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Kampala's Air Quality is Red-Flagged

Awareness of the “Silent Killer” remains low

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Today, polluted air is the greatest environmental risk to health around the entire world. The World Health Organisation (WHO) estimates that 7 million people annually die as a result of living with polluted air.¹ In 2019, Uganda scored third on the African continent for recording the highest and most dangerously polluted air – only Ghana and DR Congo produced worse results. In global comparison, Uganda ranks among the top 25 of countries with the highest amount of Particulate Matter (PM), an airborne contaminant which negatively affects human health.² Escaping these microscopic pollutants is virtually impossible, especially in the capital city Kampala.

What are the facts?

The above rankings are computed using comparable air quality measurement scales. A commonly used tool is the so-called Air Quality Index (AQI) which traces different types of pollutants in the air, most notably the concentrations of particulate matter, lead, ground-level ozone, carbon monoxide, sulfur dioxide and nitrogen dioxide.³

The main indicator of the AQI (see Figure 1), Particulate Matter, is crucial because its concentration is directly and daily influenced by our actions. It “is the pollutant widely regarded as most harmful to human health. [...] Its microscopic size allows the particles to enter the blood stream via the respiratory system and travel throughout the body, causing far-reaching health effects, including asthma, lung cancer and heart disease.”⁴

Particulate Matter of a diameter of 2.5 µm and smaller is the routine indicator to measure air pollution – in comparison, the diameter of a human hair is around 60 µm.⁵ The so-called “PM2.5” originates from dust, car engines, fires and complex chemical reactions emitted from industries.⁶ In a high concentration, it poses a serious threat to human health. Accordingly, the WHO has established thresholds to guide countries in their fight for breathable air: Air quality is labelled “non-hazardous” with a maximum PM2.5 concentration of 25 µg/m³ for the 24-hour mean and of 12 µg/m³ for the annual mean.⁷







US AQI Level		PM2.5 (µg/m ³)		Health Recommendation (for 24hr exposure)
	Good	0-50	0-12.0	Air quality is satisfactory and poses little or no risk.
	Moderate	51-100	12.1-35.4	Sensitive individuals should avoid outdoor activity as they may experience respiratory symptoms.
	Unhealthy for Sensitive Groups	101-150	35.5-55.4	General public and sensitive individuals in particular are at risk to experience irritation and respiratory problems.
	Unhealthy	151-200	55.5-150.4	Increased likelihood of adverse effects and aggravation to the heart and lungs among general public.
	Very Unhealthy	201-300	150.5-250.4	General public will be noticeably affected. Sensitive groups should restrict outdoor activities.
	Hazardous	301+	250.5+	General public is at high risk to experience strong irritations and adverse health effects. Everyone should avoid outdoor activities.

Figure 1: IQ Air, 2019 World Air Quality report, p. 6

How does the AQI work?

The AQI shows the pollutant concentrations in the air. Its scale ranges from 0 to 500 – a higher value indicates a higher level of air pollution and thus a bigger health risk. A value below 100 generally indicates a level of air pollution that complies with public health standards. Values beyond 100 refer to deteriorated air quality which, with growing AQI value, becomes increasingly unhealthy for a larger number of persons.

Along these values, the AQI is divided into six categories, each corresponding to a different level of health concern.⁸

Air Quality in Kampala

In 2019, Kampala registered a mean annual PM2.5 concentration of 29.1 µg/m³, thus bouncing the capital to number 21 of the world’s capitals with the unhealthiest air⁹ (but other studies have registered much higher PM2.5 concentration values¹⁰). While Kampala did improve its rank compared to 2018, this is also a result of more air quality measurement stations being opened in “less-polluted” areas of the city, thus making it appear as if air pollution, in fact, had dropped. Nonetheless ranking among giants like Kinshasa, Beijing and Delhi in 2019, Kampala is faced by serious concerns about the development of the capital’s air quality.

A look at an individual stations' AQI data throughout the past months (see Figure 2) illustrates the intensity of the health risk. The graph depicts the percentage of recorded days per month on which the air quality reached a value of 150 or higher on the AQI. Borrowing from the AQI index, the values are categorised into “unhealthy” (stage 1 and 2) and “very unhealthy”.

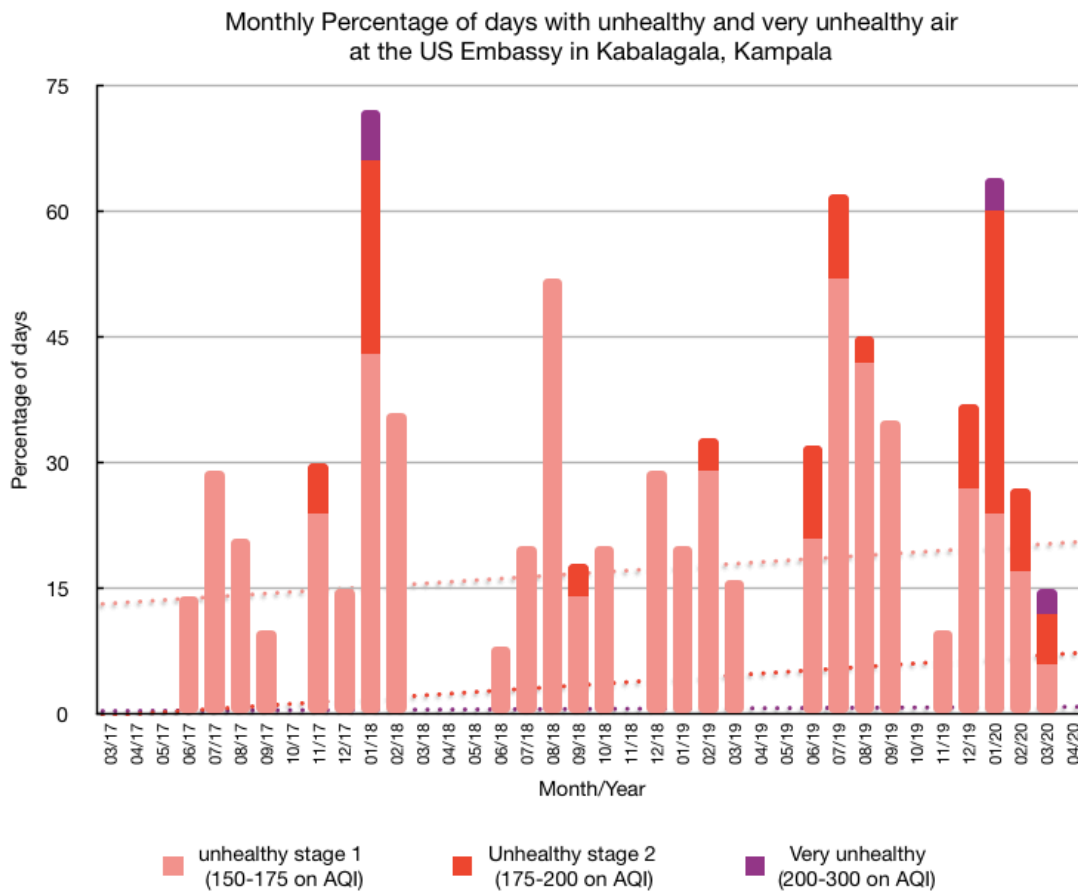


Figure 2: Unhealthy Air in Uganda (Individual data extracted and compiled from <https://aqicn.org/city/uganda/kampala/us-embassy/de/m/>)

The graph suggests that a high percentage of days with “unhealthy” or “very unhealthy” air quality is recorded with increasing frequency. This also becomes visible through the dotted line which indicates the rising linear trend. Not only does the absolute percentage of days with air categorised as “unhealthy” or worse increase, but among these days, we notice an increasing percentage of “unhealthy stage 2” and “very unhealthy”. The daily averages paint a similarly alarming picture. During peak traffic hours and during the night, the air quality is almost exclusively measured as “unhealthy”.¹¹ Simply put, Kampala’s air quality is deteriorating in every sense. If the situation remains unchanged “our children probably have to wear masks at particular hours in the near future”, noted Dr. Mugisha Noleb from Cancer Institute Kampala at the Platform for Uganda Green Growth (PLUG) in early 2020.

What does the COVID-19 lockdown tell us about air quality in Kampala?

Interestingly, during the COVID-19 lockdown, the concentration of PM_{2.5} came down significantly in comparison to a) the same time period in 2019 and b) the days before the lockdown was initiated. Data by Airqo and the US embassy (see Figure 3) prove that during the COVID-19 lockdown, Kampala's air quality has improved noticeably which points at the suggestion that was yet to be confirmed: Kampala's polluted air is indeed a man-made problem and not merely a result of the city's geographical environment. Traffic, industrial production and human activities make up the bulk load of Kampala's polluted air and, only when reduced to an absolute minimum, are no longer harmful to the population.

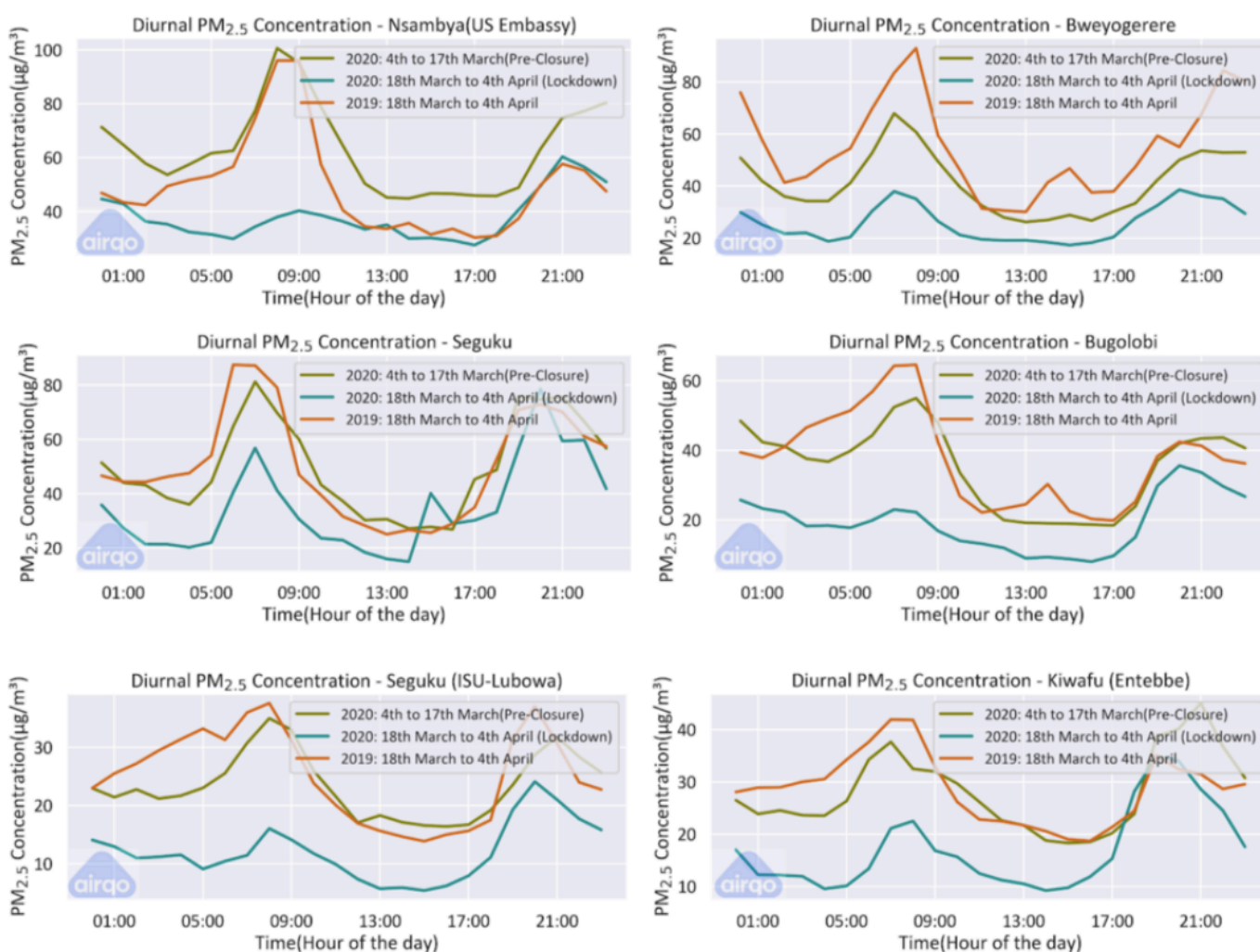


Figure 3: Air quality during the COVID-19 lockdown in Uganda. (Source: <https://www.airqo.net/blog>).

Is Kampala representative for Uganda as a whole?

For the case of Uganda, country-wide data are only partially available as the US embassy and Airqo have installed air quality measurement stations mainly throughout Kampala and the southern parts of Uganda.¹² It must thus be noted at the outset that data are not representative for Uganda as a whole. Much rather, “nationwide averages” named by the WHO or by IQ Air are computed using the data of few locations. Due to the high discrepancies between the values measured in different areas, calculated averages can distort the picture for the distinctively different rural and urban areas.

Notwithstanding the fact that data are restricted to certain locations, the results of individual collection stations and several studies researching the health effects of air pollution on residents are beyond worrying: The data show a pattern consistently suggesting that air pollution constitutes a nationwide concern that merely unfolds in different areas with different adverse effects.

Distinguishing ambient air pollution and household air pollution

To better understand these various adverse effects measured in rural and urban environments, the term “pollution” must undergo closer scrutiny. When examining the air quality in Uganda and in Kampala in particular, the public discourse is commonly linked to the transportation sector. It is critical, however, to acknowledge that air pollution results from a multitude of factors impacting the environment. A simplified equation of “pollution = transport” is a common misperception.

The World Health Organisation thus splits the umbrella term “pollution” into “household air pollution” and “ambient air pollution”. In a second step, the two concepts are broken down into their most common sources of pollutants.

Household air pollution appears particularly in low-income countries like Uganda, where wood and charcoal smoke (from cooking), kerosene lamps but also burnt plastics and other toxic trash - as a result of a poor waste management system - fill the air. Household air pollution constitutes a serious health risk, with the average Ugandan being exposed to high doses of pollutants on a daily basis, thus affecting their health negatively.



Figure 4: What are the sources of air pollution? (Source: <https://bit.ly/30a8z29>)

Ambient air pollution, on the other hand, is associated with the larger environment we live in as sources include “vehicles, power generation, building heating systems, agriculture/waste incineration and industry.”¹³ It is also more closely linked to general sources of CO₂ emission, thus to commonly known drivers of air pollution.

In Uganda, another special environmental factor comes into play to reinforce ambient air pollution: The local climate of dry and rainy seasons implicates variations impacting the prevalence of air particles. At the peak of the dry season, much more dust is swirled up and carried through the air.

Moreover, the hilly geography allows pollutants to settle in the valleys – under windless weather conditions, these settled particles circulate at lower valley points, cannot be blown away and thus fail to distribute more thinly as would be the case on flat geographical surfaces.¹⁴

Health effects of air pollution in Uganda

Air pollution is generally linked to a variety of health risks. These range from ischemic heart disease and strokes, chronic obstructive pulmonary disease to acute lower respiratory infections and even lung cancer. Worldwide, over 4 million annual premature deaths, most of which occur in low- and middle-income countries, have been associated with poor air quality.¹⁵ Indoor air pollutants in particular correlate with “a wide range of adverse health outcomes in both children and adults, from respiratory illnesses to cancer to eye problems. Members of households that rely on polluting fuels and devices also suffer a higher risk of burns, poisonings, musculoskeletal injuries and accidents.”¹⁶



Those who suffer most from air pollution are already vulnerable populations, namely children, the elderly, women, persons with pre-existing health conditions, outdoor workers and, among all of those groups, minorities and low-income communities.¹⁷

Discussing health effects of air pollution in Uganda at the PLUG roundtable in 2020, Dr. Noleb Mugisha from *Airqo* specified the first visible symptoms of exposure to air pollution: The irritation of eyes, nose and throat, coughing, wheezing and breathing problems - in other words, symptoms that numerous Ugandans can relate to. He noted that “the air we are breathing in Kampala and other areas in Uganda is full of poisons.”

Beyond these immediate effects, a 2016 WHO study conducted in Uganda found that 20% of respondents in rural and urban areas suffered from a chronic respiratory condition (COPD, asthma, chronic bronchitis and restrictive

spirometry pattern) - other studies cite even higher prevalence rates, depending on the application of study criteria.¹⁸ In all these research undertakings, the place of residence was the most important factor determining the prevalence of chronic respiratory conditions: Asthma, which is linked to ambient air pollution, was more than twice as prevalent in Uganda’s urban areas than in rural settings and, vice versa, COPD-prevalence in rural areas (with 6.1%) was four times the percentage of urban areas.¹⁹ The high prevalence of COPD in rural areas was strongly related to daily wood smoke exposure from cooking.²⁰

The recorded low lung volumes in many respondents were additionally “associated with a history of treatment for pulmonary tuberculosis and being underweight, both of which are common in low- and middle-income countries.”²¹ This is because exposure to certain risk factors “such as childhood respiratory infection, micronutrient deficiency and both ambient and household air pollution, can influence lung size and function, thereby predisposing individuals to obstructive pulmonary disease in adulthood.”²²

Additional adverse health effects are already traceable in children. A study conducted by Dr. Kirenga, director of the Lung Institute at Mulago Hospital, compared lung function and health of children in rural and urban areas. The latter were found to expose signs of lung damage already in early childhood.²³

It should be mentioned that these adverse health effects are not just costly for the individuals seeking treatment but also for the Ugandan economy. In 2016, the World Bank calculated that air pollution in sub-Saharan Africa “impairs the earning potential of younger populations, [to the extent that] annual labor income losses represent the equivalent of 0.61 percent of GDP.”²⁴

Demand for further action

*There are particular concerns [with regard to air pollution] about sub-Saharan Africa, where rapid urbanization and population growth are coupled with an inadequate health infrastructure and poor urban planning.*²⁵

In Uganda as well, poor urban planning alongside a lack of accessible health services co-exist with a rapidly expanding population, particularly in urban areas. Here, increased human activities are not yet met with appropriately coordinated efforts to combat air pollution.

Lack of awareness

One prominent reason for these shortcomings lies within those who are actually affected: The general public in Uganda is oblivious to the hazard. Accordingly, the issue only finds weak lobby support and ranks low on the priority list of most Ugandans. A first step in addressing this was the 14th Annual Air Quality Awareness Week 2020 under the theme “Better Air, Better Health”, which aimed at raising awareness about the negative health effects of air quality.

With more reliable and widespread data comes also the possibility to better lobby for the inclusion of air quality in the public discourse. To walk this path, *Airqo* - the first local air quality monitoring research initiative located at Makerere University – collects, monitors and analyses air quality data in Uganda. The modelling platform is so far the biggest in Africa and wants to fill the data gap to inform scientifically-grounded actions, says Deo Okure, air quality specialist at the initiative. The company with the slogan “clean air for all African cities” installed over 80 air quality machines in different places around Kampala as well as on BodaBodas to paint a more comprehensive picture of the Kampala air situation. Such efforts are necessary to produce more reliable and comprehensive inputs which can subsequently feed into the political agenda.

Combatting household air pollution

In spite of all scientific and concerted efforts, Ugandans will continue to be exposed to dangerous pollutants as long as cooking with wood and charcoal, usage of petroleum lamps and private burning of toxic trash remains common practice. Besides regulations on public infrastructure and industries, a crucial step will therefore also consist of mass-sensitisation efforts for the general public. Of course, this poses an immense challenge to a country which struggles to fund advocacy campaigns for seemingly “much bigger” issues like women’s rights, new-born health or HIV testing.

And apart from mind-set and awareness, high household air pollution is also related to economic factors. As long as access to electricity is not a nationwide standard, practices will continue. Currently, 28% of Uganda’s population has access to electricity, though the Rural Electrification Agency seeks to connect half of all Ugandan households to the grid by 2030 and all households by 2040.²⁶ This would, according to the “Rural Electrification Strategy 2013-2022”, provide the option to switch to electric cooking and lighting.²⁷

Unfortunately, electrification alone will not suffice as poverty also plays into this. The purchase of an electric stove, for instance, is an expenditure that most families cannot afford. Living “from hand-to-mouth” makes it virtually impossible to accumulate the funds for such a major investment compared to the relatively low costs

of buying charcoal and kerosene or collecting firewood. So far, it is unclear how the transition from traditional energy sources would then be implemented.

The lack of public awareness on sustainable waste management and its effects for health and environment will also have to be addressed. In the capital, Kampala Capital City Authority (KCCA) must address the common practise of burning of toxic waste and the low number of sustainable trash collection companies if the plan to transform Kampala into a “clean, habitable and healthy city” stands. Progress in this area seems to be rather slow: KCCA announced the call for Private Public Partnerships in Kampala's waste management in 2012, but it took three years to contract the firms.²⁸ In 2020, KCCA still does not name waste collection companies for Kampala's zones 1 and 6, i.e. the relatively poorly developed North of the city.²⁹ Once again, awareness and financial constraints curtail the efforts: Ten-thousands of Kampala residents continue to burn their waste because they cannot afford waste collection, have not heard of it or underestimate the health risks.

Shortcomings in urban infrastructure

Motor vehicles and the state of urban infrastructure further contribute to Kampala's rising levels of air pollution. In 2018, the government did ban the import of cars whose production date lies more than 15 years in the past. Nevertheless, a large amount of Uganda's motor vehicle fleet consists of much older cars which were imported before the ban - these operating vehicles move without restrictions and quality standards.

On a positive note, KCCA introduced non-mortised transport zones near downtown which hold more space for pedestrians and bicycles.³⁰ In other areas, infrastructure is less developed: Several highly frequented roads all throughout Kampala are not yet tarmacked and dust is swirled up in the air. Tarmacking projects of the Ugandan National Roads Authority have been clearly visible in the rural areas, yet urban centres lack additional support. In Kampala, KCCA's Second Kampala Institutional and Infrastructure Development Project (KIIDP 2) “seeks to enhance infrastructure [...] and improve urban mobility for inclusive economic growth”³¹ through upgrading roads and conceptualising a transportation master plan. The project has worked on roughly 150 kilometers, but potholes on newly constructed roads and removal of tarmac to construct drainages raise questions about the sustainability and coordination of efforts. Moreover, the long-promised “Kampala-flyover project” could ease traffic congestion and thus reduce carbon dioxide emission, but progress is yet to be made.

Those who attempt to stay clear of using private vehicles are faced with almost no viable options. Coordinated and city-wide public transport is currently non-existent. The implementation of a public bus system failed and busses which were supposed to operate in this capacity are currently rusting in the parking lot of Mandela National Stadium. The recently proposed “Tondeka Metro bus services” with the aim to operate in Kampala, Wakiso District and Mukono District have been put on hold due to procurement investigations.

The other options, walking and biking, rank between unsafe to virtually impossible. A large number of Kampala's road kilometres forces bicyclists and pedestrians to operate directly on the roads where traffic competes for space. Those sideways which do exist are marked by potholes or simply not broad enough for pedestrians and bicyclists to move at the same time.

Is Relief Anticipated?

KCCA, government agencies and companies like *Airqo* have taken first steps to curb the increase of air pollution. This mirrors the commitment that Uganda pledged internationally, for instance by becoming a signatory to the former Kyoto Protocol and to the United Nations Framework Convention on Climate Change.

The country's membership to the East African Community's Climate Change Policy underscores these attempts on a regional level and also national plans such as the "Uganda Vision 2040" include sections on air pollution and emissions.

Unfortunately, these policy attempts are limited, not prioritised and have not trickled down into urgently needed relief of air pollution. Increased industrial production, growing numbers of vehicles and continuous harmful practises by the rapidly growing population seem to neutralise institutional efforts. This clash of interests is where Dr. Dan Okello from the KCCA pinpoints the problem: At the PLUG Roundtable, he cautioned participants that all efforts boil down to raising awareness, addressing the mindset and thereby changing the behaviour of Ugandans. To get there, joint efforts of government as well as civil society will need to institute the topic of air pollution in public discourse. Only then will it also appear more prominently on the political agenda with a lobby to advocate for change.

In the Ugandan civil society space, the Konrad-Adenauer-Stiftung hopes to contribute to such efforts by raising awareness through briefing papers like this one and through a first series of roundtables under the title *Platform for Uganda Green Growth* (PLUG).

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- ³ Office of the Air Quality Planning Standards (2020), *AQI Basics*, p. 1.
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- ⁵ *Ibid*, p. 5.
- ⁶ United Nations Environmental Protection Agency (2018), *Particulate Matter (PM) Pollution*. Online: [<https://www.epa.gov/pm-pollution/particulate-matter-pm-basics>].
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