C4O CITIES
CLIMATE LEADERSHIP GROUP

BENEFITS OF URBAN CLIMATE ACTION

C40 Cities Technical Assistance Report 2019

LIMA

Efficiency incentives for restaurants & rotisseries

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.

LIMA

With an area of 2,700km[2] and a population of approximately 8.8 million people, Lima is the capital city of Peru and home to a third of the national population. The municipality supervises regulations over the 43 districts of Lima's Province.

Lima's stationary energy represents one of the greatest contribution to greenhouse gas (GHG) emissions, accounting for 40% of the total Scope 2.[1]

40% OF GHG EMISSIONS IN THE CITY COME FROM **STATIONARY ENERGY**

THE NEED TO TACKLE AIR QUALITY

Air quality is a rising issue in Lima, and the government has launched the Clean Air campaign that commits to clean transport, energy and waste treatment.

According to the World Health Organization (WHO), the annual average concentration of $PM_{2.5}$ should not exceed 10 μg/m³. In Lima, the annual average is around 28 μg/m³, indicating that people are exposed to harmful levels of air pollution.

$PM_{2.5}$ CONCENTRATION IS 2.8 TIMES GREATER THAN THE WHO RECOMMENDED VALUE

THE HEALTH BURDEN

Pollutants such as $PM_{2.5}$ and NO_2 represent a major risk to people's health, particularly affecting children and the elderly. Often used as an indicator of air pollution, $PM_{2.5}$ can penetrate deep into lungs and is linked to respiratory and cardiovascular morbidity and mortality, even at low concentrations.

In Lima, about 1,660 premature deaths every year are attributable to the current $PM_{2.5}$ levels.[2]

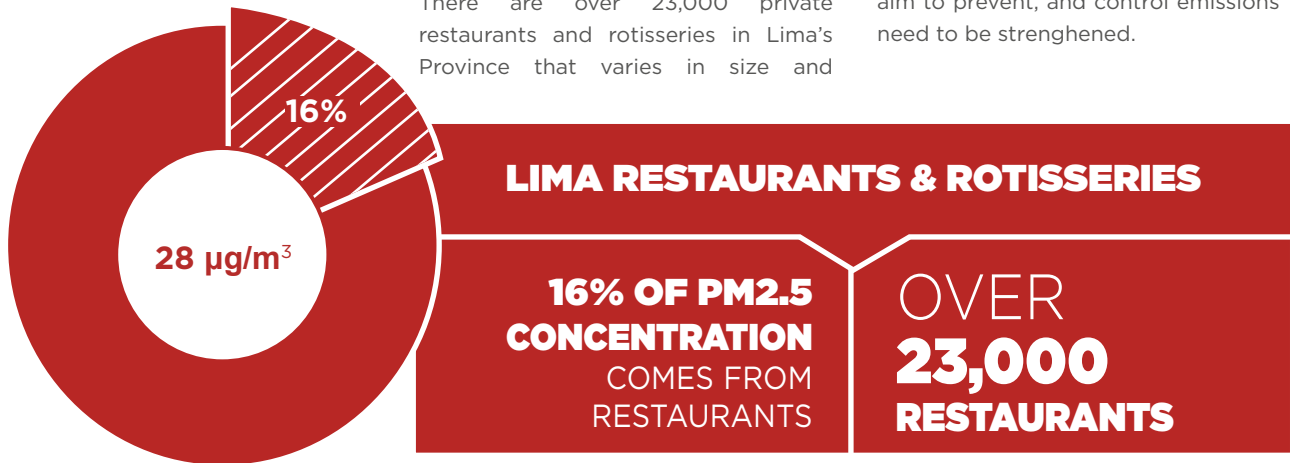**1,660 PREMATURE DEATHS EACH YEAR** IN LIMA AREA ARE DUE TO PM2.5 LEVELS

Understanding the problem

Charcoal is the traditional fuel that is used for cooking in Lima and it produces a lot of particulate matter and volatile organic compound during the combustion. Although the city's restaurants are not the main source of pollutants, they contribute to almost 16% to $PM_{2.5}$ emissions.

There are over 23,000 private restaurants and rotisseries in Lima's Province that varies in size and characteristics: 5% of establishments are large activities (>250m^2), 8% medium size (100-20 m^2), 87% are very small (<100m^2).

The Province of Lima has the authority to assess and supervise these restaurants and rotisseries, but the current regulations and measures that aim to prevent, and control emissions need to be strenghened.

16%

28 μg/m^3

LIMA RESTAURANTS & ROTISSERIES

16% OF PM2.5 CONCENTRATION COMES FROM RESTAURANTS

OVER **23,000 RESTAURANTS**

The action

The Province of Lima is exploring options, within a wider programme, that can prevent and control emissions in the commercial food sector. The programme will promote the implementation of cleaner technologies and products in restaurants and rotisseries. It also aims to improve the skills of city staff so that they can carry out supervisions, as well as to acquire proper equipment to measure polluting emissions.

The programme will promote cleaner and more efficient stoves, that reduces the charcoal use by 30%. The reduction in charcoal consumption also impacts the businesses, allowing a reduced payback time of the stove investment.

Several pilot restaurants have already invested in cleaner and more efficient stoves, and one of the city's district, Cercado de Lima, is leading the way on air pollution prevention and control.

Cercado de Lima plans to phase in a new regulation on stoves, that will target large and medium establishments in a first step, before being rolled out to the whole city.

EFFICIENCY REGULATIONS

MORE **EFFICIENT STOVES**

30% LESS CHARCOAL USE

ACROSS THE **WHOLE PROVINCE OF LIMA**

The benefits

With support from C40, the city analysed the social and economic impacts of promoting cleaner and more efficient stoves in all city restaurants. The results showed that a massive improvement in air quality is possible, resulting in significant health improvements and a reduced economic burden.

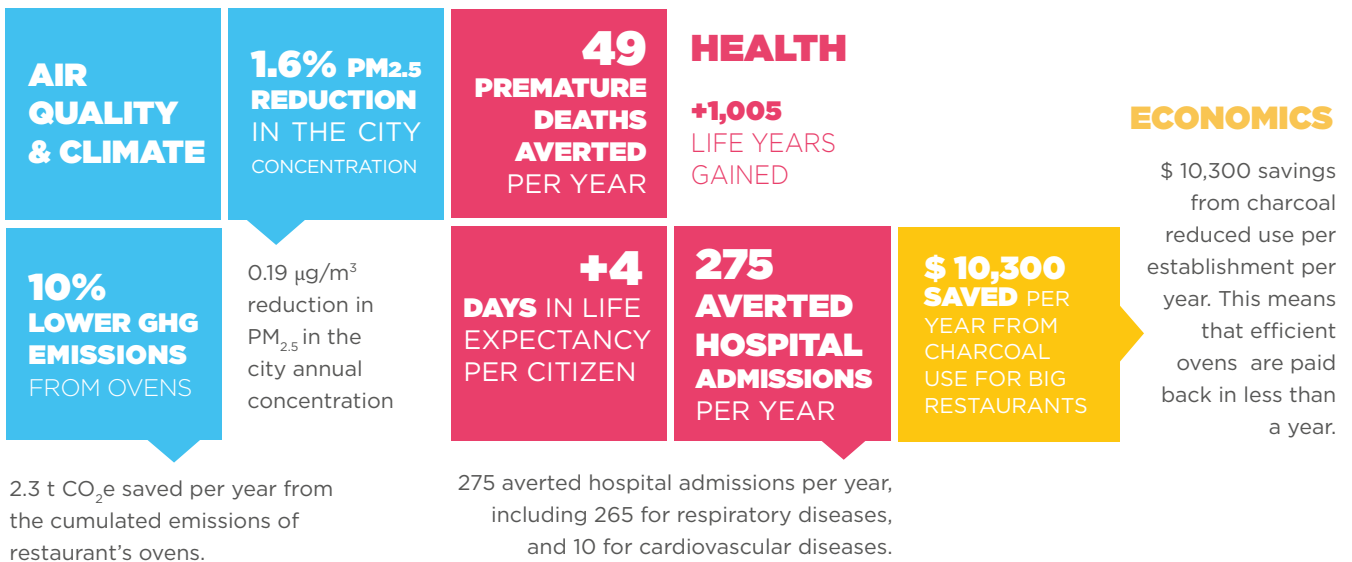There is an improvement in air quality, with reduced $PM_{2.5}$ levels across the whole city. The air quality improvement, in turn, reduces the incidence of cardiovascular- and respiratory-related diseases and deaths.

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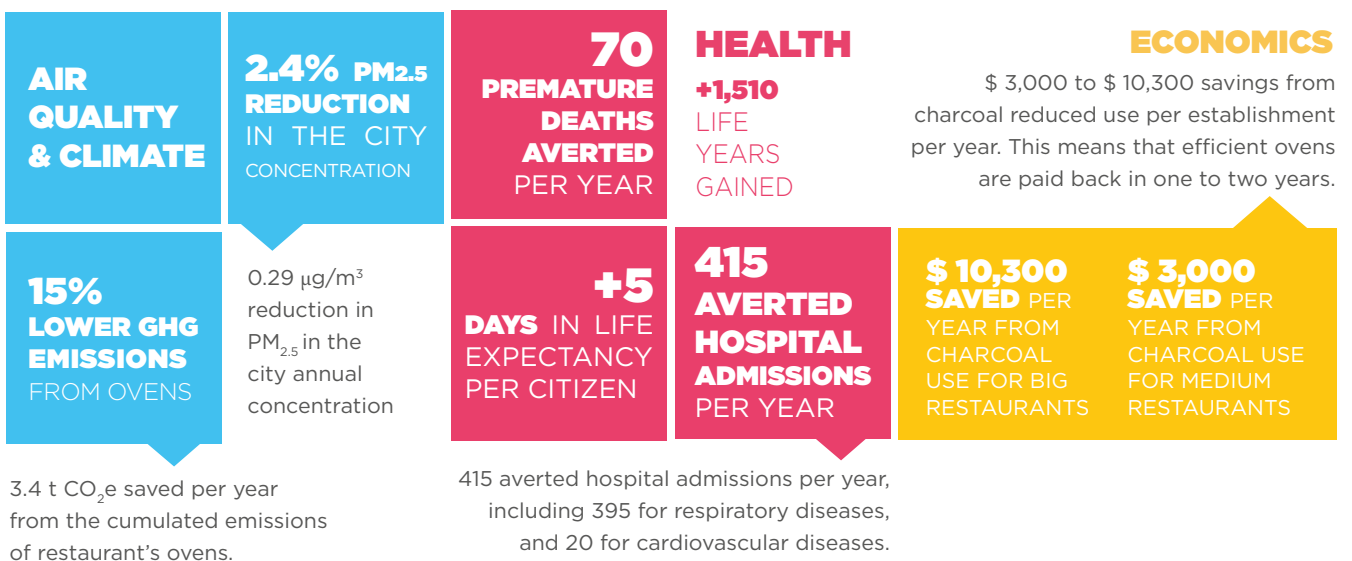 for morbidity, while the change in premature deaths, life expectancy and life years gained are used to quantify mortality impacts.

The economic impact represents the monetary value of averting a hospital admission and of gaining an extra year of life.
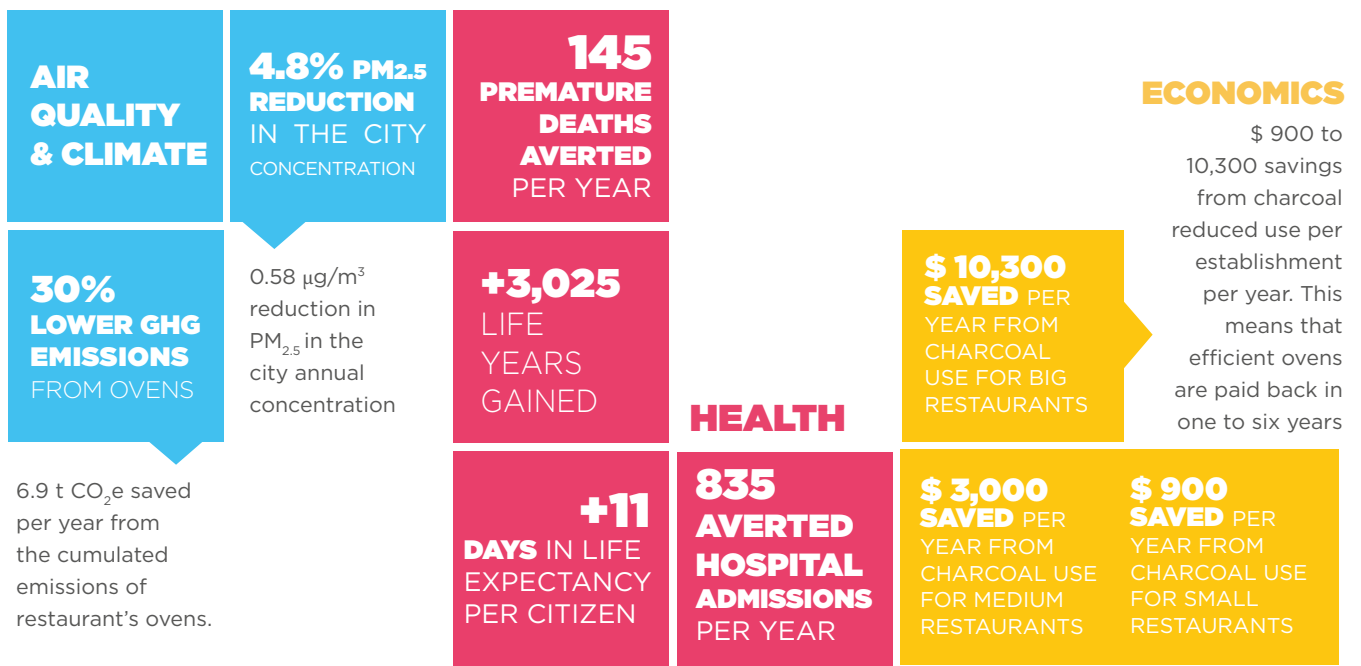
Scenario 1: If big restaurants (>250 m²) were taking efficiency measures

AIR QUALITY & CLIMATE

1.6% PM2.5 REDUCTION IN THE CITY CONCENTRATION

49 PREMATURE DEATHS AVERTED PER YEAR

HEALTH

+1,005 LIFE YEARS GAINED

ECONOMICS

$ 10,300 savings from charcoal reduced use per establishment per year. This means that efficient ovens are paid back in less than a year.

10% LOWER GHG EMISSIONS FROM OVENS

0.19 μg/m³ reduction in $PM_{2.5}$ in the city annual concentration

+4 DAYS IN LIFE EXPECTANCY PER CITIZEN

275 AVERTED HOSPITAL ADMISSIONS PER YEAR

$ 10,300 SAVED PER YEAR FROM CHARCOAL USE FOR BIG RESTAURANTS

2.3 t CO_2e saved per year from the cumulated emissions of restaurant's ovens.

275 averted hospital admissions per year, including 265 for respiratory diseases, and 10 for cardiovascular diseases.

Scenario 2: If big (>250 m²) and medium restaurants were taking efficiency measures

AIR QUALITY & CLIMATE

2.4% PM2.5 REDUCTION IN THE CITY CONCENTRATION

70 PREMATURE DEATHS AVERTED PER YEAR

HEALTH

+1,510 LIFE YEARS GAINED

ECONOMICS

$ 3,000 to $ 10,300 savings from charcoal reduced use per establishment per year. This means that efficient ovens are paid back in one to two years.

15% LOWER GHG EMISSIONS FROM OVENS

0.29 μg/m³ reduction in $PM_{2.5}$ in the city annual concentration

+5 DAYS IN LIFE EXPECTANCY PER CITIZEN

415 AVERTED HOSPITAL ADMISSIONS PER YEAR

$ 10,300 SAVED PER YEAR FROM CHARCOAL USE FOR BIG RESTAURANTS

$ 3,000 SAVED PER YEAR FROM CHARCOAL USE FOR MEDIUM RESTAURANTS

3.4 t CO_2e saved per year from the cumulated emissions of restaurant's ovens.

415 averted hospital admissions per year, including 395 for respiratory diseases, and 20 for cardiovascular diseases.

Scenario 3: If all restaurants are taking action

AIR QUALITY & CLIMATE

4.8% PM2.5 REDUCTION IN THE CITY CONCENTRATION

145 PREMATURE DEATHS AVERTED PER YEAR

ECONOMICS
$ 900 to 10,300 savings from charcoal reduced use per establishment per year. This means that efficient ovens are paid back in one to six years

30% LOWER GHG EMISSIONS FROM OVENS

0.58 μg/m³ reduction in $PM_{2.5}$ in the city annual concentration

+3,025 LIFE YEARS GAINED

$ 10,300 SAVED PER YEAR FROM CHARCOAL USE FOR BIG RESTAURANTS

6.9 t CO_2e saved per year from the cumulated emissions of restaurant's ovens.

HEALTH

+11 DAYS IN LIFE EXPECTANCY PER CITIZEN

835 AVERTED HOSPITAL ADMISSIONS PER YEAR

$ 3,000 SAVED PER YEAR FROM CHARCOAL USE FOR MEDIUM RESTAURANTS

$ 900 SAVED PER YEAR FROM CHARCOAL USE FOR SMALL RESTAURANTS

835 averted hospital admissions per year, including 795 for respiratory diseases, and 40 for cardiovascular diseases.

DRIVING ACTION

INFORM THE PUBLIC ON AIR QUALITY

There is a lack of publicly accessible, real-time air quality information. To address this, the city plans to prepare thematic maps and communication materials that will disseminate air quality information to Lima's residents.

GET MORE BUY-IN

Cooking with charcoal is a traditional practice in Lima and an economic option compared to other fuels (e.g gas). Furthermore, restaurants have concerns considering the potential change in food flavour by changing the ovens and it will be difficult to obtain sufficient commitment from restaurants and rotisseries to implement the regulations in full.

IMPROVE TECHNICAL KNOWLEDGE

The city needs to find efficient and economical technologies that control emissions, and that are available on the national market, to increase the feasibility of implementation. Likewise, technical support is required for the training of the city personnel that will carry out the assessments, along with detailed guidelines or protocols for the control of the emissions.

NEXT STEPS

The city is starting a pilot with a university research group that develops air quality sensors. After the pilot, the plan is to install sensors in strategic locations across the city.

Some establishments have already implemented control systems on their own initiative, which makes it possible to test their effectiveness and propose improvements. Some commercial food establishments are, therefore, likely to reduce their emissions.

The measures that have been outlined above will encourage research and the development of innovative technologies that prevent coal use and reduce restaurant emissions.

METHOD AND ASSUMPTIONS

Methodology available [here](#).

Key assumptions:

• *The air quality monitoring is based on the 2018 World Air Quality Report, IQ Air.*

• *The background concentration was taken from one station Estación Prohvilla Protransporte (2012), taking the assumption that the condition was representing non-city concentration*

• *The change in charcoal use was measured on restaurant that already have taken the initiative, highlighting a change of 30% in charcoal use but no change has been measured in $PM_{2.5}$ emissions. As the ovens should be also cleaner, the analysis is thus taking conservative assumptions on the change in air quality.*

The analysis has been carried out following the methodology outlined in the online Benefits Methodology.

Notes [1] *C40 Cities, Global Protocol for Community-scale GHG Emission Inventories (GPC).*

[2] *Comision Multisectorial para la gestion de la iniciativa del aire limpio para Lima y Callao, 2019, Diagnóstico de la Gestión de la Calidad Ambiental del Aire de Lima y Callao.*

Cover page picture : Photo by Willian Justen de Vasconcellos on Unsplash

Image by ygrrr from Pixabay

Johnson&Johnson

BUROHAPPOLD
ENGINEERING

C4O
CITIES
CLIMATE LEADERSHIP GROUP