Breathe Better:
How leading cities have rapidly cut air pollution

Breathe Cities

Acknowledgements

AUTHORS

Toby Coombes
Vivian Pun
Fadhil Firdaus
Pongsatorn Greigarn
Florinda Boschetti

CONTRIBUTORS

Zoe Allen
Mariana Batista
Rose Beynon
Nadav Bigelman
Honorine van den Broek d'Obrenan
Phoebe Calcutt
Zoe Chafe
Alejandro Colsa
Liv Cowgill
Matilda Crawley
Agata De Ru
Stelios Diakoulakis
Ying Gao
Camila Herrero
Iyad Kheirbek
Michael O'Neill
William Roderick
Priya Shankar
Camille Tallon
Manuel Trujillo
Mingming Wang
Joshua West
Christina Xiao
Xian Zhou

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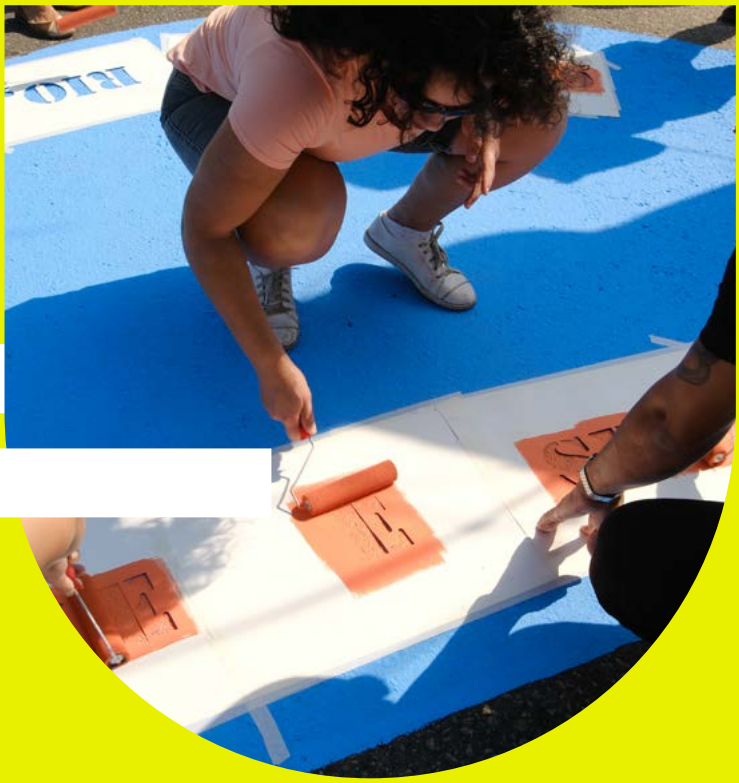
About Breathe Cities

Breathe Cities is a global initiative supporting cities to clean the air and enhance public health. Delivered by Bloomberg Philanthropies, Clean Air Fund and C40 Cities, the initiative offers cities tools to take ambitious clean air action by expanding access to data and raising public awareness. Launched in 2023 by Michael R. Bloomberg, the UN Secretary-General's Special Envoy on Climate Ambition and Solutions and founder of Bloomberg Philanthropies, and Sadiq Khan, Mayor of London and C40 Cities Co-Chair, Breathe Cities is accelerating action in 14 cities to improve the air 77 million people breathe. To learn more, visit Breathe Cities' website or follow on Instagram and LinkedIn.

1. Clean air progress is real and measurable



Air pollution remains the largest environmental health risk worldwide.[1] It causes cardiovascular and respiratory disease, increases childhood asthma, contributes to premature birth and low birth weight, and disproportionately affects lower-income communities.[2]

Cities are at the frontline of this air pollution challenge. The concentration of vehicles, buildings and industry in cities creates large sources of emissions, which their dense populations are exposed to on a daily basis. The health, economic and social costs are therefore often felt most acutely in urban areas.

However, cities are also uniquely positioned to act. They play a central role in transport planning, land use, enforcement and public investment. City leadership can drive rapid and sustained improvements when aligned with national policy and regional frameworks.

This report examines air quality trends in C40 and Breathe Cities between 2010 and 2024. It identifies **19 cities that achieved remarkable reductions of at least 20% in both fine particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) over the past 15 years**, in some cases achieving reductions of around 45%. These cities span Europe, North America and Asia. Notably, **nearly half of the leading cities are in Central and East Asia, proving that rapid structural improvement is not confined to long-established regulatory systems**. It is also highly achievable in fast-growing, densely populated contexts as well.

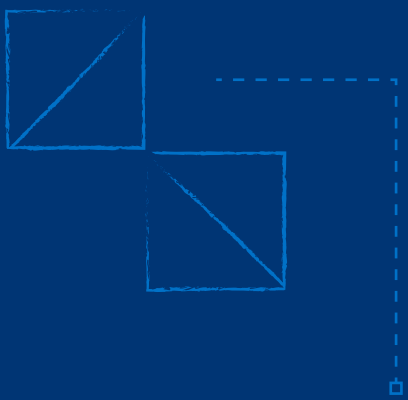
To understand what successful action looks like in practice, this report analyses the common systems, governance structures and policy reforms implemented across these 19 cities. The aim is not to attribute progress to a single intervention, but to identify common elements that underpin rapid and sustained improvement that can inform future action.

The report also provides a deeper look at two of the leading Breathe Cities, Paris and Warsaw, showing how they have applied the Breathe Cities approach across data, policymaking, and community engagement to successfully tackle air pollution. Finally, the report turns to two Asian Cities, Jakarta and Bangkok, highlighting how these more recent Breathe Cities are applying and expanding the Breathe approach in order to achieve similar improvements in air quality.

Air pollution impacts

Air pollution is the largest environmental risk factor worldwide, causing significant harm to both public health and the economy.[1] It increases disease and mortality rates, strains healthcare systems and reduces peoples' ability to work, participate in society, and generally enjoy a good quality of life.[2]

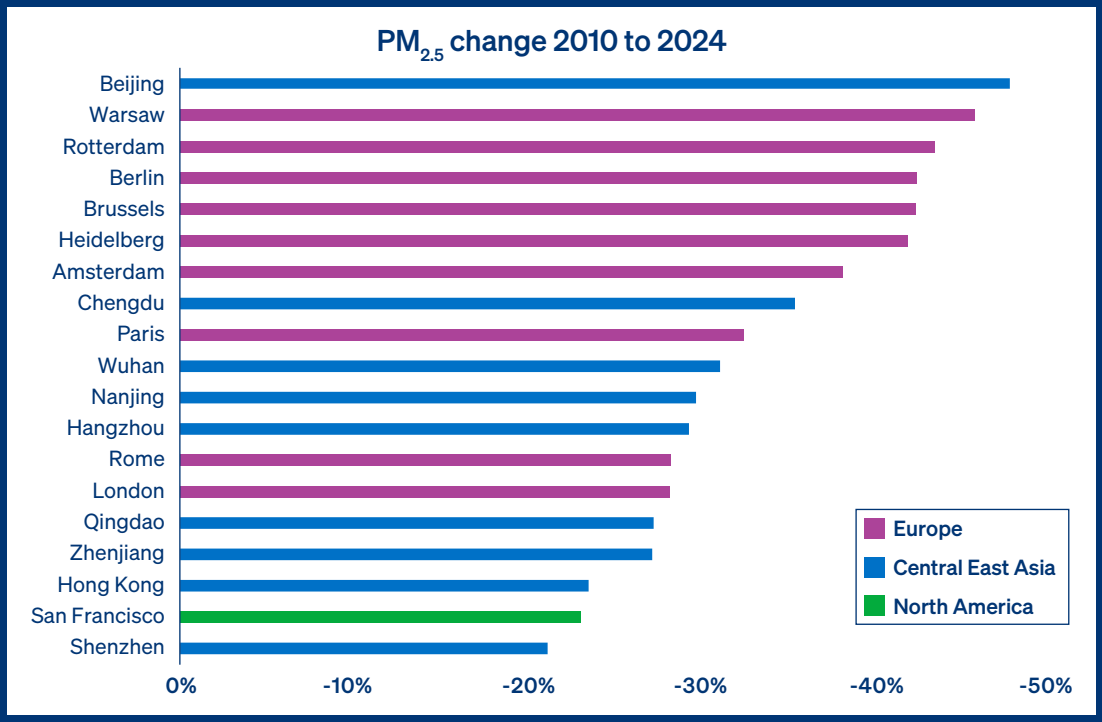
These impacts are not evenly distributed and often exacerbate existing inequalities. Air quality is frequently poorer in lower-income neighbourhoods[3], and some groups are more vulnerable than others. Older people are especially susceptible to illnesses linked to exposure to $PM_{2.5}$, which is also associated with serious childhood health issues, including premature births and low birth weight. In addition, exposure to NO_2 is strongly linked to higher prevalence of childhood asthma.[1] Because emissions are concentrated and populations are dense, the effects of air pollution are often felt most acutely in urban environments.

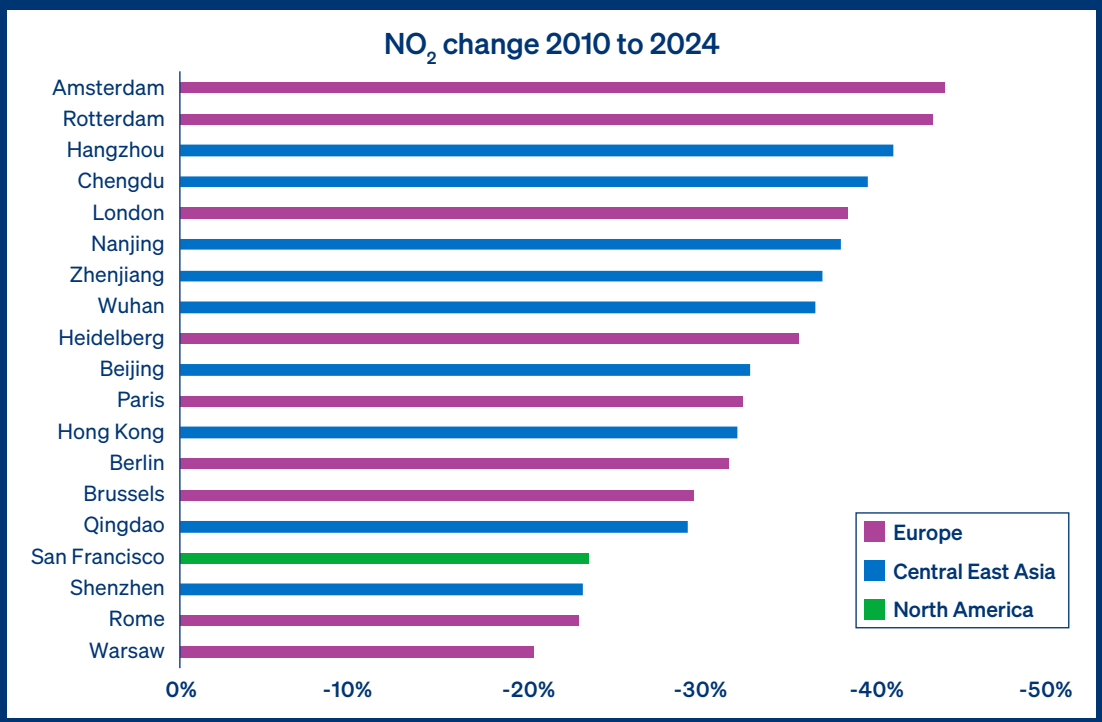


2. What the data shows

Using standardised global air pollution datasets that enable comparisons across cities and over time (see methodology), we analysed trends in $PM_{2.5}$ and NO_2 across all cities in the C40 and Breathe Cities networks (2 of the 14 Breathe Cities are non-C40 members) between 2010 and 2024. While the average pollution levels declined across the network, 19 cities stood out for cutting levels of both pollutants by at least 20%.

The largest reductions in $PM_{2.5}$ were recorded in Beijing (48%) and Warsaw (46%). The biggest reductions in NO_2 were achieved by two Dutch cities, Amsterdam (44%) and Rotterdam (43%). These results demonstrate that sustained air quality progress is possible across a wide range of political, economic and governance contexts.





Figures 1 and 2. Reductions in population-weighted annual average $PM_{2.5}$ and NO_2 for C40 and Breathe Cities that achieved at least a 20% reduction in both pollutants from 2010 to 2024.

This analysis does not attribute specific reductions to individual policies or attempt to rank interventions by impact. Instead, drawing on desk research, C40 data, and consultation with regional and technical experts, the analysis identifies common governance approaches, delivery systems and structural reforms implemented by these 19 cities since 2010 that are consistently associated with long-term progress.

The evidence highlights two key points. **First, substantial reductions can be achieved within 15 years. Second, progress does not happen automatically; it requires deliberate, coordinated action sustained over time**.

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Air pollution reductions in Breathe Cities

Four of the 19 leading cities are Breathe Cities: Brussels, London, Paris and Warsaw. Levels of NO_2 in London, Paris and Brussels fell by 29% to 38%, and in Warsaw by 20% between 2010 and 2024. $PM_{2.5}$ reduced by 28% in London, 32% in Paris, 42% in Brussels and a near world-leading 46% in Warsaw.

Breathe Cities has successfully supported these cities with enhanced data collection and dissemination, designing and implementing policies to reduce emissions, and growing community engagement and approval for action on air pollution.

This approach is being expanded across 10 additional global cities, which are sharing their knowledge and experience to scale up best practices and improve air quality across the world.

3. What leading cities have in common

While contexts differ, the 19 leading cities share several common approaches. These recurring elements provide practical insight into how sustained, measurable air quality improvements are achieved.

3.1 Anchor action in evidence and accountability

Leading cities have made significant investments in air quality monitoring and emissions analysis. Since 2010, they have expanded dense air quality monitoring networks. More recently they have utilised innovative monitoring technologies such as small sensors, and most cities make this data publicly accessible. Nearly all 19 cities have developed emission inventories and air quality management plans to identify priority polluting sectors and guide intervention sequencing. Strengthening monitoring capacity and compliance systems has improved enforcement and public trust across cities and regions. Transparent data strengthens accountability, sustains political mandate and enables course correction over time.

Strong data systems allow cities to:

- Identify dominant pollution sources
- Prioritise structural reforms
- Track progress over time
- Build public trust through transparency

CITY ILLUSTRATIONS

Beijing, China

Over the past decade, Beijing has built an advanced three-dimensional air quality monitoring network. It integrates more than 70 reference stations, over 1,000 high-density sensors, satellite remote sensing and vertical atmospheric profiling. This system allows policymakers to distinguish local emissions from regional transport emissions, quantify source contributions and dynamically adjust measures.

London, UK

London produces regular emissions inventories, and publishes publicly available summary reports.[4] This evidence base has supported large-scale city actions such as the Ultra Low Emission Zone, which reduces vehicle emissions across the city.[5] Together with Breathe Cities, London has also created a large network of air pollution sensors in collaboration with schools, hospitals and community groups. The data is all made public, which has enabled wider public understanding of air pollution and its impacts.[6]

San Francisco, USA

In 2020, San Francisco worked with the Bay Area Air Quality Management District to produce a Citywide Air Quality Health Risk Assessment.[7] The assessment provides an air pollution emissions inventory from stationary and mobile sources, including maritime sources such as ferries and the port. The city combined this data with pollution dispersion modelling to create a map, the 'air pollutant exposure zone', showing concentrations of air pollution and levels of cancer risk from $PM_{2.5}$ across San Francisco. The Citywide Air Quality Health Risk Assessment shows that while air quality in San Francisco is good in most areas, air pollution levels and associated health risks are higher for communities living close to freeways, industrial activities and ports. The map is publicly available online, increasing transparency and enabling residents to learn about air pollution and health risks in their neighbourhoods.[8]

3.2 Promote active travel

Most leading cities have taken major steps to reshape urban space in favour of clean mobility. They have expanded cycling networks and pedestrianised zones at scale, and reallocated road space away from private vehicles. Many cities have also expanded green spaces and reduced parking provision as part of the broader transport reform. These visible changes reinforce long-term behavioural shifts while improving urban quality of life.

CITY ILLUSTRATIONS

Amsterdam and Rotterdam, Netherlands

Both cities continue large-scale investment in their cycling infrastructure and prioritising walking, cycling and wheeling over car travel. Roads and parking spaces have also been repurposed into bike parking, green areas and playgrounds to reduce reliance on motor vehicles.[9] Active travel has become a structural pillar of urban mobility rather than a supplementary initiative.

Heidelberg, Germany

Heidelberg has developed an extensive bike lane network[10] and designed new districts such as Vauban and Bahnstadt to prioritise active transport and limit vehicle traffic.

Paris, France

Through the successful Plan Velo du Paris (Paris Bike Plan),[11] first launched in 2015, Paris has rapidly built hundreds of kilometres of bike lanes. At the same time, thousands of parking spaces have been removes[12] and streets redesigned to create a greener, more pedestrian-friendly environment.

Brussels, Belgium

Brussels has doubled the length of its dedicated bike lane network, installed around 40,000 secure bicycle parking spaces, and pedestrianised a large part of the city centre. The city has also created 'School Streets' at 11% of primary schools to promote walking and cycling.[13]

Warsaw, Poland

Warsaw expanded its cycling network from 275 km in 2010 to over 870 km by 2025.[14] This growth has been complemented by increased green infrastructure and community-focused public spaces designed to reduce reliance on private vehicles.[15]

San Francisco, USA

San Francisco has pioneered parking reform in the USA through demand-responsive pricing, and by eliminating parking minimums in 2019, which had required businesses to provide a certain number of parking spaces. While car parking occupies vast areas of US cities, it now accounts for just 3% of land area in central San Francisco.[16]

Hangzhou, Nanjing and Chengdu, China

Chinese cities such as Hangzhou and Nanjing have revitalised cycling infrastructure at scale. Hangzhou, the first Chinese city to implement a public bike-sharing scheme, has developed an extensive network of over 4,000km of cycling greenways.[17] Nanjing has introduced comprehensive action plans to promote walking and cycling, resulting in thousands of kilometres of green walking paths and cycleways.[18] Chengdu was the first city to propose the 'park city' concept and has served as a demonstration area for the concept. Green coverage of the city's built-up area is now 46%, with more than 10,000 kilometres of greenways accessible to walkers and cyclists.[19]

3.3 Modernise and electrify public transport at scale

Most of the 19 cities have expanded or modernised their public transport systems since 2010. Metro and tram networks have been extended, rail connectivity improved, and nearly all cities have invested in electrifying their bus fleets, recognising that diesel buses can be a large source of $PM_{2.5}$ and NO_2 emissions. Investment in high-capacity transit creates emissions reductions and supports long-term mode shift away from private vehicles.

CITY ILLUSTRATIONS

Chinese cities

Nearly all surveyed Chinese cities have built or substantially expanded their metro systems since 2010, reinforcing high public transport mode share. Shenzhen became the first major city in the world to fully electrify its bus fleet, while Beijing and other cities expanded their metro systems rapidly since 2010 alongside large-scale deployment of electric buses. Several cities have also strategically limited parking availability near metro stations to encourage transit use.[20]

Berlin and Heidelberg, Germany

Berlin has gradually extended its S-Bahn commuter rail system since 2010, while Heidelberg has upgraded and expanded its tram lines and now operates over 60% of its bus fleet as electric.[21]

Warsaw, Poland

The city has invested heavily in the public transport system with the opening of a new tram line in 2014 and the construction of the M2 metro line, which were designed to create a shift away from car travel. Low and zero-emission buses now make up about 40% of the fleet, with a goal of 100% electric operation by 2050.[21]

London, UK

London has continued to develop its public transport with the construction of the Elizabeth Line, a railway that crosses the city centre and connects east and west of the city as well as Heathrow airport. The city has also introduced more electric vehicles, with 25% of its bus fleet now electric and all other buses upgraded to meet Euro 6 emissions standards.[22]

3.4 Accelerate the transition to electric vehicles (EVs)

Where walking, cycling or public transport cannot meet all transport needs, many of the 19 cities have moved faster than national or regional requirements to electrify motorised transport. Cities have created public-private partnerships to install electric charging infrastructure and, in some cases, even introduced charging mandates in commercial and residential buildings to support uptake of EVs. Targeted incentives and subsidies have also supported uptake and fleet renewal.

CITY ILLUSTRATIONS

Paris, France

The city has installed more than 2,000 public EV charging points through a joint public-private partnership.[23]

San Francisco, USA

San Francisco has complemented California's promotion of EVs by mandating the instalment of charging infrastructure in all new developments and major renovations.[24] The city also provides financial incentives of up to US$120,000 to support the installation of EV charging infrastructure in all existing and new buildings.[25]

Rotterdam and Amsterdam, the Netherlands

Both Dutch cities have provided targeted incentives and subsidies to encourage residents to switch from fossil fuel vehicles to electric alternatives.[26,27]

Chinese cities

China remains a global leader in vehicle electrification. Most of the cities studied have achieved majority-electric bus fleets, with Shenzhen setting a global benchmark by fully electrifying its entire bus fleet several years ago. Beijing and Shenzhen have combined national subsidies with local incentives and restrictions on fossil fuel licence plates. The necessary charging infrastructure has also expanded rapidly across these cities, exemplified by Beijing deploying more than 3,000 public charging stations and Shenzhen introducing a mandate for EV charging in all new buildings and car parks. [28,29]

3.5 Restrict older, dirtier vehicles

Many of the cities, particularly in Europe, have implemented low emission zones to limit access for older, high-emitting vehicles from entering or driving in the city. Freight access regulations have been tightened in several urban centres, while construction machinery standards have been strengthened in cities such as London and Berlin. These measures directly target high-emitting sources in dense urban areas. To ensure fairness, cities such as London have offered financial assistance to drivers to scrap or retrofit their non-compliant vehicles. This has mitigated the impact on people or businesses with fewer means to purchase compliant vehicles.

CITY ILLUSTRATIONS

London, UK

London expanded its pioneering congestion charge zone in the city centre to a world-leading Ultra Low Emission Zone that now covers the entire city. This applies a charge for vehicles driving within the zone that do not meet strict emissions standards. The expansion of the zone was supported by a scrappage scheme, where people could claim money to scrap or retrofit older and more polluting vehicles.[5]

Amsterdam and Rotterdam, Netherlands

Where driving is necessary, both cities have targeted vehicle emissions by enforcing restrictions on older, more polluting freight vehicles. Amsterdam has gone a step further by designating 30% of the city as a low emission zone for all vehicles.

Berlin, Germany

Berlin has also addressed emissions from construction activity by imposing strict emissions standards on non-road mobile machinery[30], and implementing a low emission zone for all vehicles in the city centre.

Brussels, Belgium

In 2018, Brussels turned the entire city into a low emission zone, banning high-polluting vehicles from driving anywhere in the city.

Paris, France

Paris has implemented a city-wide low emission zone. It has also created approximately 300 'school streets' that restrict vehicle access around schools, particularly during drop-off and pick-up times.[31]

3.6 Transition to clean fuels for cooking and heating

In cities where coal or solid fuels are widely used for cooking and heating, these sources often account for a large share of air pollution. Authorities have introduced bans on solid fuels, alongside financial or technical support to help households transition to cleaner sources. These measures address dominant pollution sources directly while supporting vulnerable households, delivering both environmental and social benefits.

CITY ILLUSTRATIONS

Beijing, China

Beijing undertook one of the largest urban clean heating transitions worldwide. The city renovated 28,000 MW of coal-fired boilers and converted 1.3 million households from coal to gas or electricity, achieving coal-free status across its plain areas. Subsidy-backed phase-out programmes addressed residential combustion and contributed significantly to sustained air quality improvement.

Paris, France

All municipal services in Paris have been powered by renewable energy since 2015.[32]

Warsaw, Poland

Warsaw has tackled one of its largest sources of particulate emissions by implementing a full ban on coal burning for heating in households, which the city has supported by providing financial aid to help residents transition to cleaner fuels.[33]

Qingdao, China

Qingdao has installed district heating in several parts of the city, which extracts thermal energy from rivers and treated wastewater and distributes it to homes and businesses. This integrated renewable heating network has replaced coal as the main energy source, reducing carbon and air pollution emissions.[19]

These ingredients are driven by city leadership, but their impact often extends beyond municipal boundaries. In many cases, cities are not simply implementing national policy - they are shaping it. By piloting regulatory reforms, demonstrating successful delivery models and building institutional capacity, leading cities help inform and accelerate broader systemic change. Sustained improvement therefore reflects alignment across levels of government, where local action both responds to and influences national direction.

3.7 Multi-level alignment: Translating city leadership into systemic change

Sustained improvement is strongest where local action aligns with supportive national and regional frameworks. All 19 leading cities are located in countries or regions that have imposed relatively strict vehicle emissions standards for new vehicles. European cities have benefitted from European Union policy on vehicle emissions standards for new vehicles, with Euro 5 standards first introduced in 2009 and Euro 6 in 2014. In North America, National Ambient Air Quality Standards (NAAQS) have been regularly updated, requiring regional and local programs to improve air quality to meet compliance. The NAAQS have been supported with tighter vehicle emissions standards and requirements for carmakers to increase EV shares. In China, strict emission standards for internal combustion vehicles have been implemented alongside rapid development of a domestic EV industry.

The replacement of older vehicles with newer, cleaner ones has supported on-road emissions reductions. In many of the leading cities, new vehicles are manufactured domestically or regionally, supporting faster fleet turnover as older, high-emitting vehicles are replaced. This transition can be more challenging in regions where the majority of vehicles are second-hand and imported, slowing the pace of fleet modernisation.

National policy has also played an important role in reducing industrial and energy-related emissions. Across Europe, coal power generation dropped by almost a third from 2012[34] as countries move away from coal towards cleaner fuels and renewables. China has also been transitioning away from coal in the energy and industrial sectors, achieved by switching power plants to cleaner fuels, enforcing stringent emissions standards for industrial facilities, and closing iron and steel-making facilities.

These measures reduce background air pollution across entire regions. In some cases, cities have directly benefitted from the closure of a coal plant or heavy industrial facility within or near the city boundary, such as the Hemweg coal plant in Amsterdam.[35] In North America, standards to increase renewable energy generation and state-level programmes to clean up heavy-duty trucks have also contributed to broader emissions reductions.[36]

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4. The Breathe Cities approach

Breathe Cities make up four of the 19 leading cities; London, Paris, Brussels and Warsaw. Breathe Cities is a global initiative delivered by Bloomberg Philanthropies, Clean Air Fund, and C40 Cities. It supports cities around the world to clean their air and enhance public health. With 14 member cities, the Breathe Cities approach is based on four pillars:

1 **Expanding data:** helping cities increase their air pollution data to provide evidence for policy making.

2 **Technical support for policymaking:** aiding cities with technical assistance and capacity building for city governments to implement bold clean air solutions.

3 **Raising awareness:** engaging local communities to build public knowledge and support for clean air action.

4 **Lesson sharing:** connecting cities to share and scale effective solutions.

The following section presents case studies on two of the leading cities that are also Breathe Cities, Paris and Warsaw. The case studies describe the work they have done, in some cases supported by Breathe Cities, to improve air quality. Each example is mapped to the Breathe Cities approach.

The section then highlights case studies on Jakarta and Bangkok, two Breathe Cities in Asia that are taking the lead in the region by implementing the Breathe approach.

5. Breathe Cities in Action

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Air pollution reductions

$PM_{2.5}$

32%

NO_2

32%

from 2010-2024

Case study: Paris

Paris has dramatically improved its air quality in a short time, largely because of long-term local measures to reduce road traffic and broader trends in declining road traffic emissions. Breathe Cities has contributed by collecting air-quality data and conducting impact assessments on a diverse set of local measures, demonstrating how these interventions reduce exposure and how they can reinforce one another in the pursuit of cleaner air.

Expanding data

- Data collection for impact analysis: Paris regularly measures the impact of different mobility and urban space policies. This enables the city to understand how each measure affects community exposure to pollution and contributes to improved air quality over time. This approach helps identify which interventions work best, how they reinforce each other, and where further action is needed.

- Innovative ultrafine particle (UFP) research: Breathe Cities provided support to Airparif to conduct studies on UFP levels and sources in Paris. UFPs are particles smaller than 0.1 micrometres which penetrate deep into the body, including the lungs and bloodstream. As UFPs are not yet regulated globally, Paris' monitoring will help build the evidence base to establish limit values, like those that exist for $PM_{2.5}$ and NO_2, and strengthen epidemiological research. The studies identified road traffic and residential wood burning as the two main sources of UFPs in the city, providing clear direction for future policy action to tackle this health hazard.

Policymaking

- A pioneering 'school streets' program: Paris has created around 300 'school streets', which restrict access to cars around schools. The policy aims to reduce children's exposure to air pollution and noise, while also encouraging walking and cycling. This expansion followed a data-gathering exercise which placed low-cost air pollution monitors in and around schools. The results showed NO_2 levels were significantly lower within enclosed schoolyards compared to the street outside.

- Low emission zone: Paris was the first French city to implement a low emission zone in 2016 with restrictions for high-polluting vehicles becoming more stringent over time. The limits of the zone were extended in 2019, with impact assessments showing the policy has significantly reduced nitrogen dioxide emissions.[37] In 2024 Paris also created a limited traffic zone in the city centre, prohibiting through-traffic by car and only allowing journeys that begin or end in the zone.

- Expanding walking and cycling: At the same time as restricting traffic, Paris has made walking and cycling safer and more accessible. Following the launch of 'Le Plan vélo de Paris' in 2015, backed by €150 million investment, the city has rapidly installed over hundreds of kilometres of bike lanes, enabling residents to shift away from car travel.

Raising awareness

- Working in the community: Breathe Cities has supported Paris' ambitious efforts by working with local grassroots organisations. These groups educate, raise awareness, and engage the public to improve understanding of air pollution and its health impacts. Engagement takes place through activities like public events and workshops in primary, middle and high schools within the city.

Case study: Warsaw

Warsaw's focus on improving air quality has paid off after nearly halving $PM_{2.5}$ levels in the last decade. Air pollution is continuing to improve, with a 19% reduction in $PM_{2.5}$ since 2019. Breathe Cities has supported work with the city to strengthen the reduction in emissions from solid fuel burning, and improve public access to air pollution data. The city is now going further with the recent introduction of Poland's first low emission zone.

Expanding data

- Sensor network and data platform: Breathe Cities has supported an audit of Warsaw's air pollution sensor network. This provided the city with recommendations to ensure high-quality data capture, which is essential for evidence-based policymaking and informing the public. A further project funded by the European Union has enabled the city to establish a public data platform, making the monitoring data easily accessible to residents.

Policymaking

- Coal heating ban: Coal used for heating houses was responsible for around half of Warsaw's $PM_{2.5}$ levels. A ban on certain types of coal and wood boilers was introduced in 2017 alongside financial provision given to households to switch to cleaner fuels. This led to an 80% reduction in prohibited boilers. Mazovia Regional Council then adopted a full ban on domestic coal burning in 2022, which was made effective in Warsaw in 2023. The policy has been a huge success, with Warsaw's levels of $PM_{2.5}$ reducing by more than any other C40 or Breathe City since 2010 except for Beijing.
- Low emission zone: To counter rising increases in traffic in Warsaw, the city has for several years considered a low emission zone to combat transport emissions. Breathe Cities supported the city by commissioning an impact assessment study that measured air pollution, health and economic impacts across the city, which found that implementation would lead to significant reductions in NO_2 and $PM_{2.5}$, bringing major health and economic benefits. The city used the recommendations from the study to design and ultimately launch the low emission zone in 2024.

Raising awareness

- Public campaigns: The low emission zone has been bolstered by extensive public awareness campaigns. Warsaw has actively engaged with the community through initiatives such as the "Streets for Kids" event, which allowed 60 children to reclaim the streets. The city facilitated interactions among 30 parents, NGOs, residents, and representatives from the offices of air protection, architecture, education, and traffic management, and the Warsaw Roads Authority.

6. Breathe Cities in Asia Pioneering the Future


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Case study: Bangkok

Bangkok's air pollution is driven by a complex mix of seasonal crop burning, transboundary haze, and dense transport networks. While the Bangkok Metropolitan Administration (BMA) maintains a robust air quality monitoring network, it has historically lacked the direct authority to regulate pollution sources both within and beyond city limits. To bridge this gap, the Breathe Cities programme is aligning with the Governor's vision of strengthening not only Bangkok's 'arteries' (major infrastructure) but also its 'capillaries' (local community services). By focusing on these vital local connections, the programme's four pillars are designed to address vulnerable populations while navigating the city's institutional and legal constraints.

Expanding data

- Integrating air quality, health, and vulnerability mapping: Although BMA maintains a robust air quality monitoring system, it has not been integrated with data on health and vulnerable populations. Through a collaboration with Breathe Cities, BMA established the Committee to Drive Policy and Database System to Improve and Mitigate Bangkok's Air Quality Crisis. The committee brings together multiple agencies to integrate health and air quality data and create vulnerability mapping, overlaying pollution exposure with at-risk populations.

Policymaking

- Clean Air Management Plan: Thailand is developing a Clean Air Management Act bill that is expected to grant BMA with expanded authority to manage its air quality. Breathe Cities is helping Bangkok to align its long-term Clean Air Management Plan with the additional authority from the bill ensuring that BMA is prepared to exercise its authority the moment the bill is ratified.

- Shifting from city limits to airshed management: To tackle pollution sources within and outside the city, Breathe Cities is working with BMA to develop a joint Pollution Control Zone plan with BMA and ten neighboring provinces across the region. Similar joint efforts to reduce agriculture burning significantly reduced winter $PM_{2.5}$ concentrations. Breathe Cities' efforts will institutionalise and scale this progress through the joint Pollution Control Zone plan.

Raising awareness

- Bottom-up approach to air quality management: BMA is working with Breathe Cities to identify local communities within 15 districts that are most vulnerable to air pollution, gather feedback on BMA air quality policies in these communities, and build the capacity of community leaders to participate in clean air policymaking and participatory budgeting processes.

Lesson sharing

- Hosting the Breathe Cities Global Workshop: In September 2025, Bangkok hosted the 3rd Breathe Cities Global Workshop, showcasing its various air quality management initiatives and robust air quality monitoring and forecasting system to peers in the Breathe Cities network.

Case study: Jakarta

Breathe Cities is supporting the Jakarta Provincial Government to strengthen air pollution data collection and improve understanding of air quality across the city's diverse neighbourhoods. Breathe Cities is also helping design actions to reduce emissions from leading pollution sources, particularly transport and industry.

Expanding data

- Air quality monitoring network and open-access platform: Breathe Cities is working with Jakarta to strengthen its air quality monitoring network by deploying new sensors. Data from these, together with the existing monitor network, is being shared through a public-facing platform (https://udara.jakarta.go.id/).

- Mainstreaming health into air pollution management: Breathe Cities is also working with Jakarta to develop public health guidance and early-warning systems to better protect vulnerable communities. By scaling the use of low-cost air quality sensors, Jakarta is helping to identify pollution hotspots and understand populations at greatest risk.

Technical support for policymaking

- Multi-sector clean air zone: Breathe Cities is supporting Jakarta to design an integrated clean air zone (Kawasan Rendah Emisi Terpadu). This holistic approach combines solutions to reduce emissions across the transport, buildings and waste sectors. The design of the Clean Air Zone used an innovative method to ensure equity and fairness when choosing where to locate the project in the city. This involved an assessment of neighbourhood mobility levels, access to public transport, urban land use, and demographic diversity.

- Vehicle emissions testing: Jakarta is strengthening and enforcing city-wide vehicle emission testing. A relatively small proportion of high-emitting vehicles account for a disproportionate volume of vehicle emissions in the city. Breathe Cities is supporting Jakarta by developing a fair tax multiplier for high-emitting vehicles, by assessing public willingness and ability to pay a vehicle pollution tax.

- Acting on industrial emissions: Jakarta, with support from Breathe Cities, is improving enforcement of emissions standards in industrial facilities. The assessment includes a cost-benefit analysis of transitioning from coal to gas, and identifies the barriers and opportunities of switching to cleaner fuels. Breathe Cities is also supporting Jakarta to create a framework that evaluates the impacts of industrial emissions on health.

Raising awareness

- Health and clean air policy campaigns: Breathe Cities in Jakarta is working with neighbourhoods that experience the highest levels of air pollution to prioritise support where it is most needed. Breathe Cities is helping Jakarta increase public awareness on air pollution through school outreach programs and public campaigns. Partnerships are being strengthened through the establishment of a group of Breathe Jakarta Civil Society Organisations, a collaboration with local communities and civil society groups.

Lesson sharing

- Jakarta-Beijing knowledge exchange study tour: Breathe Cities organised a knowledge exchange in which 10 officials from Jakarta visited Beijing to share experience between the cities. Discussion focused on how to integrate low-emission zones into wider air pollution and climate actions, and the need to balance environmental sustainability and economic development.

- Towards a Breathable Jakarta workshop: Breathe Cities collaborated with Jakarta's Information and Knowledge Access initiative to co-host a workshop in the city, enabling different organisations to exchange knowledge and best practices. The main focus was on sharing strategies between Global South cities that are working on clean air zones.

7. Why this matters for cities now

The experience of the 19 leading cities demonstrates that substantial air quality improvement is possible. The data shows that reductions of 20 to 50 percent in $PM_{2.5}$ and NO_2 are achievable within 10 to 15 years. This occurs because cities modernized transport systems, electrified fleets, regulated dominant pollution sources, and embedded accountability through transparent monitoring and enforcement systems. City leadership also plays a decision role in translating national frameworks into local impact. Coordinating and aligning across multi-level governments accelerate impacts. National vehicle standards reduce emissions from new fleets, while city-level enforcement restricts high-emitting vehicles. Regional energy transitions lower background pollution, where city heating reforms eliminate local use of solid fuel.

For rapid urbanizing regions, particularly in Asia, this evidence is especially important. Economic growth does not inevitably mean prolonged pollution if clean infrastructure and regulatory reform are embedded early. The experience in Beijing, Warsaw, London and others shows that when cities invest in clean fuels, electrified transport and transit-oriented development during the economic developing phase, they avoid locking in high-emission systems, resulting in air quality improvement even as economies expand.

As more cities confront rising public health pressures and climate risks, the question for cities today is no longer whether progress is possible. The successful pathway has already been tested at scale, as demonstrated by the 19 leading cities. Their experience shows that rapid air quality improvement is not only achievable, but replicable where leadership is sustained, data evidence guides decisions, and structural reforms are implemented consistently.

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Annex

Methodology

Air pollution data

Annual mean population-weighted $PM_{2.5}$ and NO_2 concentrations were derived for all 99 C40 and Breathe Cities from standardised global-gridded datasets.

$PM_{2.5}$ data was taken from Washington University's Satellite-Derived $PM_{2.5}$ V5.GL.06,[38] which combines satellite retrievals and ground-based air pollution monitor measurements with simulations and data-driven algorithms, providing annual estimations of $PM_{2.5}$ at approximately 1km^2 grids.[39]

NO_2 concentrations at approximately 100m^2 grids were provided to C40 as part of the Global Burden of Disease (GBD) 2023 study. Data for 2005-2019 combines global land use regressions with daily air pollution monitor averages collected from 8,250 locations, and also applies data from Nasa's Ozone Monitoring Instrument (OMI) satellite ozone that estimate NO_2 columns to scale to different years.[40] For 2019-2024 the data uses forward projections using TROPOMI satellite data, which were developed by George Washington University for GBD 2023.[41] Both datasets show nearly identical 2019 values, ensuring a smooth transition and allowing for a longer, consistent time series that is consistent with the GBD approach.

The changes in annual air pollution levels were calculated for each city for 2010 and 2024, with cities that achieved at least a 20% reduction in both $PM_{2.5}$ and NO_2 included in this report.

Limitations with the methodology

- The air pollution data used here depends on monitor data for accuracy. Cities with fewer monitors are likely to have greater uncertainty in the results, and generally Global South cities are likely to have fewer monitors than Global North. However, using satellite/monitor datasets allows for standardised calculation of population-weighted $PM_{2.5}$ averages within entire city boundaries, and reduces the uncertainty compared to only using data from ground monitors.

- The NO_2 data combines different methodologies for 2005-2019 (using OMI satellite data), and 2019-2024 (using TROPOMI satellite data). The TROPOMI data generally shows larger year-to-year variability in NO_2 levels, and more variations especially in Global South cities. This may be due to informal or rapidly changing emission sources, incomplete inventories, limited monitoring, stronger meteorological effects, and fast urban growth.

- Using single-year (2010 and 2024) observations allows the possibility that a city could be excluded or included because of an anomalous air pollution measurement in either of those years. For example, a city that saw temporarily heightened $PM_{2.5}$ levels in 2024 due to wildfire activity, compared to other years, would be excluded from this analysis. However, we believe the criteria used in this method demonstrate long-term changes in cities' air pollution levels, and provide a basis with which to demonstrate that rapid improvements in air quality are possible.

- This report only includes cities that have shown a significant reduction in air pollution between 2010 and 2024. There are cities that did not meet the criteria for inclusion that already had lower $PM_{2.5}$ and NO_2 levels in 2010 than many of the cities included here in 2024. Similarly, some cities achieved large reductions in one pollutant but not enough of a reduction in the other to qualify. The exclusion of such cities from this report is not intended to devalue their achievements, rather the focus is on cities who have achieved large, recent and rapid improvements in air quality across different pollutants.

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