

Towards a transdisciplinary research ecosystem for tackling traffic-related air pollution (TRAP) in an African City

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About AirQo (www.airqo.africa)

Founded in 2015 at Makerere University, to close the gaps in air quality management in Uganda and across Africa through leveraging technology innovation to influence action through contextual evidence

Vision

Clean air in all African Cities

Mission

Develop and deploy a robust, scalable open infrastructure to collect, analyse and forecast air quality data and work with partners to advance evidence-driven clean air actions in African cities..



The Africa Air Quality Brief 2026

A continental overview of air quality, progress on action, and future priorities.

- AfriCAN, Copernicus Atmosphere Monitoring Service (CAMS) and State of Global Air

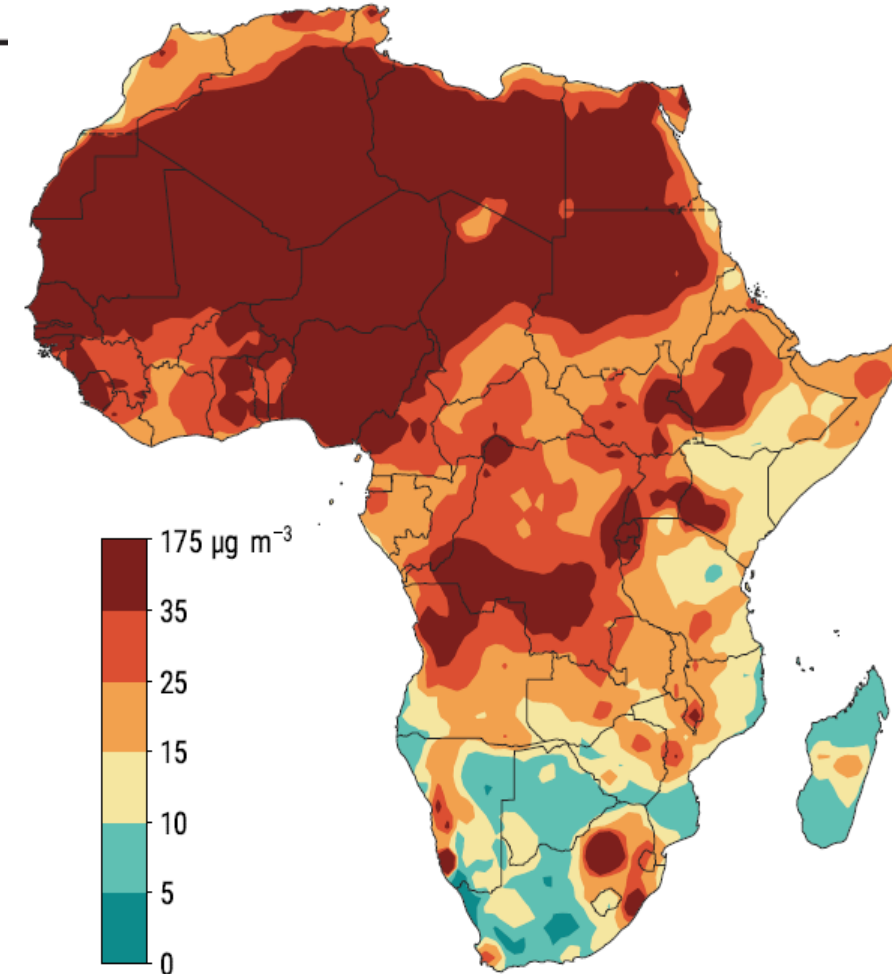
A combination of Earth observation data, ground monitoring data, and atmospheric models

- CAMS dataset on global reanalysis of atmospheric composition



- **30 countries** met the least stringent annual WHO interim target for PM_{2.5} (35 µg/m³)
- TRAFFIC and solid fuel for cooking the most prominent anthropogenic sources
 - seasonal dust and landscape fires across West and Central Africa.
- Data is a means to an end
- Intervention levers vary widely - from monitoring to market instruments

Annual mean PM_{2.5} in 2025



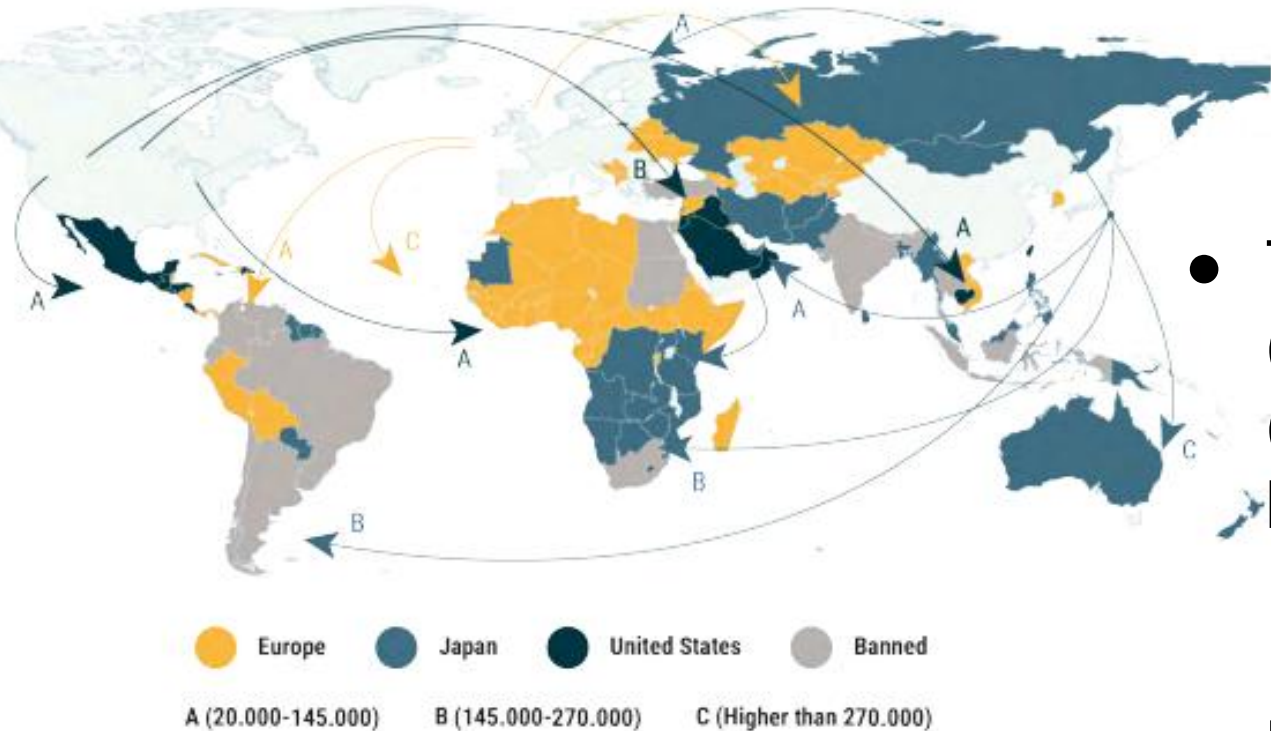
Data: CAMS global reanalysis (EAC4) • Credit: CAMS/ECMWF
© EuroGeographics for the administrative boundaries • Source: Eurostat/GISCO



Africa
Clean Air
Network



TRAP in Africa: Research landscape



Source: UNEP, based on data collected from major exporters, 2017

<https://www.unep.org/resources/report/global-trade-used-vehicles-report>

- Three major exporters: EU (54%), Japan (27%) and US (18%) - 14 million vehicles between 2015 - 2018.
 - 40% came to Africa, 24% - Eastern Europe
- Limited regulations in managing imports and exports
- Pollution, energy and cost of maintenance

TRAP in Africa: Research landscape²



- Similar questions, different contexts
- Policy scenarios: 1.1% Africa, (42%-Europe, 32% -Asia, 18.9% North America, etc)
- Different intervention levers and innovative policy instruments
- Management, monitoring and market instruments (infrastructure investments)
- COVID-19 “natural urban experiments” around the world
- Road safety and pollution in parallel

Ghaffarpasand et al. 2024. The impact of urban mobility on air pollution in Kampala, an exemplar sub-Saharan African city <https://doi.org/10.1016/j.apr.2024.102057>

Khreis, et al. 2023. Urban policy interventions to reduce traffic-related emissions and air pollution: A systematic evidence map.. <https://doi.org/10.1016/j.cities.2011.11.005>

METHODOLOGICAL CASE STUDIES: *How can multi-stakeholder-driven efforts be structured to deliver effective mitigation?*

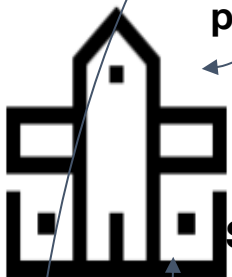
ACTION ECOSYSTEM

Government



Emission standards and
regulations, transport
infrastructure

Universities and
training
institutions



Research to inform
policy on transport
pollution control

Industrial research on
cleaner technologies

Skilling on improved
maintenance
practices



Maintenance and
inspection programme

Mechanics

Manufacturers, car
& fuel dealers

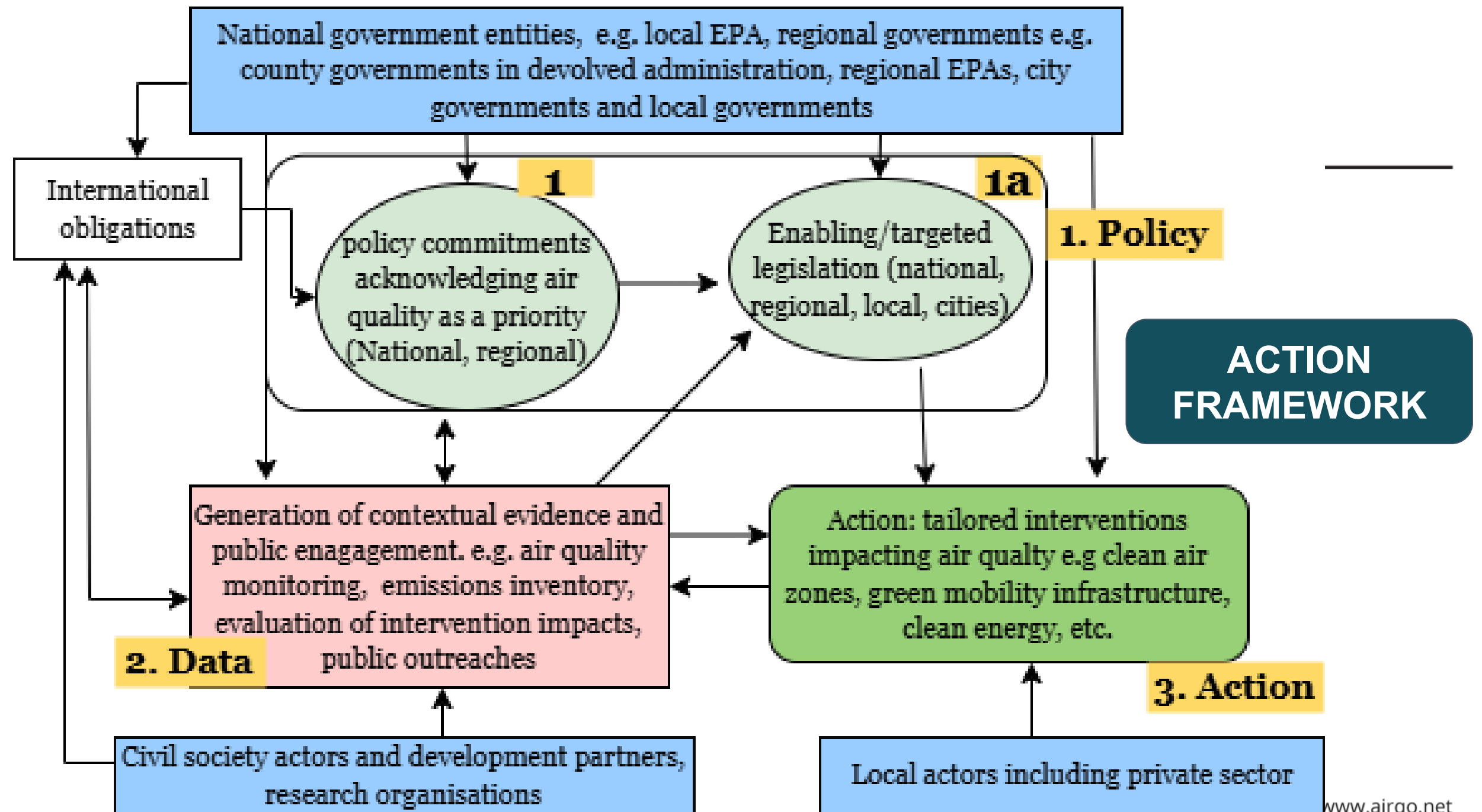


Citizen awareness on green
mobility initiatives

Commercial access to
motorised
transportation

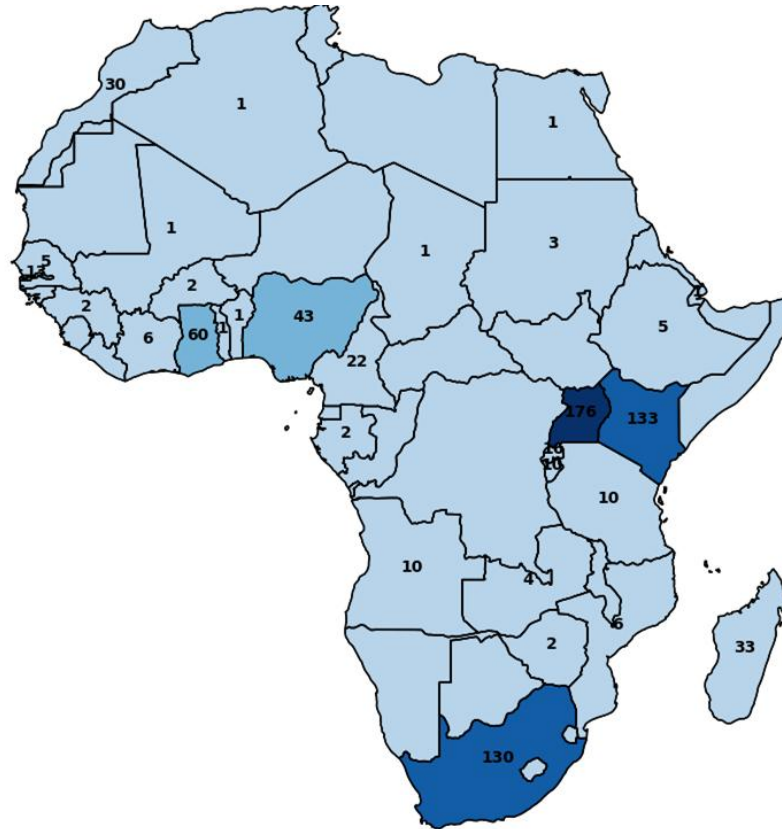


Citizens and urban commuters

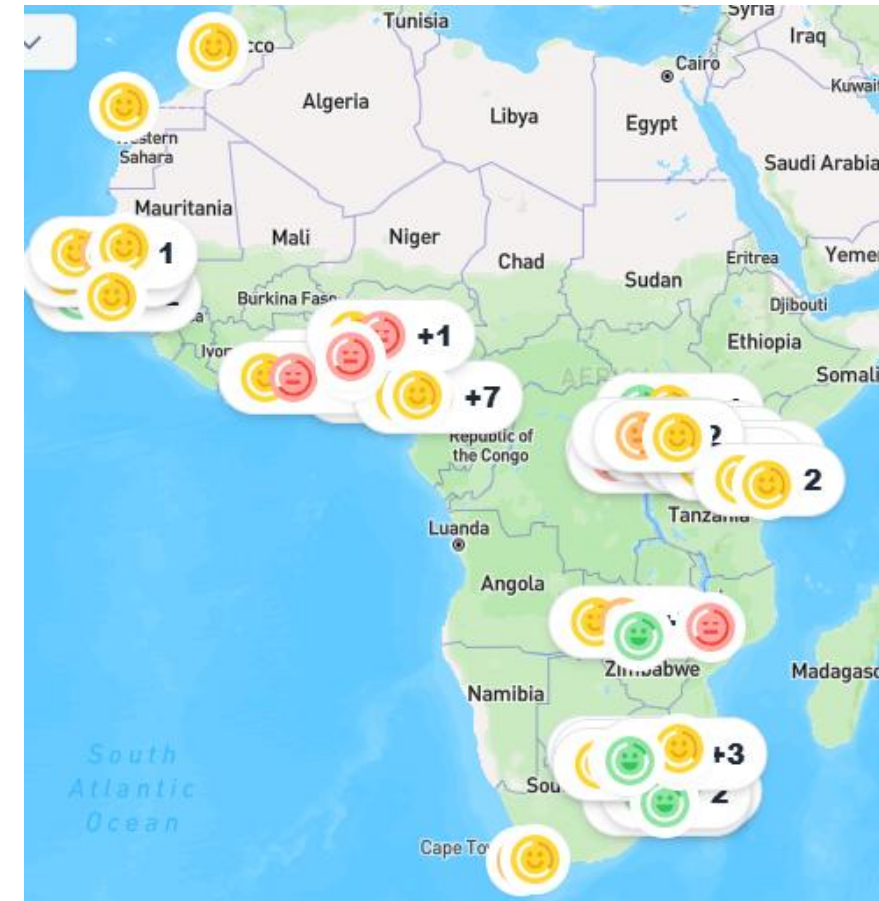


Evolution of continuous monitoring networks and the role of sensors

1. Shared data challenges across the region
2. Steady growth in continuous monitoring and LCS offers unique opportunity to grow data capacity in unmonitored regions
3. Non-government initiatives playing a critical role in closing data gaps
4. Reliable data infrastructure transcends installation of ground monitoring tools
5. Availability of data is not an end in itself.



Okure et al. (ongoing)



<https://nexus.airgo.net/user/map>

www.airgo.net

CASE STUDIES AND USE CASES



Africa Clean Air Forum
Pretoria 2026

Elandspoort 357-Jr

Pretoria, Gauteng, South Africa

38.7

PM_{2.5} µg/m³

Sensitive Groups

13TH-16TH JULY

Shared from the AirQo a...

Digital platforms, ML and modelling to increase public engagement

Elig Efi

Yaoundé, Région du Centre, Cameroon

Tuesday, September 8

Daily

Hourly

Tu
27
☺️

We
30
☺️

Th
30
☺️

Fr
30
☺️

Sa
30
☺️

Su
29
☺️

Mo
30
☺️

PM_{2.5}

27.4 µg/m³

Moderate

Forecast confidence

23°C
Temp

89%
Humidity

1.5 m/s
Wind NW

2.9 mm
Rain

Air quality guidance

You can go outside, choose lighter exercise,



Motor vehicle mechanics: Building a critical mass for action



Challenge

- Myths and misconceptions e.g catalytic converters
- Rudimentary maintenance practices
- Limited policy and economic incentives

Intervention

- Equipment vehicle mechanics can have a domino effect on the wider urban population

1. Design and build custom image capturing hardware, for collection of traffic data.
2. Build a machine learning (ML) and computer vision-based system for vehicle recognition and classification.
3. Develop a vehicle emissions estimation API that returns the emissions estimate per location.

(enhanced) custom sensing box capable of capturing traffic images/streams

Pole

Hardware + on the edge CV (multi-inference modes)



custom sensor box based on arm technologies

Vehicle sensing box

Vehicle recognition
i.e., vehicle or no vehicle

Vehicle classification
e.g., Motorcycle, car, bus, truck

Attribute extraction
e.g., Make, model, year, speed

Traffic and AP on public health using Low-Cost Source Apportionment (LoCoSA) -Bousiotis et al. (ONGOING)

Objectives:

- Perform LoCoSA to identify and understand the dominant sources of Kampala's air pollution, with a specific focus on quantifying TRAP contributions.
- Study distinct locations in Kampala, selected to capture spatial variability in TRAP exposure.
- Develop a tool to estimate typical exposure of citizens to TRAP and quantify the health impacts and inequalities associated with exposure.
- Explore the relationship between exposure and factors such as travel needs, behaviour, and urban design.



LoCoSA Framework

Bousiotis et al. 2025. <https://doi.org/10.1016/j.scitotenv.2025.180257> www.airqo.net

Reflections

- Similar questions, different contexts
- Effective intervention can be part of a broader policy package
- Capacity building takes many forms
- It is not possible to regulate your way out of traffic air pollution



The poster features a vibrant background image of a green park with a lake and trees under a blue sky with clouds. In the top left corner, the airqo logo and Makerere University crest are displayed. The main title, 'Clean air zones as credible incentives for green mobility in emerging economies', is written in large white text across the middle. At the bottom, a blue rounded rectangle contains event details: a calendar icon for '5th September 2024', a clock icon for '4 pm to 6 pm EAT', and a Zoom icon with the link 'https://bit.ly/4fRkp5A'.

airqo
Breathe Clean.

MAKERERE UNIVERSITY

Clean air zones as credible incentives for green mobility in emerging economies

5th September 2024 | 4 pm to 6 pm EAT | zoom <https://bit.ly/4fRkp5A>



APWOYO!