not, but avoidance requires that appropriate policy measures be put in place in advance of the degradation’s occurrence. Such measures do not necessarily adversely affect economic development but do need careful consideration and will differ from country to country. In China, an action plan from 2013 to 2017 in the Beijing area reduced concentrations of fine particles by 25% by invoking mitigation measures, many of which could have been applied much sooner to potentially avoid the worst of the pollution.

Without doubt, cost-effective solutions are available, but these require the collaboration of many disciplines—including atmospheric science, environmental medicine, engineering, economics, and social and political science—and need to be sensitive to the social and political context of the individual country. Many countries, including my own, have substantial foreign-aid budgets, and it is unfortunate that this kind of joint activity does not yet appear to have adequate resourcing.

### Integrated Urban Planning



**Yue Qin**  
The Ohio State University

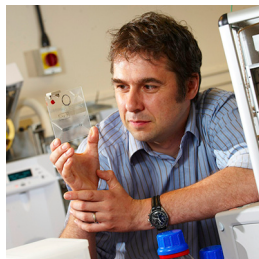
Urban air pollution has caused substantial premature deaths. Fast-growing population and rapid urbanization, together with other critical societal and environmental challenges, could further exacerbate such risks. Integrated planning is thus key.

First, we must integrate strategies for mitigating air pollution with each city's unique socio-economic conditions, geography, and demographics. Air-pollution efforts can be flexible, feasible, and sustainable only if we factor the root causes in social, technological, and political dimensions and the resources at our disposal into city-specific sources of air pollution.

Second, we must integrate urban air pollution with outside population groups. Transboundary air pollution can affect outside populations via atmospheric transport and vice versa. Relocating polluted industries to suburban or rural areas could thus end up jeopardizing more vulnerable population groups without significantly improving urban air quality. We need to cut air pollution at the source to provide cleaner air for all.

Third, we must integrate urban air pollution with other environmental challenges to seek co-benefits and avoid trade-offs. Inefficient and dirty energy production and consumption are one primary reason for urban air pollution, which often simultaneously contributes to local water stress and global climate change. Strategies such as electrifying urban economy with clean energy can provide win-win opportunities. Importantly, given that electrification addresses only endpoint problems, building a clean power grid is needed to alleviate multiple environmental stresses throughout the entire lifecycle.

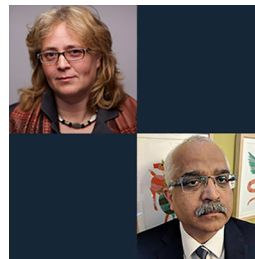
### Clean Air for Cities Starts Well beyond Their Borders



**Alastair Lewis**  
University of York

Although perhaps counterintuitive, strategies for clean air in cities must start outside their boundaries in the suburban and rural environments that surround them given that air pollution is highly mobile between regions and nations. The policy choices that are made around controls on emissions from wider manufacturing, the energy sector, and agricultural activities have profound effects on the final air quality that can be achieved in the urban environment. National-scale decarbonization of electricity production, the elimination of coal combustion, the minimization of agricultural-waste burning, and the provision of alternatives to the use of open fires for home heating and cooking are all essential pre-requisites in any effective air quality strategy. Without clean air arriving at the boundaries to cities, local-scale interventions such as traffic-fleet management, congestion charging, public-transport infrastructure, and so on might deliver only modest improvements to urban residents. But there are reasons to be optimistic about urban air quality in the coming decades if peripheral pollution sources can be effectively eliminated. Road transport is the largest source of many air pollutants in cities at present, but the quantity of emissions from the tailpipe will undoubtedly decline as electrification of vehicles slowly gathers pace.

### Invest in Public Transportation and Electric Cars



**Nives Dolsak and Aseem Prakash**  
University of Washington

About half of the world's eight billion people reside in urban areas, and about 80% of them experience outdoor air-pollution levels that exceed World Health Organization guidelines. The poor are the worst affected.

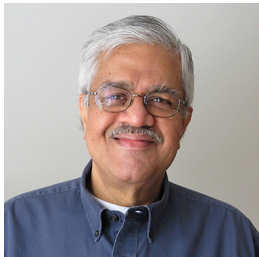
The transportation sector is an important contributor to air pollution. Cities lack adequate public transportation, and biking is often not a viable option given the urban sprawl. Residents increasingly rely on personal vehicles to meet their transportation needs. Rising urban affluence also shifts preferences toward personalized transport.

Too many vehicles lead to congested roads. The stop-and-go traffic burns more gas and accentuates air pollution. Congestion pricing or demand-side policies (such as high-occupancy lanes or the odd-even rule) have spotty efficacy and are politically unpopular.

Cities need to redouble their investments in public transportation, whether bus based or train based. Although the switch to cleaner fuels and the induction of low-emission vehicles will lower pollution, widespread adoption of electric vehicles will be a game changer. Cities need to construct charging stations and launch an aggressive buyback of gasoline vehicles.

However, city budgets face rising demands for education, sanitation, water, and housing. The political challenge is to raise the salience of air pollution to motivate urban governments to invest in the low-emission transportation infrastructure.

### Addressing the Urban Air-Pollution Challenge



**Madhav G. Badami**  
McGill University

The persistently poor urban air quality, especially in Asia, is a major health challenge. Urgent action is imperative but needs to be undertaken intelligently. Given that the sources of and their contribution to air pollution vary from city to city, policymaking needs to be tailored to the particularities of each urban region.

Generating quality city-specific data on the contribution of various sources to health-critical pollutants is therefore important. Further, a wide range of policies will be necessary for addressing the multiple sources and factors relating to urban air pollution. For long-term effectiveness, it is vital to consider how different groups in society are affected by and respond to policies, which they might sometimes do in policy-defeating ways. Attention to equity is also important.

In the case of air pollution from transport, for example, new vehicle emission and fuel quality standards are important but inadequate. Measures to minimize motor-vehicle activity by means of integrating land use with transport, convenient and affordable public transport, pricing policies, and infrastructure and facilities for walking and cycling will also be required. Such an integrated approach can help achieve multiple objectives (congestion reduction, energy conservation, safety, and social justice) in addition to mitigating air pollution and greenhouse gas emissions.

### Clean-Air Science and Technology Await



**David Parrish**  
Jinan University

Unhealthy air quality has affected all of the world's urban areas. Decades of effort in earlier developing cities overcame substantial scientific and engineering challenges; today, the knowledge and technology developed in that effort are available to all cities. Los Angeles is an early success story; no city ever suffered worse air quality. Improvement was slow but dramatic; ozone pollution decreased by a factor of five between 1980 and 2015, and particulate matter (PM, the air pollutant with the greatest health effects) similarly declined. Beijing is a later success story. A decade ago, Beijing air pollution was in the world's headlines, but today it is much improved, particularly with regard to PM. Both cities reduced all air-pollutant emissions in any way possible. Emissions from industrial and electrical facilities were reduced or eliminated. Over decades, the US and Europe developed technology to reduce on-road vehicle emissions—a particularly important target—and this was much more rapidly implemented in Beijing. This city also developed effective public transportation, including an extensive subway system, which is absent in Los Angeles. These two cities demonstrate that healthy urban air quality is technically feasible, and with the technology now readily available, it can be achieved much more quickly than the decades required in Los Angeles. The great challenge for developing cities is to effectively allocate their scarce economic resources to address the pressing needs of the populace; in addition to air pollution, these include clean food and water, affordable housing, reliable electricity, and efficient transportation. When the political will is developed to also prioritize clean air, the science and technology await.