C40 CITIES
CLIMATE LEADERSHIP GROUP

BENEFITS OF URBAN CLIMATE ACTION

C40 Cities Technical Assistance Report 2020

JAKARTA

Electric buses

CLIMATE, AIR QUALITY AND HEALTH

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 30 cities to date to measure the air quality and health benefits of climate action, and use this to make a stronger case for action.

The time for urgent climate action

Cities are responsible for about 70% of global CO_2 emissions and play a leading role in limiting global temperature rise to 1.5°C, in line with the Paris Agreement. Simultaneously, cities need to take adaptation measures to protect themselves against current and future extreme weather events, such as extreme cold and hot weather, floods and droughts. Finally, cities need to attend to 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.

JAKARTA

Located in the delta of 13 rivers and with 40% of its landmass below sea level, Jakarta and its 10 million residents are extremely vulnerable to climate risks, particularly extreme or sudden changes in rainfall and sea level rise.

The city is famous for its busy and polluted roads. Transport is one of the main sources of greenhouse gas emissions, accounting for 48% of the total GHG emissions in the city.[1]

48% OF GHG EMISSIONS FROM **TRANSPORT**

THE NEED TO TACKLE AIR QUALITY

Over the last decade, air pollution in Indonesia has increased significantly, with 80% of the 256 million Indonesians exposed to pollution levels that exceed World Health Organisation (WHO) guidelines. In Jakarta, the annual average concentration of particulate matter ($PM_{2.5}$) is more than 4 times higher than the WHO recommendation (48 µg/m³).

The situation in Jakarta is such that citizens are now sueing the government for its lack of action on air quality. To city is now targeting its policies towards addressing land transportation to reduce both GHG and pollutant emissions. [2]

$PM_{2.5}$ CONCENTRATION 4 TIMES HIGHER THAN THE WHO RECOMMENDED VALUE

THE HEALTH BURDEN

Pollutants such as $PM_{2.5}$ represent a major risk to people's health, particularly affecting children and older people. Often used as an indicator of air pollution, $PM_{2.5}$ can penetrate deep into the lungs and is linked to respiratory and cardiovascular morbidity and mortality, even at low concentrations.

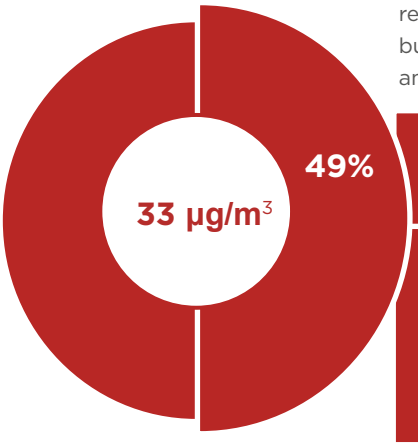
In Indonesia, it is estimated that about 123,700 premature deaths every year are attributable to the current ambient air pollution levels.[3]

123,700 PREMATURE DEATHS EACH YEAR IN INDONESIA ARE DUE TO AIR POLLUTION

Understanding the problem

In Jakarta, it is estimated that half of $PM_{2.5}$ and 70% of PM_{10} emissions come from transport. The city's growing population has led to an increase in the number of vehicles and associated emissions. [4]

Motocycles are the greatest source of emissions, with more than 13 million vehicles registered in the city, which are used for both private and hop-on services. Mini buses also represent a popular tranport mode, often stopping at the side the road and increasing traffic congestion.



JAKARTA TRANSPORT SECTOR

49% OF PM2.5 CONCENTRATION **COMES FROM THE TRANSPORT SECTOR**

MORE THAN 17 MILLION VEHICLES REGISTERED

The action

In September 2019, the city signed C40's Green and Healthy Street declaration, committing to procure only zero-emission buses in contracts and concessions signed from 2025 and ensuring that a major area of the city will be zero emission by 2030. The city also signed C40's Clean Air Cities declaration, outlining ambitious pollution reduction targets and the implementation of substantive clean air policies by 2025.[5]

"Jakarta faces significant air quality problems with vehicular pollution one of the leading causes of this. Our vision is to transform Jakarta away from a traffic dominated, congested and polluted city to a world leader in public and sustainable transport, where residents and visitors feel that using public transport is safe, sustainable and comfortable." said the Governor of Jakarta, Anies Baswedan.

With a revitalized Bus Rapid Transit system operated by TransJakarta that increased from 94 milllion to 264 million yearly passengers from 2015 to 2019 and with the desire to shift to electric buses, the Governor hopes to address the city's transport and air quality challenges.[6]

However, private operators are common throughout the city and are running old and highly polluting vehicles. The city is undertaking an important initiative that aims to bring these minivans and microbuses currently operating around the city into the Transjakarta network. Electrifying the public bus fleet would have a significant impact on air quality but to ensure that those changes are climate-positive, the country must work towards a decarbonised energy grid.

GREEN AND HEALTHY STREETS

CLEAN PUBLIC TRANSPORT

L O W EMISSION ZONE

ACROSS THE **WHOLE CITY**

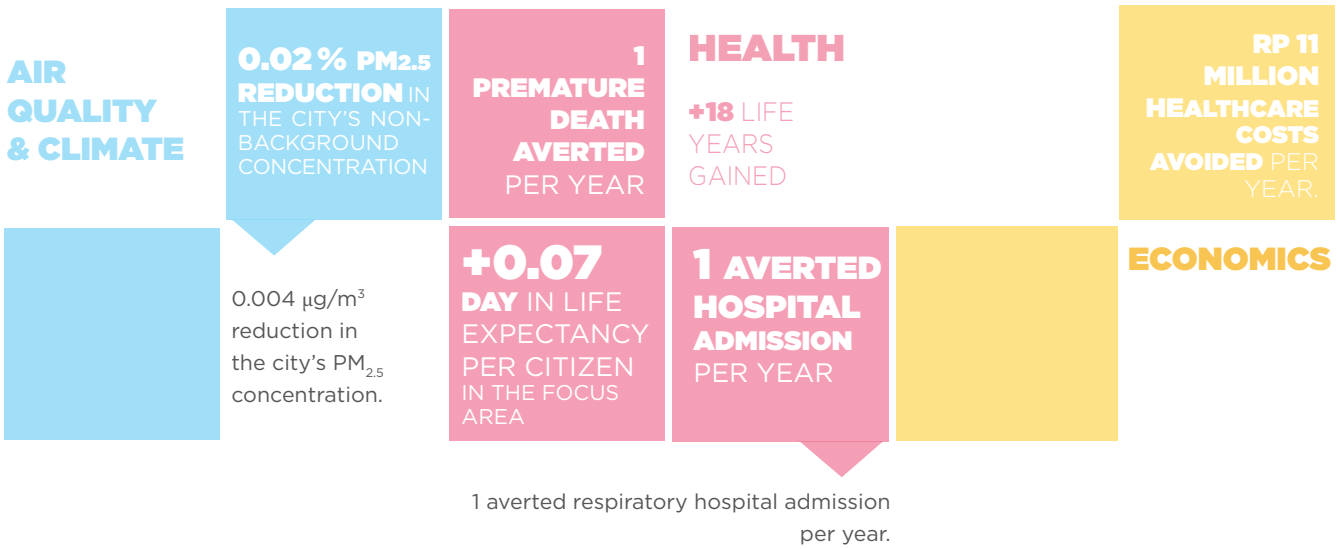
The benefits

With support from C40, the city analysed the social and economic impacts of switching the city's buses from diesel and CNG to electric vehicles. The city bus fleet is also increasing as TransJakarta is bringing the old informal buses to the formal transport sector, without having to add more vehicles to the roads. The results showed a massive improvement in air quality ($PM_{2.5}$) leading to health improvements for the city's population and a reduced economic burden.

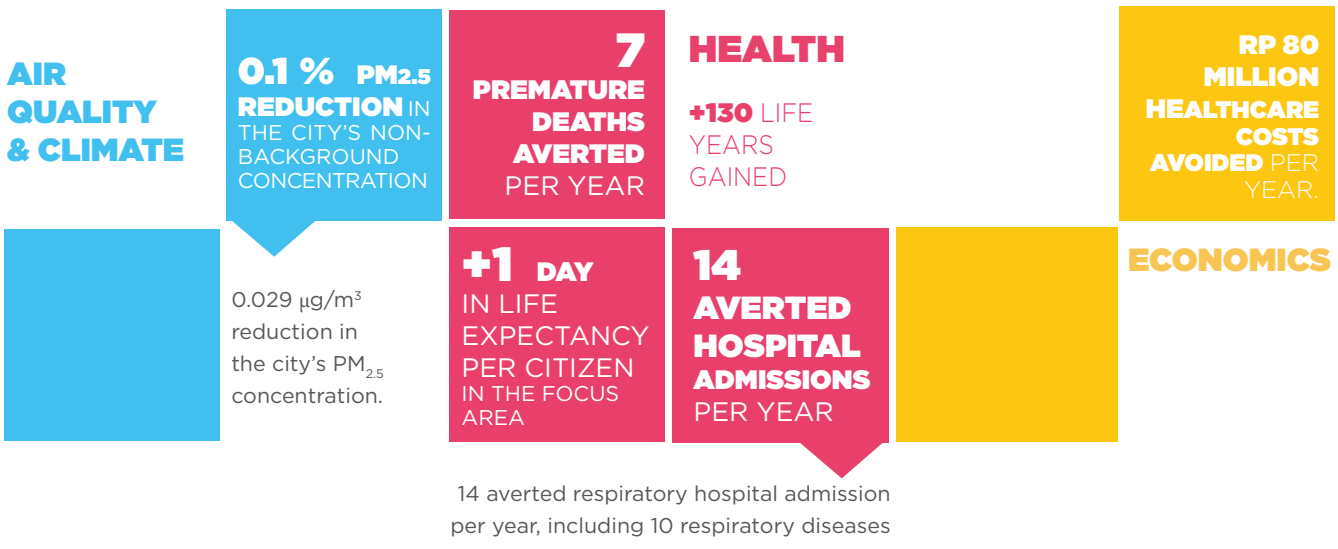
The air quality improvement leads to a reduction in the health burden of cardiovascular- and respiratory-related diseases and deaths. Hospital admissions are used as an indicator for morbidity, while the change in premature deaths, life expectancy and life years gained are used to quantify mortality impacts.

The economic impact represents the monetary value of averting a hospital admission and of gaining an extra year of life.

Target 2020 : Electrification of 100 large buses among Transjakarta fleet (3,965 vehicles)



Target 2022 : Electrification of 20% of Transjakarta's bus fleet (Total fleet 10,000 vehicles)



Target 2030 : Electrification of 100% of Transjakarta's bus fleet (Total fleet 14,000 vehicles)

AIR QUALITY & CLIMATE

0.8 % $PM_{2.5}$ REDUCTION IN THE CITY'S NON-BACKGROUND CONCENTRATION

0.21 µg/m³ reduction in the city's $PM_{2.5}$ concentration.

58 PREMATURE DEATHS AVERTED PER YEAR

+4 DAYS IN LIFE EXPECTANCY PER CITIZEN IN THE FOCUS AREA

HEALTH

+975 LIFE YEARS GAINED

100 AVERTED HOSPITAL ADMISSIONS PER YEAR

100 averted respiratory hospital admission per year, including 75 respiratory diseases and 25 cardiovascular diseases.

RP 600 MILLION HEALTHCARE COSTS AVOIDED PER YEAR.

ECONOMICS

DRIVING ACTION

GETTING FUNDING

E-buses and e-mobility as a wider concept are relatively new technologies in Indonesia. The lack of capacity related to e-buses is not only due to technical limitations, but also because of issues around financing and daily operations.

BRING TECHNICAL SUPPORT

Technical assistance from development organisations and support to make e-bus operations financially viable are the main drivers to achieve more buy-in from the city. Other environmental, economic and social benefits will strengthen the commitment of the city to further develop e-bus infrastructure and operations.

NEXT STEPS

The next step is to build ownership internally in the city. After the support to make e-bus operations financially viable and to improve capacity development, the city should be able to continue its e-bus operations. The city needs to build a strong public transport strategy that integrates vehicle electrification.

TransJakarta already has a vision to grow and transition its current fleet of 10,000 traditional buses to 14,000 electric buses by 2030. The aim is to get to 60% of trips made in the city via public transport.

METHOD AND ASSUMPTIONS

Methodology available here.

Key assumptions:

- *The air quality data is based on the average over 3 monitoring stations in 2019.*
- *The source apportionment of PM2.5 concentrations come from BreatheEasy Inventory in 2017.*
- *Population and deaths data come from the Health department, and are from 2018 and 2016 respectively.*
- *Vehicle data comes from the number of registered vehicles in 2016.*
- *Burden of air pollution on mortality was calculated by using the relative risk from published studies that relate air pollution concentrations to health outcomes. This was applied to the difference between city-wide annual average $PM_{2.5}$ concentration and the Global Burden of Disease's theoretical minimum exposure, and to the mortality rate in the local population. This is assuming impacts only in adults (ages 30+).The analysis has been carried out following the methodology outlined in the BUCA Guidance Manual.*

Proxy and assumptions

- *As hospital admissions were not available for cardiovascular and respiratory diseases, the proxy was taken from UK hospital admissions breakdown per age and gender. This may underestimate the morbidity results.*
- *The background concentration is the national average concentration of $PM_{2.5}$ in 2016 as no other local data or source apportionment was available.*
- *The modelling takes the assumption of a constant number of buses across all scenarios as the city is planning to increase the vehicle fleet by operating more unformal buses rather that buying additional ones.*
- *The emission factors are generic from the European Environment Agency, and do not reflect the traffic congestion nor the state of the roads.*
- *Emissions coming from the increase in electricity-use for the new buses are not counted in the analysis: the increase in energy demand compared to energy demand from buildings and industry will not be significant enough to reflect on the city concentration.*

Notes

[1] *GHG EMISSIONS INVENTORY, C40, 2020.*

[2] *Indonesia worsening air quality and its impact on life expectancy, AQLI, 2019.*

[3] *IHME Global Burden of Disease, data from 2017.*

[4] *BreatheEasy Inventory, 2017.*

[5] *Clean Air City Declaration, C40, 2019.*

[6] *Perkembangan Pelanggan Transjakarta Selama 5 Tahun, 2019.*

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