CLIMATE SMART CITIES CHALLENGE

Makindye Ssabagabo challenge brief

Partners

Challenge leads

Viable Cities

UN HABITAT
FOR A BETTER URBAN FUTURE

Funding partners

VINNOVA
Sweden's Innovation Agency

Swedish Energy Agency

Teknikföretagen

City leads and partners

Alcaldía Mayor de Bogotá D.C. | Bogotá

Bristol City Council

Bristol Housing Festival

Bristol One City

Goram Homes

Curitiba

IPPUC

aguia cwb
Agência Curitiba de Desenvolvimento e Inovação

Delivery partners

nesta Challenges

Ignite Sweden

Competition challenge partners

Business Sweden

MI Mission Innovation

SEK

Smart City Sweden

Swedish Agency for Economic and Regional Growth

SI. Swedish Institute

Expo 2020 Sweden
Sverige
Official Organisation

Scania

Contents

Figures

Tables

Glossary

CO_2e	Carbon dioxide equivalent
GHG	Greenhouse gases
GKMA	Greater Kampala Metropolitan Area
SEACAP	Sustainable Energy Access and Climate Change Action Plan
SDGs	Sustainable Development Goals
SME	Small and Medium Enterprise
UN-Habitat	United Nations Human Settlements Programme

Foreword

Makindye Ssabagabo is one of the fastest growing areas in the Greater Kampala Metropolitan Area, with a population growth rate of 10 per cent and the highest population density in the country.

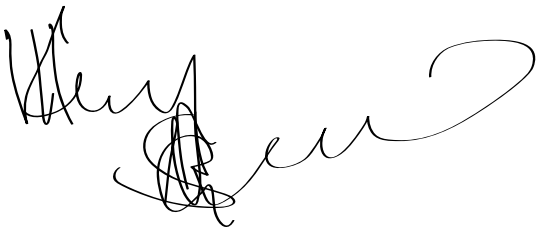
When the city was elevated to a municipal council in 2016, its residents had very high expectations and envisaged quality services in the short-term. However, this was not realized due to limited financial resources coupled with the enormous challenges in transport, housing, waste management, health, water and sanitation subsectors, prompting the city to pursue collaboration with development partners in order to address these challenges.

The city therefore submitted its application to the Open Call for Cities of the Climate Smart Cities Challenge in 2020 in order to deal with the challenge of increasing greenhouse gases (GHGs) from existing residential homes that account for 9 per cent of the GHGs. This is coupled with an acute shortage of affordable housing projected at 189,115 units in 2023. The lack of affordable and green housing therefore exacerbates the city's ability to reduce carbon emissions and approach net zero. There is therefore a need to develop scalable, affordable green technologies and models to accommodate the growing population sustainably, either through retrofitting existing housing stock or building new model homes that are climate-smart.

Through a series of consultations involving different stakeholders, the city is ready to undertake the Green Homes project under a public-private partnership given the conducive legal and regulatory frameworks that protect the innovators and their clients. The city has also secured land on which the innovators can test their ideals and prototypes.

The successful implementation of this project will greatly improve aesthetics and liveability in the entire city while guaranteeing green jobs for the residents.

I take this opportunity to thank UN-Habitat, Viable Cities, Nesta Challenges and all the Swedish partners for the support extended so far.



Engineer Ssemwanga Godfery
Mayor, Makindye Ssababgabo Municipality

1.

Introduction

1.1 About Makindye Ssabagabo

Makindye Ssabagabo Municipality is one of the local governments that constitute the Greater Kampala Metropolitan Area (GKMA) in Uganda. The municipality borders the nation's capital city, Kampala, and has a combination of urbanized, affluent, less affluent and slum areas.

Makindye Ssabagabo assumed its municipal status in July 2015. It was elevated from a sub-county status, which at the time formed one of Wakiso District's sub-counties. Makindye Ssabagabo lies along a major transport corridor. Therefore, it is used as a dormitory for people who work in Kampala but reside in the municipality.

The municipality's population is growing at 8.98 per cent per annum (National Census, 2014). With such a rapid rate of growth, municipal authorities cannot keep pace with the ever-growing demand for housing, employment, services and utilities. The challenges of growth, development and servicing of Kampala have triggered a sprawl of growth centres in the municipality.

Location

The Makindye Ssabagabo Municipality planning area lies in the central region of Uganda, bordering Kampala in the north, Mukono District in the east, Kajjansi Town Council in south-west, Lake Victoria in the south and Nsangi Town Council in the north-west. Makindye Ssabagabo is between coordinates N 000°14'34.0", E 32°33'36" off the Equator with an average elevation of 1,432 metres above mean sea level. It covers a total land area of 8,473.4 ha (84.734 km², of which 1,761.8 ha (17.618 km²) is covered by water and 6,711.6 ha (67.116 km²) is free land. Makindye Ssabagabo lies along the latitude 32.640557 and longitude 0.397239 and covers 98.83 km².

The municipality is divided into three administrative levels namely divisions, 8 wards and 56 cells. The municipality is also divided into two main topographic zones, the Lake Victoria Zone and the High Land Zone (Central and Northern Hills). It is also endowed with adequate surface and subsurface water reserves with numerous streams, rivers and wetlands.

The city has a warm tropical climate, with temperatures ranging from 25°C to 29°C (77°F to 84°F). There are two wet and two dry seasons. The dry seasons run from December to February and June to August, while wet seasons are from March to May and September to November. March to May is wetter and warmer, while December to February is hotter and drier, when it can sometimes reach 36°C (96.8°F).

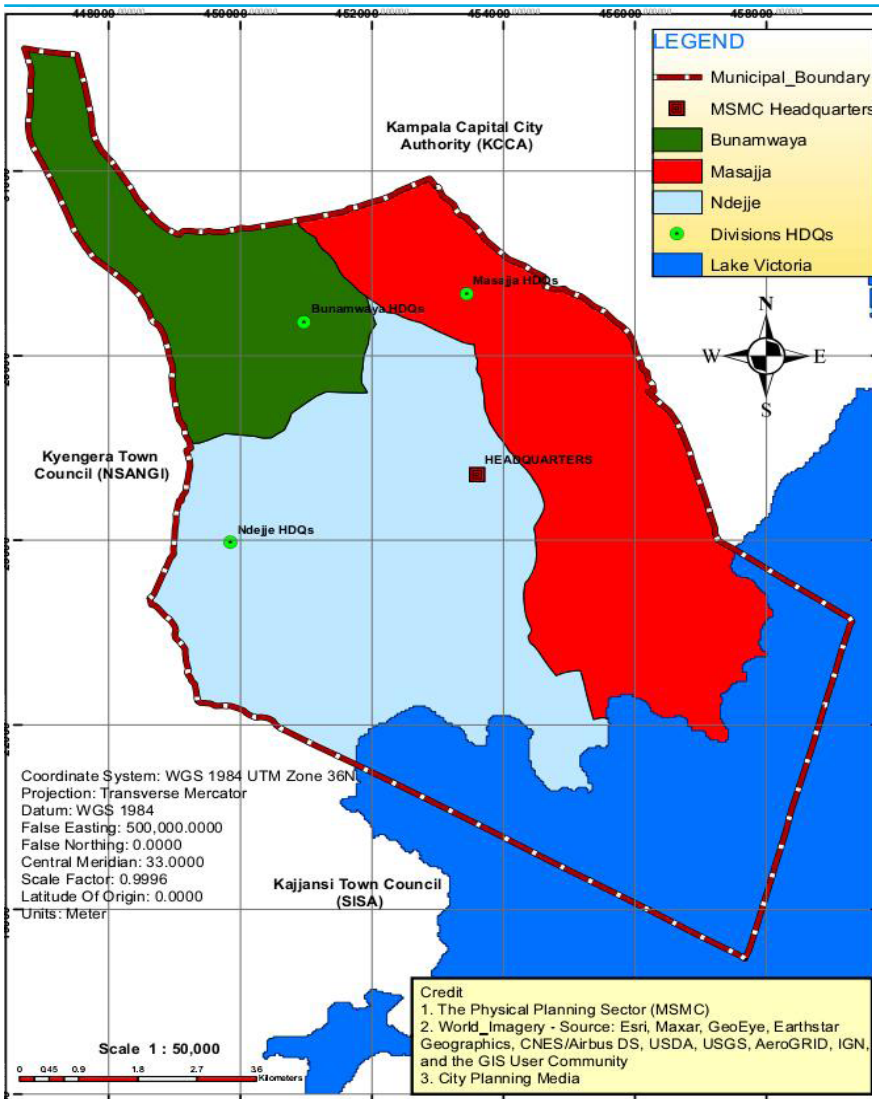
Land tenure

The land tenure is predominantly customary but most residents hold an interest on Buganda Kingdom land, which translates into lack of security of tenure. This also explains the reason for the poor quality of housing in the divisions. Land values are very high, ranging from USD 851.30 to USD 283,768 per acre (1 acre = 0.4047 hectares).

Population

According to the 2014 population census, Makindye Ssabagabo (see figure 1) has a total 70,780 households made up of 282,664 residents. The Uganda Bureau of Statistics projection for the municipality's population in 2021 is 449,622 of whom 210,574 are male and 239,048 female.

Figure 1: Makindye Ssabagabo Municipality



Population density

The population density in Makindye Ssabagabo is 4,549 residents per km^2 (Uganda Bureau of Statistics, 2021). The built-up area in 2010 was approximately 3,070 hectares. Now the trend of development has quadrupled that of 2010.

Socioeconomic conditions of residents

The residents of Makindye Ssabagabo are a diverse group of people. According to Uganda National Household Survey, the median monthly household income for Kampala residents was USD 176 (UGX 667,000).

The inhabitants of Makindye Ssabagabo, like many other municipalities in Uganda, are a heterogeneous mix of different ethnic groups although most are the Baganda. The most common language spoken in the municipality is Luganda.

In terms of social services, there has been an irregularity in the hierarchy of services provided, with health and education among the worst. These facilities are generally characterized by the lack of adequate supervision of services, especially those offered by the private sector; an absence of skilling institutions in the municipality; while the public institutions offering services operate from squalid buildings.

The manufacturing sector is more predominant in Kampala and the central region. The Municipal Physical Development Plan shows that 27 per cent of residents sampled in this region were employed by the manufacturing sector.

There is a high rate of unemployment as implied by the figures of the National Population and Housing Census of 2014. According to these figures, 17.3 per cent of the youth population were not in school and were jobless. About 68.7 per cent of the working population, defined as people 16–64 years, were employed. The high rate of unemployment and underemployment is revealed in the disguised activities of petty trading, hair dressing, meal hawking in trading centres, motorcycle taxis and the fetching of water.

According to the Uganda Household Survey 2019–2020, the absolute numbers of persons living in urban poverty increased from 1 million people in 2009–2010 to 1.3 million people in 2019–2020. This has been exacerbated by the COVID-19 pandemic that has seen the percentage of the urban poor jump from 11.7 per cent to 11.9 per cent. The number of urban households engaging in income generating activities fell from 51 per cent before the pandemic to 37 per cent now.

Infrastructure in Makindye Ssabagabo

With regard to infrastructure and utilities, only 45 km of 390.2 km of roads are paved. The non-paved roads are non-motorable during the rainy season; generally, they lack drains, shoulders and have rough surfaces. Furthermore, 70 per cent of the roads lack the appropriate width. With Makindye Ssabagabo being a tourism destination there is great demand for improved roads, but this requires integrated planning. There is an absence of public parking, road safety and traffic management systems. In terms of water supply, 74.5 per cent of households are connected to the national grid. However, 47.4 per cent use public standpipes.

Solid waste disposal is also parlous. A lot of open dumping of solid waste is common due to absence of collection and disposal facilities. Additionally, 90 per cent of the population rely on on-site sanitation for excreta disposal and 35.3 per cent use cesspool emptiers, while sludge is mainly transported to the neighbouring Kampala City Council Authority.

Concerning energy, the municipality is serviced by spread with 132kV high voltage distribution and 66kV high lines, which power factories, commercial establishments and institutions. Low voltage 132kV and 66 kV distribution lines supply 87.8 per cent of households with lighting. But some 91.8 per cent cook over charcoal stoves. According to the Uganda Household Survey 2019–2020, the proportion of households nationwide on the national electricity grid has decreased 22–19 per cent from year 2016–2017 to the present, due to high connection costs and bureaucracy. However, the use of solar photovoltaic systems increased 18–38 per cent in the same period.

Types of housing in Makindye Ssabagabo

The overall housing situation in the municipality is characterized by inadequacy in quality and quantity. This is so for rural and urban areas. According to the Uganda National Household Survey 2021, urban areas, including Makindye Ssabagabo, had a higher percentage of iron sheet roofed owner-occupied dwellings (at 84 per cent) than their rural counterparts. In urban areas, 8 in 10 households (that is 84 per cent) in owner-occupied dwellings live in brick-walled homes compared with 62 per cent in rural areas. For owner-occupied dwellings in urban areas, 6 of 10 (64 per cent) live in dwellings with cement or tiled floors compared with their rural counterparts (24 per cent).

In the high-density residential areas, a large percentage of the land is taken up by built-up structures compared with low-density residential areas, resulting in improved aesthetics and liveability (see table 1).

Table 1: Plot coverage

Density	% of plot coverage
High-density residential	70%
Medium-density residential	50%
Low-density residential	30%

1.2 Makindye Ssabagabo's climate challenge

The biggest challenge the municipality faces is the unplanned and informal physical developments taking place, especially in the upcoming peri-urban areas of the municipality, due to rapid urbanization and the increasing influx of people from Kampala.

Like many other rapidly urbanizing cities in the world, Makindye Ssabagabo has not been spared the impact of climate change. The GKMA region in which the city lies is experiencing rapid urbanization and population growth, which are some of the key generators of greenhouse gas emissions. The city experiences occasional floods resulting in fatalities, air pollution and increasing particulate matter associated with the dry weather and other human activities. In 2019, seven residents died due to floods, the Kampala newspaper, Daily Monitor, reported.

The waste sector in general, specifically solid waste and the waste treatment subsectors, respectively, account for the biggest percentage of GHGs in the city. This distribution is related to the population and the different practices for waste and wastewater treatment, which are characterized by pit latrines, opening incineration and scattered dumping grounds for solid wastes. The emissions from waste also relate to its chemical transformation characterized by methane from decomposing matter. Also, the city lacks a mass transport system, obliging residents to rely on commercial motorcycles, commuter taxis and personal cars, all of which use internal combustion engines that result in air pollution.

2.

The challenge:

Reducing the climate impact of unsustainable buildings and construction

The GHGs associated with residential buildings and homes are largely the result of the unsustainable production and use of building materials like clay, earthen bricks, and timber, coupled with unsustainable building techniques as well as the indiscriminate disposal of solid waste and water. There is also the failure to harvest rainwater and to adopt energy saving technologies, dependency on biomass for domestic energy, and lack of green spaces.

Although there is an acute shortage of decent housing, the city is keen to overcome this deficit through a circular approach under a public-private partnership model. The approach is to build affordable new model green homes or, with the active participation of all key stakeholders, retrofit existing housing stock to be climate adaptive. These interventions will go a long way in attaining 10 of the 17 United Nations Sustainable Development Goals on poverty, health, water, energy, industries, cities, resource efficiency, climate and partnerships.

2.1 Specific issues to consider

A thorough review was made of existing literature and key findings of a digital survey conducted as part of the Climate Smart Cities Challenge. The review involved residents, local leaders, city and national government officials, engineers, architects, academia, financial institutions, think tanks and civil society organizations. The review revealed several issues that the city hopes to resolve through the Climate Smart Cities Challenge. These include the following:

1. Green technology, new building methods or tools

- Although the majority of respondents are open to retrofitting existing homes to make them climate smart, there is still a (perceived) gap in cost-effective solutions
- Land in the area is very expensive
- There is a need to popularize and utilize existing green materials cited in the survey. These include grass, timber, precast bricks, bamboo, rammed earth and recycled steel
- There is still a large skill gap among engineers, architects and masons to engage with green building and material solutions
- There is a weak supply chain for green building materials
- The most critical aspects that should be considered when promoting green homes include green designs, use of sustainable building materials, efficient water use, renewable energy use and sustainable waste management

2. Communication, awareness and public knowledge

- The main barriers stopping people from embracing green homes include the following:
  - Residents tend to be conservative and stick to what they know
  - Ignorance of green homes and their long-term benefits, especially in aspects related to environmental sustainability, financial and human resources
  - There is a need to develop clear strategies to communicate to the city residents

3. Financing, investments and financial incentives

- Financial institutions do not offer clear monetary packages to customers (residential or commercial), nor do government bodies to encourage the shift to green homes or for homeowners to install existing ones with green features
- The majority of respondents feel that affordable green homes should range from USD 10,525 to 21,052 per unit. Notably, the questionnaires showed that respondents believe green homes are cheaper than conventional ones

4. Supporting policy landscape for effective implementation

- There is a need for incentives for manufacturers to offer new products and services to clients
- There is a need for incentives for residents to change to new technologies (for example, tax-free solar panel installation)
- The city's project team is passionate about the scheme, which should be maintained and involved during the implementation phase for the sake of sustainability
- The roles of the National Physical Planning Board and National Building Review Board could be strengthened in the promotion of green homes

2.2 Towards a green and affordable housing model

Overcoming the housing challenge, promoting sustainable building practices and empowering communities and stakeholders will have enormous benefits for the city. The main objectives to improve this are as follows:

1. Technological advancement and innovation capacity

- Make use of new and available green technologies
- Bring more innovations and innovative capacity to the city
- Strengthen the public sector through innovation and innovator/SME inclusion
- Build capacity to analyse and monitor data and information on housing
- Support investments in new technologies and tools that directly reduce GHG emissions

2. Positive environmental and health impact

- Significantly improve understanding of the relationship between buildings and GHG emissions
- Improve the capacity of the public sector to intervene to reduce emissions
- Identify and quantify the impact that technologies can have on emissions reductions
- Reduce building emissions
- Measure and evaluate the impact of the residents' health, as well as health-related costs incurred by the city.
- Evaluate and understand data and information on GHG emission concentrations in certain areas or of certain buildings

3. Community participation and engagement

- Identify ways of engaging community members
- Shift mindsets and open new avenues to rethink building construction and retrofitting options at an individual level
- Provide incentives for individuals to build, rebuild, or retrofit their housing based on green building principles

4. Competitiveness and market readiness

- Identify opportunities to improve on the issue of costs
- Develop sustainable public-private-partnerships that benefit the city's goals

2.3 Ingredients to solve the challenge

There is a need to bridge the knowledge and service gap between innovators like manufacturers, financial institutions and communities embracing green homes. This will be achieved mainly by setting up pilot demonstrations of green homes on land identified under a public-private partnership arrangement. One of the two demonstration sites is approximately 4 acres (1.62 hectares) and sits on a gentle slope, surrounded by a wetland and overlooking Lake Victoria. This site will test the design and validity of the approach, and adjustments can be made at this stage before full-scale demonstrations are developed. The pilot will represent bridges between generating basic knowledge and technological breakthroughs on the one hand, and industrial applications and commercial adoption on the other.

2.4 Other challenges

Besides the challenges directly related to GHG emissions and acute housing shortage, the city has some limitations which, if not tackled, may affect its capacity to consolidate gains made in mitigating climate change effects.

- **Capacity limitation of the municipal technical team**

There is an urgent necessity to support municipal technical officers to acquire advanced training in climate change adaptation and mitigation in addition to research methodologies in order to consolidate the gains made so far.

- **Technical studies requirements:**

Makindye Ssabagabo lacks the financial resources to conduct a GHG assessment and formulate the Sustainable Energy Access and Climate Change Action Plan (SEACAP). It also lacks money to conduct a comprehensive baseline survey to generate and build social and economic indicators and monitor the progress made towards the city's social and economic development goals.

3.

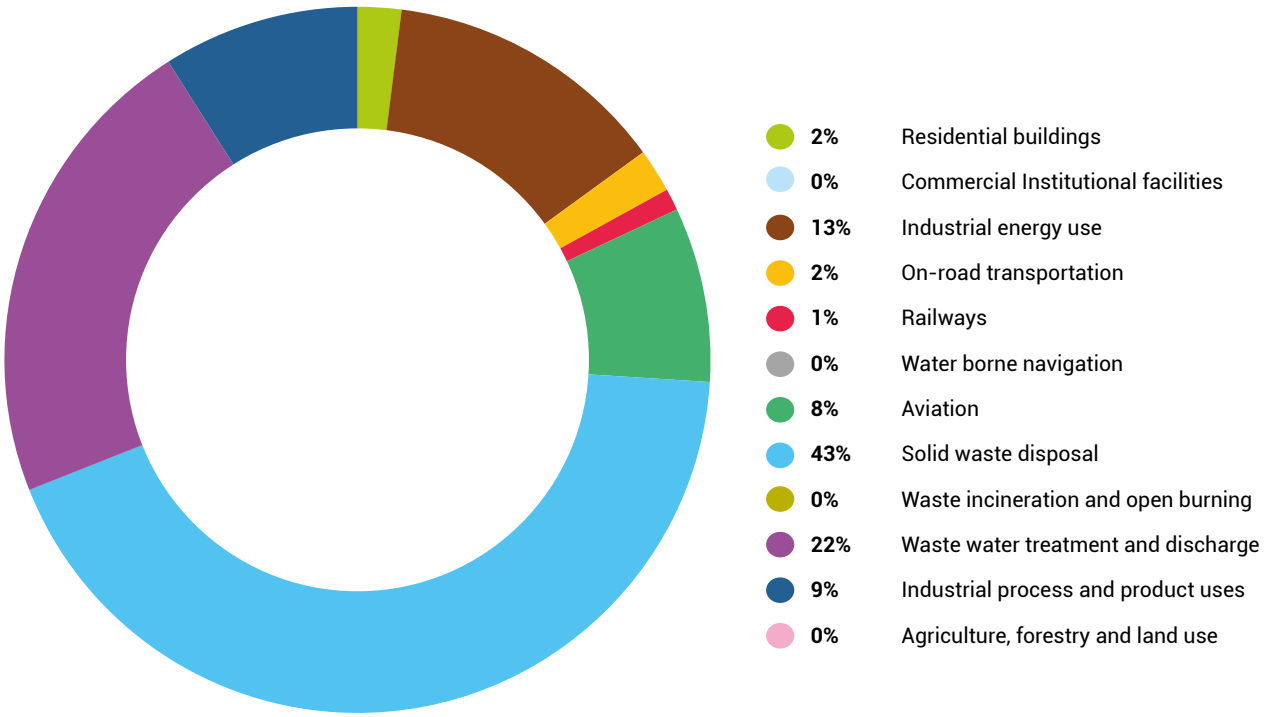
Carbon emissions characteristics

3.1 Total emissions in the city

According to the Greenhouse Gas Emissions Inventory for Kampala City and Metropolitan Region 2013, the total tonnes (t) of carbon dioxide (CO_2) equivalent (e) stand at 313,320 tCO_2e. The inventory shows that 53,178.5 tCO_2e comes from stationary units; 26,407.3 tCO_2e from mobile units; 203,771 tCO_2e from wastes; 29,926.4 tCO_2e from industrial processes and product uses; and 35.5 tCO_2e from agriculture, forestry and land use. Using the adjusted population of the city, the per capita emission stands at 0.18216 tCO_2e for the in-boundary population and 0.08801 tCO_2e for combined in-boundary and out-boundary populations.

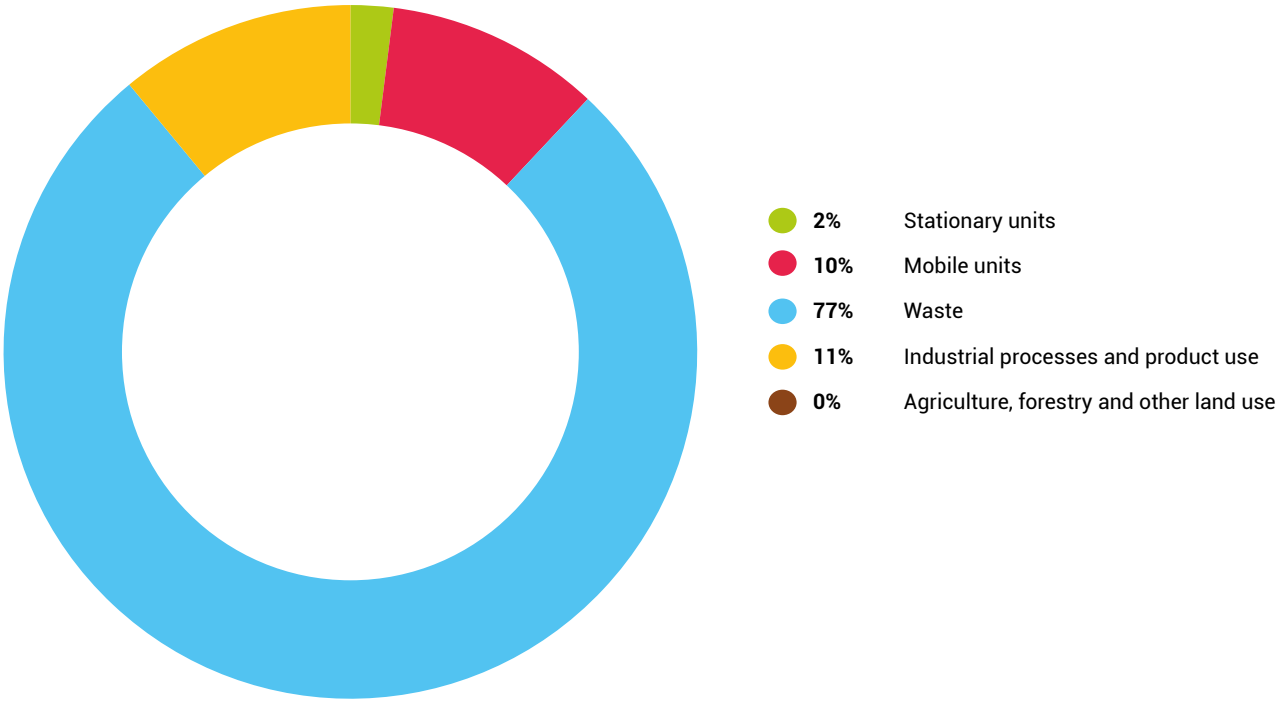
Estimates of methane (CH_4) and nitrous oxide (N_2O) are calculated as CO_2 equivalents using the standard warming factors. A summary of the results by major sector are shown in figure 2 and by subsector in figure 3.

Figure 2: Total emissions by sector in 2012



Source: GKMA Emissions Report 2012

Figure 3: Total emissions by subsector in 2012



Source: GKMA Emissions Report 2012

The summary results provide insight into the lifecycle of materials in the city as well as pathways for the generation of emissions. In that respect, the distribution of emissions by sector also gives insight into entry points for mitigation planning.

3.2 Drivers of emissions and demand

Increase in GHG emissions are attributed to rapid and unplanned urbanization. The result has been the indiscriminate disposal of solid waste; construction of residential buildings and industries with a high carbon footprint; household dependency on biomass as a source of energy; lack of a mass transport system, leading to dependency on commercial motorcycles, commuter taxis and use of personal cars. All this is worsened by decreasing carbon sinks due to deforestation and the degradation of wetlands.


FREEDOM
MIYAGGI
DIOR
STAR BOY

4.

About Makindye Ssabagabo's housing challenge

4.1 Profile of the sector

Makindye Ssabagabo's population will grow tremendously by 2040. This translates into increased demand for land for housing, services, infrastructure and other facilities. Trends, however, depict a general improvement in housing conditions, although most parts are informally developed due to lack of planning. However, currently, the demand for housing far outstrips supply. This is more so in the medium- and low-income earner categories. Most communities have emerged organically without any form of agreed settlement pattern and conformity to planning and building standards as well as by-laws. According to the Municipal Physical Development Plan 2019–40, 59.6 per cent of the sampled households in the municipality resided in bungalows, 22.2 per cent in one-bedroom units which are overcrowded.

There is a positive correlation between the income levels and the housing quality. Hence, in order to ensure affordable and decent housing for all categories of residents, income levels also need to be improved. This is because the cost of land is too high, especially for the low-income segment. This results in a huge housing problem, especially for the urban poor. Another housing challenge is poor quality. This has been put down to the lack of security of tenure to the majority of households. The situation largely applies to those occupying Kingdom's Land (with weak administrative control) in the administrative divisions of Ndejje and Masajja. These areas are sites of unplanned informal settlements that accommodate at least 60 per cent of the municipal population. Moreover, infrastructure, electricity, water, sewerage, drainage, solid waste collection is either deficient or non-existent in some places.

The high influx and growth of the private real estate sector since the early 2000s focuses primarily on providing developable plots of land and housing for middle class households. But this has done little to meet the demand for low-income housing. The majority of the urban poor who are engaged in informal employment are unable to afford mortgage finance, hence the increased supply of tenement units for them in the informal settlements and slums. The available public land within the municipality, which would otherwise be used for service delivery, has been heavily encroached on by informal settlements. The rest of the land is owned by private individuals and therefore unavailable.

Inadequate housing should be treated as an indicator of poverty in urban settlements. The housing demand in Makindye Ssabagabo has been increasing due to the expanding population and in-migration. Therefore, residential and housing development must be carefully planned to eliminate if not curtail any further haphazard, erratic, unmanageable sprawl and slums.

Urban transition resulted in densification of the already developed areas and expansion into hitherto virgin areas in 2010 with a built-up area of 32,772.8 ha. Currently, more densification is occurring as well as the conversion of formerly agricultural areas into urban housing estates. The built-up area is currently at 4,325.3 ha accounting for 10.5 per cent change since 2010.
Extrapolation of current population growth trends indicates that the municipality will host some 2,649,836 persons by 2040 (based on a best-case scenario growth rate of 7.4 per cent). From the projection and analysis of municipal land rationalization, there will be demand for 1.5 million housing units and 76,545 ha of land for that purpose (see table 2.)

Table 2: Municipal population targets and land for housing requirements

Year	Population projection	Average HH size	Projected number of HHs	Average number of persons living in a housing unit	Projected housing demand (units)	Land projected housing requirements
2014	283,272	4.0	70,818	2.17	153,675	7,773.6
2018	376,895	3.8	105,149	2.17	228,173	11,542.4
2023	538,570	3.8	161,637	2.17	350,752	17,743.0
2028	769,597	3.8	248,470	2.17	539,180	27,275.0
2033	1,099,727	3.8	381,951	2.17	828,834	41,927.1
2038	1,571,471	3.8	587,140	2.17	1,274,094	64,451.0
2040	1,812 ,	3.8	697,325	2.17	1,513,195	76,545.9

Source 1: Municipal Physical Development Plan (2019–2040)

Most houses are built on plot sizes of between 200 and 450 m^2, which explains the compact development in the southern part of the municipality.

Table 3: Percentage change in built-up area for Makindye Ssabagabo between 1995 and 2018

Year	Built area coverage (ha)	Change (%)
2000	307.6	0.8
2005	2,614.2	23.1
2010	3,272.8	6.6
2018	4,325.3	10.5

Source: Municipal Physical Development Plan (2019–2040)

4.2 Existing data collection and monitoring systems

The report has largely been informed by the baseline data compiled during the formulation of the Municipal Physical Development Plan. Other sources include the Uganda National Survey Report 2019–2020 and two baseline surveys conducted recently to ascertain the waste and housing situations in the city.

Efforts by the city to generate timely data related to the project has been severely hampered by the COVID-19 restrictions. Another constraint has been limited financial resources and skills to conduct a comprehensive survey to access updated information on different socioeconomic indicators.

The assessment of the overall performance of this project will be guided by an elaborate monitoring and evaluation framework. The rationale for using the framework is to ensure that implementation is followed up to confirm its effectiveness, relevancy, sustainability and impact.

Reporting on performance

The technical working group involving all partners will ensure that everyone performs as expected and report quarterly, biannually and annually against their workplans and budgets for activities implemented. At each sector level, highlights of performance shall be presented to the Technical Planning Committee meeting of the Municipal Council showing progress of implementation on the initiative. This will be for their attention, discussion, decision and remedial action as relevant or required.

Reviews and evaluation

In line with corporate best practice, programme requirements, and in line with the National Policy on Public Sector Monitoring and Evaluation (2013), Makindye Ssabagabo will conduct a midterm and final evaluation of the project.

4.3 Existing research into the sector and data availability

Makerere University: Enhancing sustainable construction in Uganda's building sector
To further the sustainability agenda of the building sector, recent research and practice suggest that integrating embodied carbon in the sustainability assessment of buildings is necessary. This paper presents an investigation to assess whether the consideration of embodied carbon in the development approval process could enhance sustainable construction. Findings show that construction professionals were highly aware of sustainable construction, suggesting that initiatives of enhancing it could be easily appreciated. However, the concept of sustainable construction was found to be largely interpreted in terms of environmental sustainability, implying that measures that highly promote environmental sustainability could be adopted.

UN-Habitat: Greenhouse Gas Emissions Inventory for Kampala City and Metropolitan Region
This report presets a greenhouse gas emission inventory that was conducted as a baseline for Kampala and 2012 as the base year. The baseline results are estimates of community-based emissions attributed to the 196 km^2 surface area of Kampala and the city region that covers an area of 941.2 km^2.

Uganda Martyrs University: Best Practice in Environmental and Sustainable Architecture
This paper sheds light on the basic concepts of passive solar architecture, environmental design and sustainability in the context of Uganda and to showcase examples from Uganda where these practices have or are being implemented with existing technology and resources.

Solar architecture seems to refer to the heating of buildings, while in tropical regions cooling of living spaces is the primary objective in design. Passive and low-energy design, or solar architecture takes "advantage of the climate when it is advantageous, and protects the building from the climate when it is not." (Rosenlund, 2000, p. 10) Passive solar architecture for the tropics can, therefore, be described as "architecture which minimizes – nor negates – the impact of climate" (Misra, 1999, p. 14). Specific design techniques employed in passive solar architecture utilize what the earth has to offer; reducing or slowing down the adverse impact on the environment, which would have happened otherwise. For the tropics, this implies passive systems for cooling through the use of natural heat sinks. These include the sky and outer spaces, temperature variations and vegetation (Misra, 1999).

Uganda Martyrs University: Vernacular Architecture, Advocating Volcanic Stone Constructions as a Viable Alternative to Fired Brick in Mountainous Areas of South-Western Uganda
This research discussion explores the use of volcanic stone in south-western Uganda as a viable and widely available alternative to brick. The discussion attempts to analyse why brick walling is still more common despite poor soils in those areas. Natural stone possesses physical properties suited for structural walling, yet in Uganda it is habitually specified for its aesthetic finish. In comparison to compressed earth block and compressed soil blocks, stone has not been explored enough as a potential front runner among sustainable walling alternatives. Furthermore, little is being done to empower local communities to meet their own aspirations, as industry, economics, and urban development conspire to interrupt the transition to sustainable development, particularly with regards to the propagation of environmentally unfriendly materials like fired bricks.

Interviews revealed a general perception among residents that stone construction is expensive. Residents report that stone construction requires a lot more sand and cement mortar than fired brick. Also, due to low popularity of the material, skilled masons in the area are rare and expensive. Interviews further revealed that the construction process takes a long time owing to a longer duration required to dry the huge chunks of mortar.

5.

Social and development challenges

5.1 Profile of the communities impacted by the housing challenge

Most areas overlooking Lake Victoria, hills and gentle slopes are occupied by affluent residents owning bungalows. Contrastingly, the urban growth centres and low-lying areas are occupied, respectively, by middle- and low-income earners. These are characterized by commercial buildings and rentals.

5.2 Equity in the city

Access to services is characterized by extreme gaps in the standards of service, especially in the periphery and infrastructure distribution. The wealthy and the middle classes can afford modern commercial and personal services, and private quality education and health. The less affluent remain dependent on basic informal services, inferior education (public or private), and basic health services (inferior private, public or non-governmental). The poorest, at subsistence level or below, continue to battle for access while the gap continues to widen.

5.3 Sources of information for residents

The traditional way of disseminating information regarding proposed city interventions has been through meetings. However, this approach has been distracted by the COVID-19 restrictions of social distancing. So, slowly, the city is now trying to embrace social media and use other digital approaches. These new systems do not, however, favour the elderly, children and persons with disability. Efforts still need to be made to reach out to these vulnerable persons through their representatives.

5.4 Building sector's impact on residents

Urbanization and the built environment will further densify and encroach into the municipal and GKMA peri-urban, rural areas and agricultural lands. Worse, this phenomenon will encroach into environmentally sensitive spaces. Environmental degradation can be expected to continue apace. With the current challenge of limited sewage coverage and the scale of human settlement, the wetlands will most likely fail to filter the waste; groundwater sources within the built areas will be contaminated and unusable.

The already growing and wide income inequality and poverty will become further entrenched and multigenerational for most of the population largely in the municipality's periphery. Most of the working poor will be housed in informal settlements at the periphery, and the numerous centres will progressively densify and develop into slums to house the very poor.

6.

Costs and planned investments

6.1 Investment and infrastructure plans related to the housing sector

Makindye Ssabagabo hosts the biggest housing project for Uganda's affluent. The project, paid for by the National Social Security Fund, comprises 2,741 units marketed as high-end apartments with four bedrooms, a closed-circuit television security system, swimming pool, Wi-Fi, gym, club house and elevators. The project will cost USD 400 million over a ten-year period.

The city will also host the country's largest specialized hospital now under construction in Lubowa. The USD 379 million project is a public-private partnership involving the Government of Uganda.

The city had prioritized paving of roads since 2019. So far, 30 km of earth roads have been upgraded to bitumen standard. Currently, 17 per cent of the total road network of approximately 354 km is surfaced with asphalt. In order to upgrade more roads, the city is procuring a road surfacing unit in a phased manner.

6.2 Financial resources and investment plans available

One reason for the high construction costs in Uganda is the continued use of the inherited British colonial building code. Buildings in Uganda are over-engineered to meet these colonial code standards. For example, non-load bearing walls are often built with structural materials like concrete masonry unit blocks. Therefore, they have a compressive strength of 3.5 megapascal (MPa), which is needlessly high. This utilizes more cementitious materials than necessary. Also, the British use standard shapes and sizes of structural materials. This allows them to save on fabrication time to cut down on labour costs. Cost of labour outweighs the cost of materials in Britain. however, in Uganda, labour costs far less than construction materials. Therefore, Uganda should focus on reducing the amount of reinforced concrete materials used so it can slash construction costs. Uganda needs to take advantage of its vast natural resources like bamboo and earth. Bamboo and compressed stabilized earth blocks can substitute for these high-cost construction materials and allow more Ugandans to afford standard permanent houses, according a study titled *Opportunities for Affordable Construction in Uganda using Locally Available Materials*.

According to the Uganda Green Growth Development Strategy, 2017/18–2030/31, embracing planned green cities will increase worker productivity of USD 977.8 by at least 50 per cent at USD 5,217.65 for new workers. In addition, economic flows from industrial cities and increased worker productivity from subsistence farmer level will increase from USD 3.06 billion per year in 2020 to USD 5.28 billion per year; cumulatively equaling USD 44.9 billion (equivalent to UGX 163.88 trillion) over a period of 10 years.

The full implementation of the Uganda Green Growth Development Strategy interventions will enhance national gross domestic product by 10 per cent, deliver an additional four million green jobs and reduce greenhouse gas emissions by 28 per cent relative to the conventional growth pathway.

6.3 Costs associated with inefficient housing

It is often argued that environmentally friendly building should not be a priority for developing countries; after all a more pressing concern is the provision of basic shelter and services. Such an approach, however, ignores decades of data from around the world that show this to be wrong, according to a study titled *Best Practice in Environmental and Sustainable Architecture.*

By ignoring environmental issues in providing shelter, it will become increasingly difficult in the near future to meet housing needs. Ignoring environmental concerns will subject the most vulnerable sections of society to uncomfortable living conditions, greatly increase their lifetime living costs, and negate any initial savings in the production of the dwelling through modifications inhabitants must undertake to make the spaces more comfortable. Certainly, this is more of a worry in cooler climates. Nevertheless, it is a concern in Uganda, as work by Olweny (1996) revealed, that the energy crisis is as much a problem for low-income households as it is for those of high income.

The surroundings of a building have a significant impact on its interior. At the same time, the built environment modifies the urban climate – a cyclic process that creates the urban heat island effect. Knowledge of the physical surroundings as well as the macro and microclimates are, therefore, useful in formulating passive energy design solutions. Many times, however, these issues are ignored in the design of buildings in Uganda.

The central region of Uganda is extremely hilly, a geographical relief of which the nation is largely proud. Unfortunately, building design has for the most part ignored this aspect. Most buildings appear to ignore the slope, with many building designs taking the sites as flat – even though relatively few places in the area are flat. This approach to building design has caused significant damage to the natural environment, not to mention that this approach is extremely costly, and poses significant risks for residents in terms of climate vulnerability.

7.

Creating a conducive environment for innovation

7.1 Laws, regulations and policies related to the challenge

1. Physical Planning Act 2010
The Act provides for the establishment of the National Physical Planning Board, as well as district, urban and local physical planning committees; to provide for the making and approval of physical development plans and for the applications for development. It also oversees the national and regional physical development plans, as well as district and local physical development plans, and oversees development control and permissions of land use and division.

2. Building Control Act 2013
The Act is in place to consolidate, harmonize and amend the law relating to the erection of buildings; to provide for building standards; to establish a National Building Review Board and Building Committees; to promote and ensure planned, decent and safe building structures that are developed in harmony with the environment.

3. Public Health Act 2010
The Act empowers medical officers of health to inspect premises to ensure they are fit for utilization.

4. Investment Code Act 2019
The Act protects investors and their property.

5. National Intellectual Property Policy 2019
The policy intends to encourage public and private sectors to recognize and harness the value of intellectual property for the benefit of all Ugandans.

6. National Energy Policy 2019
This policy serves to ensure reliable, adequate and sustainable exploitation, management and equitable utilization of energy resources.

7. National Housing Policy 2016
The policy seeks to promote the progressive realization of adequate housing for all, and is premised on the principle of partnership, involving the Ministry of Lands, Housing and Urban Development, private sector, landowners, financial institutions, cooperatives and individuals.

8. National Environment Management Authority Act 2019
The Act provides for the management of the environment for sustainable development; to establish the Environmental Protection Force; to provide for enhanced penalties for offences under the Act; to provide for procedural and administrative matters.

9. Municipal solid waste by-laws
As outlined in the National Environment (Waste Management) Regulations S.I. No. 49 of 2020, a local government shall put in place measures for the management of domestic and municipal waste generated within its jurisdiction, including collection, transport and disposal of the waste.

7.2 Relevant government authorities and plans

Authorities at the national level

a) Ministry of Lands, Housing and Urban Development

The ministry is responsible for policy direction, national standards and coordination of all matters concerning lands, housing and urban development.

b) Ministry of Water, Environment and Natural Resources

The ministry ensures provision of quality water and environmental protection services in the country.

c) National Building Review Board

The Board has the mandate to monitor building developments, ensure aspects of accessibility of public buildings and oversee and monitor operations of building committees.

d) National Physical Planning Board

The Board advises the Government on all matters relating to physical planning and to advise on broad physical planning policies, planning standards and the viability of any proposed subdivision of urban or agricultural land. It also approves regional, urban or district physical development plans.

e) National Investment Authority

The Authority may advocate for incentives for investors.

Municipal-level authorities

a) Municipal physical planning committee

The functions of a District Physical Planning Committee are to prepare local physical development plans, through its officers, to recommend to the National Physical Planning Board development applications for change of land use, to recommend to the district council the subdivision of land which may have a significant impact on contiguous land or be in breach of any condition registered against a title deed in respect of such land. Another of the committee's function is to approve development applications relating to housing estates, industrial location, schools, petrol stations, dumping sites or sewerage treatment, which may have injurious impact on the environment as well as applications.

Relevant existing plans

a) National Development Plan III 2021–2022; 2024–2025

The National Development Plan stipulates the country's medium-term strategic direction, development priorities and implementation strategies. In addition, it details Uganda's current development status, challenges and opportunities. It will guide the nation in delivering the aspirations articulated in Uganda Vision 2040.

b) Uganda Investment Authority Plan 2020–2025

Among others, it aims to attain inclusive, productive and liveable urban areas for socioeconomic transformation; reduce the housing deficit; enhance economic infrastructure in urban areas; increase efficiency in solid waste collection; and provide more coverage of urban green spaces.

c) Municipal Sustainable Energy Access and Climate Change Action Plan

The plan is currently under development. One of the main issues preventing its completion is the lack of financial resources, as well as the data required to make it effective.

d) The Greater Kampala Metropolitan Area has a climate action plan

The GKMA has a climate action plan, namely the Kampala Climate Change Action Strategy. It highlights the short- and long-term adaptation of the GKMA to climate change impacts.

e) Uganda Green Growth Development Strategy, 2017–2018; 2030–2031

The Government developed the Uganda Green Growth Development Strategy to operationalize green growth principles and accelerate the implementation of sustainable development goals, Uganda Vision 2040 and the second National Development Plan.

f) Municipal Five-year Development Plan 2020–2021; 2024–2025

This document highlights all the approved priority projects that will be undertaken over a five-year period.

g) Municipal Physical Development Plan 2019–2040

The Physical Plan is a tool to harmonize the diverse needs for human settlements, production and conservation. This is by adopting best practices in land utilization for purposes of growth in agriculture, industry, housing, among other sectors; and taking into account population trends but without losing control over conservation of ecological systems.

Absent plans that carry relevance

Some of the key findings in this Challenge Brief include the absence of plans that are of relevance to this particular challenge in Makindye Ssabagabo. While the Government has prepared development plans at different tiers of governance, there are specific areas that may need strengthening in order to embrace, fully, a transition towards a green, smart and sustainable city. For instance, plans that may benefit the city include the following:

- Green building codes, decentralized at the municipal level
- Building approval authorities that pay particular attention to green homes and green building features
- A Makindye Ssabagabo Master Plan as well as a Land-use Plan, integrating important aspects on Lake Victoria, its inclusive planning, as well as the opportunities for residents and stakeholders in shaping a sustainable blue economy
- An innovation and digitalization strategy
- Digitized spatial plans

7.3 Monitoring frameworks

The **Greenhouse Gas Inventory** is the general measurement tool for monitoring and evaluating the progress of initiatives related to the reduction of GHG emissions. However, the last Greenhouse Gas Inventory, with the support of UN-Habitat, was completed in 2013. But the city requires a more up-to-date inventory to track the largest sectors causing emissions in the municipality, and take appropriate action based on the findings.

The **2019–2020 Uganda National Household Survey** was conducted to generate and build social and economic indicators and monitor the progress made towards social and economic development goals of the country and internationally.

However, the city lacks a comprehensive monitoring and evaluation framework that touches on all the relevant sectors, including socioeconomic, financial, economic, environmental and political conditions. Such plans are also important to define clear mechanisms for social inclusion.

7.4 Communication

The Makindye Ssabagabo Municipal Council has a communications focal person who can also transmit clear messages on challenges. This is important to ensure that stakeholders are regularly updated on a particular problem. Tools used to engage the audience include social media, focus group meetings with residents, WhatsApp engagements and more. The Municipal Council is also lobbying for financial resources to embrace sports, music, dance and drama as mediums through which messages can be conveyed.

7.5 Experimentation environments and test beds

While this Challenge Brief recognizes that the city has not yet set up clear experimentation environments or test beds, the city is determined to initiate such processes and actively participate in strengthening its innovation capacity. Therefore, through the Climate Smart Cities Challenge, the city commits to the following key points:

- **Facilitate access to data sets** for the innovators and developers to experiment with census, statistical and spatial data, where appropriate and available. Even if the data is not up-to-date or available, the city stands ready to support innovators with information on the city, its neighbourhoods, buildings and residents, where applicable.
- **Connect the innovator teams** of the Climate Smart Cities Challenge with relevant stakeholders in the building and housing sectors in order to develop most relevant and fitting tools, methodologies or prototypes.
- **Provide the platform for partnerships** between the innovator teams, SMEs, entrepreneurship hubs or labs, academic institutions, developers, architects, civil society and the public sector in order to:
  a. Access city assets or infrastructure, obtain regulatory permissions to test out the innovations from the test bed.
  b. Connect innovator teams from the Climate Smart Cities Challenge to potential allies and investors.

References

Floods washes away Msakinde Ssbagabo. Entebbe Post, 4 May 2021. Available at https://entebbepost.com/floods-washes-away-makindye-ssabagabo-residents-homes/

Kibwami, N., "Enhancing Sustainable Construction in the building sector in Uganda." Available at https://www.researchgate.net/publication/304658241_Enhancing_sustainable_construction_in_the_building_sector_in_Uganda

Lwasa, S. Greenhouse Gas Emissions Inventory for Kampala City and Metropolitan Region, 2013. Kampala, [28 February 2013]. Available at https://mirror.unhabitat.org/downloads/docs/12220_1_595178.pdf

Martyrs University Nkozi, "Vernacular Architecture, Advocating Volcanic Stone Constructions as a Viable Alternative to Fired Brick in Mountainous Areas of South Western Uganda", 30 May 2017. Available at https://elithumu.wordpress.com

Nuwagaba, Herbert M., Opportunities for Affordable Construction in Uganda using Locally Available Materials, 2019, M.A. Thesis, University of Illinois, 2020. Available at https://dspace.mit.edu/bitstream/handle/1721.1/127321/1192447788-MIT.pdf?sequence=1&isAllowed=y

Olweny, Mark and Shem Sebbowa "Best Practice in Environmental and Sustainable Architecture," PREA Workshop, 2006. Available at http://ir.umu.ac.ug/bitstream/handle/20.500.12280/559/Olweny_FoBE_CON_2006.pdf?sequence=1&isAllowed=yIbid

Seven killed in rain. Daily Monitor, 27 May 2019. Available at https://www.monitor.co.ug/uganda/news/national/seven-killed-in-city-rain-1828810

Uganda, *Uganda Green Growth Development Strategy, 2017/18 – 2030/31*. Available at https://www1.undp.org/content/dam/LECB/docs/pubs-reports/undp-ndc-sp-uganda-ggds-green-growth-dev-strategy-20171204.pdf.

Uganda, Ugandan Bureau of Statistics (UBOS), *Uganda National Household Survey 2019–2020 Report* (Kampala, 2021). Available at https://www.ubos.org/wp-content/uploads/publications/09_2021Uganda-National-Survey-Report-2019-2020.pdf

Uganda, Municipal Physical Development Plan 2019–40

Uganda, Municipal Five-Year Development Plan 2020/21–2024/25

Uganda, National Population and Housing Census, 2014. Kampala.

Uganda, *National Development Plan III 2020/21–2024/25*. Kampala.

Resources on green buildings and energy efficiency by UN-Habitat

Energy and Resource Efficient Urban Neighbourhood Design Principles for Tropical Countries: Practitioner's Guidebook, 2020. Available at https://unhabitat.org/sites/default/files/2020/06/gh046e_compressed.pdf

The Ecological Living Module, 2018. Available at https://www.unep.org/news-and-stories/story/smart-housing-prototype-shows-promise-rapidly-urbanizing-africa

Build Green: 100 ways to save money and the environment, 2016. Available at https://unhabitat.org/sites/default/files/2020/06/gh053e.pdf

Build Green. Charter for Sustainable Building, Neighborhood Design and Urban Mobility in Tropical Countries, 2015. Available at https://unhabitat.org/build-green-charter-for-sustainable-building-neighborhood-design-and-urban-mobility-in-tropical

Sustainable Building Design for Tropical Climates, 2015. Available at https://unhabitat.org/sustainable-building-design-for-tropical-climates

Green Building Interventions for Social Housing, 2015. Available at https://unhabitat.org/green-building-interventions-for-social-housing

Building for the future: A United Nations showcase in Nairobi, 2013. Available at http://www.unece.lsu.edu/greenbuilding/documents/2013Mar/gb13_03.pdf

Promoting Energy Efficiency in Buildings in East Africa, 2011-2015. Available at https://unhabitat.org/partnership-towards-energy-efficiency-buildings-in-east-africa and https://mirror.unhabitat.org/downloads/docs/Technical%20material-%20Promoting%20Energy%20Efficiency%20in%20Buildings.pdf

A better quality of life for all in an urbanizing world

UN HABITAT
FOR A BETTER URBAN FUTURE

UNITED NATIONS HUMAN SETTLEMENTS PROGRAMME
P.O. Box 30030, Nairobi 00100, Kenya
www.unhabitat.org