C40 CITIES
CLIMATE LEADERSHIP GROUP

BENEFITS OF URBAN CLIMATE ACTION

C40 Cities Technical Assistance Report

HO CHI MINH CITY

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 26 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 increases in temperature 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 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.

HO CHI MINH CITY

Ho Chi Minh City is located in Southern Vietnam and covers an area of about 2,000 km². With a population of approximately 8.8 million people (National Statistics Office 2016), Ho Chi Minh City is the largest and most populous city in Vietnam.

Ho Chi Minh City's road transport sector represents a key contribution to the city's overall greenhouse gas (GHG) emissions. In particular, road transport emissions in Vietnam are dominated by motorcycles, ahead of cars, heavy duty vehicles and buses.

8.8 MILLION PEOPLE

AREA OF 2,000 KM²

THE NEED TO TACKLE AIR QUALITY

Air pollution is a serious problem in Ho Chi Minh City, causing a high incidence of air quality related health issues.

According to the World Health Organization (WHO), the annual average concentration of $PM_{2.5}$ should not exceed 10 µg/m³. In Ho Chi Minh City, the annual average is around 31 µg/m³, showing that people are exposed to very harmful levels of air pollution.[1]

PM2.5 CONCENTRATION IS 3 TIMES ABOVE THE WHO RECOMMENDED VALUE

THE HEALTH BURDEN

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

In Ho Chi Minh City, about 7,300 premature deaths[2] every year are attributable to the current $PM_{2.5}$ levels.

7,300 PREMATURE DEATHS EACH YEAR IN HO CHI MINH CITY ARE DUE TO PM2.5 LEVELS

[1] *WHO Database Maps*

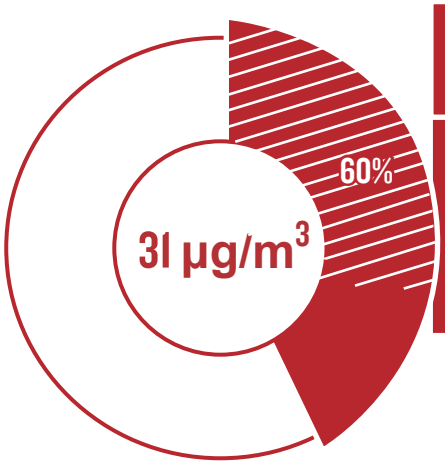
[2] *Burden of air pollution on mortality was calculated by using the relative risk from published studies relating air pollution concentrations to health outcomes. This was applied to the difference between city-wide annual average $PM_{2.5}$ concentration and the GBD's theoretical minimum exposure (5.8 µg/m³), and to the mortality rate in the local population. This is assuming impacts only in adults (ages 30+).*

Understanding the problem

The road transport sector in Ho Chi Minh City is responsible for 40% of the total $PM_{2.5}$ concentration in the city. Within this sector, 60% of the total contribution is generated by motorbikes and 3% from buses.

Ho Chi Minh City has about 7.3 million motorbikes. These motorbikes, which are all privately owned, operate on fossil fuels and contribute significantly to poor air quality in the city.

40% OF PM2.5 CONCENTRATION COMES FROM THE ROAD TRANSPORT SECTOR



HO CHI MINH CITY MOTORBIKES

60% OF ROAD TRANSPORT SECTOR $PM_{2.5}$ CONCENTRATION IS GENERATED BY MOTORBIKES

7.3 MILLION MOTORBIKES

3% OF ROAD SECTOR $PM_{2.5}$ CONCENTRATION IS FROM BUSES

The action

Ho Chi Minh City is looking to introduce two key actions to reduce air pollution in the city: converting 1,300 buses from diesel to CNG (Compressed Natural Gas) and promoting the uptake of electric motorbikes in place of gasoline ones. A pilot project to shift to using electric motorbikes is expected to start at the start of 2019. For the purpose of this analysis, the benefits of upgrading 10% of the existing motorbike fleet has been quantified.

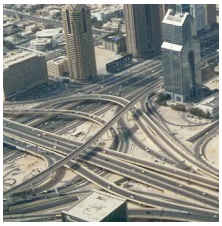
The bus and motorbike upgrades will affect the urban area of the city, which represents about a quarter of the total city area and 6.7 million people.

CLEANER BUSES AND MOTORBIKES

1,300 BUSES USING CNG

PROMOTE ELECTRIC MOTORBIKES

1/4 OF THE TOTAL CITY AREA



The benefits

With support from C40, the city analysed the social and economic impacts of upgrading 1,300 buses from diesel to CNG, as well as shifting 10% of the current motorbike fleet to electric. The results showed a massive improvement in air quality, which would improve the population's health and produce considerable economic benefits.

Air quality improvements, in terms of reduced concentrations of $PM_{2.5}$ are observed in the whole city.

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.

Benefits of shifting to 10% e-motorbikes

AIR QUALITY

- 0.5% $PM_{2.5}$ REDUCTION IN WHOLE CITY AREA
- 2.3% $PM_{2.5}$ REDUCTION IN INTERVENTION AREA

ECONOMICS

- ₫ 111 BN TOTAL VALUE OF AVERTED DEATHS
- ₫ 2.7 BN AVOIDED HEALTHCARE COSTS

The value of averted hospital admissions is ₫1.9 billion (Vietnamese Dong) for respiratory and ₫470 million for cardiovascular diseases.

HEALTH

- 106 PREMATURE DEATHS AVERTED PER YEAR
- +1,400 LIFE YEARS GAINED OVER THE WHOLE CITY
- +6 DAYS IN LIFE EXPECTANCY PER CITIZEN
- 172 AVERTED HOSPITAL ADMISSIONS PER YEAR

6 day increase in life expectancy for each citizen. For those living in the intervention area, it increases to 7 days.

172 averted hospital admissions per year, including 125 for respiratory diseases, and 47 for cardiovascular diseases.

Benefits of upgrading 1,300 buses from diesel to CNG

AIR QUALITY

- 0.1% $PM_{2.5}$ REDUCTION IN WHOLE CITY AREA
- 0.5% $PM_{2.5}$ REDUCTION IN INTERVENTION AREA

ECONOMICS

- ₫ 26 BN TOTAL VALUE OF AVERTED DEATHS
- ₫ 626 M AVOIDED HEALTHCARE COSTS

The value of averted hospital admissions is ₫454 million for respiratory and ₫172 million for cardiovascular diseases.

HEALTH

- 25 PREMATURE DEATHS AVERTED PER YEAR
- +331 LIFE YEARS GAINED OVER THE WHOLE POPULATION
- +1 DAY IN LIFE EXPECTANCY PER CITIZEN
- 40 AVERTED HOSPITAL ADMISSIONS PER YEAR

1 day increase in life expectancy for each citizen. For those living in the intervention area, it increases to 2 days.

40 averted hospital admissions per year, including 29 for respiratory diseases, and 11 for cardiovascular diseases.

DRIVING ACTION

SUPPORT BUS OWNERS

The key barriers to the implementation of the bus upgrade programme are related to the delays in the provision of CNG fueling stations.

Further discussions with the relevant departments are to be conducted in order to push this action. In addition, the bus owners are to be supported financially, by means of reduced-interest loans.

RAISE PUBLIC AWARENESS

The main challenge to the uptake of electric motorbikes is the lack of public awareness on the environmental, social and economic benefits associated.

To this end, the city will use the results from this analysis to promote behavioural change through public campaigns.

Financial incentives for upgrading to electric motorbikes are not yet in place, though these may be discussed with policymakers and relevant departments.

BOOST COLLABORATION

The air quality and health benefits will also be communicated to the relevant departments within the city (e.g. Health, Environmental, Air Quality and Transport departments) through several workshops, with the aim to consolidate the collaboration and improve the analysis with more accurate and local data.

Further actions to tackle air pollution in the city will be reviewed, mainly involving solid waste management and industrial emissions.

NEXT STEPS

The installation of charging stations to support the transition to a cleaner circulating fleet will be discussed and planned with the transport department.

The estimated benefits will be presented to the mayor to gain support for the action and for public campaigns. These could take many forms, such as lectures on air pollution in schools and universities, public radio campaigns and roadside displays of air quality levels.

The city will install around 20 automatic monitoring stations in the city by the end of 2020. The city will also apply for additional funds and collaborations with universities. These measures will improve data availability and understanding of air quality issues.

METHOD AND ASSUMPTIONS

Methodology available here.

Key assumptions:

- *$PM_{2.5}$ concentration values used for the whole city are are an average of the modelled annual mean $PM_{2.5}$ data range provided by the WHO Maps database.*
- *In the absence of local $PM_{2.5}$ source apportionment data, the WHO data have been used. As HCMC is not present in the WHO database, Hanoi has been used as a proxy.*
- *Proxy data from Hanoi used for hospital admissions for respiratory and cardiovascular diseases.*
- *Proxy data from Auckland (New Zealand) used for VOLY and VHA and converted using the relevant PPP exchange rate.*
- *Burden of air pollution on mortality was calculated by using the relative risk from published studies relating air pollution concentrations to health outcomes. This was applied to the difference between city-wide annual average $PM_{2.5}$ concentration and the GBD's theoretical minimum exposure (5.8 $\mu g/m^3$), 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.

Next steps for the analysis:

Future data collection activities based on the data gaps in the analysis include:

- *Collecting data for NO_x and NO_2*
- *Collecting hospital admission data by gender and age*
- *Developing VOLY and VHA estimates.*

Cover Picture : Min An, Unsplash

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