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TOWARD A HEALTHIER WORLD

CONNECTING THE DOTS BETWEEN CLIMATE, AIR QUALITY & HEALTH



ACKNOWLEDGEMENTS



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ENGINEERING**

Cities

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CITIES ARE DELIVERING

Urgent action is needed to curb climate change and mitigate the dangerous impacts of air pollution. Quantitative health impact analyses are powerful tools that cities can use to advance the climate agenda, as these have been shown to provide the evidence cities need to accelerate climate action and capture the massive benefits linked to it.

“ As Mayor of Paris my first priority is to protect the health and wellbeing of Parisians. This research reveals that the policies we are implementing to clean the air we breathe and restrict the polluting diesel and petrol vehicles will add three weeks onto the life of every citizen, whilst also **preventing climate change.** ”

Anne Hidalgo, Mayor of Paris and C40 Chair

“ Our citizens have the **right to breathe** cleaner and healthier air. As mayors, we are entrusted with the responsibility to reduce pollutant emissions in our territories. This is an invitation to all Latin American cities to join us on this journey. So together, we implement zero-emissions transportation systems and strategies that lead us to a cleaner future. ”

Mr Federico Gutiérrez, Mayor of Medellin

“ We will use the experience and results demonstrating the health benefits of climate action to support our political leadership in their effort to make meaningful change and to ensure we can, with the rest of the world, move in the same direction to reduce the climate-change effects in **our cities.** ”

Emmanuel Letebele, Head of Division of Hydro-meteorology and Climate Change, Durban.

Limiting global warming to 1.5°C and reducing the current dangerous levels of air pollution should be a priority in all cities' decision-making. These goals can and should be achieved simultaneously to create healthier and thriving cities.

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GLOSSARY

TERM	DEFINITION
$\mu\text{g}/\text{m}^3$	A measure of concentration in terms of mass per unit volume. A concentration of $1\mu\text{g}/\text{m}^3$ means that one cubic metre of air contains one microgram of pollutant.
BURDEN OF ATTRIBUTABLE DEATHS	The number of deaths that are caused by a risk factor (such as air pollution), across the whole population in any one particular year, at current levels of pollution.
CARDIOVASCULAR DISEASE	Disease related to the heart and blood circulation. Includes stroke and problems with arteries or veins in other parts of the body not just the heart.
CONCENTRATION (BACKGROUND AND NON-BACKGROUND)	The amount of a pollutant in a given volume of air, generally expressed in micrograms per cubic metre ($\mu\text{g}/\text{m}^3$). Background concentration refers to concentration of pollutants not emitted by local sources but transported into the considered area (from regional, national or natural sources). The non-background concentration represents the city's contribution to its average pollutant levels, and is the only portion of pollutants that can possibly be impacted by a city action. This value is calculated by subtracting the background from the average concentration.
CONCENTRATION RESPONSE FUNCTION	A quantitative relationship between the concentration of a pollutant and an increased risk of an effect on health (in this case, mortality & morbidity).
EMISSION	Direct release of a pollutant into the atmosphere from a specific source in a specific time interval. Generally expressed in tonnes per year (t/y).
LIFE EXPECTANCY AT BIRTH	Average number of years that a new-born could expect to live if he or she were to pass through life subject to the age-specific mortality rates of a given period.
MORBIDITY	Rate of disease in the population.
MORTALITY	Number of deaths in the population.
NO_2 and NO_x	Nitric oxide (NO) is mainly derived from road transport emissions and other combustion processes such as the electricity supply industry. Once released to the atmosphere, NO can rapidly oxidize to nitrogen dioxide (NO_2), which can be harmful to health. NO_2 is also emitted by combustion.
PM_{10} and $\text{PM}_{2.5}$	Particulate matter. The collection of solid and liquid particles found in the air. PM_{10} is defined as the mass concentration of particles smaller than $10\mu\text{g}$ aerodynamic diameter, and includes $\text{PM}_{2.5}$. $\text{PM}_{2.5}$ represents the mass concentration of all particles of generally less than $2.5\mu\text{g}$ aerodynamic diameter. Often referred to as fine particles, they can penetrate deep into the lungs.
RESPIRATORY DISEASE	Disease related to the lungs.
VALUE OF LIFE YEARS	The monetary value of a year of life lost. It is based on studies that assess the willingness to pay for reducing mortality risks associated with air pollution.

TOWARD A HEALTHIER WORLD

CONNECTING THE DOTS BETWEEN CLIMATE, AIR QUALITY & HEALTH

CITIES ARE FACING A CLIMATE AND AIR QUALITY CRISIS

In 2016, C40 adopted 1.5°C as the only viable science-based target for humanity's long-term future.

Globally, estimates show that 7 million premature deaths are caused by air pollution every year.

7 MILLION DEATHS

70% GLOBAL GHG EMISSIONS

Cities account for more than 70% of global CO₂ emissions.

1.5 DEGREES

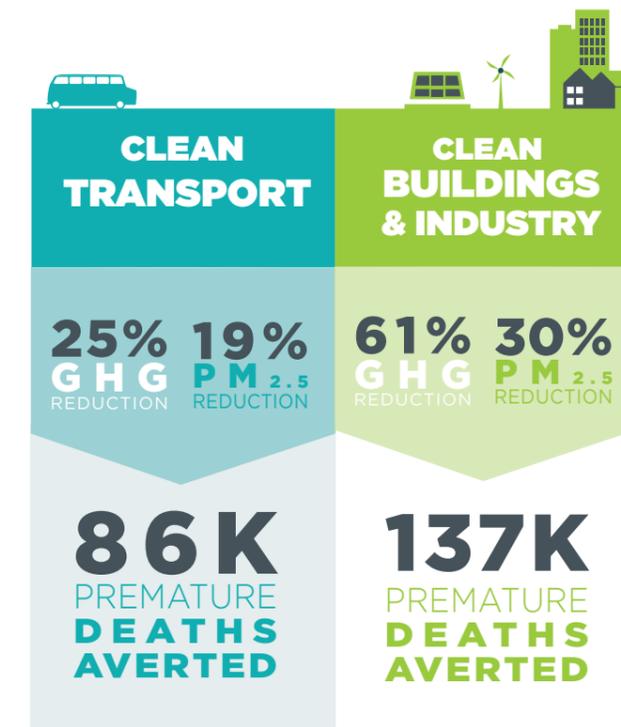
95% UNSAFE EXPOSURE

95% of the population in C40 cities is exposed to unsafe air quality.

GHG EMISSIONS AND AIR POLLUTION HAVE COMMON SOURCES



CLEAN TRANSPORT, BUILDINGS & INDUSTRIES WILL REDUCE EMISSIONS AND IMPROVE HEALTH



\$76 - 224 BILLION ECONOMIC IMPACT

\$122 - 359 BILLION ECONOMIC IMPACT

CITIES ARE DELIVERING



EXECUTIVE SUMMARY

Cities have a leading role to play in preventing a climate crisis. Although urban areas only occupy 2% of the world's land, their carbon footprint is enormous. Cities consume over two-thirds of the world's energy and account for more than 70% of global CO₂ emissions. Cities are also extremely vulnerable to the impacts of climate change and are increasingly exposed to climate hazards such as longer and more frequent periods of extreme heat, flooding due to heavy rainfall, rising sea levels and powerful coastal storms.

At the same time, cities are facing significant air pollution problems. Pollutants such as PM_{2.5} and NO₂ represent a major risk to people's health, particularly children and the elderly, and an estimated 95% of the populations in C40 cities are exposed to air pollution levels that exceed the World Health Organization's (WHO) recommendations. WHO estimates that air pollution causes 24% of all adult deaths from heart disease, 25% from stroke, 43% from chronic obstructive pulmonary disease and 29% from lung cancer (WHO, 2018a).

The climate challenge and the air pollution problem are linked, and many actions that tackle greenhouse gas (GHG) emissions will also reduce air pollution. Recent research from C40 and BuroHappold (2018a) has shown that if all C40 cities achieved clean transport, buildings and industry, underpinned by a decarbonised grid, PM_{2.5} levels in these cities would drop by 49%, on average, while reducing their GHG emissions by 87%, on average. The air quality improvement would result in massive health benefits for citizens and potentially avert a total of 223,000 premature deaths per year across all C40 cities.

This report shows cities how they can use the compelling evidence to connect the dots between climate, air quality and health and make a much stronger case for action. The report introduces a practical toolkit and methodology that allows cities to quantify the multiple benefits of taking climate actions in their cities, including the extent to which climate actions reduce air pollution, improve health and provide wider economic benefits.

**Cities have a leading
role in preventing a
climate crisis
and a tremendous opportunity
to clean the air and improve
citizen health.**

Twenty-five participating C40 cities have trialed the methodology and proposed ambitious measures for the transport, buildings and energy sectors that tackle both air pollution and GHG emissions. Analysis reveals that these climate actions could effectively reduce GHG emissions by 3.5MtCO₂e while bringing about a sizeable improvement in air quality for 77 million citizens across the 25 cities. It is estimated that carrying out these actions would reduce PM_{2.5} non-background concentrations, on average, by 5.9%, and reduce NO_x levels by 16.7%, on average. The delivery of the proposed actions could also prevent 2,655 annual premature deaths due to air pollution, translating into 31,135 life-years gained across all 25 cities. The decrease in air pollution would positively impact the health of cities, and the number of annual hospital admissions would decrease by 9,275.

It has also been estimated that the 25 cities' proposed climate actions would generate a total economic value of \$1 billion per year. The overall value of reducing hospital admissions linked to air pollution has been estimated at \$59 million.

These gains are possible from just one high-impact action in each city and show the enormous potential benefits if action were taken on an even greater scale. Los Angeles was a participating city in addition to the 25 core cities, showing the benefits accrued from a bold, city-wide programme of action. Los Angeles has committed to ambitious action to tackle climate change and air quality across transport, buildings and industry, resulting in 26.1MtCO₂e savings as well as the avoidance of over 1,650 annual premature deaths and 660 hospital admissions, saving an estimated \$15.6 million in healthcare costs.

Urgent action is needed to curb climate change and mitigate the dangerous impacts of air pollution. This will require ambitious and transformative actions from cities, and the opportunities for public health and the economy are huge. This report shows that these goals can and should be reached simultaneously to create healthy, thriving cities.

25

C40 CITIES
TAKING
ACTION

25 participating C40 cities have proposed ambitious measures for transport, buildings and energy with huge potential benefits for over 77 million citizens

3.5
MtCO₂e

These actions could reduce GHG emissions by 3.5MtCO₂e and air pollution by an average of 5.9% for PM_{2.5} and 16.7% for NO_x.

DROP IN

PM_{2.5}
5.9%

NO_x
16.7%

2,655

PREMATURE DEATHS
AVERTED

The actions could prevent 2,655 premature deaths each year and improve life expectancy.

1 - 100
DAY
INCREASE IN
LIFE EXPECTANCY

9,275

FEWER HOSPITAL VISITS

\$59
MILLION
HEALTHCARE
COSTS AVOIDED

Annually, the number of hospital admissions would decrease by 9,275, bringing huge healthcare costs savings.

INTRODUCTION TO CLIMATE, AIR QUALITY AND HEALTH

1.1 PARTNERSHIP FOR CLIMATE, AIR QUALITY AND HEALTH

Johnson & Johnson and C40 Cities have created a partnership to connect the dots between climate action, improved air quality and better health.

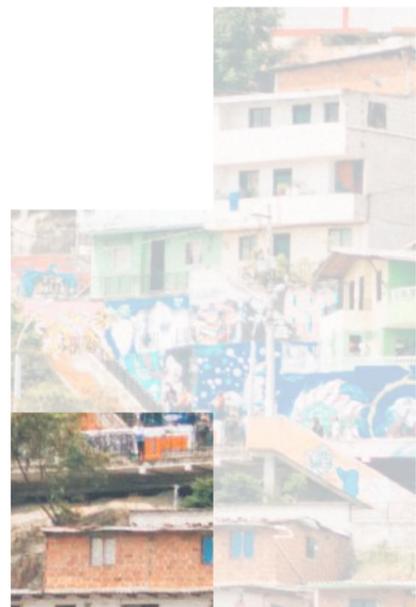
This partnership contributes to Johnson & Johnson's *U.N. SDG 2020 Commitment* (Sustainable Development Goals) with the aspiration to create healthier places for people to live, work and play.

As a result of this partnership, C40 has undertaken cutting-edge research to demonstrate the air quality and health benefits of climate action, working with 25 cities to measure potential health and economic impacts of greenhouse gas (GHG) mitigation.

The methodology used to quantify the potential air quality, health and economic gains

of urban climate action was developed by C40 Cities in collaboration with BuroHappold Engineering, London School of Hygiene and Tropical Medicine and Cambridge Environmental Research Consultants. This methodology was tested by the 25 participating cities, and the resulting tools and support materials are now available as a toolkit for any city to use to assess its climate action plans. The results of this study are augmented by the Air Quality City Demonstrator project in Los Angeles, which shows the potential to scale up climate action through an integrated plan.

By enabling cities to quantify and demonstrate the multiple benefits of climate action, the methodological approach described in this report will help make the case for the right and necessary actions.



1.2 THE WORLD IS HEADING TOWARDS A CLIMATE CRISIS

The Paris Agreement commits signatories to “pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels”. This ambition was supported by the recent Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2018), which showed that human activity has already caused nearly 1°C of global warming above pre-industrial levels and that there is a significant difference in terms of the severity of climate impact under a 2°C and a 1.5°C global warming scenario. At current rates, global warming is likely to reach 1.5°C between 2030 and 2052. Therefore, it is urgent that we take action now to bend the current emissions curve and limit climate change impacts as much as possible.

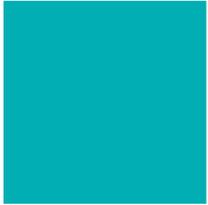
In 2016, C40 adopted 1.5°C as the only viable science-based (IPCC, 2018) target for

humanity's long-term future. One of the conditions for membership of C40 is that, by the end of 2020, all cities will have published and commenced delivery of a detailed climate action plan to limit the global temperature rise to 1.5°C.

Cities have a leading role to play in preventing a climate crisis. Although urban areas only occupy 2% of the world's land, their carbon footprint is enormous. Cities consume over two-thirds of the world's energy and account for more than 70% of global -CO₂ emissions (IEA, 2008). At the same time, cities are extremely vulnerable to the impacts of climate change; with 90% of the world's urban areas situated on coastlines, they will be exposed to rising sea levels and powerful coastal storms, and they will face longer, and more frequent, periods of extreme heat exacerbated by



¹ Twenty-five cities tested the methodology in 2017 and 2018, and their results are illustrated in this report. Four new cities joined the Benefits Programme in mid-2019. Including Los Angeles a total of 30 cities are supported by the research.



the Urban Heat Island effect (C40 Cities and Arup, 2018).

The high level of urban emissions, along with significant exposure to negative climate impacts, is why cities need to take action to fight climate change. In order to do that, it is estimated that average per capita emissions across C40 cities will need to drop from over 5tCO₂e today to around 2.9tCO₂e by 2030 and reach net zero by 2050 (C40 Cities and Arup, 2016).

Cities are already taking ambitious actions: at the Global Climate Action Summit in September 2018, cities from all over the world committed to the Green & Healthy Streets,



Net Zero Carbon Buildings and Advancing Towards Zero Waste declarations (C40, 2018).

However, limiting global warming to 1.5°C requires an immediate and steep decline in cities' GHG emissions by drastically moving away from business-as-usual emissions scenarios. This will need ambitious and transformative actions from all cities. The time for action is now, as measures can take many years to reach full scale.

The time for action is now



1.3 CITIES ARE EXPERIENCING AN AIR QUALITY CRISIS

Like climate change, air pollution is a tremendous problem in many cities, as it affects people's quality of life and life expectancy. Pollutants such as PM_{2.5} and NO₂ represent a major risk to people's health, particularly children and the elderly. The World Health Organization (WHO) provides air quality guideline values for a range of key air pollutants. For PM_{2.5}, the WHO (2006) recommends a maximum guideline level of 10µg/m³ for long-term exposure (annual mean) and 25µg/m³ for acute exposure (24-hour mean). Pollutant levels in most cities, however, exceed the WHO thresholds, showing that citizens all over the world are exposed to dangerous levels of air pollution (see page 14). In fact, C40 estimates that 95% of the populations in C40 cities are exposed to air pollution levels that exceed the recommended PM_{2.5} 10µg/m³ threshold.

PM_{2.5} can penetrate deep into lungs and is linked to respiratory

and cardiovascular morbidity and mortality, even at low concentrations.² NO₂ can also affect health, with evidence showing that exposure to high concentrations can create new cases of asthma, in addition to exacerbating existing conditions (McConnell et al., 2010).

Globally, estimates show that 7 million premature deaths every year are caused by ambient (4.2 million deaths) and household (3.8 million deaths) air pollution.³ Air pollution is recognised by the WHO as a critical risk factor for non-communicable diseases, causing an estimated 24% of all adult deaths from heart disease, 25% from stroke, 43% from chronic obstructive pulmonary disease and 29% from lung cancer (WHO, 2018a). Air pollution's effect on children can worsen health outcomes over their whole lifetime.



² For PM_{2.5}, low concentrations refer to less than 10µg/m³ and high concentrations refer to more than 26µg/m³.

³ The effect of ambient and household air pollution can overlap and therefore total premature deaths estimates are not additive.

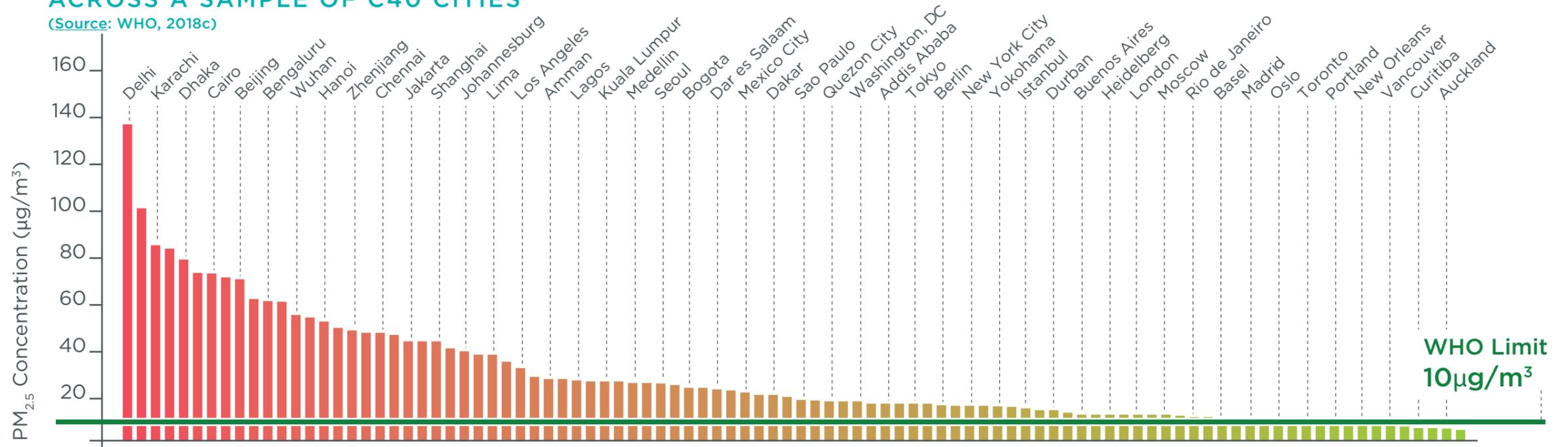
THE NEED TO
TACKLE
AIR QUALITY

95%
OF THE POPULATIONS IN
C40 CITIES
ARE EXPOSED TO
UNSAFE
AIR QUALITY

Populations in low-income countries are the most impacted. 97% of cities in low- and middle-income countries with more than 100,000 inhabitants don't meet WHO air quality guidelines.

**PM_{2.5} CONCENTRATION LEVELS
ACROSS A SAMPLE OF C40 CITIES**

(Source: WHO, 2018c)



WHO Limit
10µg/m³

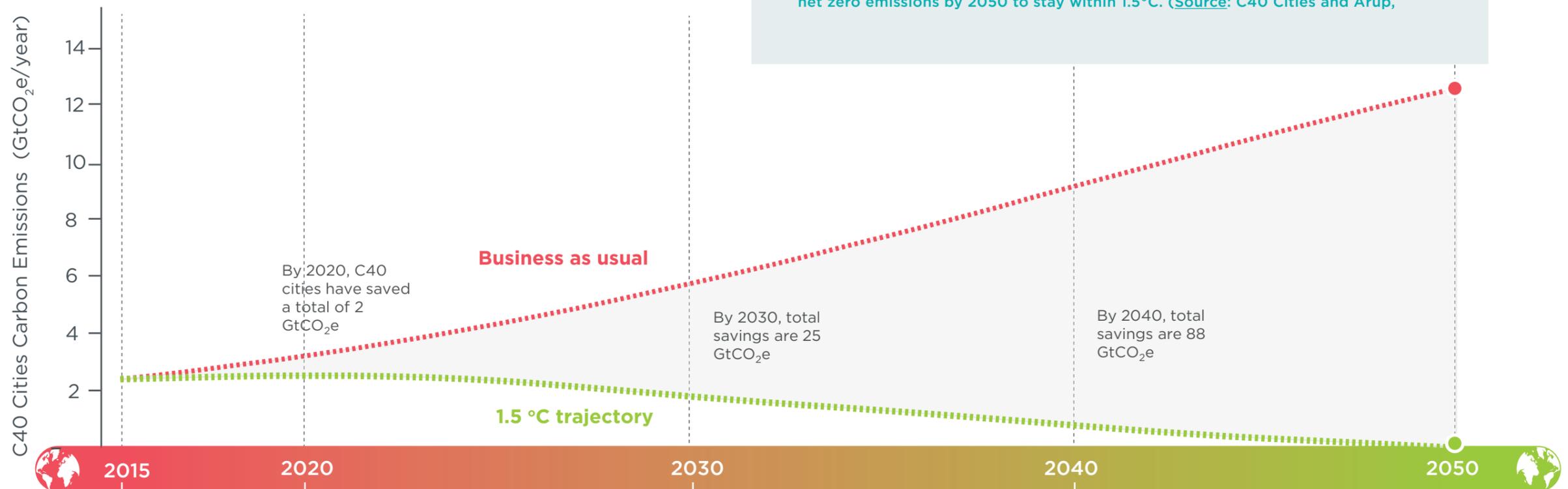
THE TIME FOR
URGENT
CLIMATE ACTION

LIMIT
TEMPERATURE
INCREASE TO
1.5°C
CO₂

Cities have a leading role in limiting temperature increase to 1.5°C, in line with the Paris Agreement. Climate change causes serious hazards experienced by cities, such as extreme cold and hot weather, floods and droughts.

C40 TRAJECTORY TO REMAIN WITHIN 1.5 DEGREES

(Source: C40 Cities and Arup, 2020)



C40 cities need to achieve peak emissions by 2020, halve them by 2030 and reach net zero emissions by 2050 to stay within 1.5°C. (Source: C40 Cities and Arup, 2020)

1.4 DEMONSTRATING THE BENEFITS OF ACTION

In order to meet the dual challenges posed by global warming and air pollution, cities need to be bold and take action on a large scale. The benefits can be substantial: significant changes in air quality will bring about immense improvements in the health of citizens, as well as economic benefits. Recent research from C40 and BuroHappold has shown that if all C40 cities achieved clean transport, buildings and industry, underpinned by a decarbonised grid, PM_{2.5} levels in these cities would drop by 49% on average, while reducing their GHG emissions by a significant 87% (C40 Cities and BuroHappold, 2018a). The air quality improvement would result in massive health benefits for the citizens and potentially avert a total of 223,000 premature deaths per year across all C40 cities.

The methodology and accompanying toolkit developed through this research will support cities to take bold measures by demonstrating how climate actions also reduce air pollution, improve health and provide wider economic benefits. By quantifying these benefits, cities can make a stronger case for ambitious climate action and:

- **Increase policymakers' understanding of the links between climate, air quality, health and economics;**
- **Help policymakers to achieve existing targets, to better design projects and plans for scaling up climate action; and**
- **Make the case for investments by demonstrating public health returns and engaging the public health sector in environmental policymaking and planning.**

MAIN TAKEAWAYS

- **Cities have a leading role to play in preventing a climate crisis and in limiting global warming to 1.5°C, but meeting the Paris Agreement's ambition requires that cities take bold and transformative climate action within the next 10 years.**
- **Like climate change, air pollution is a tremendous problem in many cities. Pollutants such as PM_{2.5} and NO₂ represent a major risk to people's health, particularly children and the elderly and an estimated 95% of the populations in C40 cities are exposed to air pollution levels that exceed health recommendations.**
- **Globally, estimates show that 7 million premature deaths every year are caused by ambient (4.2 million deaths) and household (3.8 million deaths) air pollution.**
- **The World Health Organization (WHO) estimates that air pollution causes 24% of all adult deaths from heart disease, 25% from stroke, 43% from chronic obstructive pulmonary disease and 29% from lung cancer.**
- **In order to meet the dual challenges posed by global warming and air pollution, cities need to take action on a large scale. The methodology and accompanying toolkit showcased in this report will aid cities in their efforts to implement transformative measures by quantifying how climate actions also reduce air pollution, improve health and provide wider economic benefits.**

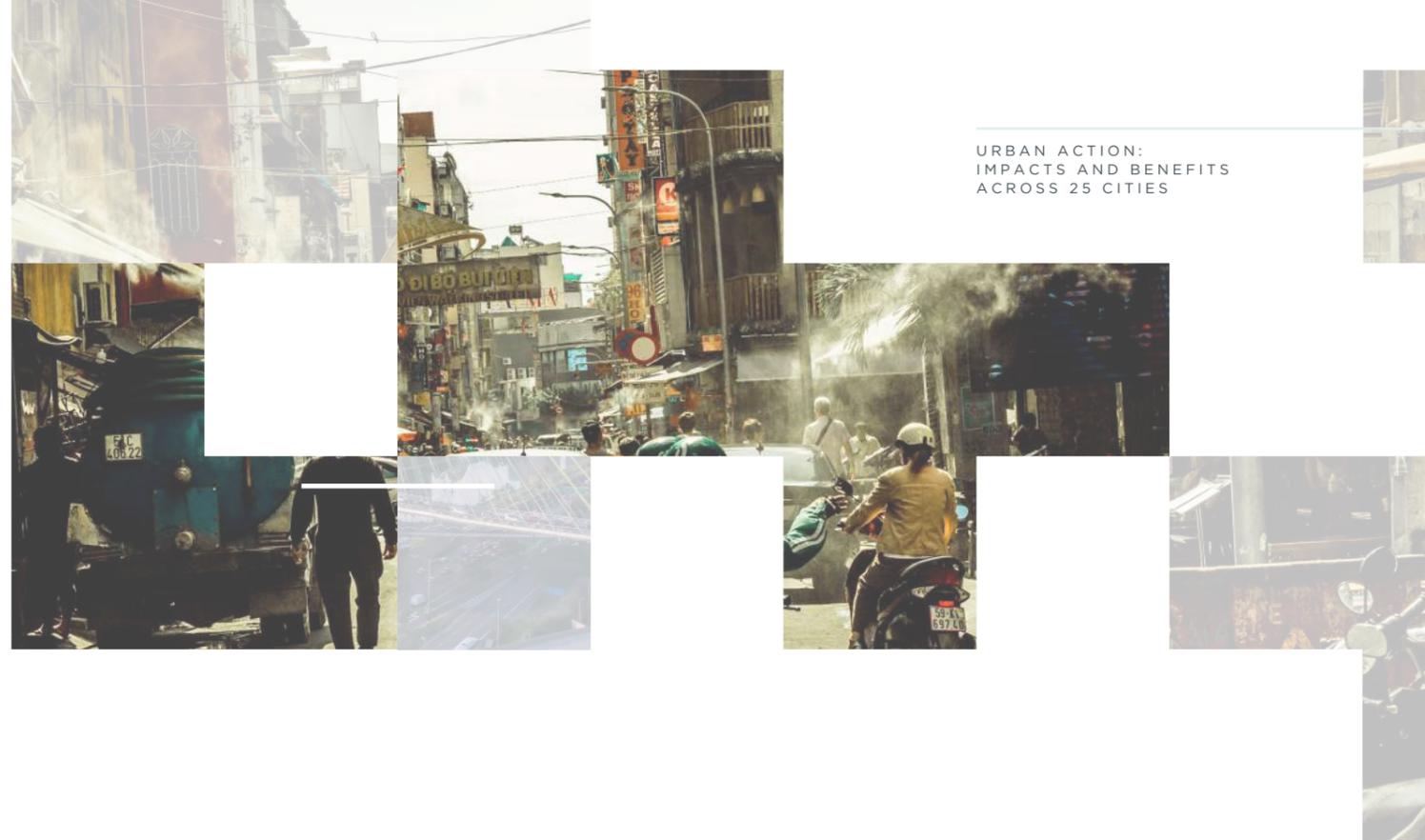
URBAN ACTION: IMPACTS AND BENEFITS

The 25 cities participating in this research, as well as the Los Angeles Air Quality City Demonstrator, have proposed ambitious actions to tackle their main sources of air pollution and GHG emissions, including measures for cleaner transport, buildings and industry, and quantified the corresponding air quality and health improvements. The results of analysis, carried out at the pre-implementation stage, aimed to elicit more support for climate action from the public and private sectors, and to unlock additional funding.

The research has resulted in a [toolkit](#) and a methodology that aim to quantify the benefits of improved air quality on mortality and morbidity, and the consequent economic value of a healthier population. The methods used in the report have been adapted to this programme but based on well-established, peer-reviewed health impact methods that are used in regulatory planning. The analysis was carried out by the participating cities, supported by C40 and BuroHappold, and it was reviewed by public health and air quality experts from UCL and LSHTM.

The toolkit is intended for policymakers from multiple sectors (transport, buildings, energy, environment and air quality), and designed to work efficiently with limited data requirements. The toolkit process benefits from, and fosters, collaboration between departments. The methodology and toolkit are available on-demand and can be used directly by cities (see Appendix B for more information).

A wide range of actions was considered throughout the programme:



CLEAN TRANSPORT



Most cities focused on reducing pollution in the transport sector, including initiatives such as bus rapid transit (BRT), bus and private vehicle electrification, on-road vehicle testing and traffic limitation through low-emission zones and congestion charges.



CLEAN BUILDINGS

Many cities also looked at upgrading their buildings, specifically replacing highly polluting stoves and heating systems to improve both indoor and outdoor air quality.



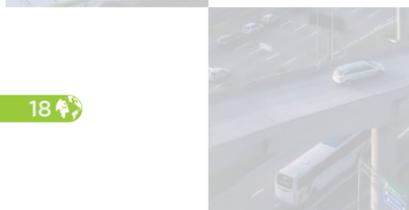
CLEAN INDUSTRY

Industrial efficiency was also targeted by some cities in the programme to reduce polluting emissions from urban industry. Benefits are particularly significant for residents living in close proximity to and/or downwind of industrial areas.

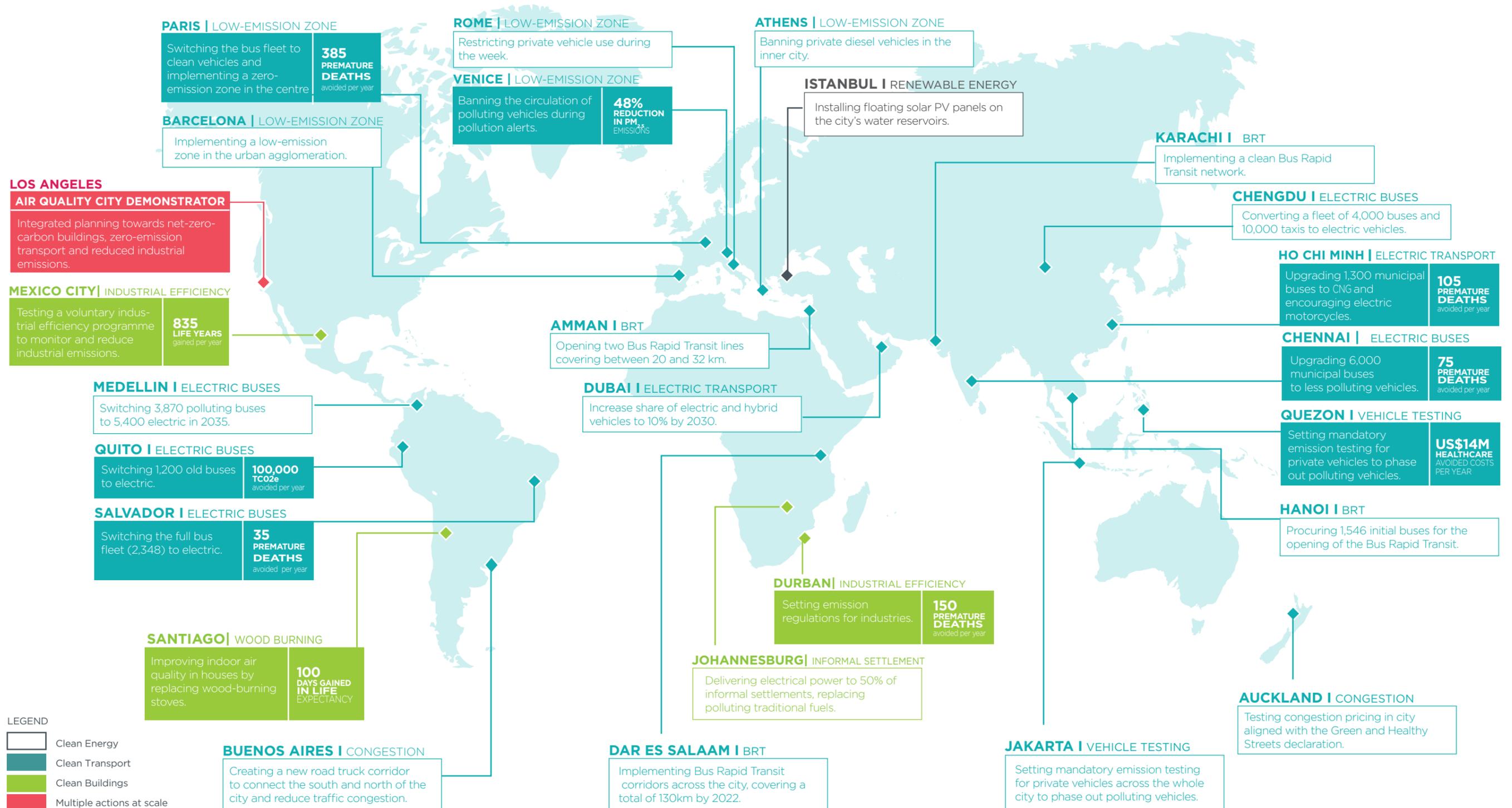


DECARBONISE THE GRID

As many actions rely on the electrification of energy uses, it is critical that these are accompanied by plans to decarbonise the grid. Offsetting polluting fossil-fuel power plants with renewable technologies can have substantial air quality impacts.



OVERVIEW OF CITIES AND EXAMPLES OF ANALYSED ACTIONS IN THE BENEFITS PROGRAMME



LEGEND

- Clean Energy
- Clean Transport
- Clean Buildings
- Multiple actions at scale

Click on the filled tiles to access the full case study.

2.1 CLIMATE IMPACTS AND BENEFITS

C40 cities produce significant GHG emissions of around 2.4 GtCO₂e every year. But to be compliant with the goal of a maximum 1.5°C temperature increase, cities have a total carbon budget of 22 GtCO₂e between 2020 and 2100. Without any further climate action, therefore, C40 cities will use up their entire 1.5°C-compliant carbon budget within the coming decade.⁴ The scale of the challenge increases if we include consumption-based emissions, i.e. emissions that account for the total climate impact accumulated globally for a good or service.

C40 cities' production-based emissions represent 6% of global GHG emissions (C40 and

BuroHappold, 2019).

The good news is that C40 cities are leading the way in taking bold climate action. Production-based emissions have already peaked in 27 C40 cities, meaning that their

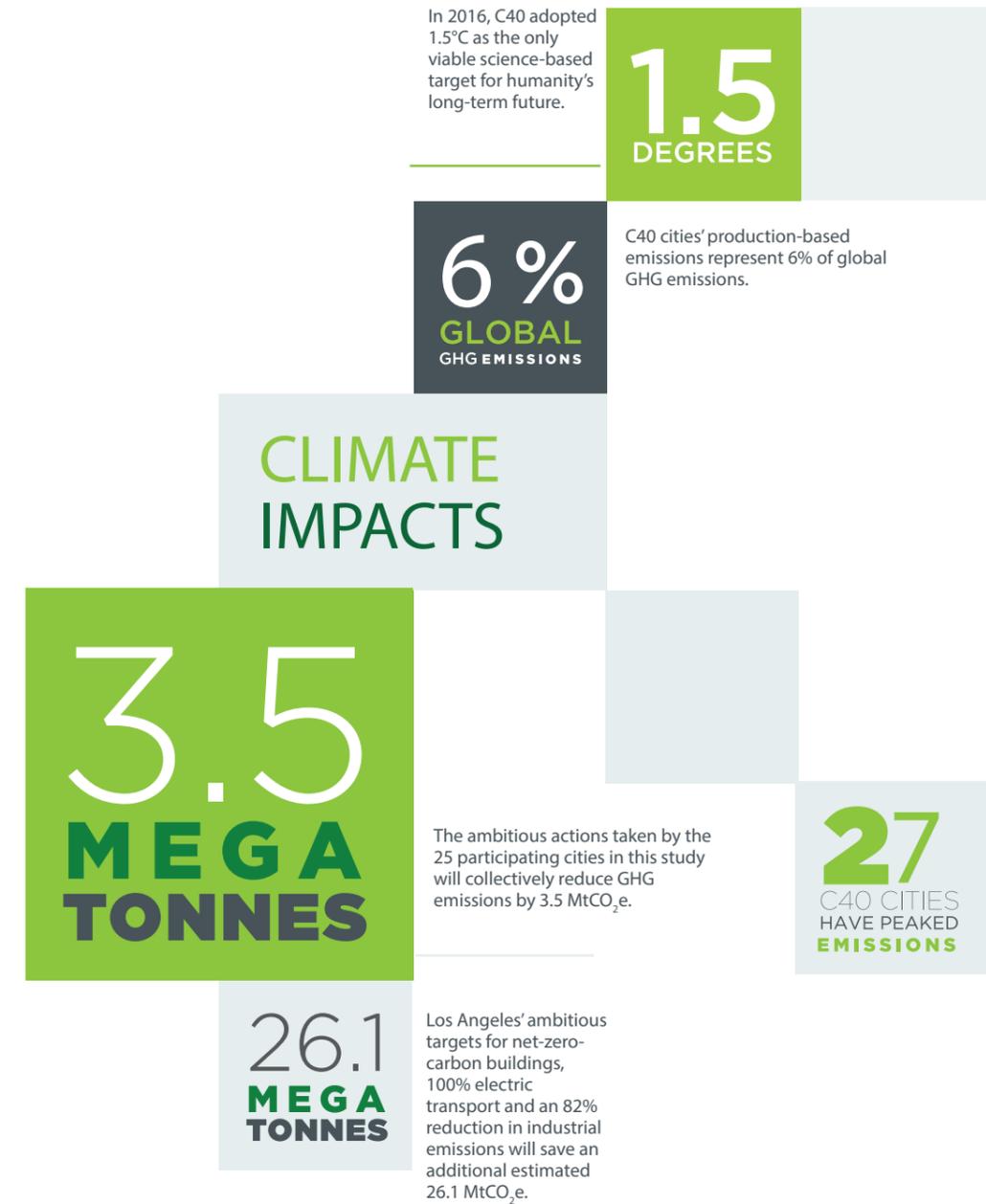
emissions have continuously decreased over a period of several years (C40, 2018). And the recent C40 report, *The Future of Urban Consumption in a 1.5°C World*, sets out the first roadmap for cities to tackle consumption-based emissions (C40 Cities, Arup and University of Leeds, 2019).

The ambitious actions taken by the 25 cities participating in this study will collectively reduce GHG emissions by 3.5MtCO₂e. These results, which take into account just one high-impact action, can be extrapolated to show the even greater potential

GHG reductions of scaled-up action, as shown by the actions taken by Los Angeles (in an independent programme), which have led to 26.1 MtCO₂e being saved each year.

In addition to the benefits calculated for GHG emissions, many of these climate actions will reduce black carbon with

significant additional impact on climate change and air quality. Black carbon is a component of particulate matter and is a major contributor to climate change; research estimates it to be the second-largest contributor after CO₂ emissions (Ramanathan and Carmichael, 2008). Whilst it was beyond the scope of this study to estimate the benefits of reduced black carbon, these are likely to be significant given that the actions taken target common sources of this pollutant (e.g. diesel engines, wood stoves and industrial processes). Furthermore, black carbon is a short-lived pollutant staying in the atmosphere for only a few weeks, so reducing these emissions would have an immediate effect on climate change, compared with several decades for CO₂ (C2ES, 2010).



⁴ Scope 1 emissions are direct emissions from the combustion of fuels for heating, transportation, etc. and scope 2 are indirect emissions from consumption of purchased electricity, heat or steam.

MEXICO CITY

AIR QUALITY PROBLEM

Located in a high mountain valley that traps air pollutants and prevents them from dispersing, Mexico City's PM_{2.5} level is 2.3 times greater than the WHO recommended value. (Annual average from city monitoring stations in 2016: 23µg/m³.) Annual high PM_{2.5} levels are also responsible for about 6,700 premature deaths in the city annually. Being one of the biggest sectors in Mexico City's economy, industry accounts for 13% of the total PM_{2.5} concentrations. The combination of highly polluting activities (i.e. industry and transport), geography and a growing population is exacerbating the air quality issue in the city.

BENEFITS

Mexico City has studied the social and economic impacts of expanding the programme to all 700 industries in the city and the benefits associated with scaled-up action are summarised as follows:

6%
PM_{2.5}
REDUCTION
IN INTERVENTION
AREA

65 PREMATURE DEATHS AVERTED
575 HOSPITAL ADMISSIONS AVERTED PER YEAR
3 DAYS IN LIFE EXPECTANCY GAINED PER CITIZEN

MEX \$217 MILLION
TOTAL VALUE OF AVERTED DEATHS

MAKING THE CASE

The city will use the results to involve and gain support from the new local and national governments and participation will be promoted by simplifying the administrative procedures for joining the programme. In addition, the city will provide further technical support to industries, potentially producing a manual showing best practice, to achieve better efficiency and environmental performance.

POPULATION
9 MILLION



ACTION INDUSTRIAL EFFICIENCY

AIR QUALITY ACTION

The city launched a voluntary environmental compliance programme with 27 industries to improve efficiency of productive processes and introduce more environmentally sustainable technologies.

The programme helps industry to assess their current environmental performance, provides opportunities to identify areas for improvement and recommends good environmental measures.

This programme also supports industry in installing control emissions technologies, as well as setting viable targets to comply with legal requirements. In addition, participating industries receive fiscal incentives. If the programme expands to all 700 industries, PM_{2.5} concentrations are expected to reduce by 6%.

POPULATION
2.7 MILLION



ACTION VEHICLE TESTING

AIR QUALITY ACTION

As part of the Anti-Smoke Belching programme adopted in Metro Manila, the Environmental Protection and Waste Management Department (EPWMD) in Quezon City conducts roadside testing of vehicle exhaust opacity levels to verify that PM_{2.5} limits are respected. In order to pass the test, the opacity level should not exceed a light absorption coefficient of 2.5. Latest data available show that Quezon City's Anti-Smoke Belching Unit was able to process over 10,054 vehicles in 2018. However, data also shows that 13% of the tested vehicles passed the test while the remaining 87% were directed to conduct maintenance. Currently, the daily tests are carried out by a team of 30 people.

QUEZON CITY

AIR QUALITY PROBLEM

Quezon City's PM_{2.5} level is 1.8 times greater than the WHO recommended value and high PM_{2.5} levels could lead to about 3,900 premature deaths in the city each year. (Annual average from a city monitoring station in 2017: 18µg/m³.) Quezon City is located at the heart of Metro Manila. It is a strategic convergence point for commercial activities and a major intersection of national roads and highways, traversed by public and private vehicles from different parts of the metropolitan area. The road transport sector represents about 69% of the PM_{2.5} concentrations in the city. Road traffic also affects poor visibility, impacting transportation safety.

MAKING THE CASE

The city will use the results of this analysis to demonstrate the opportunities to increase roadside testing. Alternative transport strategies are being rolled out by the city, such as the procurement of electric tricycles and expansion of its cycling infrastructure. Under an international cooperation agreement, "Clean Air for a Sustainable Future: A Transdisciplinary Approach to Mitigate Emissions of Black Carbon (TAME-BC)", the Quezon City government is actively working with various international non-governmental organizations, national government agencies, and academic institutions to examine and develop mechanisms to mitigate transport-induced black carbon emissions.

BENEFITS

Quezon City analysed the social and economic impacts of doubling to 60 the number of officials conducting daily roadside and garage tests of suspected polluting vehicles. The benefits associated are summarised below:

2.4%
PM_{2.5}
REDUCTION
IN INTERVENTION
AREA

55 PREMATURE DEATHS AVERTED
75 HOSPITAL ADMISSIONS AVERTED PER YEAR AND
14 DAYS IN LIFE EXPECTANCY GAINED PER CITIZEN

₱ 761 MILLION
TOTAL VALUE OF AVERTED DEATHS

2.2 AIR QUALITY IMPACTS AND BENEFITS

Alongside reducing GHG emissions, the pilot cities' selected climate actions would also target harmful air pollution. Across the 25 cities, it is estimated that the analysed actions could reduce PM_{2.5} non-background concentrations by 5.9% and NO_x levels by 16.7%, on population-weighted average, within the intervention areas. Why is this important?

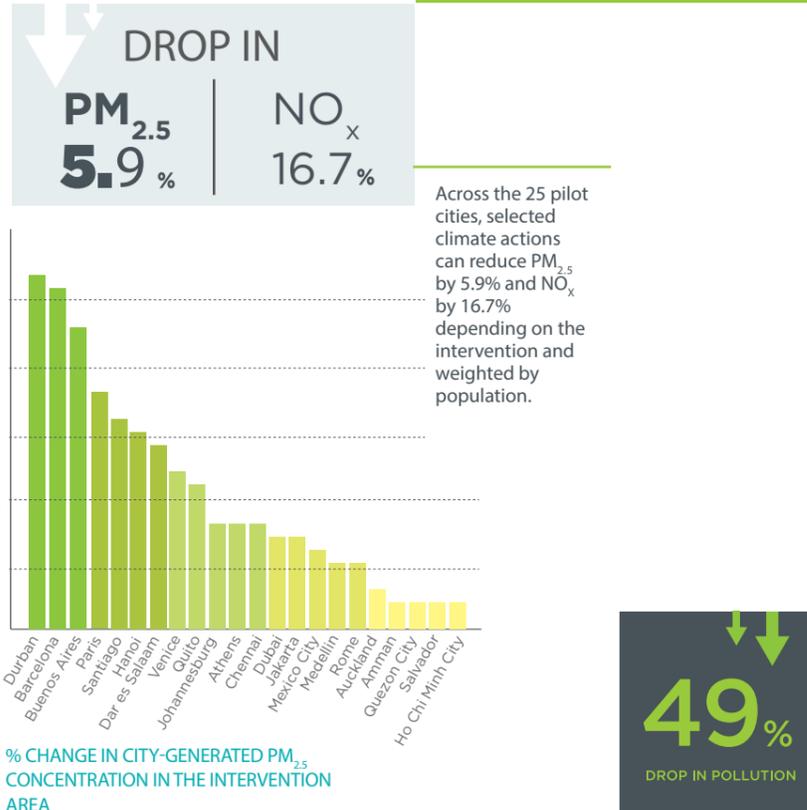
Air pollution is a mix of gases and suspended particles that can come from natural (sea, sand, dust, forest fires) and man-made sources (transport, industry, energy). While many types of airborne contaminant affect public health, including commonly regulated pollutants such as particulate matter (PM), ozone (O₃), nitrogen dioxide NO₂ and sulphur dioxide (SO₂), this report focuses on PM and NO₂, two pollutants common in urban areas and which account for a large share of the health impacts.

Particulate matter (PM) refers to small solid and liquid particles composed of various

compounds depending on its source: transport (exhaust and non-exhaust sources), industry, energy generation, or domestic coal and biomass used for cooking. Open burning and agriculture can also be major sources, especially in low- and medium-income countries. Particles below 10 microns in diameter, PM₁₀, can penetrate deep into the airways and smaller particles, PM_{2.5}, can pass through the lungs into the bloodstream, causing a wide range of negative health consequences. Time-series studies have demonstrated links between short-term spikes in air pollution and health consequences such as heart attacks, asthma attacks, increased hospitalisations, and premature deaths. Long-term studies have demonstrated links between PM_{2.5} exposures and lower life expectancy.

Nitrogen dioxide (NO₂) is mainly formed through fossil-fuel combustion from transport, industry and energy generation. Exposure to NO₂ causes inflammation of the airways

and studies have demonstrated increased symptoms of respiratory diseases being reported on days with higher levels of NO₂. Recent evidence has demonstrated links between long-term exposure to NO₂ and premature death.



QUITO

AIR QUALITY PROBLEM

Quito's PM_{2.5} level is 1.5 times greater than the WHO recommended value and high PM_{2.5} levels are responsible for about 380 premature deaths in the city. (Annual average from city monitoring stations in 2017: 15µg/m³.) The road transport sector is responsible for most of the PM_{2.5} level and buses account for about 31% of the PM_{2.5} concentration. In addition, high altitude exacerbates pollution from road transport by reducing engine efficiency and worsening pollutant emissions.

MAKING THE CASE

The municipality is engaging with the city's 60 public transport companies and guaranteeing that, every year, each company will replace at least one diesel bus with one that's zero-emission between 2020 and 2025. Then, from 2025 onwards, the rate will increase to at least three diesel buses being replaced to ensure that Quito's entire fleet – which accounts for a total of 3,184 buses - is zero-emission by 2040. Similarly, the city will look at switching from fossil-fuelled taxis to electric. Zero-emissions vehicles and the installation of charging infrastructure will be promoted.

Results from the analysis will be presented to the city's decision-makers to make the case for bolder actions and will also inform the update of the city's Climate Action Plan in 2020.

BENEFITS

Quito has studied the social and economic impacts of upgrading the city's circulating fleet with electric buses. Specifically, the analysis calculates the potential benefits associated with 1,200 buses being updated to electric. The results are summarised below:



POPULATION 2.2 MILLION



ACTION BUS UPGRADE

AIR QUALITY ACTION

Quito is in the process of procuring a total of 70 electric buses to replace its current old and poorly performing Euro II (94% of the total circulating fleet) and Euro III (6%) buses. The action responds to objectives and targets set out in the city's Development and Land Use Plan (PMDOT 2015-2025) and in the Environmental District Plan, which includes the Climate Action Plan and the Natural Resources Plan.

VENICE

AIR QUALITY PROBLEM

Located in the Pianura Padana Area – where the peculiar orographic and climatic conditions prevent air pollutant dispersion - Venice's PM_{2.5} level is 2.8 times greater than the WHO recommended value (ARPAV 2017, 28µg/m³). High PM_{2.5} levels are also responsible for about 1,200 premature deaths in the city. The road transport sector accounts for about 25% of the total concentration, with around 200,000 circulating vehicles in Venice, 42% of which are below Euro4 standards.

MAKING THE CASE

Venice is leading the way in evaluating the environmental, social and economic benefits of banning highly polluting vehicles. The positive results can support cities in Veneto and other regions that are part of the Bacino Padano Agreement in making the case for bigger and bolder actions to tackle air pollution.

BENEFITS

The city of Venice has studied the benefits of banning the circulation of polluting vehicles in the case of a medium-level air quality alert: Euro 0 motorcycles, Euro 0-1 petrol cars, Euro 0-4 diesel cars and Euro 0-3 diesel light duty vehicles. Benefits associated with this action are summarised as follows:



POPULATION 850 THOUSAND

VENICE METROPOLITAN AREA



ACTION BUS UPGRADE

AIR QUALITY ACTION

As part of the Bacino Padano Agreement, Venice is looking at implementing a low-emission zone to reduce emissions from the road transport sector. The agreement came into effect in October 2018 and is valid until March 2026. Every year the typologies of vehicles affected by the restrictions will be updated, with a plan to progressively reduce the emissions of the road fleet. The traffic limitations will apply during the winter season, from Monday to Friday between 08.30 and 18.30.

2.3 HEALTH BENEFITS

Analysis of health benefits from reduced PM_{2.5} levels shows that by taking ambitious climate action, cities could prevent 2,655 annual premature deaths caused by air pollution. This translates into 31,135 life years that could be gained across all 25 cities. Furthermore, the analysis shows a potential increase in life expectancy per citizen of over 100 days in some cities, such as Johannesburg and Santiago, for residents directly impacted by actions. Reducing the incidence of respiratory and cardiovascular diseases, through improved air quality, will also cut the number of hospital admissions by 9,275 annually across all cities.

These results show the impact from single, high-impact actions taken.

Independent of the present study, the ambitious programme of city-wide actions that Los Angeles is taking shows

the potential benefits to be gained at scale. By committing to 100% electrification of transport, net-zero-carbon buildings and an 82% reduction of industrial emissions, Los Angeles could avoid over 1,650 annual premature deaths and 660 hospital admissions, saving an estimated \$15.6 million in healthcare costs.

For cities needing to make the case for health-related benefits that can result from climate actions, there is a wealth of existing research that can be referenced. For instance, exposure to PM_{2.5} is also associated with high symptoms of anxiety (Power et al., 2015) and increases in PM₁₀, NO₂, and O₃ may exacerbate depressive symptoms among the elderly (Lim et al., 2012). Moreover, children who lived

in high-pollution areas at a young age are significantly more likely to develop major depression by the age of

18 (Roberts et al., 2019). Implementation of a Low Emissions Zone in London contributed to decreases in drug prescription rates for asthma of between 5% and 10% for the citizens most exposed to air pollution within the zone (Kelley et al., 2011).

In addition, active transport interventions (promoting walking and cycling) reduce GHG emissions and improve air quality while promoting physical exercise, which lowers mortality risk (Arem et al., 2015). Active transport options, electric vehicles and more fuel-efficient combustion-engine vehicles also tend to be quieter. This addresses the harm of noise pollution – excesses of which the WHO considers to pose a serious health risk (Transport & Environment, 2012).

31,135
LIFE-YEARS
GAINED

2,655
PREMATURE DEATHS
AVERTED

Climate actions reduce annual premature deaths and hospital admissions caused by air pollution in the 25 C40 cities.

9,275

FEWER HOSPITAL VISITS

HEALTH
BENEFITS

Air pollution increases anxiety symptoms and depression among the elderly and children.

REDUCED
ASTHMA

Drug prescription rates for asthma decreased between 5% and 10% for citizens most exposed to the low-emission zone in London.

INCREASED
WELL-BEING

PHYSICAL
ACTIVITY

Walking and cycling can increase physical activity. WHO recommends 150 minutes of physical activity per week.

2.4 ECONOMIC BENEFITS

Delivering ambitious climate actions that reduce GHG emissions and air pollution can bring about positive economic outcomes in cities around the world. It has been estimated that the 25 cities' proposed climate actions would generate an economic value of \$1 billion per year by avoiding 2,655 premature deaths linked to air pollution.⁵

Additionally, healthcare costs will decrease as fewer hospital admissions will be required for respiratory and cardiovascular issues linked to air pollution. It has been estimated that the proposed actions will produce \$59 million worth of additional value for the 25 pilot cities.⁶ Several other economic benefits can be linked to improved public health in cities. An example is avoided medication costs for chronic diseases such as asthma. Improved air quality can also have an effect on reducing work-loss days and restricted activity days (Hunt et al., 2016).

These additional economic benefits were not considered in this study, however, since the report focused on hospital admissions as an indicator of reduced morbidity. For this reason, it is expected that the above-mentioned economic benefits underestimate the full benefits in the 25 cities. On the other hand, it should be noted that actions taken by the cities to improve air quality can incur high capital costs. Therefore, the required investment should be taken into account if performing a cost-benefit analysis (which was not the purpose of this study).

Noted previously for its health benefits, switching to walking from driving can also have an economic impact by reducing the costs associated with congestion (Litman, 2003). And in Istanbul, implementing the MetroBus BRT reduced operating costs by 23%, compared with other public transportation systems (World Resources Institute, 2013).

In New York City, walking facilities in Union Square North reduced commercial vacancies by 49% due to the increased footfall in the area, while bus and bike lanes on 1st and 2nd Avenue reduced commercial vacancy rates by 47%. In London, there was a 42% increase in weekly consumer expenditure when switching from bus/car to walking (Litman, 2003).

⁵ The value of a life lost and its value to society can be defined in several ways but the Value of Life Year (VOLY) is an indicator that is widely used by the health sector. It is based on studies that assess the willingness to pay for reducing mortality risks associated with each disease. This does not take into account the costs of infrastructures.

⁶ The Value of Hospital Admission quantifies the overall value of reducing hospital admissions linked to air pollution.



LOS ANGELES

AIR QUALITY CITY DEMONSTRATOR

POPULATION
4 MILLION



INTEGRATED
PLANNING

NET ZERO-CARBON
BUILDINGS

100% ELECTRIC
TRANSPORTATION

82% REDUCTION OF
INDUSTRY EMISSIONS

AIR QUALITY PROBLEM

Los Angeles is facing significant air quality issues, and has been ranked in the ten most polluted cities in the US (American Lung Association, 2019). Low-income families and communities of colour are disproportionately impacted.

Separately to the other 25 cities participating in this study, the city has been selected as an Air Quality Demonstrator, and is leading ambitious actions to reduce air pollution and GHG emissions dramatically. C40 is supporting the city to deliver a cutting-edge package of policy and actions and evaluate their wider benefits.

AMBITIOUS CLIMATE GOALS

Los Angeles is committed to the Paris Agreement, and recently launched their Green New Deal sustainability plan. The LA plan sets out reduction targets for greenhouse gas emissions (GHGs) to ensure the city stays within its carbon budget between now and 2050 and becomes carbon neutral by 2050. LA's Green New Deal puts the city on the road to a zero-carbon future with targets and key milestones in every sector: 100% electrific transportation, net-zero-carbon buildings, 82% reduction of industrial emissions, zero-carbon grid and zero-waste.

INTEGRATED ACTION PLAN

The 2019 LA Green New Deal is the first four-year update to the 2015 pLAn. It accelerates LA's emission targets with more aggressive goals, but is also deeply rooted in climate justice. It puts a strong focus on how action to reduce pollution can also reduce inequality, create new and better jobs, develop a stronger, more sustainable economy, and improve the health and well-being of Angelenos. It is based on four key principles:

- Act with urgency to uphold the Paris Climate Agreement.
- Establish justice and equity, community resilience, affordability, health & well-being.
- Create pipelines to good paying jobs and a just transition to a green economy.
- Demonstrate the art of the possible and lead the way.

“If we wish to build a truly fair, just, and prosperous city, we have to ensure everyone experiences the benefits of a sustainable future.”

L.A.'S GREEN NEW DEAL

BENEFITS

The South Coast Air Quality Management District (SCAQMD) conducted a high-level estimate of the health and associated monetised benefits resulting from the City of Los Angeles's emission reduction targets. These results from Los Angeles show the benefits accrued from the bold, city-wide programme of actions on transportation, buildings and industries, underpinned by a decarbonized grid. LA's Green New Deal to secure clean air and a stable climate will provide massive air quality benefits for LA citizens, as well as leading the world on tackling climate change.

MAKING THE CASE

Climate change is not fair. Those who have done least to cause environmental pollution, the least well off globally and within all societies, are hit hardest by its consequences. That is why, when designing policies to tackle climate change, political leaders also need to demonstrate that there will be immediate and tangible benefits for everyone. The tough decisions required to slash emissions and safeguard everyone's future will never win popular legitimacy unless they also address the immediate concerns of voters - feeding a family, paying the rent, and accessing healthcare. The plan sets targets by 2025 to dramatically reduce exposure to health-harming pollutants in the most disadvantaged communities.

96% PM_{2.5}
NON-BACKGROUND
CONCENTRATION
REDUCTION

1,650 ANNUAL PREMATURE
DEATHS AVERTED

660 ANNUAL FEWER
HOSPITAL ADMISSIONS

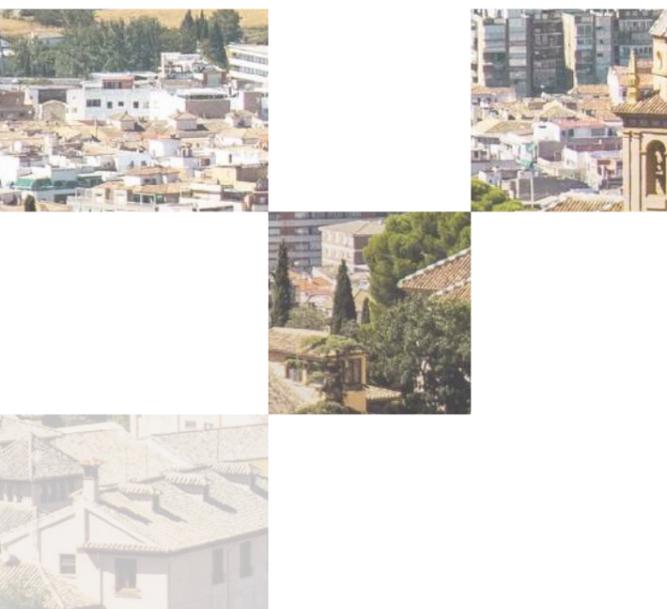
\$15.6M AVOIDED
HEALTHCARE COSTS

26.1 MtCO_{2e}
EMISSIONS AVOIDED

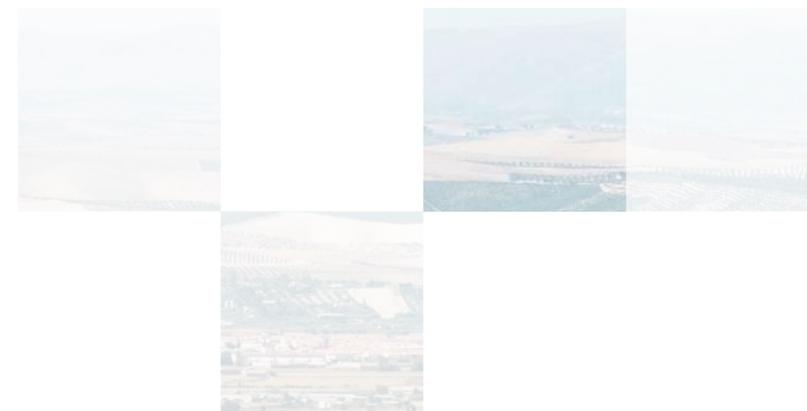
POLICY CHECKLIST: KEY CONSIDERATIONS FOR DECISION-MAKERS

Cities can drive ambitious climate action and be at the forefront of the fight against climate change. Making a strong case for action, by highlighting its multiple benefits, is instrumental in getting the job done.

Based on the experience of working with the cities in this programme, C40 has gathered insights on the most important elements to be considered throughout the whole decision-making process. This process can have many challenges and barriers; the sections below outline recommendations on how cities can address these to drive bold and ambitious action, tackling climate change and air quality simultaneously and harnessing the maximum benefits for their people.



**Cities
are
driving
ambitious
action**



PRIORITISATION: Identify the most impactful action

Cities' decision-making processes should start with understanding the problem. In other words, cities need to work with the best available data on the source apportionments of emissions and pollutants to understand where GHG emissions and air pollution are coming from, as well as who is affected. This will allow the development of a solution that addresses their city-specific issues and therefore maximises the benefits.

Furthermore, cities should map all potential impacts in order to make more holistic decisions and quantify or, where that is not possible, qualify all the benefits that speak to their decision-makers. By identifying synergies and proposing actions that tackle multiple objectives (e.g. climate, air quality and health), cities can make a stronger case based on a wide range of benefits.

AMBITION: Take bold action

In order to address climate and air pollution issues, cities should think big. Cities need to take bold action, taking every opportunity to scale up outcomes.

Adopted solutions will be context driven and specific. Opportunities to leapfrog to better, more ambitious solutions (e.g. instead of upgrading to a more efficient diesel bus fleet, leapfrog to fully electric) should be identified – at the same time recognising that a significant journey can start with multiple smaller steps. Cities are encouraged to think big at an early stage in their decision-making process, so as to plan effectively for ambitious actions.

Beyond bold action, ambition should also be understood as 'acting fast'. Cities need to act **now**, to avoid the consequences of climate change. Cities should harness the potential of short-term action and generate quick wins for climate and air quality, while ensuring these are part of a longer-term, integrated strategy.

IMPACT: Costs and benefits

To ensure the best overall impact from actions, cities should consider both negative impacts (costs) and positive impacts (benefits). Understanding the net impact of actions allows cities to make informed decisions around action planning and implementation. Cities should be considering benefits beyond what is quantifiable and take into account illustrative and qualitative results when building their case.

The success of cities in delivering high-impact climate action largely relies on effective implementation. Contingent and contextual factors (e.g. political context, social issues, economic development, climatic conditions) affect the outcomes and impacts of an action. Cities need to consider such factors in order to ensure successful action and impact.

INCLUSIVE CLIMATE ACTION: Fair distribution of impacts

Equity of impact is a key outcome that cities should strive for when fully realising the positive environmental, health and economic impacts of actions. Equitable gains mean ensuring the fair distribution of negative and positive impacts of climate and air quality action among all citizens.

To ensure equitable and fair policymaking, cities should include all relevant stakeholders in the decision-making process – citizens, government departments, private entities, and so on.

In order to help cities jointly tackle climate change and inequality, C40 Cities has published a report that collates guidance and lessons learnt from ongoing and past initiatives across the world on inclusive climate action (C40 Cities and BuroHappold, 2019).

COLLABORATION: Partner with external stakeholders

While cities are at the forefront of climate action and are leading the way towards a healthier and more sustainable future, they can't act in isolation. Collaboration with different levels of government, and with private and civic sector partners, is required to successfully drive action – especially when dealing with cross-boundary climate and air quality issues.

Not only should cities collaborate across both regional and national levels of government, but they should also recognise the importance of a cross-sector and cross-city collaborative effort. This is especially important when considering multiple benefits, and entails engagement with different departments within a city and with other cities to join efforts and share learnings.

Implementing bold, ambitious climate action is complex and challenging. Cities are encouraged to share successes and failures to help unlock the most effective action.

COMMUNICATION: Quantify benefits and disseminate results

Clear, effective and transparent communication is instrumental in promoting collaboration and stakeholder support. Cities need to identify stakeholders and prioritise benefits early on in order to build a strong case that will speak to decision-makers and ensure their support for any proposed action(s). Citizens and private companies are crucial stakeholders, who should be engaged in the proposals and in assessing scenarios early in the project lifecycle. Once cities have quantified the impact of their action(s) on climate and air quality, it is important to communicate the results widely and in a compelling way to strengthen existing stakeholder relationships and potentially build new ones.

CONCLUSION AND RECOMMENDATIONS

Bold action is needed to stop climate change and improve quality of life for people living in cities. Limiting global warming to 1.5°C will require that all cities take transformative action, yet climate change and air pollution are far from being the main topics on the agenda for many citizens and their leaders. Demonstrating the wider health, economic and other benefits of climate action enables cities to tackle multiple priorities and maximise impact on the ground.

The methodology developed as part of this programme allows cities to quantify the potential air quality, health and economic gains of urban climate action. These results can help cities make the case for bigger and bolder actions and harness their wider benefits. Twenty-five cities across the world have already started this process, analysing a variety of actions aimed towards cleaner transport, buildings and industry, and presenting the evidence to their policymakers to ask for ambitious change. The actions proposed have the potential to reduce PM_{2.5} non-background levels by 5.9% on average within intervention areas, reducing annual premature deaths due to air pollution by 2,655 and decreasing annual hospital admissions by 9,275 across all cities. This translates into a total of 31,135 life years gained. These results – from taking just one high-impact action across 25 cities – show the potential for tackling the climate and air quality crisis if all cities take multiple actions, as Los Angeles has done in an independent programme of climate actions.

The methodology and toolkit pioneered by this research should be used by all cities to quantify the air quality, health and economic benefits of potential actions appropriate to the local context.

The results and case studies provided in this report – the learnings of the 25 cities that participated in the study – can also be used to make the case for similar actions, allowing cities to advocate for a more ambitious climate agenda.

To achieve this, cities should collect robust data for understanding sources of pollution, their health risks, and the potential benefits of their mitigation. This includes improving the network of air quality monitoring stations in cities, carrying out source apportionment studies, creating or updating high-quality emissions inventories and conducting air quality modelling to better assess pollution exposures and their sources. Collecting health data and associated economic data for use in cost-benefit analysis (such as hospital admissions, death rates, hospitalisation costs and the Value of a Life Year, i.e. VOLYs) will enable cities to better study the impacts of air quality changes in their local populations. Finally, by collecting refined spatial data, cities will get a better understanding of how the impacts are distributed and ensure equity of benefits and costs.

The toolkit and methodology are available on demand from the C40 Benefits Research Team.



AIR QUALITY BENEFITS TOOLKIT

C40 and Johnson & Johnson are working in partnership to connect the dots between climate action, improved air quality in cities and better health amongst citizens.

C40 has undertaken cutting-edge research, working with 25 cities to date to measure the air quality and health benefits of climate action, and to use this to make a stronger case for action.

The time for urgent climate action

Cities are responsible for more than 70% of global CO₂ emissions and play a leading role in limiting global increases in temperature to 1.5°C, in line with the Paris Agreement. Simultaneously, cities need to take adaptation measures to deal with local issues of air pollution, including pollutants and toxic compounds.

In order to tackle both air quality and climate change, cities need clean and efficient transport, buildings and industry solutions.

UNDERSTAND: Key facts & findings resources

PROGRAMME REPORT

THOUGHT LEADERSHIP

KEY FACTS SUMMARY

The Programme Report presents the global need and opportunity for climate and air quality actions. The Thought Leadership document calls cities to action, showing the benefits if all cities were to take action on transport, buildings and industries in a short graphic summary.

MEASURE: Tools to assess your projects

Drawing on the existing **evidence-base** and working with leading experts, we developed a **methodology** to enable cities to quantify the health benefits of climate and air quality action. The **tool and its learning material** have been tested by 30 cities to date.

Additional exercises are provided to help cities develop a **communication** strategy and consider **inclusivity** to ensure that efforts to address climate change help create sustainable cities for all.

BENEFITS TOOL

GUIDANCE

WEBINAR

METHOD SUMMARY

EVIDENCE DATABASE REVIEW

INCLUSIVITY TOOLKIT

COMMS TOOLKIT

All the publications mentioned here are available on demand from the C40 Benefits team.

ELECTRIC BUSES & MOTORCYCLES HO CHI MINH CITY	INDUSTRIAL EFFICIENCY MEXICO CITY	GREEN & HEALTHY STREETS PARIS	LOW EMISSION ZONE VENICE
ELECTRIC BUSES QUITO	INDUSTRIAL EFFICIENCY DURBAN	ELECTRIC BUSES CHENNAI	GET INSPIRED Case Studies
VEHICLE TESTING QUEZON CITY	SETTLEMENT ELECTRIFICATION SANTIAGO		

Zoom on the tool:

The tool has been developed to enable cities to effectively and efficiently undertake a rapid assessment of the health benefits of climate and air quality actions on transport, buildings, industry and energy:

- ◆ Reduction in air pollution
- ◆ Premature deaths avoided per year
- ◆ Life years gained
- ◆ Increase in life expectancy
- ◆ Reduction in respiratory and cardiovascular hospital admissions
- ◆ Value of avoided deaths
- ◆ Healthcare costs savings

Lorem ipsum

The C40 Benefits Research programme

Equipping C40 mayors with the evidence and tools to make the case for a much greater speed and scale of action, supporting cities to unlock action and avoid false trade-offs.

AIR QUALITY TOOL

WALKING & CYCLING TOOL

DEEP BUILDING RETROFITS

IMPACT FRAMEWORK

For details, see the benefits webpage:
<https://www.c40.org/benefits>

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METHODOLOGY