



Energy and Climate Profile





With the support of



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FOREWORD



There are many answers to the frequently asked question “why KCCA?”. The simplest would be because climate change is already there in the city and because we are a part of this global phenomenon and a part of the solution, as Authority and as individuals.

“Local authorities construct, operate and maintain economic, social and environmental infrastructure, oversee planning processes, establish local environmental policies and regulations, and assist in implementing national and subnational environmental policies. As the level of governance closest to the people, they play a vital role in educating, mobilizing

and responding to the public to promote sustainable development.”¹

According to this vision, KCCA intends to play a key role locally to integrate climate change and energy issues within each of its public policies. This includes the exemplarity of the administration and the development of an inclusive approach that aims at benefiting and engaging local stakeholders and communities, especially the most marginalized. Human beings are at the beginning of this process and the ending point.

For Kampala, the Strategy must address two issues: the short and long term adaption of the City to climate change impacts, and the low carbon development of the City. The pathway to sustainability is a daily work in a such fast growing city where planning activities are often overtaken by events. But the stakes are there, the different level of Authorities are aware and engaged, the citizen are more and more sensitize and have important expectations. This creates a good environment for action.

Some projects and initiatives have already been implemented in Kampala. These pilot projects should be now disseminated and pave the way for new solutions, whether carried by public authorities, private actors or citizens. The residents that have visited the eco-pavilion at the Kampala Annual Festival have left messages that all express the desire for a greener city. Young and adults where there with great interest for some and many solutions to reveal for others. There is a lot of enthusiasm to participate in the development of Kampala, to propose solutions, to experiment and to work together. People must keep continuing to see themselves as a part of the environment which is a natural and vital service provider to us.

Our strategy starts from KCCA. The Authority must give the example on its own activities and assets management and create the good conditions to support public and private initiatives. But the objectives will be reached only with the strong mobilization and cooperation of the local stakeholders. KCCA only represents less than 1% of the GhG emissions of the territory. There is then an important work to achieve to have everyone on board. What we do is designed to improve the living conditions in Kampala. To ensure that the investments we make and the programs we set up succeed, it is important to plan and explain them to local actors. The change and the new modes must be explained to facilitate their implementation. Technology will not do everything either. The strategy deals with behavior change which takes time, needs consistency and work with the appropriate local relays to the communities.

The Kampala Climate Change Action is the roadmap of our Strategic plan to make Kampala a Vibrant, Attractive and Sustainable City that contributes to the international and local challenge of climate change.

¹ Art. 28.1 UN Conference on Environment & development, Rio 1992

EXECUTIVE SUMMARY

General framework

The Kampala Climate Change Action Strategy has been developed in consistency with different frameworks: The United Nations Framework Convention on Climate Change (UNFCCC) signed by the Uganda Government the 13th of June 1992 and ratified on 8th of September 1993, The United Nations Sustainable Development Goals, The East African Community Climate Change Policy, Strategy and Master Plan, The National Adaptation Program of Action and The National Climate Change Policy, The Vision 2040 and the National Development Plan II.

In the context of the COP21 in Paris in December 2015 and of the partnership between France and KCCA, this process has been supported from the beginning by Expertise France, AFD and FFEM.

Kampala and KCCA

Kampala is the capital city of Uganda located in Budanga. KCCA is the Authority which is the governing body of the Capital City who administers it on behalf of the central government according the KCCA Act 2010 which defines the functions of the Authority.

The Kampala Climate Change Action is a strategy that aims to mitigate the GhG emissions induced by these functions and to adapt the City to short and long term impacts of climate change. KCCA has decided to extend the perimeter of its strategy to the whole territory of Kampala including local communities, public and private stakeholders.

There is 1,5 million inhabitants in Kampala (418 787 households) and 3,5 million inhabitants in the Metropolitan Area (Greater Kampala: 1 million households). The projected population is between 10 and 15 million inhabitants with an urbanization rate of 5,2% per year. This is a very important stakes regarding the mitigation objectives of the Strategy. Combined with a high rate of population growth, the expected GhG emissions volume should raise significantly. That is why the Strategy aims at integrating energy and climate issues in every sectorial policy related to the City development and at reducing the GhG emissions per inhabitants.

The annual rainfall in Kampala is 2000 mm, the average monthly temperature is 21°C and the current trends indicate an increase of 1.5-3°C.

The annual energy consumption in Kampala is estimated at 10 000 GWh equivalent supplied with 47% from fossil fuel (14 920 GWh and 54% for Greater Kampala). The rest is supplied from charcoal, wood fuel and other renewable sources which are produced outside the City boundaries.

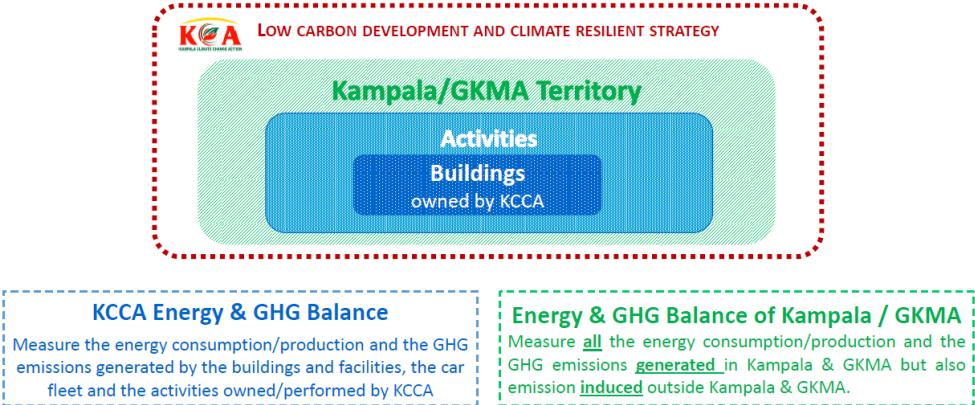
The methodology

Under the management of ED's Office and the supervision of the Top Management, a team of 9 experts has implemented a participative process to produce this Energy and Climate Profile which includes the GhG and Energy Balances of KCCA, Kampala, Greater Kampala; The Climate change trends, scenario and vulnerabilities; The Strategic Objectives and a first Draft of Action Plan.

The Profile is based on: the most accurate and available studies and data collected at international, national and local levels, the existing literature produced at different scales, a

series of numerous interviews with relevant stakeholders and specialists, more than 16 internal workshops with the KCCA directorates, the conclusions of the Stakeholder's Dialogue and workshops, the experiences shared with partners and networks.

The perimeter of the Strategy is not limited to the only public assets and activities but extended to the whole territory of Kampala and Greater Kampala. Kampala is not an island. It is important to take into account the impacts generated by our activities beyond our boundaries as we have to assess the contribution of external activities on Kampala and GKMA.

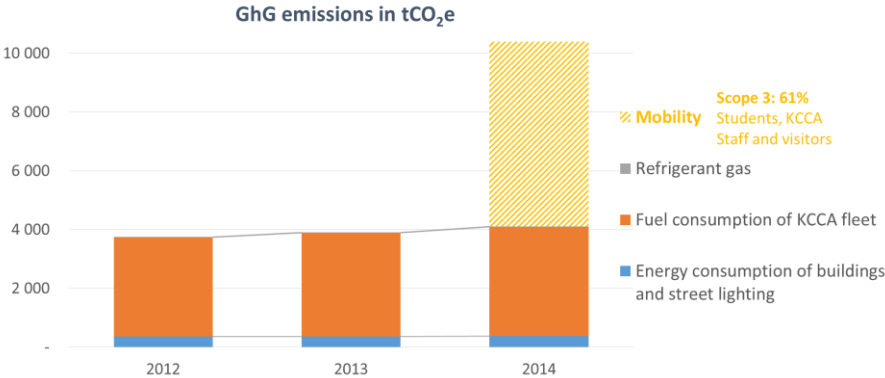


It aims at integrating the energy and climate component in every sectorial activities of KCCA and to mobilize the stakeholders on their own leverages to adopt and achieve common goals. But the diagnosis is not only quantitative but qualitative: the entry point is not only a figure but an assessment on how the things are designed upstream, how they are implemented, how inclusive they are, what kind of externalities they produce, how the change in behaviour can be supported, how the governance and the implementation can be more inclusive, how best practices, best ideas and enthusiasm can be supported. That is why internal and external workshops, interviews, conferences and other events have been organized.

The quantitative diagnosis assess for the territory (Kampala and Greater Kampala) and for KCCA the energy consumptions, the energy generation, the direct and the indirect GhG emissions.

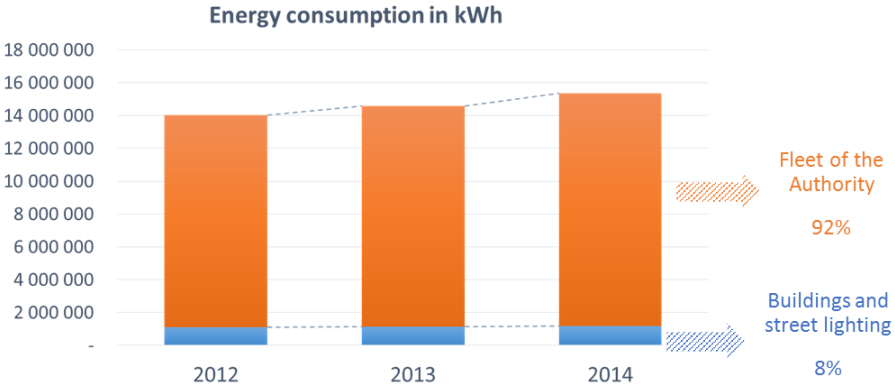
These firsts' results have been shared the 14th of October 2015 with the main stakeholders at the Serena Hotel in Kampala in presence of the Executive Director, the Deputy Executive Director, the representative of the Ugandan Government, the French Ambassador, the UNDP representative, the World Bank Eastern Africa Director and more than 150 stakeholders.

The energy and GhG balance of KCCA



The global volume of GhG emissions has increased by 9% between 2012 and 2014. It is characterized by a very high proportion of GhG emissions from fuel consumption. The energy consumed by the buildings is very low in comparison, especially if we include the street lighting where there is no consumption at the moment thanks to the energy supplied by the photovoltaic solar panels.

In addition, the study has proposed to also assess the induced emissions from transport. These emissions are not the direct emissions generated by the car fleet of KCCA used by the staff but the emissions generated by the "visitors" - other people that KCCA staff like students going to school, inhabitants going to health centers or to the City Hall for administrative purpose, etc.



The global volume of energy consumed has increased by 10% between 2012 and 2014. It is characterized by a very high proportion of fuel consumption due to the use of the car fleet which represents around 92% of the total energy consumed. 50% of the fuel consumption is related to the waste and pit latrines collection and 24% to the road construction activity.

Energy consumption of KCCA (assets & activities)

Buildings and street lighting

8% of energy consumption

Energy mix of KCCA buildings

- Electricity of the grid: 25%
- Gasoil: 71%
- Firewoods: 3%

INDICATORS - 2014

- 293 750 kWh of electricity
- 484 kgCO₂e/kWh of electricity
- Electricity consumption →
- Consumption of the City Hall: 42 600 kWh of electricity

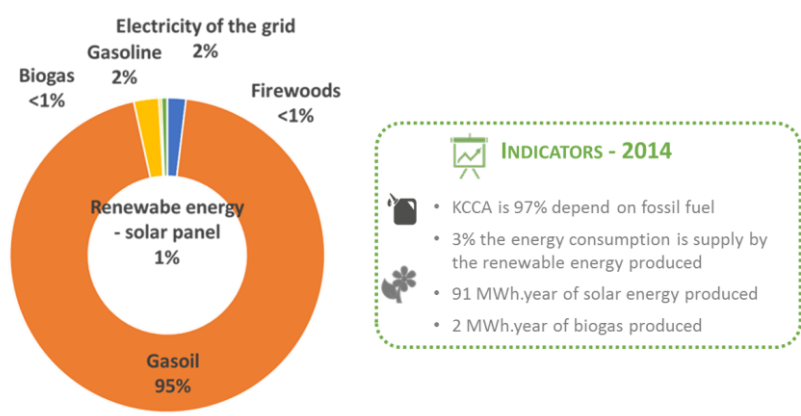
Type of building	kWh/year
Administrative	9 465,67
Health Facility	1 932,00
Landfill	17 199,00
Schools	2 300,00

Fleet of the Authority

92% of energy consumption

INDICATORS - 2014

- 1 400 000 liters of gasoil consumed by the fleet
- 40 200 liters of gasoline consumed by the fleet
- 723 000 liters consumed for garbage and peat latrine collection

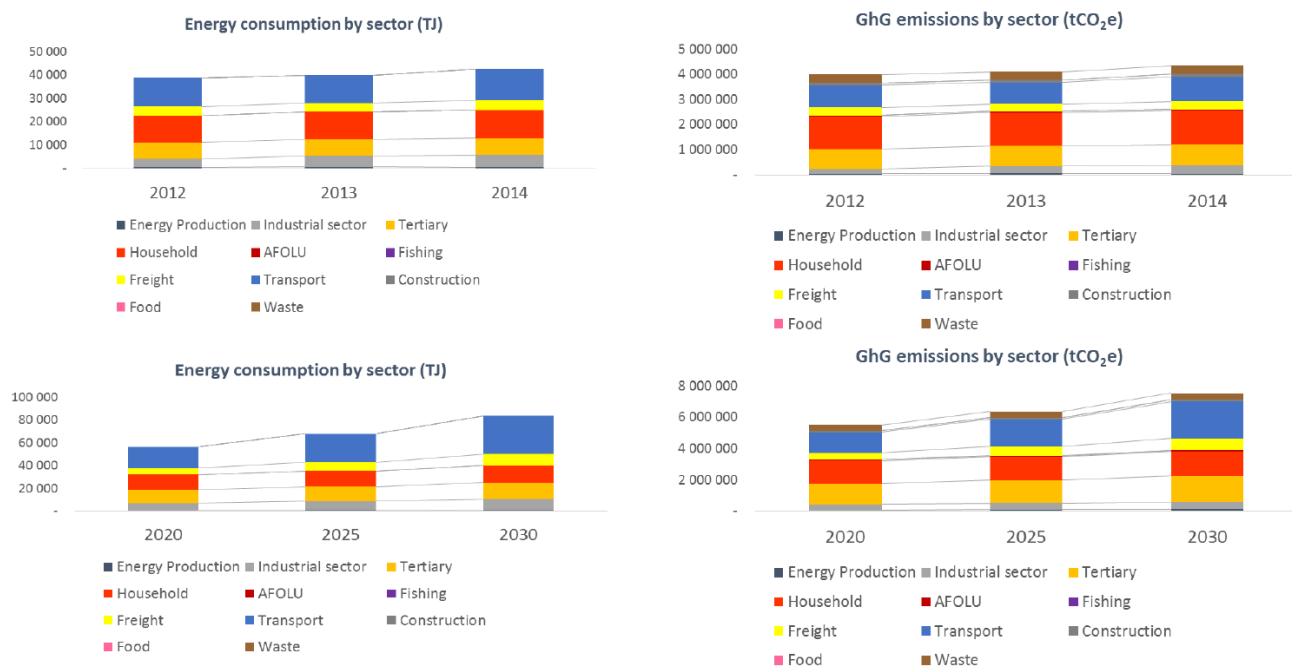


The energy and GhG balance of Kampala

The energy supplied to Kampala City is consumed by the following sectors: energy production, the industrial sector, tertiary, residential sector, freight and transport sectors. The energy consumption is mostly in the form of diesel or heavy fuel oil by energy producers to generate electricity.

Kampala households have more diverse sources of energy for cooking and lighting. Households using electricity for lighting were at 78.4%, while 5.8% used lantern and 5.2% used tadooba (wick lamp), the rest uses other sources of energy. The energy use for cooking in households was 80.2% for charcoal which the current way of use are dramatic for air quality and public health (incl wood fuel). The use of kerosene and firewood for cooking was 7.6% and 2.1%, respectively. The use of electricity for cooking is 2.1%. It is very low because of the high electricity tariff (Uganda National Household Survey, 2012/2013). The household sector was the second largest consumer (28.1%) of the total energy in Kampala City.

KAMPALA



The energy and GhG balance of Greater Kampala

The energy consumption in GKMA increased from 2012 to 2014 by 12%. There is a general increase in the energy consumption in all sectors. The contribution of the industrial sector

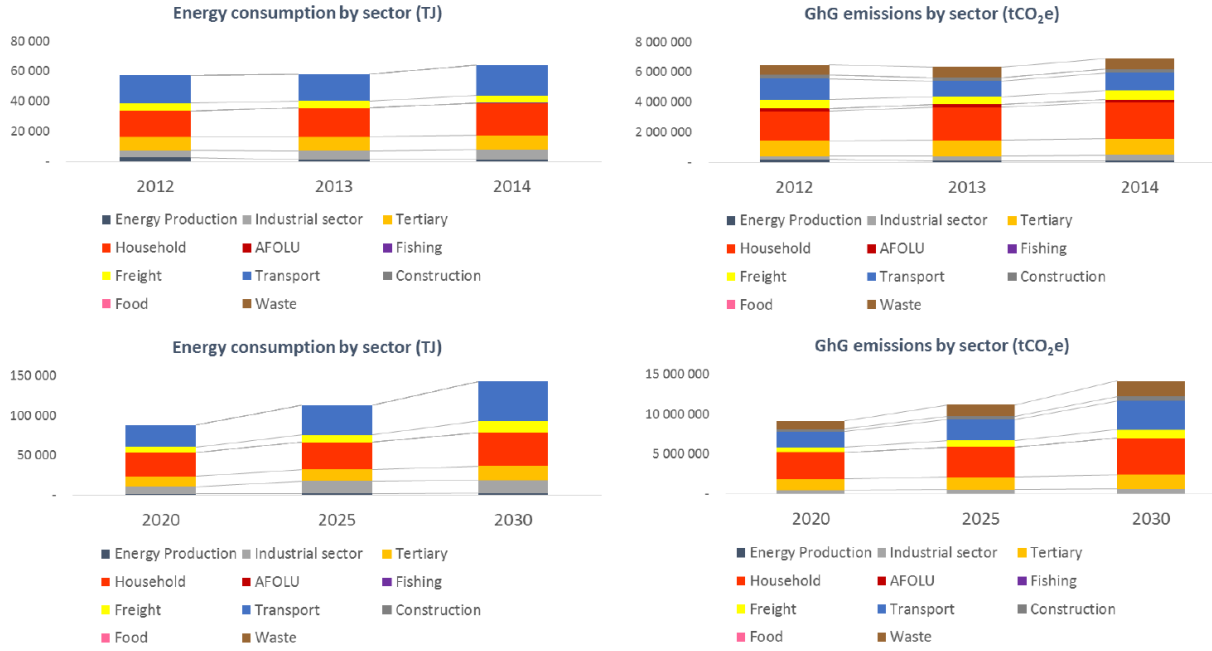
energy consumption increased from 8.2% in 2012 to 10.5% in 2014. That was due to the increased industrial development within GKMA. The increasing population in this region created a demand for services such as education and commercial services. The energy contribution from the energy consumption increased from 15.8% in 2012 to 15.1% in 2014. In the household sector the most developed fuel is biomass, the contribution of this sector to the GKMA total energy consumption increased from 30.4% in 2012 to 33.3% in 2014. Table 2 shows energy consumption in GKMA. Most of the petroleum fuels are used in the transport and freight. There is general increase in the energy consumption in these sectors.

The main sources of biomass and electricity supply are outside Kampala region. Charcoal is mostly supplied from the Central and northern parts of Uganda. Hydropower is the dominant source of electricity and it is supplemented with thermal power plants. Electric energy supply to the national grid, hydropower contributes about 90.5%, cogeneration (sugar factories, Kinyara and Kakira sugar factories) 6.7% and thermal plants 2.8%. All petroleum fuels are imported. There were two thermal power plants in GKMA.

Most of the industrial and commercial activities in the country take place within GKMA. It is for this reason that the highest concentration of the anthropogenic emissions is expected to be within GKMA. The residential sector is composed of urban and peri-urban households. The emissions sources are mostly from charcoal combustion for cooking in the households. The main sources of anthropogenic emissions are from the use of kerosene and LPG use for lighting and cooking. Most of the waste generated in GKMA is organic waste. As for Kampala, it is hard to inventory the non-energy emissions at GKMA level because of a low availability of data. But the usage of air conditioning (direct and indirect emissions) has to be taken into account in the coming years.

The waste emissions are from the landfill, industrial liquid and solid waste, sewage liquid and wastewater. Direct emission is from combustion of fuels in a given activity, while indirect emission is the use of electricity generated from thermal systems. There is very limited mechanized agriculture in GKMA but a limited keeping animal by grazing and poultry business. The direct emissions from energy consumptions is then low but the potential use of fertilizers, pesticides, the burning of bio and green waste are all source of emissions.

GREATER KAMPALA



The climate change vulnerabilities

The most significant climate change impact on Kampala city comes from increased precipitation that leads to flooding. The urban poor settlements such as Bwaise, Kinawataka, Natete, Ndeeba, Katwe are prone to increased flush floods that destroy infrastructure of roads, culverts, drainage systems, houses and water supply. This exposes infrastructure, livelihoods and housing to severe impacts of destruction, damage, dampness and health challenges.

The first driver of flooding is related with land use. The development of housing on hill tops results in clearing of natural vegetation. This reduces infiltration of rainfall and increases runoff. On the other hand, it is associated with exposure, that is, the location of human settlements in wetlands. The encroachment of low-lying valleys and wetlands not only increases exposure, but increases as well vulnerability, as it reduces their capacity to capture, store and dissipate surface water run off.

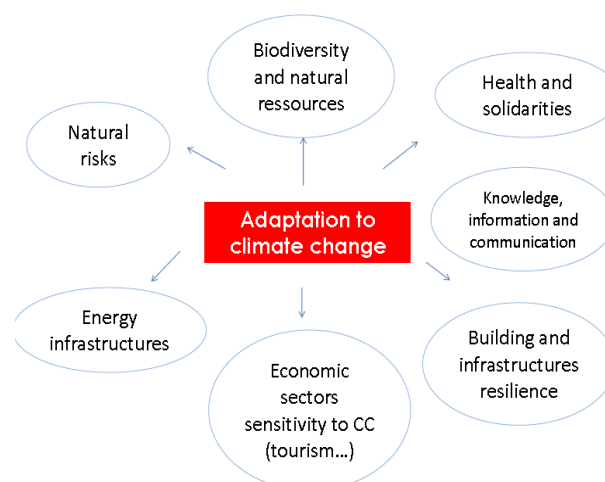
The second driver of vulnerability to heavy rains is insufficient, poorly design and poorly maintained urban infrastructure mores especially the drainage systems. The frequent and high intensity tropical rain storms generate extremely high run-off that quickly exceeds the capacity of the urban storm water drainage system. Moreover, the urban infrastructure is typically poorly designed.

Poor solid waste management and garbage dumping practices also contribute to flooding. Currently solid waste collection, recycling and disposal systems are very weak in the city, with inadequate logistics, unauthorised dumping, burning of waste, and inadequate landfill, and no composting facilities perspective. Solid waste is disposed everywhere. When rain comes, it accumulates in the area (as a low-lying area) and cannot be carried away because the narrow channels are blocked with solid waste.

Regarding droughts, vulnerability is also significant. First, the city has not identified and developed alternative water supply sources to Lake Victoria, such as, for instance, water harvesting systems, and the extension of the pipes into the lake seems to be limited. Secondly, the main source of electricity for the city in hydro and droughts could reduce water that could affect energy supply.

A program has been launched to identify and to work on Urban Heat Islands phenomenon in Kampala which will increase in the coming years. This stake is directly targeted by the physical planning activities but also by every policies that will support the natural function of nature within the City.

The dimension of vulnerabilities and adaptation to climate change for Kampala City



The strategic objectives of the Kampala Climate Change Action Strategy

The strategy address simultaneously the adaptation to climate change and the mitigation of the GhG emissions at KCCA, Kampala and Greater Kampala level.

It deals with the direct and indirect emissions whether they have an energy or a non-energy source. It always recommend first to develop rational use of energy, then energy efficiency / recovery and the development of renewable energy sources. Beyond energy, the Strategy aims at conserving the whole natural assets of the city and the environment including air quality and water resources.

The entry point is the KCCA assets and properties, its activities and its policies. The scope is enlarged to the other public and private organizations located in Kampala and Greater Kampala on a voluntary basis. A commitment charter is proposed to everyone who wants to join this participative and inclusive strategy. A specific communication, participation and governance strategy is prepared to achieve this structural objective.

The process also interrogates the consistency of the objectives with the decentralized functions of KCCA. It confirms that strong integration and cooperation between national authorities, public agencies and KCCA must be reinforced. It questions the opportunity to strengthen the decentralization of some functions from national to KCCA, for instance in the fields of physical planning, law enforcement, water and wastewater management, mobility, public utilities management, budget and tax system.

The strategic objectives that will be declined into a multi-annual and partnership action plan are:

▶ Being an example as a Capital City

(Governance, human resources, public green procurement, energy and water management, mobility of the staff, street lighting, education, eco-schools...)

▶ Communicating with and engaging local stakeholders

(Communication and participation strategy, communication toolbox, Stakeholder's Dialogue, communities dialogue, knowledge platform, Kampala Festival, Kampala Goes Green, weather observatory and info system, energy and climate local agency, events...)

▶ Landscaping a more resilient low carbon Kampala

(Smart city, Connectivity, transit option, land use mix, density, public transport, non-motorized transport, Bus Rapid Transport, cable cabin, freight and logistic, green space, biodiversity, carbon sinks, urban nature, wetlands restoration, drainage...)

▶ Developing smart utilities and community services

(City Energy Master Plan, Renewable energy and recovery, charcoal and wood fuel substitutions, solar cadastre, energy recovery from waste, waste prevention and sorting (Reduce, recycle, reuse strategy), smart grids, water and wastewater green management, sanitation, drainage...)

▶ Supporting the green economy

(Inventory of the existing and potentials green activities and businesses, in-service and initial training offer, green jobs promotion, logistic and freight strategy, labelling, urban agriculture, green tourism, eco-business club, R&D, green clusters and green parks ...)

CHAPTER 1. CLIMATE PROFILE AND VULNERABILITIES OF KAMPALA

1. Introduction

This vulnerability assessment of Kampala city and Greater Kampala region in light of current and future impacts of climate change is part of the general energy and climate profile. It is the first step in the process aimed at development a Low Carbon Development and Climate Change Resilient (LCDCCR) strategy for Kampala Capital City authority (KCCA). Among others, the strategy is aimed at building climate change resilience in the territory.

As part of the strategy the climate change profiles of Kampala have been prepared as well as the exposures and vulnerabilities of the territory to the impacts of climate change.

The climate profiles and vulnerabilities have been prepared through review of literature and documents and consultations with the KCCA technical staff. The first part of this document updates the observed and projected climate change and impacts - it highlights the past and future climate risks and hazards

The second part presents finding of exposure to the Kampala territory to the impacts of climate change on the different sectors/thematics.

2. Climate Change Profiles

2.1. Past climate trends

2.1.1. Global climate trends

The Intergovernmental Panel on Climate Change (IPCC) released its Fifth Assessment Report (AR5) in 2013 - 2014. The report confirms that the earth's climate is warming i.e. since the 1950s, the rate of global warming has been unprecedented compared to previous decades and millennia. Each of the last three decades has been warmer than all previous since 1850. The first decade of the twenty-first century (2001-2010) has been the warmest since 1850.² The report also confirms human responsibility in climate change process through greenhouse gas emissions.

The average temperature at the Earth's surface has increased by about 1°C over the period 1901-2012. Ocean warming represents the biggest change in the energy content of the earth. The oceans have absorbed 90% of the energy accumulated on earth between 1971 and 2010. The most significant warming occurs on the surface (from 0 to -75 meters): + 0.11°C per decade between 1971 and 2010 i.e. +0.44°C in less than 40 years.

Confidence in precipitation change averaged over global land areas since 1901 is low prior to 1951 and medium afterwards. Averaged over the mid-latitude land areas of the Northern Hemisphere, precipitation has increased since 1901 (medium confidence before and high confidence after 1951). For other latitudes area-averaged long-term positive or negative trends have low confidence

Changes in many extreme weather and climate events have been observed since about 1950. It is very likely that the number of cold days and nights has decreased and the number of warm days and nights has increased on the global scale. It is likely that the frequency of heat waves has increased in large parts of Europe, Asia and Australia. There are likely more

² IPCC (2013). Climate Change 2013: The Physical Science Basis. Headline Statements from the Summary for Policymakers.

land regions where the number of heavy precipitation events has increased than where it has decreased. The frequency or intensity of heavy precipitation events has likely increased in North America and Europe.

2.1.2. Past climate trends for Africa and the East African region

For Africa, the main climate change observations are as follows:

Observed temperatures: There is evidence that warming over land across Africa has increased over the last 50–100 years. Surface temperatures have already increased by 0.5–2°C over the past hundred years. Data from 1950 onwards suggests that climate change has changed the magnitude and frequency of some extreme weather events in Africa already. There is strong evidence that observed temperature increases exceed natural climate variability and have been influenced by greenhouse gas emissions due to human influence.

Observed rainfall: Most areas of Africa lack sufficient observational data to draw conclusions about trends in annual rainfall over the past century. Where data are available, these indicate a very likely decrease in annual rainfall over the past century in parts of the western and eastern Sahel region in northern Africa and very likely increases over parts of eastern and southern Africa.

Observed extreme events: Based on data since 1950, evidence suggests that climate change has changed the magnitude and frequency of some extreme weather and climate events in some global regions already, although there is a general lack of data for Africa.

Observed sea level rise: The rate of sea-level rise since the mid-19th century has been larger than the mean rate during the previous two millennia (high confidence). Over the period 1901–2010, global mean sea level rose by 19 cm, and will continue to rise during the 21st century.

For the East African region, the climate observations are as follows:

Observed temperature: The equatorial and southern parts of eastern Africa have experienced a significant increase in temperature since the early 1980s. Seasonal average temperatures have also risen in many parts of eastern Africa in the last 50 years. Countries bordering the western Indian Ocean experienced warmer temperatures and more frequent heat waves between 1961 and 2008.

Observed rainfall: Rainfall in eastern Africa is very variable in time and space. Several physical processes, including the El Niño Southern Oscillation, affect rainfall. Some models suggest that rapid warming of the Indian Ocean may be the cause of less rainfall over eastern Africa between March and May-June in the last 30 years. Summer monsoon rainfall declined throughout much of the Horn of Africa over the last 60 years.

Observed extreme events: There is a lack of evidence about trends in extreme temperature, extreme rainfall and drought in East Africa. However, droughts and storms have been more frequent in eastern Africa in the last 30–60 years. Continued warming in the Indian Ocean has been shown to contribute to more frequent East African droughts over the past 30 years. It is not clear whether these changes are due to anthropogenic influence or to natural climatic variability.

2.1.3. Observed climate trends for Uganda

The climate change trends observed worldwide are confirmed in Uganda:

Increased temperature. In Uganda, observed averages in annual near-surface temperatures are around 21°C. The observed temperatures between 1900 and 2009 shows an increase in average annual temperature of between 0.8°C - 1.5 with typical rates of warming around 0.2°C per decade. The period 1960 - 2008 has been progressively warmer. It was also found that the nights are warming faster compared to the days.

Observed rainfall. Observed annual rainfall totals for Uganda vary from 500 mm to 2800 mm, with an average of 1180 mm. The observed rainfall for 1900–2009 rainfall indicates that for period 2000–2009, rainfall has been on average about 8 percent lower than rainfall between 1920 and 1969. Although the June–September rainfall appears to have been declining for a longer period, the March–June decline has only occurred recently. Three long epochs of below-normal rainfall occurred between 1940 and 1960, around the 1970s and again around the 1980s and 1990s. Above-normal rainfall periods occurred during the early 1960s and late 1970 and late 1990s. It is interesting to note that episodes of exceptionally high rainfall totals during the 1960s and 1970s were preceded by relatively long low rainfall periods.

Extreme weather events: It is estimated that 90% of Uganda's natural disasters are climate change related. The country has been repeatedly affected by extreme events such as droughts and floods. Available evidence suggests that droughts in Uganda are becoming more frequent and more severe³. For example between 1991 to 2000, Uganda experienced seven severe droughts. Over 5 million people in Uganda have been affected by climate related disasters since 1979 - over 4 million have suffered severe droughts, about 1 million affected by floods. The western, northern, and north-eastern regions have been experiencing more frequent and longer-lasting droughts than seen historically. Climate related disasters have negatively affected agriculture. For example, an average of 800,000 hectares of crop is destroyed annually by climate-related effects, resulting in losses in excess of UGX120 billion. During the 1997/1998 floods, there was a 60 per cent drop in coffee exports and suspension of tea estates operations in eastern parts of the country, while 300 hectares of wheat were lost in the Kapchorwa District due to these floods. In September 2010, flood disasters hit the Teso sub-region, leading to rotting cassava, sweet potato tubers and groundnuts worth UGX8 billion. Economic losses resulting from transport accidents, fires and other climate related disasters have been estimated at UGX 50 billion annually.

2.1.4. Climate Trends in Kampala City

Kampala, the capital city of Uganda is situated near the equator, on the northern shores of Lake Victoria. The city covers an area of approximately 195 sq. km although the city 'region' of Kampala (Greater Kampala) covers an estimated land area of 1895 sq km engulfing the satellite towns of Entebbe, Wakiso, Mukono, Lugazi and Gayaza.

Given its proximity to the equator, Kampala should be experiencing an equatorial climate. However, the city experiences a tropical climate and this is due to its high altitude, its long distance from the sea, its relief and its proximity to the large water mass of Lake Victoria. The city is situated at an average altitude of 1,120m above sea level it sits on various low flat topped hills that are surrounded by valleys that are covered by wetlands.

To assess the vulnerability of Kampala to the impacts of climate change, it is necessary to analyse past climate trends to better understand future developments. These past trends are analysed from the main climate parameters, namely the changes in temperature and rainfall over the area.

Past climatic conditions

As already mentioned above, despite its proximity to the equator, Kampala's climate is not typically equatorial but is tropical. The city has moderate temperatures with the daily temperature mean ranging between 20 and 22°C annually, an average high of 27–28°C and an average low of 17–18°C. Kampala receives an annual rainfall of between 1,750 mm and 2,000 mm per year, with two annual rainy seasons - the first runs from March to May, peaking in April; and the second runs from August to November, peaking during October and November. Though the area two wet season patterns, heavy rains occur even in relatively dry months of the year. Given that the Kampala rain is generally convective, rainstorms are highly localized, often covering less than 10 square kilometres, intense (violent) and of short duration, usually lasting an hour or less. The convective nature of the rains makes rainstorms

³ Intergovernmental Authority on Development (IGAD). 2010. *IGAD Environment Outlook*.

particularly damaging, as they can occur when people and responsible authorities might not be prepared.

Data from the European Centre for Medium-range Weather Forecast (ECMWF) Reanalysis (ERA-Interim) shows average near-surface temperatures increased in Kampala between 1979 and 2005 by about by about 1°C (Figure 1). In contrast, data from Global Precipitation Climatology Centre (GPCC) and Uganda Bureau of Statistics (UBOS) (2014) show that between 1951 and 2014 there was significant change in rainfall in Kampala (Figure 2)

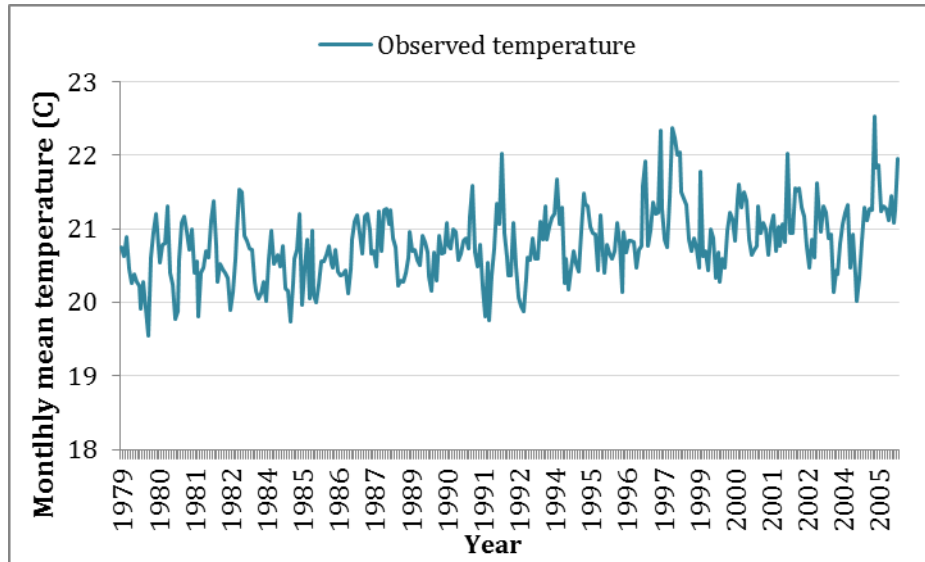


Figure 1: Kampala domain area averaged observed ERA-Interim reanalysis monthly near-surface temperature averages (°C) - 1979-2005.

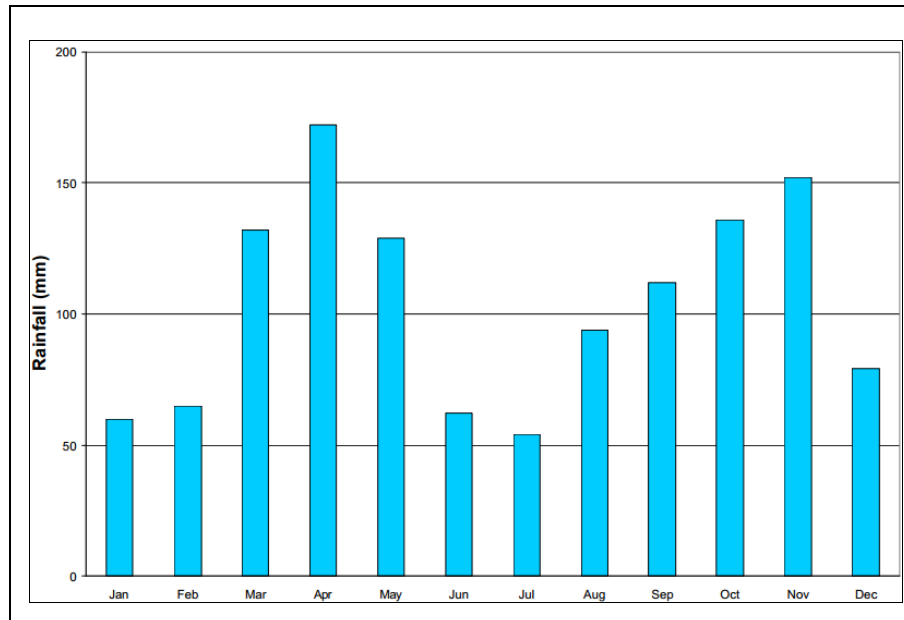


Figure 2: Long-term mean monthly rainfall in Kampala - 1943-1999

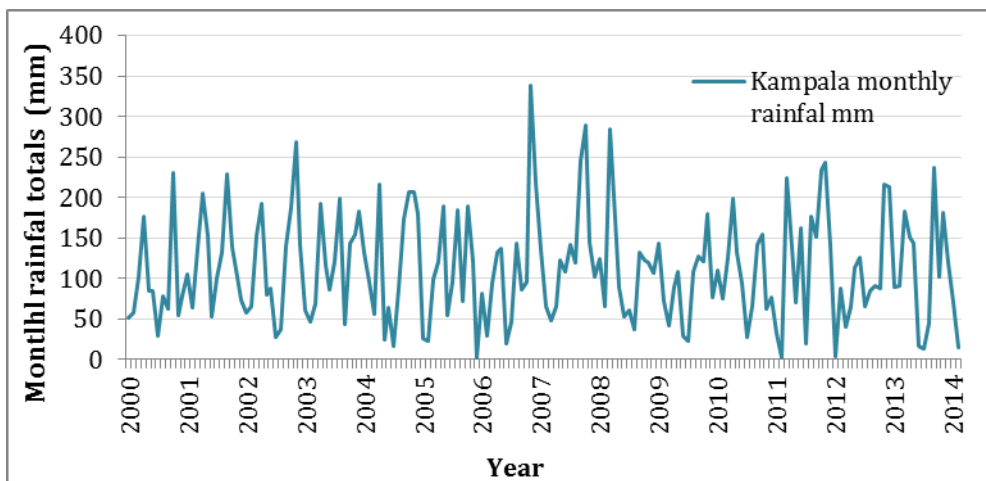


Figure 3: Kampala monthly rainfall. January 2000 – February 2014 (mm) Source: UBOS (2014)

However, there is a general opinion that climate variability has increased. According to officials from the Office of the Prime Minister (OPM), rainfall is now more difficult to predict, as heavy rains occur more frequently in times when they are not expected. According to MWE officials, the frequency of prolonged periods of extreme events, such as heavy rainfall leading to floods, and lack of rainfall (droughts) has increased. The residents of the flood prone areas of the city, like Bwaise, Kalerwe and Katanga reveal that storms have become more erratic, unpredictable and frequent, as well as more severe. However, existing data do not provide reliable information on specific heavy rains.

Table 1: Summary of Past Climate trends

	Temperature	Precipitation	Extreme weather events
Global	<ul style="list-style-type: none"> • Average temperature on the surface: + 1°C (1901-2012) • Annual mean temperature of sea surface : + 0.44°C in less than 40 years 	<ul style="list-style-type: none"> • No clear trends 	<ul style="list-style-type: none"> • Global mean sea level rise Over the period 1901 to 2010 - 0.19 [0.17 to 0.21]m; i.e 1.7 mm/year; • Increase in sea level almost twice as fast since 1993 (3.2mm/year)
Africa/ Eastern Africa	<ul style="list-style-type: none"> • Africa's surface temperatures has increased by 0.5–2°C over the past hundred years. • Eastern Africa have experienced a significant increase in temperature since the early 1980s. 	<ul style="list-style-type: none"> • No clear trends but a decrease in annual rainfall in the western and eastern Sahel region an increase over parts of eastern and southern Africa. • In Eastern Africa, rainfall is very variable in time and space. 	<ul style="list-style-type: none"> • Increase in the magnitude and frequency of droughts and floods, although there is a general lack of data for Africa.
Uganda	<ul style="list-style-type: none"> • Average temperatures + 0.8 - 1.5°C (1900 -2009) i.e. warming of about 0.2°C per decade. 	<ul style="list-style-type: none"> • Between 2000–2009, rainfall has been on average about 8 percent lower than rainfall between 1920 and 1969. 	<ul style="list-style-type: none"> • 90% of Uganda's natural disasters are climate change related. • Since 1990, the magnitude and frequency of droughts and floods has increased with over 5 million people directly affected.

Kampala city	<ul style="list-style-type: none"> Near-surface temperatures + 1°C - 1979 and 2005 	<ul style="list-style-type: none"> No significant change in rainfall between 1951 and 2014 	<ul style="list-style-type: none"> Increased in frequency and magnitude of heavy rainfall, floods and droughts
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2.2. Projected climate trends

IPCC conducts climate assessments and projections at regular intervals. To assess climate change and its impacts, IPCC uses different models of the climate system, as well as economic and demographic studies, representing a wide range of possible climate changes. Climate simulations take into account many factors, distributed in two groups:

- Natural factors - volcanic eruptions, solar activity, etc;
- Anthropogenic factors - emission of greenhouse gases (GHG), aerosols, etc.

2.2.1. Global climate change projections

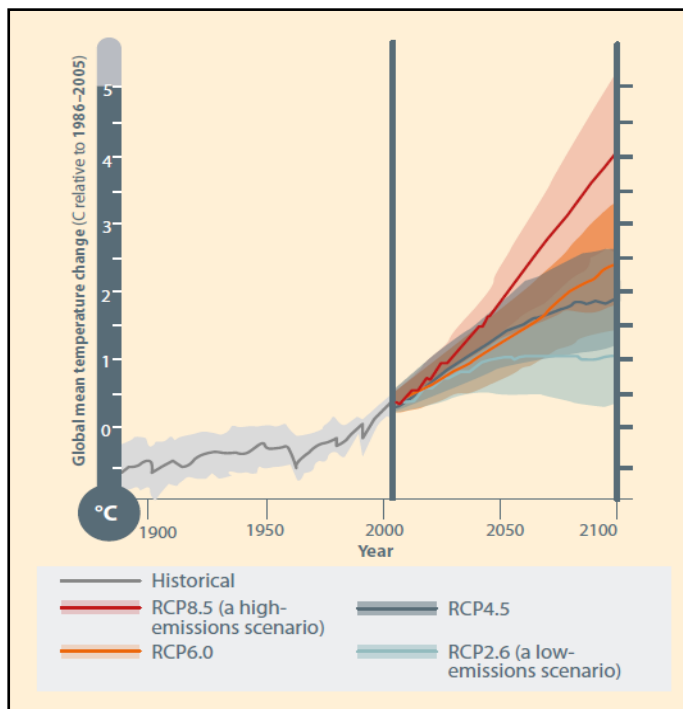


Figure 4: Observed warming and warming under IPCC scenarios (3)

The IPCC AR5 (Working Group I) in 2013 confirmed that the global climate system is changing and that warming will continue depending on the level of emissions greenhouse gas in the 21st century. In assessing future climate change, the IPCC AR5 presents four scenarios, known as Representative Concentration Pathways (RCPs – see Figure 4⁴). The scenarios show the result of different levels of emissions of GHG, from the present day to 2100, on global warming. In all scenarios, carbon dioxide concentrations are higher in 2100 than they are today. The low-emissions scenario assumes substantial and sustained reductions in greenhouse gas emissions. The high-emissions scenario assumes continued high-emissions. The two intermediate scenarios assume some stabilization in emissions.

Projected rise in temperatures: The average surface temperature of the planet will increase by the end of the 21st century from 0.3 to 4.8°C depending on the GHG emission scenarios over the period 1986-2005. This warming will continue after 2100.

Based on simple extrapolations, the costs of the impacts of extreme weather alone could reach 0.5 - 1% of world GDP per annum by the middle of the century, and will keep rising if

⁴ (Fig4) Climate and Development Knowledge Network (CDKN), (2014). The IPCC Fifth Assessment report. What is it for Africa?

*the world continues to warm. With 5-6°C warming - which is a real possibility for the next century - existing models that include the risk of abrupt and large-scale climate change, estimate an average 5-10% loss in global GDP, with poor countries suffering costs in excess of 10% of GDP. Achieving these deep cuts in emissions will have a significant cost. The Review estimates the annual costs of stabilization at 500-550ppm CO₂ e to be around 1% of GDP by 2050 - a level that is significant but manageable. **Costs of mitigation of around 1% of GDP are small relative to the costs and risks of climate change that will be avoided.** - Nicholas Stern Review: The Economics of Climate Change*

2.2.2. Climate change projections for Africa and the East African Region

During this century, temperatures in the African continent are likely to rise more quickly than in other land areas, particularly in more arid regions. Increases in average temperatures are very likely in the mid and late 21st century under both low and high emissions scenarios. Under a high emissions scenario, average temperatures will rise more than 2°C, the threshold set in current international agreements, over most of the continent by the mid-21st century. Average temperatures will rise more than 4°C across most areas by the late 21st century. Changes in average temperature are projected to be greater over northern and southern Africa and relatively smaller over central Africa. Under a low emissions scenario, average temperature rises across Africa are projected to be less than 2°C by both the mid and late 21st century.

In the eastern Africa region, projections for medium to high emissions scenarios indicate that maximum and minimum temperatures over equatorial East Africa will rise and that there will be warmer days compared to the baseline by the middle and end of this century. Climate models show warming in all four seasons over Ethiopia, which may result in more frequent heat waves.

Changes in precipitation: In terms of precipitation, changes in the global water cycle will not be uniform in response to warming in the 21st century. There will be contrast between areas of precipitation; wet and dry seasons will increase, even though there will be regional exceptions.

For African region, projections for rainfall are less certain than projections for temperature. Most areas of the African continent do not show changes in annual average rainfall under low-emissions scenarios. However, projections do show a very likely decrease in annual average rainfall over areas of southern Africa beginning in the mid-21st century, and expanding substantially by the late 21st century, under a high emissions scenario. In contrast, likely increases in annual average rainfall are projected over areas of central and eastern Africa beginning in the mid-21st century for the same high-emissions scenario.

In spite of the declining global rainfall trend observed, projections suggest that by the end of the 21st century, the climate in eastern Africa will be wetter, with more intense wet seasons and less severe droughts in October-November-December and March-April-May, a reversal of recent historical trends. Regional models suggest that most parts of Uganda, Kenya and South Sudan will be drier in August and September by the end of the 21st century. Projections indicate shorter spring rains in the mid-21st century for Ethiopia, Somalia, Tanzania and southern Kenya, and longer autumn rains in southern Kenya and Tanzania.

Projected extreme events: In the next two or three decades, the expected increase in climate extremes will probably be relatively small compared to the normal year to year variations in such extremes. However, as climate change impacts become more dramatic, their effect on a range of climate extremes in Africa, including heavy rainfall, heat waves and drought, will become increasingly important and will play a more significant role in disaster impacts.

The IPCC's Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX, 2012) indicates that there will likely be more heavy rainfall over the eastern African region with high certainty and more extremely wet days by the mid-21st century. There will also likely be an increase in the frequency of hot days in the future, although a decreasing dryness trend over large areas is also projected in the region.

2.2.3. Climate change projections for Uganda

Global climate models (GCMs) to simulate Uganda's future climate. Three major climate change projection namely DEWPoint (2012)⁵, USAID (2013)⁶ and CDKN (2014)⁷ have been completed. The CDKN study in particular has used the IPCC AR5 projections with a grid box distribution of 14 x 14 = 196 over Uganda.

The studies are in agreement that projected annual rainfall totals are expected to differ little from what is presently experienced, with projected changes within a range of less than plus or minus 10% from present rainfall. However, less rainfall is expected to occur over most of Uganda, with slightly wetter conditions over the west and north-west. Rainfall totals might drop significantly over Lake Victoria (where Kampala city is situated) - 20% from present. What is significant on a seasonal time scale is the projected increase in seasonal rainfall for the DJF season (up to 100% from present), which is indicative of a longer wet season that extends from SON towards DJF.

Projected near-surface temperatures are in the order of +2°C in 50 years from present, and in the order of +2.5°C in 80 years from present. Temperatures are expected to rise more during the MAM and JJA seasons in comparison to the DJF and MAM seasons. A lower temperature increase of about 1°C is expected for Lake Victoria.

Under the more extreme climate change (RCP8.5), projected annual rainfall total changes are very similar to that of the RCP4.5 projections, and therefore still close to what is currently observed. On a seasonal time scale the MAM and JJA seasons might expect slightly less rainfall, while the percentage increase in DJF rainfall, as in the RCP4.5 projections, is again very significant. A similar drop (-20%) over Lake Victoria is projected.

Projected near-surface temperatures are in the order of +3°C in 50 years from present, and in the order of +5°C in 80 years from present. Seasonal temperatures are expected to increase between +2°C and +3°C for DJF, MAM and JJA in 50 years from present, with a slightly lower increase for SON. In 80 years from present, temperatures might rise as much as +5.5°C during the JJA season (currently the coolest season), while increases of between +4°C and +5°C are expected for the seasons DJF, MAM and SON. Smaller changes are expected over Lake Victoria. Table 2 gives a summary of those results.

⁵ DEWPoint. (2012) Support to the Strategic Programme Review for Climate Change in Uganda: Understanding the implications and appraising the response. Update to 2008 LTS Scoping Study.

⁶ USAID, 2013. Uganda climate change vulnerability assessment report. African and Latin American resilience to climate change project.

⁷ CDKN and Ministry of Water and Environment. (2014) Regional-scale Climate Change Projections of Annual, Seasonal and Monthly Near-Surface Temperatures and Rainfall in Uganda. A draft report as part of the outputs of the Economic Assessment of the Impacts of Climate Change in Uganda

Table 2: Temperature and Rainfall projections under RCP 4.5 and RCP 8.5 for Uganda.

Parameter	RCP 4.5	RCP 8.5
Annual temperature changes from the median	In +50 years to present: +1.5°C to +2°C in most continental parts of Uganda In +80 years from present: +2°C to +2.5°C in most of Uganda.	In +50 years to present: +2°C to +3°C in most continental parts of Uganda In +80 years from present: +4°C to +5°C in most of Uganda.
Annual rainfall changes from the median	In both +50 and +80 years: -5 mm (mostly in the northern half) to -10mm per month (mostly in the southern half). Up to -70mm per month over lake Victoria.	In both +50 and +80 years: -10mm to -20mm (mostly in the northern half) to -30mm per month (mostly in the south). Over -100mm per month over lake Victoria.

The decrease in rainfall in most of Uganda, combined with a significantly wetter DFJ season, will result in significantly drier conditions for the rest of the year (longer wet season that extends from SON towards DJF). This is to combine with significant temperature increases, especially during the MAM and JJA seasons.

Overall, those changes will require a number of adaptation strategies. A significant drop of total rainfall over Lake Victoria (-20% from present), combined with about 1°C temperature increase will impact the lake water level. The increased warming, with high average air temperatures, will most likely amplify water stress and increase the impact of water shortages. Warming temperatures are likely to adversely affect agriculture production, which is an important economic activity for Uganda.

2.2.4. Climate change projections for Kampala

However, the analysis of climate projections for Kampala city has limitations in that not many climate assessment has been done at the city spatial scale. For example, the UN-Habitat's (2010) climate change assessment of the city, and the UN-HABITAT (2013) study for flooding or the city's physical development plan (2012) did not use detailed projections for the city. A Climate and Development Knowledge Network (CDKN) supported study on the economic assessment of the impact of climate change in Uganda conducted a climate change scenarios for Kampala city in 2014-2015.

The study produced downscaled projections⁸ for Kampala. It provides future (2006 to 2095: 90 years) climate model simulated projections for rainfall and near-surface temperatures, under conditions of a medium-to-low CO₂ Representative Concentration Pathway (RCP 4.5) and a high CO₂ Representative Concentration Pathway (RCP 8.5). The Representative Concentration Pathways show the potential cumulative measure of anthropogenic emissions of greenhouse gases, which are used by the IPCC's AR5. RCP4.5 shows a moderate level of mitigation of greenhouse gases, resulting in some shifts in climate patterns globally, while under RCP8.5 far less mitigation takes place, resulting in much stronger changes in climate globally.⁹

⁸Downscaled projections means that global scale projections were used to produce projections at the local scale i.e. Kampala.

⁹ See e.g. http://sedac.ipcc-data.org/ddc/ar5_scenario_process/RCPs.html for an overview of the four RCPs.

Given that extended range observational station data was not available for this projection, as an alternative, estimated and reanalysed data was considered for observations. For rainfall, monthly total data was downloaded from the Global Precipitation Climatology Centre (GPCC) provided by NOAA/OAR/ESRL PSD, Boulder, Colorado, USA, for the period 1951 to 2005 (55 years). For near-surface temperature, monthly averaged data was downloaded from the European Centre for Medium-range Weather Forecast (ECMWF) Reanalysis (ERA-Interim) for the period 1979 to 2005 (27 years).

The projected climate for Kampala city is as follows:

Temperatures

Under RCP 4.5, the simulation exercise predicts near-surface temperatures to increase approximately 1.5 °C by the end of the century (2095). As can be observed in Figure 5, the 12-month average could be higher in some periods, for instance around 2080; and the average near-surface temperatures in some months could go as high as 23°C.

Under RCP 8.5, the simulation exercise predicts near surface temperatures to increase approximately 3°C by the end of the century (2095). As can be observed in Figure 6, the 12-month average could be higher in some periods, for instance around 2070; and the average near-surface temperatures in some months could go as high as 24°C.

Rainfall

Under RCP 4.5, the simulation exercise predicts annual rainfall not to change significantly along the century, with a small decline in the annual rainfall average of approximately 20 mm over a 12 month running mean. The prediction does not change significantly under RCP 8.5: the simulation exercise predicts as well a small decline in the annual rainfall average of approximately 20mm over a 12-month running mean¹⁰.

There are hardly any robust projections regarding the frequency and intensity of heavy rains. However, registers and literature suggest that they have been increasing and will increase with climate change. In any case, as noted above, Kampala's rainstorms typically are violent and happen suddenly, both during and outside of the two wet seasons.

¹⁰It is important to note that these projections for annual rainfall are based on the most recent work by the IPCC, that is, IPCC AR5, and that they are in agreement with most of the projections produced before (United Kingdom Department for International Development –DFID; United States Agency for International Development -USAID) based on IPCC AR4. The annual rainfall projections provided here differ, in contrast, with the German Climate Fact Sheet, which was based on IPCC AR4, and is not in line with the projections of DFID and USAID.

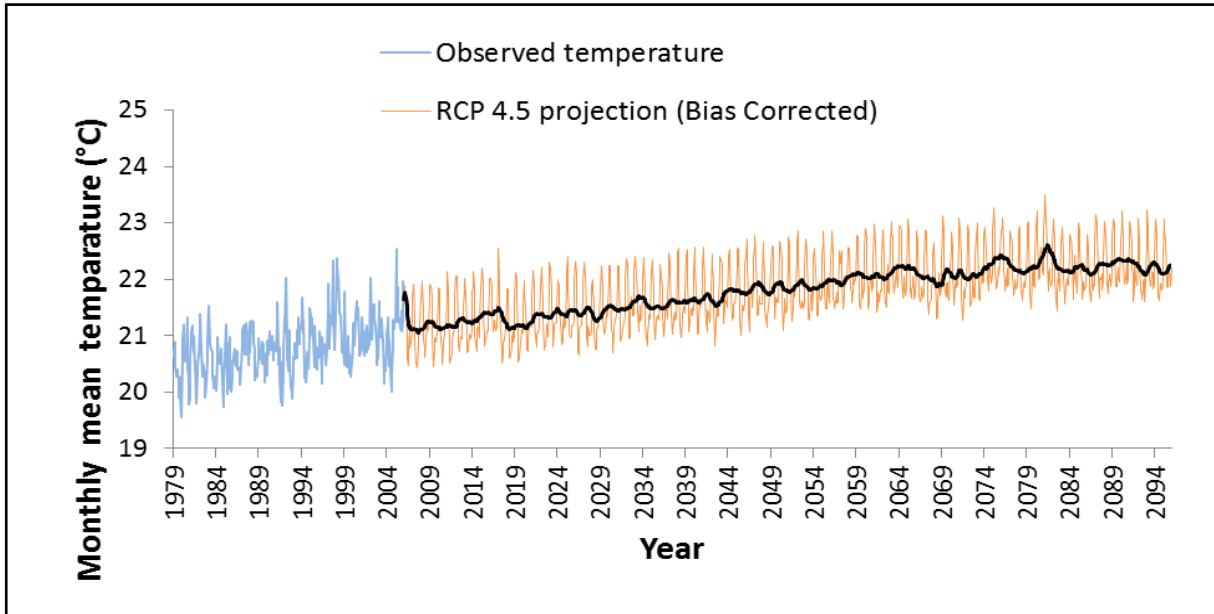


Figure 5: Kampala domain area averaged observed ERA-Interim reanalysis (blue) monthly near-surface temperature averages (°C) with bias corrected CCLM 4.8 RCM near-surface temperature projections (orange), under conditions of the RCM 4.5 pathway. The black lines represent 12-month running averages (Source: Rautenbach, 2014)¹¹

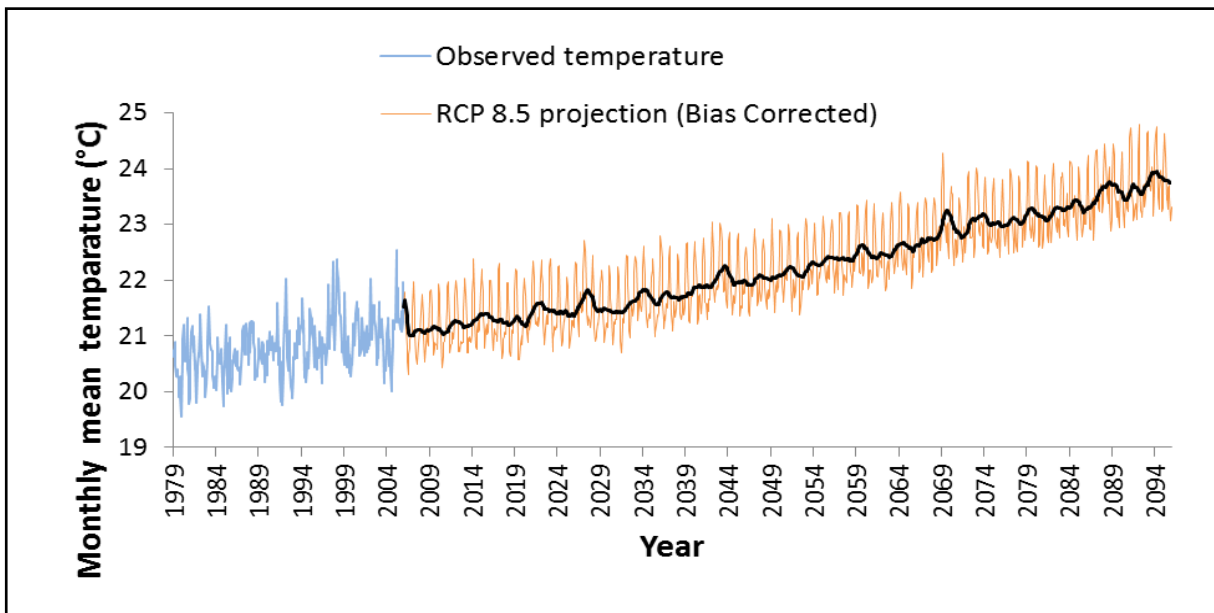


Figure 6: Kampala domain area averaged observed ERA-Interim reanalysis (blue) monthly near-surface temperature averages (°C) with bias corrected CCLM 4.8 RCM near-surface temperature projections (orange), under conditions of the RCM 8.5 pathway. The black lines represent 12-month running averages (Source: Rautenbach, 2014)¹²

The climate projections for Kampala are summarized in Table 3 below **Erreur ! Source du renvoi introuvable.**

¹¹ Rautenbach, H., (2104). Dynamical and statistical downscaling of climate change projections for Kampala, Uganda.

¹² ibid

Table 3 - Near-surface and precipitation projections under RCP 4.5 and RCP 8.5 for Kampala 2006-2095. Summary.

Parameter	RCP 4.5	RCP 8.5
Monthly totals of rainfall (mm) – bias corrected	The projected 12-month running mean shows a decrease of approximately 20mm over the period 2006 to 2095.	The projected 12-month running mean shows a decrease of approximately 20mm over the period 2006 to 2095. This is very similar to the RCP 4.5 projection.
Monthly averages of near-surface temperature (°C) – bias corrected	The projected 12-month running mean shows an increase of approximately 1.5°C over the period 2006 to 2095	The projected 12-month running mean shows an increase of approximately 3.0°C over the period 2006 to 2095

Source: Rautenbach (2014)

Table 5: Summary of Projected Climate

	Temperature	Precipitation	Extreme weather events
Global	<ul style="list-style-type: none"> Average temperature on the surface will increase by 0.3 to + 4.8 ° C by the end of the 21st century 	<ul style="list-style-type: none"> No uniform change in global water cycle Increase contrast in areas precipitation; increase in wet and dry seasons 	<ul style="list-style-type: none"> Continued ocean warming and acidification decrease the thickness of the ice Accelerated rise in sea level: 26-82 cm by 2100
Africa/ Eastern Africa	<ul style="list-style-type: none"> Africa's surface temperatures are likely to increase up to 2-4°C by the end of the 21st century. Eastern Africa have experienced a significant increase in temperature since the early 1980s. 	<ul style="list-style-type: none"> No significant change in annual rainfall over Africa, but seasons are likely to change. In Eastern Africa, rainfall is likely to increase: increase in wet seasons and decrease in dry seasons 	<ul style="list-style-type: none"> Increase in the magnitude and frequency of droughts and floods.
Uganda	<ul style="list-style-type: none"> Average temperatures +2°C to +5°C by the end of the 21st century 	<ul style="list-style-type: none"> 10mm to -20mm (mostly in the northern half) to - 30mm per month (mostly in the south). Over - 100mm per month over Lake Victoria. 	<ul style="list-style-type: none"> The magnitude and frequency of droughts and floods will increased.
Kampala city	<ul style="list-style-type: none"> Near-surface temperatures + 1.5 - 3°C by the end of the 21st century 	<ul style="list-style-type: none"> A decrease of approximately 20mm 	<ul style="list-style-type: none"> Increased in frequency and magnitude of heavy rainfall and floods, droughts

3. Climate change vulnerabilities for Kampala

To improve the knowledge and awareness of climate change in the Kampala city region as well the appropriate adaptation actions to the impacts of climate change, it is necessary to have a better knowledge on climate change risks and hazards as well as the vulnerabilities specific to Kampala's territory. These are also very instrumental to improve the reliability of the climate projections and climate early warning and disaster preparedness systems.

3.1. Overview

The most significant climate change impact on Kampala city comes from increased precipitation that leads to flooding. The UN Desinventar database indicates that in the period 1993-2014 there were 11 flooding events in the city. It was also found out that severe flooding in many areas along the primary channel in the Lubigi catchment with depths of up to 2 metres and durations of more than 24 hours occur quite often¹³.

The urban poor settlements such as Bwaise, Kinawataka, Natete, Ndeeba, Katwe are prone to increased flush floods that destroy infrastructure of roads, culverts, drainage systems, houses and water supply.¹⁴ **This exposes infrastructure, livelihoods and housing to severe impacts of destruction, damage, dampness and health challenges** for example cholera. In addition, most of the slum dwellers in Kampala do not have access to running water; their main source of water is natural springs.

During flooding, most of these water sources get contaminated due to the poor sanitary conditions, thus putting the lives of these poor communities in danger. This reduces water availability.

The first driver of flooding is related with land use. The development of housing on hill tops results in clearing of natural vegetation. This reduces infiltration of rainfall and increases runoff. On the other hand, it is associated with exposure, that is, the location of human settlements in wetlands. The encroachment of low-lying valleys and wetlands not only increases exposure, but increases as well vulnerability, as it reduces their capacity to capture, store and dissipate surface water run off.

The encroachment of the wetlands has left no room for storm water to drain, reducing its absorption capacity and increasing run off. In addition, it has contributed to the silting of Lake Victoria through Nakivubo channel and its tributaries and the loss of carbon sinks.

At city level, UN-Habitat study found that the number and size of buildings increased in all the divisions of the city in the period 2004-2010: in total the building roof area increased by 262% in the period¹⁵ contributing to the imperviousness of the land surface and, therefore, to runoff and a higher risk of flash flooding.

¹³ Sliuzas, Richard; Flacke, Johannes; and Victor Jetten(2013) Modelling urbanization and flooding in Kampala, Uganda. University of Twente.

¹⁴ Lwasa S, Mabiriizi F et al.: Assessment of Urban Vulnerabilities to Climate Change in Uganda. Nairobi: United Human Settlements Programme; 2009: 67.

¹⁵ UN-Habitat., (2013) Flood risk assessment, strategies and actions for improving flood risk management in Kampala. Kampala, Uganda.

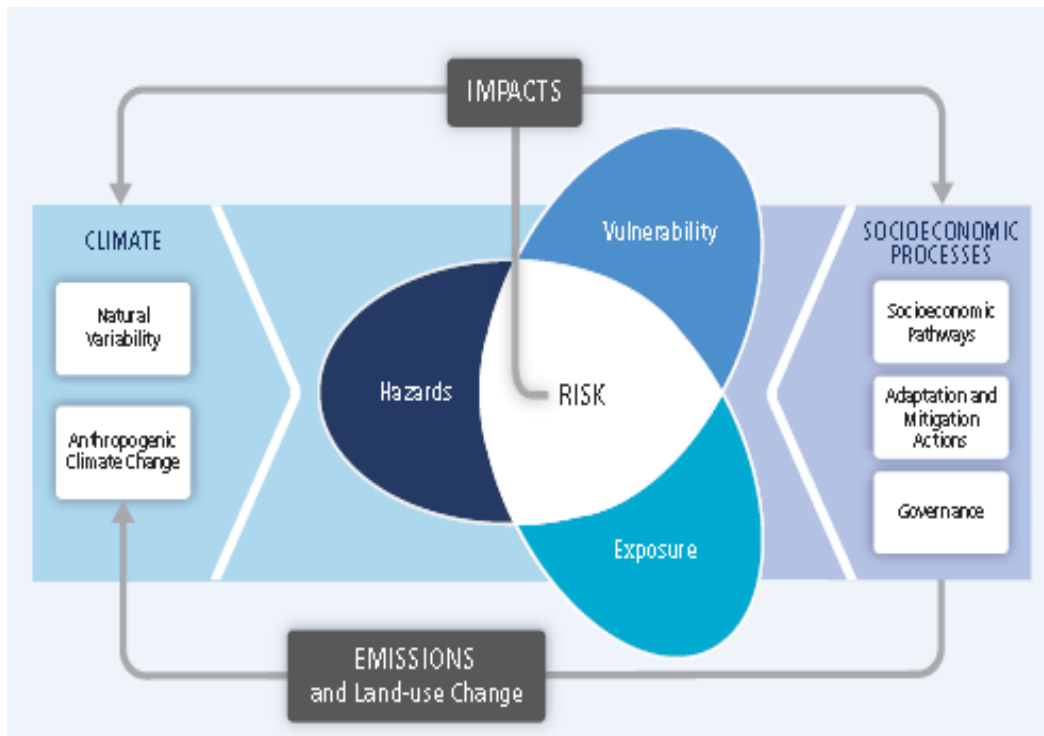


Figure 7: Illustration of the core concepts, IPCC Climate Change 2014

The second driver of vulnerability to heavy rains is insufficient, poorly design and poorly maintained urban infrastructure mores especially the drainage systems. The frequent and high intensity tropical rain storms generate extremely high run-off that quickly exceeds the capacity of the urban storm water drainage system. Moreover, the urban infrastructure is typically poorly designed. For example the existing drainage system has insufficient capacity to drain heavy rainstorm events. Some culverts, as those underneath the Northern Bypass, are insufficiently dimensioned, and the primary drain is relatively narrow and shallow. The urban drainage infrastructure is poorly maintained. The absence of regular desilting makes make the drainage system inefficient with accumulation of sediment and rubbish. More often the drainage channels are full of solid waste critically contributed to flooding in.

Poor solid waste management and garbage dumping practices also contribute to flooding. Currently solid waste collection, recycling and disposal systems are very weak in the city, with inadequate logistics, unauthorised dumping, burning of waste, and inadequate landfill, and no composting facilities perspective. Solid waste is disposed everywhere. When rain comes, it accumulates in the area (as a low-lying area) and cannot be carried away because the narrow channels are blocked with solid waste

Regarding droughts, vulnerability is also significant. First, the city has not identified and developed alternative water supply sources to Lake Victoria, such as, for instance, water harvesting systems, and the extension of the pipes into the lake seems to be limited. Secondly, the main source of electricity for the city in hydro and droughts could reduce water that could affect energy supply. The current power system is very exposed to the effects of climate change and the city has not promoted alternative forms of generating electricity, particularly renewable ones, such as solar panels.

3.2. Dimensions of vulnerabilities and adaptation to climate change for Kampala city

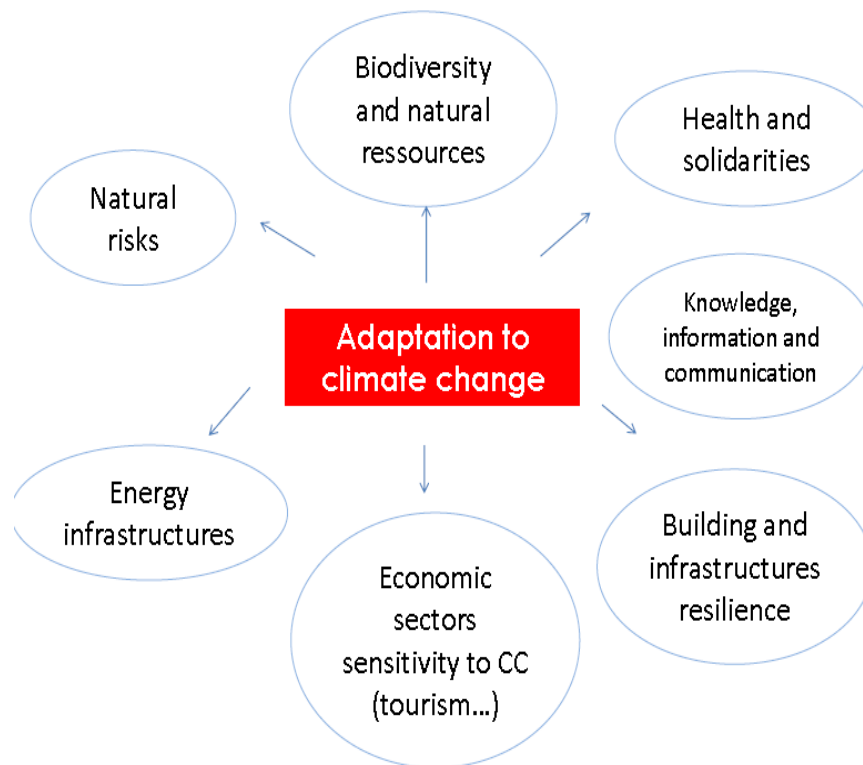


Figure 8: Dimensions of adaptation to climate change in the LCDCCR Strategy

3.2.1. Energy

Energy is at the core of economic and social development, and electricity is one of the basic needs of modern living. The great part of the activities, whether technical, personal or professional, use energy to be achieved. The Uganda Vision 2040 recognizes that energy, and in particular electricity, is a driver of socio-economic transformation of the country. The GoU's policy vision for renewable energy is to make modern renewable energy a substantial part of the national energy consumption. The overall policy goal is to increase the use of modern renewable energy to 61 percent of the total energy consumption in Uganda by 2017.

Energy is also a core issue of the KCCA Strategy. For economic development, the availability and reliability of electricity supply is a strategic for making Kampala an attractive and productive City. In Uganda, however, energy issues are centralized at national level and thus energy services are not operated by KCCA. This implies that all the energy consumed in Kampala city is produced and controlled outside the KCCA's jurisdiction. However, since the Authority lies between the national institutions and the citizens, any impacts of energy on the daily life of inhabitants, affects the activity of the authority even its image.

In Kampala city, the greatest demand for energy is for residential use, with a combination of electricity, wood fuel (charcoal and firewood) and petroleum products used for various domestic activities. Residential demand is followed by commercial and industrial demand¹⁶. While electricity is generated in Uganda, fuel (petroleum) is imported from outside Uganda.

¹⁶ UN Habitat, (2009). Climate Change assessment for Kampala, Uganda - a summary.

Energy demand forecasts for the period 1994-2010 show that petroleum demand rose at an average annual rate of 6 to 8 percent in relation to importation of vehicles¹⁷.

For the households, there is a significant dependency on wood fuel in Kampala city which has implications on deforestation, land degradation and CO₂ emission. Kampala is thus both a contributor to climate change processes and vulnerable to the effects of accumulation in the atmosphere. Such energy consumption has indirect impacts on human health.

In addition there has been an increase in energy demand and a deficit in electricity generation. There is also an increase in demand for diesel run generators as a backup system in the wake of failure of the national hydropower generating system to provide reliable energy. In Kampala city there has been a surge in usage of diesel for power generation which has implication is an increase in CO₂ emissions. Moreover, the high use of fossil fuels and the absence of a structured sector in the fields of energy efficiency services is not cost-efficient. It is also important to consider that energy gives access to information and communication economy which is very important.

The main climate change vulnerability is that the consequences of climate change impacts affect the energy supply chain. The increased intensity and frequency of severe weather events such as heavy rainfall storms and resultant floods affect energy infrastructure - by causing injuries to power plants, transmission lines and power lines in and around the city. These weather-related supply disruptions result in power cuts and higher energy prices. For example the power station on Mukwano Road area is frequently affected by flooding. The flooding resulting from severe storms and rains makes rail and road transportation inaccessible and also result in deterioration of critical bridges. The disruption of rail and road transport indirectly affects energy supply, as fuel is typically brought to the city by train from the coast and distributed by trucks.

“According to the Ministry of Energy and Mineral Development (MEMD), floods have often resulted as well in the disruption of the energy distribution networks. UN-HABITAT (2010) affirms that “the increased intensity and frequency of severe weather events impacts on energy infrastructure, by causing destruction of, for instance, power plants, transmission lines and power lines in and around the city [...] The disruption of rail and road transport indirectly affects energy supply, as fuel is typically brought to the city and distributed around it through these infrastructures¹⁸”. CDKN

Climate variability has also affected water availability whose impacts have been felt through significantly decreased water table levels in Lake Victoria. The lake is a key natural resource for energy generation (see Figures 8 and 9.),

¹⁷ ESMAP (1996), Uganda Energy Assessment ESM Report No. 193/96 Energy Sector Management Assistance Programme World Bank Washington DC

¹⁸ Economic Assessment of the impacts of climate change in Uganda – Case study 1 : Kampala

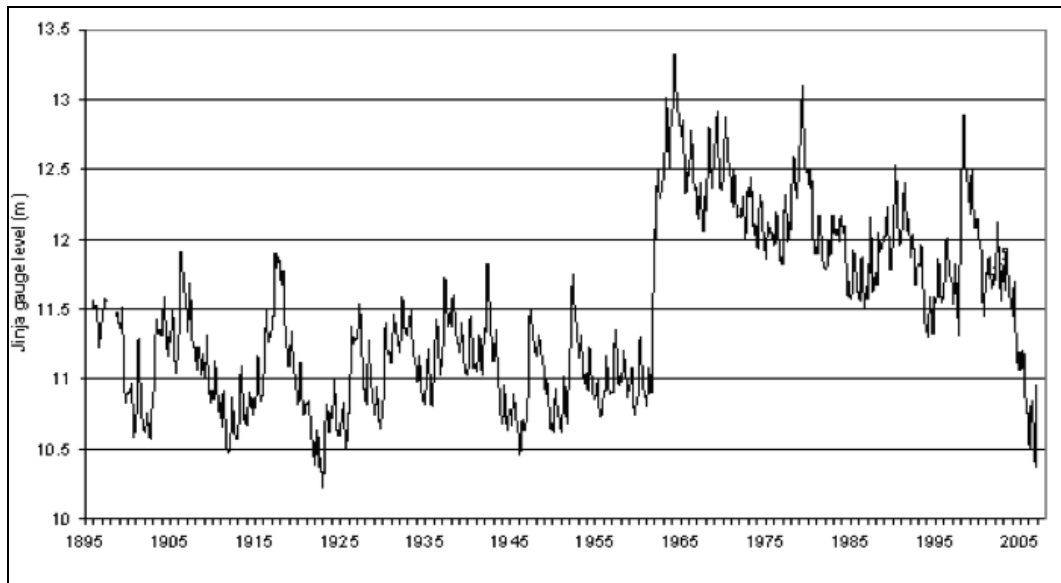


Figure 8: Observed water levels of Lake Victoria. 1895-2007¹⁹

Therefore there is need for adaptation of the key energy consumption sectors including buildings, residences, industry and the urban transport system to climate change. Both adaptation and mitigation measures are important to support continued economic growth by going greener in energy use. Renewable energy sources are available in Kampala city and provide an opportunity to turn a constraint into an asset. KCCA can even be an energy producer on its own building and facilities. The Authority can also develop, with public and private sectors, important local production installations from renewables.

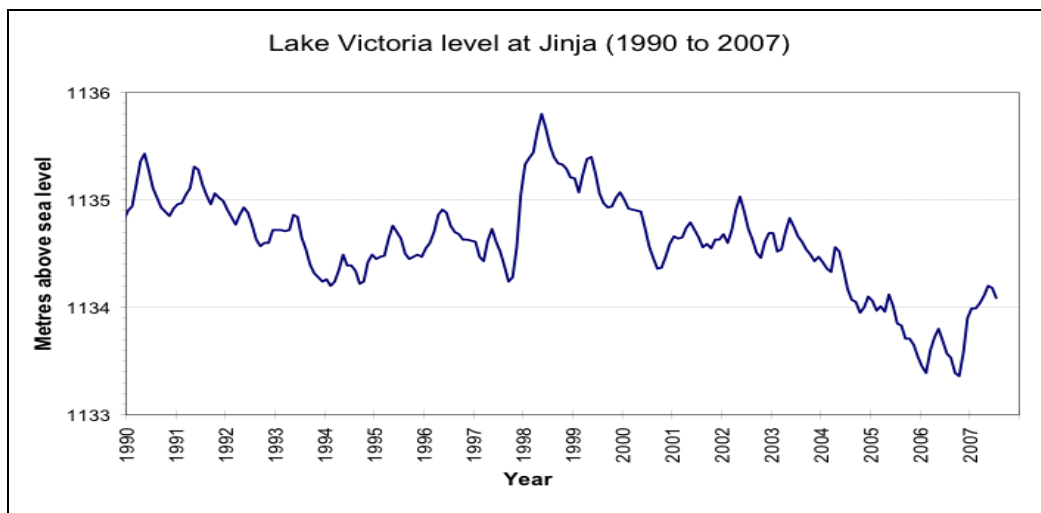


Figure 9: Lake Victoria levels at Jinja 1990-2007²⁰

“Energy supply in Uganda is dominated by traditional biomass, with electricity and other fuels playing a very small role. The current balance between supply and demand for biomass, however, is very fragile and predictions are that there will be a huge deficit of biomass in the

¹⁹ Tindimugaya (2014) Uganda's national security and the future of Lake Victoria

²⁰ Tindimugaya (2014) Uganda's national security and the future of Lake Victoria

2020s and beyond. The report concludes that a Business as Usual scenario for growth in biomass demand is not sustainable and a solution is needed to address the predicted deficit. Secondly, there is a possibility that hydropower potential will decrease due to a reduction in precipitation. Droughts have been particularly problematic at this regard. Although this affected dramatically the livelihoods of people through the country, it was particularly severely felt in Kampala, which concentrates the economic activity and, accordingly, the energy demand"²¹- CDKN

KCCA can significantly support energy efficiency and renewable energy generation and use in building and housing sectors through its responsibilities in the fields of physical planning, land use, construction/rehabilitation authorizations. For example, KCCA can suggest or impose the use of renewables or a minimum of building energy efficiency for the projects submitted to it for approval. KCCA can also re-define in the City Physical planning documents some areas where energy performance criteria are required. As for transport, it is important to consider energy networks as a structural issue in the development of the City. The integration of energy performance, production and networks has to be integrated into the City development planning. This is why Smart cities today are developing Municipal Energy Planning. These measures support both adaptation and mitigation and build climate resilient and energy secure city.

3.2.2. Built up environment



Urban growth and expansion is a major problem in Kampala.

The city is characterized by high density housing though this is not evenly distributed. Lower and middle-income neighborhoods have high densities compared to high-income neighborhoods. The poor live in the high density neighborhoods that are largely informal and most of them are slums. The slums are mainly in high flood risk locations within the city and lack the requisite infrastructure and services to withstand the effects of climate change. 40% of the population lives in unplanned, densely populated

*informal settlements that lack basic provision of water, storm drainage, sewage treatment and solid waste collection*²².

Climate change heightens vulnerability of poor and marginalized groups in slums/informal settlements who are among the most exposed to disaster risk. The UN Desinventar database registers the destruction of 123 homes (9 per year) in Kampala due to flooding from 1993 to 2014. This is particularly problematic in slums, where the buildings are often in or around wetlands, and the construction is poor. In Bwaise and Busega area, the destruction of perimeter walls and housing has been registered is a common phenomenon when heavy rains come. When this happens, households typically find accommodation with friends, while they save money to rebuild their houses. The time it takes them to find this money depends on income, but is in general relatively short: more or less one month.

The second main issue concerns the absence of **buildings/facilities construction and renovation standards** at national and local levels that could address energy and climate issues. This is combined with the loss or the lack of knowledge of **bioclimatic principles** in the

²¹ Economic assessment of the impacts of climate change in Uganda – National Level Assessment

²² Promoting Green Urban Development in African Cities, Kampala Uganda, Work Bank 2015

design of the projects. Such principles help to consider the environment and the natural components around the future building instead of considering the building solely. At the plot level, it is possible to recover rainwater, to produce energy, to treat a part of the waste, to reduce soil artificiality, to use nature (vegetal) as a component of the thermal regulation of the building and as a noise prevention component, to facilitate eco-mobility, to treat or pre-treat a part of the wastewater, to use eco-materials.

Modern buildings, for tertiary activities but also for tourism, are not considering the current and the forthcoming climate conditions. They favour for instance large or full coverage by windows and then imply the use of air conditioning systems to compensate the natural heat supply by the sun exposure. If we "can" consider AC like an immediate adaptation measure for the existing building, the solution can be avoided in the new construction. AC is emitting GhG like CO₂ because of the energy consumptions but also hydrofluorocarbon (from refrigeration system) which is thousands of times worse than CO₂ because of its global warming potential.

There is a lot to do from City level (landscape policy) to the plot level (standards, eco-neighbourhood) to reduce the urban sprawl and to improve the design, the ways of construction and the resilience of the buildings. This can be achieved through a strong cooperation with national authorities.

3.2.3. Mobility

Transport is a major issue for the city's economic development. Ideally, urban centres should have high population densities with a mix of residential and commercial buildings connected through high speed transport systems. However Kampala city has spread without adequate controls and the danger is that public transport to the extended areas is inadequate, necessitating almost exclusive reliance on motor vehicles. In addition, the centralization of economic activities in Kampala involves many transport streams in the city from greater Greater Kampala and the whole country.

Currently, the main transport challenges in Kampala city are accessibility and connectivity. There are a few roads and routes as well as limited options for transportation. The limited roads lead to a problem of poor connectivity between neighborhoods and across the city. The challenge of connectivity in Kampala is manifest in time of travel from different parts of the city to others as well as costs of travel and cost of maintenance. For example in a study by Ministry of Works and Transport within Kampala, Ggaba route had the highest travel time of 3.1 minutes/km while Entebbe had the least of 1.7 minutes/km. The absence of a public transport system has led to an increase motor vehicles and with the increase in travel time is increasing GHG emissions.

Kampala's transport is considerably exposed and affected by flooding. In particular, flooding affects the safety, efficiency, cost effectiveness and punctuality of transport. The roads and bridges, the railway line and the navigation infrastructure are strongly impacted by flooding²³. Extreme rainfall events and floods often lead to short term breakdowns and sometimes cause permanent damage on road infrastructure. During storms, roads have also been blocked by fallen trees, and buildings and vehicles during intense storms. In addition, storms and floods damage supplementary infrastructure, such as street lighting, flyovers and traffic signs. The railway lines and Lake Victoria's navigation infrastructure are also vulnerable. The latter is particularly vulnerable to variations in water levels, due to the shallowness (less than 90 metres at its deepest) and low topographical gradients of the lake.

The disruption of transport has critical economic and social impacts. Whenever traffic is disrupted, people and goods are not able to move across the city properly. Given the

²³Note that the CRMAS report for the Transport Sector (2012) is based on interviews to up to 400 people in the country and does not clearly distinguish between potential and actual impacts. Although we have tried to include only actual impacts, it must be read with caution.

economic centrality of Kampala, the impacts of floods on the city's transport have far reaching economic and social consequences at country level.

According to the Climate Change Risk Management and Adaptation Strategy (CRMAS) for the transport sector (2012) and different government officials (OPM, MLHUD, MWE), transport is considerably affected by flooding. In particular, it affects safety, efficiency, cost effectiveness and punctuality of transport. According to this report, extreme rainfall events and floods¹ constitute the most negative potential climate change impact on the transport sector²⁴.

The recent EIA of a key transport infrastructure in the CBD (the most congested section of Kampala) found for instance that critical infrastructure of the city such as the roads around the Clock Tower, the Fire Brigade center and the ShopRite-Shall shopping center are significantly prone to flooding (UNRA 2014). According to CRMAS report for the transport sector (2012), transport represented 7% of GDP in 2009. According to Vermeiren et al. (2012), already at present many urban employees travel more than 3 hours a day.

3.2.4. Water resources and water management

“Because of the generally conducive climatic profile, the country is well endowed with fresh water resources that provide livelihood to over 40% of her population in form of fishing, transport, hydroelectric power as well as tourism. However, the recent events of the last few years have clearly shown that Uganda's climate is changing and that it is threatening the natural resource base thus adversely affecting Uganda's social and economic development” –Ministry of Water and Environment

Kampala is situated on the northern shores of Lake Victoria and the lake provides the city with water and electricity, but is also an important resource for fishing, tourism and transport.

Water is an important determinant of the health status of households. Like energy, water supply is managed at the KCCA level, but is managed at the national level, by the National Water and Sewerage Corporation (NWSC).

The exposure of water resources and water supply to the impacts of climate change are very related to droughts, floods, and storm water. For instance the availability of the water resource during heat waves or droughts and the quality of water depending on how the reservoirs can be affected (by floods, storms and even droughts).

Climate variability will very probably affect water availability in Kampala because most of Kampala's fresh water supply is drawn directly from Lake Victoria. For example, when Lake Victoria water level dropped (2004-2006), the water pipes could not pump water and water supply was restricted. The result has been that the only available and functional water treatment plant is operated below capacity. NWSC had to extend the pipelines deeper (210 meters) into the Lake spending € 6.5 million. The extension was also sought to get better quality raw water, given the high level of pollution of the water in the part of the Lake that is closer to the city. The costs of water treatment has increased water prices and this itself is health risk as many urban poor cannot afford the water prices. With the projected climate change and its impacts, the treatment plant and general water supply are at risk due to the falling lake levels.

“According to NWSC officials, floods in Kampala do not affect water and sanitation infrastructure directly [...] but have an indirect impact on NWSC's budget through water treatment. [...] Droughts affect Kampala in terms of domestic drinking water supply. CDKN

²⁴ Economic Assessment of the impacts of Climate Change in Uganda, Case Study 1 Kampala, CDKN

"The National Water and Sewer Corporation acknowledged that parts of Kampala such as Kyaliwajala, Kulambiro and most places on hilltops suffer from chronic water shortages. This could be amplified with climate change"

A vulnerability assessment of the impact of climate change on Uganda's water resources to climate change²⁵ posits that the predicted climate change is likely to affect the ratio of lake rainfall to evaporation. The predicted increase in temperatures combined with a reduction in rainfall in the Lake Victoria region, is likely to result in higher evaporation and declining lake levels.²⁶ The rate of urbanisation in Kampala, and the surrounding region, is very high at more than 5% per annum. The population, urban sprawl and urban economic activity implies that more water will be needed and water distribution networks could rise. Water supply needs energy and the vulnerability of the energy can also increase vulnerability of water supply.

The change in the rainfall patterns (cycle disruption, strength of storm water...) could lead to increase in the flow, turbidity level, the levels of organic contents, the levels of bacteria, virus and parasites, the discharge of pesticides into the lake and rivers, development of toxic algae, and compromising the quality of drinking water, or the quality of surface water, etc.

If the intensity and frequency of extreme events leading to flooding do not change, current annual damages of between US\$1.3 and US\$7.3 million in 2013 could rise to between US\$3.7 and US\$17.6 million by 2025 and between US\$33.2 million and US\$101.7 million by 2050. The increase is the result of a growing population and assets that are worth more. If the frequency of extreme events doubles by 2050 and increases linearly between 2013 and 2050, damages in 2025 would range from US\$5.6 to US\$26.3 million and in 2050 from US\$66.5 to US\$203.3 million.- CDKN²⁷

As part of adaptation, the protection and the monitoring of water bodies and of the sources are very important. Water resources must be protected from potential negative externality due to the urban sprawl and the rapid city demographic growth.

"In line with the assessment of the past and present impacts of flooding, the impacts of flooding in the future are likely to be more indirect, through increased cost to treat water, than direct, through the damage of the infrastructure"²⁸.CDKN

Reducing water leakages of pipelines or developing rainwater harvesting systems participate to the increase of the resilience of water resources.

National Water and Sewerage Corporation and the Uganda Police Force have launched a joint Water Loss Prevention Unit (WALOPU) to fight water theft and illegal water use in the Kampala Water supply area.

Water provision is complementary to sanitation. In Kampala city, only about 15% of the population is served with sewerage network connections. Sanitation is dominated by latrines which serve 74% of the population. The effects of climate change are already accentuating the problem of sanitation in the city because most settlements are in flood prone areas which have high water tables. During heavy rainfall and floods, the resultant overflow of human waste increases the population's vulnerability to poor health and already water borne diseases like cholera, typhoid and dysentery. These disease epidemics are reported to be increasing during periods of heavy rains. In the case of water stress, less water implies increased health risks of diseases related to dry conditions.

²⁵ Ministry of Water and Environment., (2009) Vulnerability Assessment of Ugandan Water Resources to Climate Change.

²⁶ Economic Assessment of the Impacts of Climate Change in Uganda, Kampala Case Study Draft Report. Ministry of Water and Environment, 2015. CDKN, Baastel supported study.

²⁷ Economic Assessment of the Impacts of Climate Change in Uganda, Kampala Case Study

²⁸ Economic Assessment of the impacts of climate change in Uganda – Case study 1 : Kampala

The 2012 Kampala Physical Development Plan (KPDP) 2012 plans to upgrade the water and sanitation systems. This will involve upgrading the water network supplying high-density residential (including slums) areas to ensure increased access to affordable clean and safe water. An additional 400,000 people will be connected through network densification, construction of around 3,000 public water points and yard taps with electronic pre-paid meters. This programme is vulnerable to the projected impacts of climate change especially droughts and falling water levels. The assessment of the past and present impacts of flooding indicate that the future impacts of flooding are likely to be more indirect, through increased water treatment costs and the damage of water supply infrastructure.

In order to cope with droughts and ensure that there is a sufficient and timely supply of clean water, KPDP plans to drastically reduce the physical losses of water, manage carefully the impact of hydroelectric generation in water levels at Lake Victoria and abstract water not only from Murchison Bay, but also from Katosi Bay. It also plans to institute mitigation measures when changing lake levels are a result of climate change, but no details are provided. However, it is also important to recognise that Lake Victoria is a regional asset and that, as such, its conditions depend on the climate conditions and the impacts of the climate change along the region, together with other development issues, from water demand to water pollution.

As already indicated, the quality of the water for drinking purposes is an additional concern related to climate change. Not only the pipes may have to be extended further and deeper into the Inner Murchison Bay, but rather moved outside it, to the greater Lake with higher costs. Moreover, the impacts of droughts in Kampala will also depend on water harvesting infrastructure, which could be independent from Lake Victoria, and help on dealing with floods. KCCA could look at this area as part of its physical development and development control. Several academic papers take this seriously into account like the ones by Fura (2013)²⁹ and UN-Habitat (2013)³⁰

KCCA secured funding FY 2014/2015 from the Lake Victoria Environment Management Project II (LVEMP II; through the Ministry of Water and Environment) to implement a project for "Reduction of environmental pollution and flood frequency in Kampala."

Uganda's Second National Communication to UNFCCC recommends different fields of action to be implemented with the support of local authorities and stakeholders:

- Sensitize the population on proper land use because the biggest contributing factor to reduced rainfall is attributed to human settlement and activity.
- Undertake a thorough ground water resources investigation/study in order to explore the option of exploiting ground water when the open water resources are not reliable, most especially in the dry seasons of the year.
- Uganda's biodiversity needs to be sustainably managed. This can be achieved through enforcement of regulations, with tough penalties for people who are involved in activities that affect biodiversity
- Improvement in the provision of biodiversity information through increased sensitization of communities on the dangers relating to poor land-use, including sensitization on LULUCF.
- Lobbying of development partners to increase on the support, most especially financial, which is required for the implementation of CC projects related to biodiversity
- Ensuring that thorough environmental impact assessments are conducted when planning for and introducing an activity that may affect the biodiversity.

²⁹ Fura, Gezehagn., (2013) Analysing and modelling urban land cover change for run-off modelling in Kampala, Uganda.

³⁰ UN-Habitat., (2013) Flood risk assessment, strategies and actions for improving flood risk management in Kampala. Kampala, Uganda.

3.2.5. Biodiversity and ecosystems



Healthy ecosystems, whether natural or modified, have a critical role to play through adaptation by reducing the risk of impacts from climate extremes and disasters on human society³¹. On the other hand, ecosystem degradation undermines the ecosystem protection function against natural hazards and disasters, including climate change related hazards and disasters. Moreover, climate change exacerbates ecosystem degradation which in turn triggers more humanitarian and environmental disasters and reduces nature and societies' security and resilience.

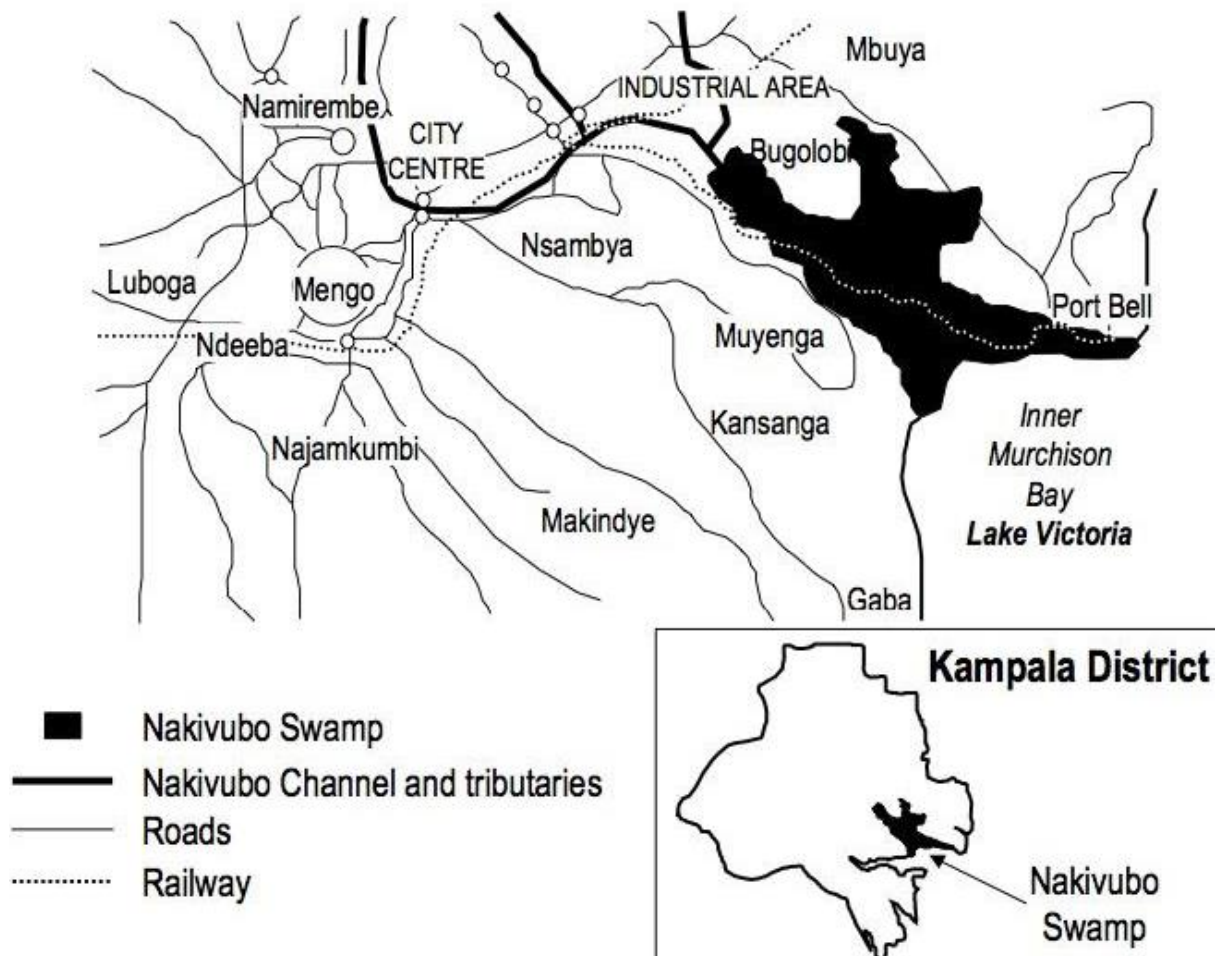
Climate has a strong influence on ecosystems, both terrestrial and aquatic. Many factors affect species directly or indirectly (concentration of atmospheric CO₂, temperature, precipitation, floods, droughts, etc.). Human activity can be an aggravating factor as it exerts pressure on water resources, wetland ecosystems. The large wetland resource in Uganda is explained by a climate factors (high rainfall) and the general topography of the country, making wetlands to be spread throughout the country.

Kampala has nine primary drainage channels and a number of secondary and tertiary channels with Nakivubo Channel as the largest wetland covering a surface area of 5.29 km², with a total catchment extending over 40 km². About 15% of Kampala city's surface area is either permanent or seasonal wetlands, a significant proportion of which has been converted to industries, commercial establishments, settlements (formal and informal) and public infrastructure. The current spatial analysis (based on the 2010 satellite image) indicates that the remaining patches of wetlands constitute approximately 9% of the total Kampala City surface area.

From 1989 to 2010, corresponding with explosive population growth, the area of developed land within the City increased from 27% to 78%³².

³¹Climate and Development Knowledge Network (CDKN). 2012. Managing Climate Extremes and Disasters for Ecosystems: Lessons from the IPCC SREX Report. www.cdkn.org/srex

³² ³² Promoting Green Urban Development in African Cities, Kampala Uganda, Work Bank 2015



Source: IUCN

The wetlands provide ecological services that supports small-scale income activities for slum dwellers such as papyrus harvesting, brick making, and fish farming. The wetlands also provides valuable wastewater purification and nutrient retention ecosystem services hence protecting Lake Victoria from pollution. In the past decade, the potential of the wetland to remove nutrients and pollutants has been greatly reduced due to continued pressure by human settlements, industrial establishments, and urban agriculture. For example, Bwaise, one of the densest settlements in Kampala city is partly located within Lubigi wetland. The Nakivubo wetland is another threatened component of the Lake Victoria catchment system. It has been encroached upon by informal settlements and industrial development. Parts of the wetland in Kinawataka, Banda and Kyambogo have been encroached on by settlements and industries.

The more the wetlands will be converted to other uses especially farming, the more the Greater Kampala is exposed to climate change impacts. Importantly also, climate change is one of the major causes of drying up of wetlands and result in reduced water tables giving way to change in land use such as cultivation and settlements. The IPCC AR5 indicates that by the end of the twenty first century, climate change may be the dominant direct driver of biodiversity loss and changes to ecosystem services globally and low-lying coasts, dry lands, mountains and river basins are the most vulnerable ecosystems. The observed recent changes in Uganda's climate, especially warmer temperatures and droughts already have significant impacts on biodiversity and ecosystems.

Despite the challenges faced arising from population growth and urbanization and their impact on wetland ecosystems, the protection of ecosystems and conservation of natural

heritage is a priority for KCCA. Indeed, the management of ecosystems is a priority in the Kampala Strategic Plan, much as it is a pillar for sustainable development in Uganda Vision 2040. The benefits of healthy ecosystems should place ecosystem services management at the heart of key policy decisions associated with climate change in Kampala city. With the projected impacts of climate change - the heat waves, droughts and floods - it is vital that essential ecosystem services are maintained in order to protect vulnerable societies. **The management of ecosystems for climate change adaptation and disaster risk reduction increases the resilience of ecosystems and secures their services.** By building resilience of natural and human systems, more ecosystem services can be used in a cost effective way to support adaptation and disaster risk reduction, so reducing impacts from climate-related disasters. KCCA should consider ecosystem based solutions for climate change mitigation, adaptation, and responses to weather and climatic extremes as an integral element of KCCA strategic, physical and development planning.

3.2.6. Health and air quality

Climate change has significant direct and indirect health implications for the Kampala region. The projected climate with rising temperatures will increase heat waves and droughts and also lead to growing variability of inter-annual rainfall, which is likely to result into heavy rainfall and increased rainfall during the dry season and flooding. These are likely to exacerbate diseases and other health-related factors as indicated below:

- Increased temperatures will **increase the speed of development and survival of the parasite and mosquito.** Increased rainfall is likely provide favourable breeding sites for mosquitoes and result in a higher burden of malaria. It has been observed in Kampala that since 1997 following the El Niño oscillations heavy rains are followed by an upsurge of malaria in Kampala³³.
- **Schistosomiasis**, a waterborne parasitic disease transmitted by snails, is a major health problem in Uganda, causing approximately 40,000 deaths per year. An estimated 8.5 million Ugandans were infected with the parasite in 2010. The projected climate change that are associated with flooding and increasing temperatures are likely to accelerate parasite transmission within the range of temperatures in which the host and parasite can live (approximately 20-30 °C)³⁴
- Flooding increase the prevalence and frequency of **outbreaks of waterborne diseases** such as cholera, dysentery, diarrhea and typhoid. In Kampala this can occur in areas with poor sanitation infrastructure (the slums) where flooding causes potable water and wastewaters to mix. The pit latrines, which are shallow due to the height of the water table in the flood plains where many Kampala residents live, overflow and human waste and faecal matter mix in the flood waters and flood into shallow wells used for drinking water. There have been numerous cholera and typhoid outbreaks in Kampala city in the recent past. Between 2003 and 2010, cholera outbreaks have occurred every year, particularly during the rainy seasons that have increased floods in the city.
- Flooding also affects the economic **livelihood of the people**, health, housing and accessibility of the neighbourhoods which have implications on the health of the population.
- During drought the population is predisposed to **meningitis epidemics and other diseases** caused by lack of water for adequate sanitation, such as eye and skin infections. Heat waves should also be a subject of concern, as increasing temperatures combine with the heat island effect associated with dense urban areas. It must be noted, in any case, that Kampala has a moderate climate, and as such heat waves have not been as strong as in other cities in Africa, but project rise in temperatures could increase its impact on health.

³³ **Lwasa, Shuaib (2010)** "Adapting urban areas in Africa to climate change: the case of Kampala". *Current opinion in environmental sustainability*, 2: 166-171.

³⁴ USAID., 2014. An overview of climate change and health in Uganda.

- Both floods and drought lead to crop failure, also leading to food insecurity and even **malnutrition**.

The predicted climate change exacerbates all the above scenarios, further worsening the environmental health of the city region's population.

There is need to develop climate early warning systems and put in place contingency plans for developing climate change-resilient health systems. KCCA is already leading many activities in term of public health. Some of them are well addressing some climate change related impacts but KCCA is missing the "whole picture" meaning that it is important to have a full and dedicated climate change entry into the overall health and risk policy of the Authority. That would also have the merit to reinforce the highly required need for raising awareness among the Authority services, stakeholders and population.

A parent health issue concerns the **air quality**. This impact is more related to the energy combustion (especially from firewood, charcoal and diesel) which emits particles in the air provoking respiratory illnesses for human beings such as allergies, sore throat, asthma, chronic bronchitis or pneumonia. An air quality and health resolution has been adopted in 2015 at the sixty-eighth World Health Organization Assembly. **"Air pollution is the largest single environmental risk and a leading cause of disease and death globally. It is a risk factor for ischemic heart disease, stroke, chronic obstructive pulmonary disease, asthma and cancer. Air pollution's negative effect on health brings an enormous economic burden. A new WHO report released 28 April 2015 reveals that in the WHO European Region alone a staggering US\$ 1.6 trillion is the economic cost of the approximate 600 000 premature deaths and of the diseases caused by air pollution in 2010"**³⁵.

In Kampala, there is no air quality monitoring system at the moment. This could be the first step to raise awareness. Regarding ICF inventory in 2009 – which has significant raised these last years – the table below gives an overview of the different air pollutants:

Table 7 Baseline Inventory of Emissions in Kampala (2009)

Source Type	Emissions (% of Total Pollutants)				
	PM ₁₀ (t/y)	PM _{2.5} (t/y)	NO _x (t/y)	SO _x (t/y)	Benzene (t/y)
Roadway Dust	14,686 (47.5%)	1,627 (10.0%)	-	-	-
Domestic Sources	15,587 (50.4%)	14,028 (86.5%)	2,676 (39.9%)	-	273 (30.9%)
Vehicle Sources	618 (2.0%)	556 (3.4%)	3,984 (59.3%)	1,747 (68.8%)	610 (69.1%)
Industrial Sources	10 (0.0%)	9 (0.1%)	55 (0.8%)	793 (31.2%)	-
Total (tpy)	30,901 (100.0%)	16,220 (100.0%)	6,715 (100.0%)	2,540 (100.0%)	883 (100.0%)

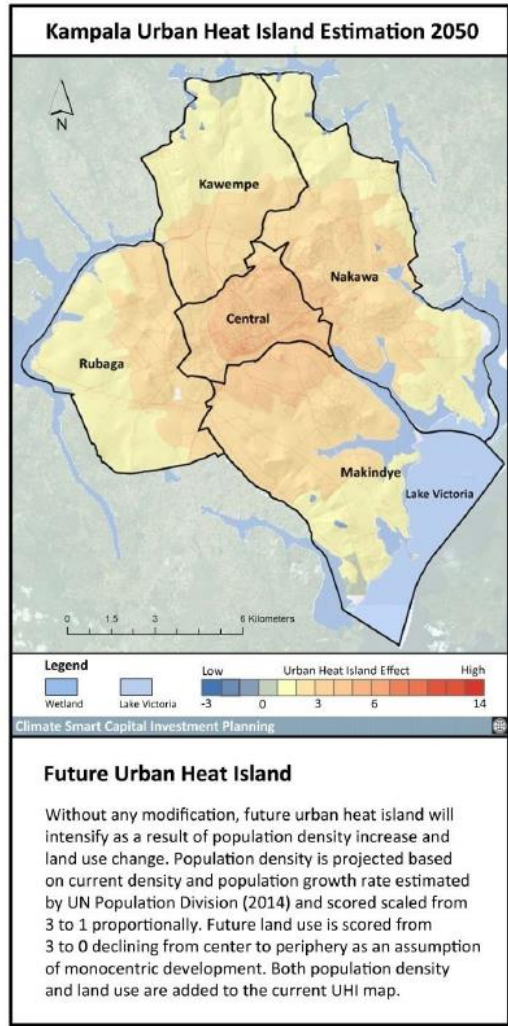
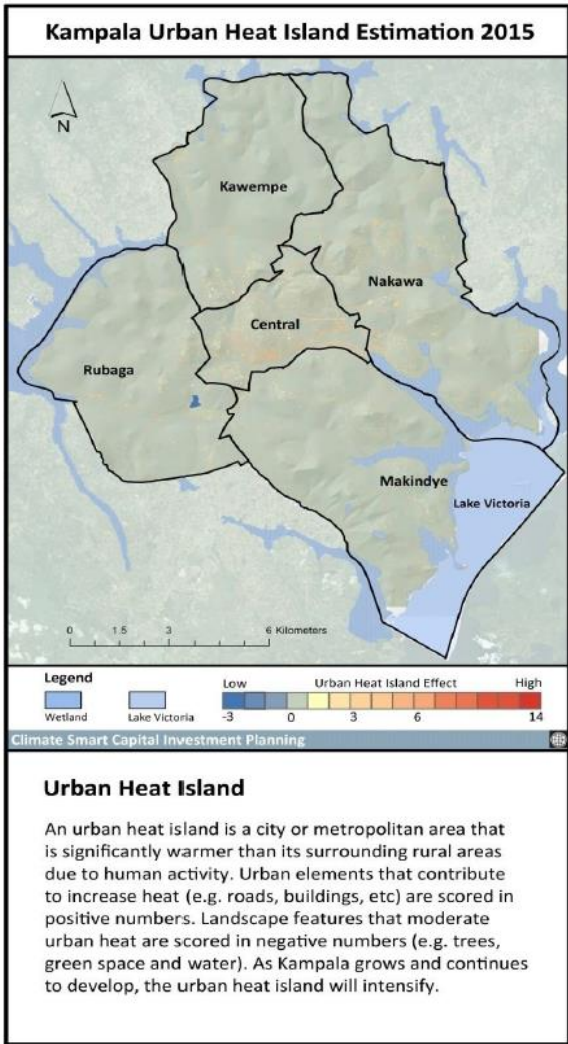
Source: ICF, 2009

According to the former ICF inventory, the main reason of air quality degradation is coming from households because of the open-air burning of waste, charcoal and firewood. Then transport is the second source of pollution due to the roadway dust and the very low performance of old cars (which a big part is imported from abroad without any control).

³⁵ "Health and the Environment : Addressing the health impact of air pollution"; http://apps.who.int/gb/ebwha/pdf_files/WHA68/A68_ACONF2Rev1-en.pdf

The very high development of boda-bodas year after year has significantly increased their impact on air quality. According to KCCA, they represent something like 40% of the vehicles' presence on the road for only 8% of passengers.

The World Health Organization in May 2015 has taken a specific resolution of air quality: *“Delegates at the World Health Assembly adopted a resolution to address the health impacts of air pollution – the world’s largest single environmental health risk. Every year 4.3 million deaths occur from exposure to indoor air pollution and 3.7 million deaths are attributable to outdoor air pollution. The resolution highlights the key role national health authorities need to play in raising awareness about the potential to save lives and reduce health costs, if air pollution is addressed effectively. It urges Member States to develop air quality monitoring systems and health registries to improve surveillance for all illnesses related to air pollution; promote clean cooking, heating and lighting technologies and fuels; and strengthen international transfer of expertise, technologies and scientific data in the field of air pollution.”*



Sou

3.2.7. Economic activities

The climate change vulnerabilities of an economy depend on the structure of the economy itself. Looking at the structure of the Ugandan economy, the sectors that are most exposed to climate change impacts are agriculture, forestry, tourism, fisheries, industry and trade. Kampala and Greater Kampala are also concerned for that matter because they concentrate (or influence) an important part of the national GDP. For sure, agriculture is not as important as in the rest of the country but indirectly, the city is exposed to food supply security.

Kampala is gifted with a tropical climate and is influenced by a "green and blue" geographical environment that helps to support different economic activities. However, this environment is very fragile and sensitive to climate change and (human) planning decision.

Heat waves, drought and floods can all affect the local economy of the city and region: declining of urban agriculture and forestry yields, loss of biodiversity, deterioration of working conditions in offices, health deterioration of the most vulnerable people, failure of infrastructure preventing movement of people and goods, loss of attractiveness of tourism destinations, deterioration of water quality, unavailability of appropriate trade areas, loss of time-money due to traffic jam, breakdown of energy supply...

Flooding is the worst enemy causing important congestion, physical damages and time-money loss. The exposure concerns the city network but also the metropolitan and the transit networks.

When Kampala's economy is affected by the impacts of climate change or otherwise, a big part of the national economy is affected but also if we consider Kampala as a road junction with neighbouring countries - South Sudan, Rwanda, Burundi and Eastern DRC), outside economies are also affected.

3.2.8. Agriculture

Agriculture is then a very important cross-cutting issue regarding health, environment and physical planning – especially in a growing city with a growing population and a high consumption of space like Kampala. In Kampala, food is produced from very small scale farming but demand is growing high and stock will reduce in the future

"Livestock productivity is very low and is adversely affected by climate and annual weather patterns. The various factors associated with climate change include extreme drought and floods that lead to death of animals due to severe reduction in quantity and quality of pastures, drinking water, increased disease and vector prevalence. The contribution that agriculture plays in poverty reduction and overall economic growth in Uganda is immense" – Ministry of Water & Environment.

Developing urban agriculture is strategic to create local employment, increase food security, reduce the sprawl of construction, improve infiltration of rainwater on land, and also reduce the GHG emissions associated with transportation food and raw material supplies from outside the city. KCCA and Government are leading a study on the valuation of biogas from farming. It is important to note that urban agriculture competes with other land uses and the future urban growth is likely to reduce the potential agricultural area because the land rent from urban farming is in general lower than the rent from other uses such as residential, industrial and recreational. Thus urban farming is threatened by displacement to the periphery, increasing the costs and even making it impossible to sell some perishable crops in the city³⁶ (Vermeiren et al., 2013).

³⁶ Vermeiren, K., et al., (2013) Will urban farming survive the growth of African cities? A case-study in Kampala, Uganda, *Land Use Policy*, 35: 40–49.

The vulnerability is that changes in rainfall associated with climate change will affect urban agriculture leading to an overall decline. The impacts of floods are likely affecting urban farming since some of it is carried out in drained wetlands. Kampala subsistence farmers produce staple crops such as matooke, cassava and potatoes; garden farmers grow staple crops, vegetables and fruits and keep in some cases domestic livestock; and commercial farmers grow staple crops, mushrooms and all kinds of vegetables i.e. production is quite diverse. In terms of food security, it is important to note as well that floods are likely to affect it also indirectly, through the disruption of transport of goods cultivated or produced elsewhere.

Through its competencies in terms of physical planning and economic development, KCCA can mobilized different levers to promote urban agriculture. Since climate change makes the weather less and less predictable, climate information systems to inform and sensitize farmers are necessary.

A portion of land at the agricultural resource center has been allocate to physical planning to setup a nursery for raising tree seedling to be planted in the city.

3.2.9. Trade and Industry

Uganda's industrial sector is the second largest sector after agriculture and about 80% of the country's industries are located in Kampala. We also need to recognize that knowing that agriculture produces raw material for agro-based industries (meat, fish, milk, coffee, grain milling, tea etc). Textiles, sawmilling, and chemical products are also part of the industrial sector. On the other hand, The Kampala Strategic Plan indicates that in Kampala City, **trade is the most important activity with 72% of the informal sector employment, manufacturing 23% and services 6%.**

Industrial activity is vulnerable to impacts of climate change. The raw materials used by the industry come from sectors highly exposed to climate change especially agriculture and fishing). Security of supply of the raw materials is an important stake as it is affected by extreme weather events - droughts and flood impacts of crop production, livestock production and on fisheries. In addition, floods and heavy storms affect road and rail infrastructure and this affects the movement of raw materials and manufactured products.

Industrial activities consume a lot of energy and so the high vulnerability of energy (supply chain and price) to the impacts of climate change also exposes industry to those impacts. About 5% of industry relies on wood for energy which has an impact on deforestation and carbon dioxide emission through combustion. The establishment of industrial sites is also a major issue in terms of impacts on the environment, exposure to climate risks (floods, fires, droughts) and impacts on road traffic. Industry has historically been located in wetlands. Between 1920 when spatial planning was first implemented in Kampala and 1994, industrial location policy involved gazettement of wetlands for industrial activity. This explains the existence of many industries in wetlands within the city region - Kyambongo, Ntinda, Industrial Area, Nalukologo (...) are all in wetlands - which are affected by flooding.

The trade sector is highly fragmented and scattered throughout the urban area. However some emerging commercial areas are located in flood prone areas - Bwaise, Ndeeba, Kalerwe, Nakulabye, Kasubi. This implies that the existing land use patterns are making much of Kampala vulnerable to the impacts of climate change. It is projected that the total number of people on steep slopes and flood-prone areas in Kampala could double by 2020 and even triple by 2030 if the present trends continue³⁷.

³⁷ Vermeiren, K. et al. (2012) Urban growth of Kampala, Uganda: Pattern analysis and scenario development. *Landscape and Urban Planning*, 106: 199–206.

Thus under its jurisdiction over land use, KCCA has the opportunity to work on an industrial and shopping activity development scheme to improve the location of production sites. It can also work on a nearby-urban agriculture policy that would improve security of supply through its actions in terms of economic development. It would also be important to study all industrial potentials in terms of energy recovery (sawmill chips, agricultural waste, waste water ...) and industrial ecology. Energy savings, energy recovery and renewables can generate money savings, improve the value chain and reduce the vulnerability of the industry to the climate risk.

3.2.10. Tourism

The tourism industry is one of the largest and fastest growing sectors in Uganda. With a rich biodiversity and beautiful landscapes, Uganda is considered to be one of the premier tourism destinations in Africa. Given that Uganda's tourism is nature based is vulnerable to the impacts of climate change. Tourism is related to climate, as tourists prefer spending time outdoors and travel to enjoy the various touristic destinations (both natural and cultural). Weather and climatic conditions are one the factors/criteria that tourists take into account when choosing a destination and thus the effects of climate change - the rising temperature and changes in rainfall patterns - affect tourist activities.

Although Kampala welcomes tourists and has a well-developed accommodation sector, it not yet a "destination" compared to other places in the country.

"Kampala's tourism potential in terms of urban, fresh water sports and leisure activities, cultural and religious tourism, is significant but has not been exploited, marketed and its supporting infrastructure still very limited. The vast bulk of Ugandans are not aware of these facilities, while at the same time the tourists and visitors to Uganda just travel through Kampala, generally staying in the City for a given period of time and not taking time off to visit these interesting sites. Apart from the business sector in most cases the tourists are not attracted to Kampala (National Museum, Lakefront, historical and cultural sites, Festival...) itself but rather to the country's natural assets elsewhere." – The Strategic Plan of KCCA

In Kampala, the use of individual car and high traffic congestion negatively affect tourism as they raise transport costs, increase travel time and reduce air quality. The image of a "green" city is not yet appropriated. The potential situations of air quality degradation, heat waves, floods can be barriers to visiting tourists or make them reluctant to visit. The direct and indirect impacts of climate change on tourism is on facilities (accommodations and leisure equipment) and the transportation of tourists. Some sites are exposed to climate change impacts, mainly floods.

World over eco-activities and green tourism are very attractive nowadays but Kampala has not taken this direction yet. The growing demand for that kind of tourism can indirectly benefit to the green economy and reduce vulnerabilities. In partnership with tourism associations, a green tourism strategy could be developed with a diverse range of actions: helping touristic industry actors to develop environmental approach, energy savings, renewable, product and services, communication. Through implementation of its Strategy, KCCA seeks to promote tourism as one of the objectives of the Strategic Plan 2019 is: *"Given the enormous potential in Kampala's tourism, KCCA shall undertake to provide conducive platform appropriate for this sector growth and ideal for attracting private sector investment in the sector"*.

3.2.11. Fishing

Kampala lies on the northern shores of Lake Victoria and fishing is an important economic activity in the city. The Kampala Strategic Plan 2019 indicates that about 1,200 people directly involved in fishing and located at the three landing sites at Portbell, Ggaba and Munyonyo. However, fishing as a potential economic sector has not been fully exploited and through the implementation of the Strategic Plan, KCCA seeks to improve the city's fisheries sector.

The rising temperatures and variability in rainfall are likely to reduce water levels on Lake Victoria, fishing activities along the shores of Lake Victoria in Kampala and Greater Kampala remain sensitive to the impacts of climate change. Droughts and prolonged dry spells lead to receding water levels. There is evidence on the impacts of droughts of fishing on Lake Victoria. In 2006, the shoreline retreated up to 50 m, affecting shipping and fishing industries, as fishing boats could not easily get to the landing site. Fish catches must then be hauled ashore through shallow contaminated edge waters, and this compromises fish hygiene within the supply chain. Bacterial loading of fish carcasses result in high or total catch rejection by European fish importers and results in significant post-harvest losses.

The drop in water levels will also disturb habitats, nutrient cycling which in turn results in a reduction of fishing grounds, loss of fish species and reduction in fish catch and fish quality. The exposure to climate change impacts also related to the quality of water and reduced biodiversity. The indirect climate change impacts on fishing can come from other sectors such as water sanitation, landuse planning that includes among other conversions of wetlands to other uses (urbanization, industrial and agriculture). Fish production statistics indicate that catches from Lake Victoria are dwindling³⁸.

Uganda's fisheries sector has been identified as one of the most vulnerable to future climate change impacts. This vulnerability is attributed to a combined effect of predicted warming, the relative importance of fisheries to national economies and diets, and limited societal capacity to adapt to potential impacts and opportunities. Although the precise impacts and direction of climate-driven change for particular fish stocks and fisheries are uncertain, the vulnerability of climate change impacts are likely to lead to either increased economic hardship or missed opportunities for development in Uganda whose economy and people's livelihoods depend upon fisheries but lack the capacity to adapt. Adaptation of the fisheries to future impacts of climate change requires to develop the observance of the phenomenon and the protection of water resources.

3.2.12. Solid waste management

More waste is generated in the city than is collected. Everyday about 1000 tons of waste are dropped in Kiteezi which represents only 50% of the waste production. Therefore about half of the waste generated in the city is disposed by means other than use of a landfill site; including burning of refuse, illegal dumping on roadsides and drainage channels.

These disposal practices manifest themselves in public health problems, blockage of drainage systems, air pollution, odors, and degradation of the urban environment. Heaps of uncollected waste are a common site on roadsides and drainage challenges. The waste dumped in drainage channels causes flooding during rains and contaminate water. In the slums where accessibility is a big problem, waste collection vehicles cannot reach the

³⁸ Ministry of Water and Environment (2009). Vulnerability Assessment of Ugandan Water Resources to Climate Change. Directorate of Water Resources Management, MWE, Kampala, Uganda

households and so a lot of waste remains uncollected. Moreover, the urban poor who reside in these neighbourhood cannot afford to pay for the waste collection services.

Thus waste collection of waste is the most exposed activity with the floods. The exposure is related to transport -road - infrastructures are flooded during rains and waste collection cannot be done. Landfills can also be flooded. The waste dumped in nature or in the water channels can create serious issues when violent storms strike with potential obstructions to the flow of rainwater or contaminating water and reducing air quality. The landfill is exposed to potential fire and to methane emissions.

There are also potential risk that heat waves and droughts increase the decomposition and degradation of waste. That phenomenon could imply an increase of the odor and dust in the neighborhood.

The risk of flooding (fluvial, flash floods, inundation at low-lying lake coastal sites) affecting facilities, access and use of mobile plant is already a reality in some parts of the city. Depending of the development of new infrastructures in the future, it is also important to consider that the reduced water availability for wet processes and site management can emerge.

For adaptation, there is a strong need to develop sensitization and education measures.

Waste should not be looked only as a problem but as a potential. Waste prevention and education campaigns can foster new business development in the recycling industry. There is also a huge potential for energy valorization from waste. Potential for biogas production through methanisation or for electricity generation from waste incineration are not yet exploited.

CHAPTER 2. ENERGY AND GHG BALANCE OF KCCA, KAMPALA AND GKMA

1. Principles

The objective of any Greenhouse gas (GhG) balance is to identify the different sources of GhG emissions in order to characterize the main stakes, the trends and the potential mitigation measures. Because they are very related, the GhG balance includes an energy balance that is why it is common to talk about “energy and GhG” balance.

The results and the exhaustiveness of such balance depend on the availability and the accuracy of the sectorial figures. Most of these information are not held by KCCA but other public and private stakeholders which makes their participation and the data collection two very strategic steps in the process.

This GhG balance is a first exercise for KCCA. Until now in Uganda, only the Ministry of Water and Environment has produced its own balance in the context of the ratification by the Ugandan Government (as a State) of the United Nations Framework Convention on Climate Change in 1993. Then for KCCA, the elaboration of a low carbon and climate change resilient strategy at city capital level is a voluntary and proactive commitment to bring local solutions to a global matter, hand in hand with the Government.

This first exercise allowed KCCA to start the construction of its own inventory system in consistency with the national authorities. Now that the first balance is issued, KCCA will improve year after year the whole elaboration process but also the precision of the assumptions that have been taken to produce this balance. Some sectorial data and emission factors are not available today for Uganda. This should be improved in the coming years with the creation of a national database with the support of UNDP.

In the meantime, best efforts have been made to find out the most recent data and to take into account the existing literature. The experts mandated to produce these balances (at KCCA level and at Kampala/Greater Kampala level) have lead a lot of specific interviews with data providers, stakeholders, ministries and public agencies. The senior expert, Mr Adam SEBBIT, is also working on the national inventory.

Taking into consideration these elements, the GhG balances provide a first overview of the direct and indirect GhG emissions generated by the activities of KCCA as a City Capital and by the activities of Kampala/Greater Kampala as a territory. They will help the definition of a specific action plan to address energy and climate issues at both global and local levels.

By now, it is the responsibility of KCCA to integrate upstream the energy and climate issues in its decision making process to minimize the impacts of its projects whatever they are. The balances will be updated on a regular basis to assess the progress.

In order to observe the current trend of the GhG emissions of KCCA and to choose a year of reference, it has been decided to produce a 3 years analysis (2012, 2013, 2014). The same has been done for the balance of the territory

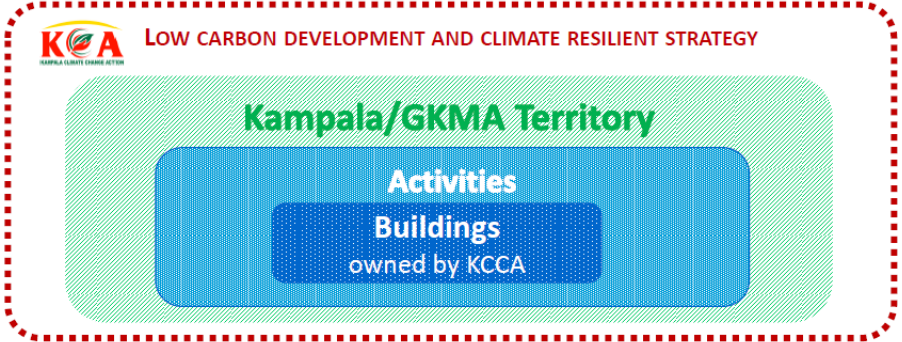
The component energy in the GhG balance has a central place. An important part of the direct and indirect GhG emissions is due to energy use (transport, cooking, industry, lighting...). This trend should be amplified in the coming years with the development of the City and the improvement of the living conditions. Moreover, the climate vulnerabilities diagnosis of the present study illustrates the weakness of the existing energy distribution networks causing some electricity breakdowns. It also interrogates the potentials impacts of climate change on the national energy supply.

Then, as the low carbon strategy is also addressing the potentials of the green growth, any action contributing to the social and economic development of the City will be encouraged.

KCCA should be an example by continuing the promotion and the implementation of energy efficiency measures and renewable energy equipment.

2. Perimeters

This energy and GhG balance concerns KCCA as organization. It assess the energy consumption, the energy production and the direct and indirect GhG emissions generated by the functioning and the activities of the Authority (part blue in the graph below).



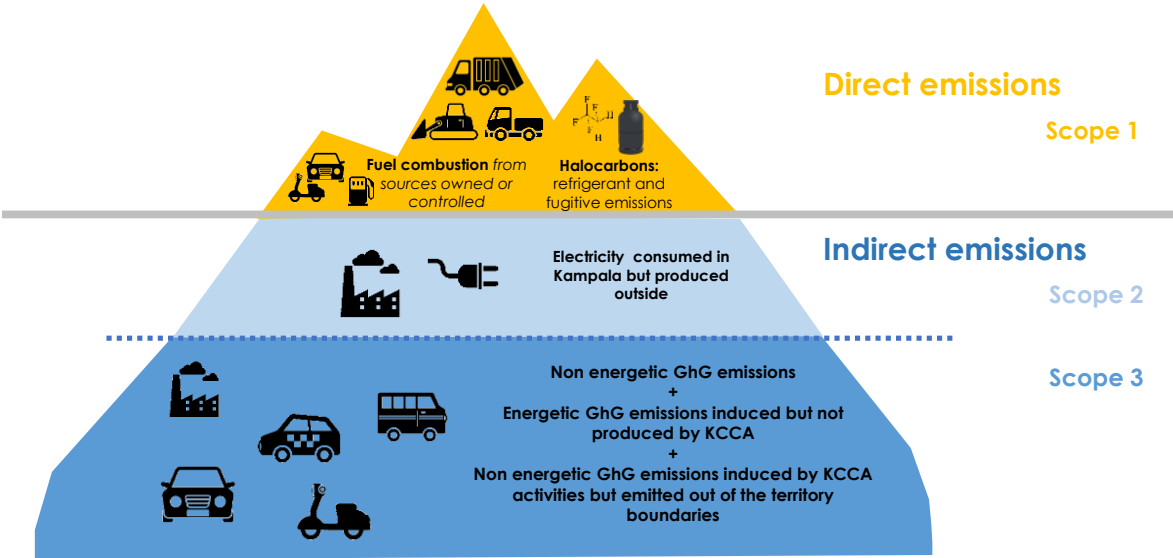
KCCA Energy & GHG Balance
 Measure the energy consumption/production and the GHG emissions generated by the buildings and facilities, the car fleet and the activities owned/performed by KCCA

Energy & GHG Balance of Kampala / GKMA
 Measure all the energy consumption/production and the GHG emissions generated in Kampala & GKMA but also emission induced outside Kampala & GKMA.

The balance of KCCA is part of the Kampala/GKMA balance which assess the GhG emissions of all the activities of the territory.

The balance classifies the GhG emissions by sectors and sources. We distinguish 3 scopes:

- **Scope 1:** stationary combustion, mobile combustion from transportation, chemical production, fugitive emissions;
- **Scope 2:** generation of purchased electricity, steam, district heating and cooling;
- **Scope 3:** all other emission sources (waste, visitor's travels, purchased materials...)



KCCA has decided that the Kampala Climate Change Action strategy should address the whole territory of Kampala. The first stage is to make KCCA an example then the action plan will first target the functioning of the administration, the management of its energy/GhG emissions, the efficiency of its public buildings, car fleet and assets, public procurement...

3. Sources of emissions

The collection of the data is a crucial part of the process. It depends on the organization put in place and the quality of the reporting. It depends above all on the availability of the data. Some of them are supposed to be inventoried and produced by KCCA. Some others are supposed to be produced by external stakeholders (like UBOS, Ministries, public agencies, private organizations...).

For the perimeter of the balance of KCCA' assets and activities, at the moment, some data are not available because they are not yet inventoried like the volume or the kind of waste produced by the KCCA Directorates. At the contrary, the global volume of waste generated in Kampala is known and included in the GhG balance of the territory.

This situation is common to every authority that realizes its first energy and GhG balance. Some data are there but not classified. Some others are missing because there is no metering systems to measure the production or the consumption, or because they are not produced by external stakeholders.

It is also important to allocate resources to human resources, specific software or metering systems to implement a quality management system dedicated to the follow up of energy and of the different sectors covered by the balance. This will also help the management of the operating costs, the assessment of the potentials and the design of the forthcoming projects.

The creation of a formalized network of referents from each directorate is also recommended to improve the data collection. This idea refers to the general recommendation to KCCA of developing its own data inventory system.

Regarding the availability of the data, the emissions sources taken into account for the energy and GhG balance of KCCA are:

Scope 1	<ul style="list-style-type: none"> ▪ Fuel consumed by the fleet of the Authority (cars, motorcycles, mowers) ▪ Fuel consumed to collect garbage and pit latrines ▪ Fuel consumed by Road Construction Equipment (RCE) ▪ Fuel consumed by generators ▪ Amount of refrigerants used by Air Conditioning equipment
Scope 2	<ul style="list-style-type: none"> ▪ Electricity consumed by KCCA administrative buildings (including street lighting) ▪ Electricity consumed by schools ▪ Electricity consumed by health facilities ▪ Electricity consumed by the landfill

Scope 3

- Travels of KCCA's offices visitors
- Travels of health facilities visitors
- Students "home-to-school" travels
- Staff of KCCA "home-to-work" travels

Two ways of progress are identified to improve the exhaustiveness of the balance:

- Enlarging the coverage of the balance to all the sectors (for example kind and generation of waste) by a better inventory and reporting of the data
- Improving the precision of the data collected to improve the analysis, for example:
 - Monitoring the energy consumption of each building and generator
 - Measuring the energy consumption/production of the street lighting
 - Monitoring the fuel consumption for each kind of vehicle
 - Specifying the characteristics of A/C equipment (type of refrigerant, amount of gas filled every year, etc.)
 - Inventorying the number of visitors every years (city hall, schools...)
 - Assessing the impact of public procurement

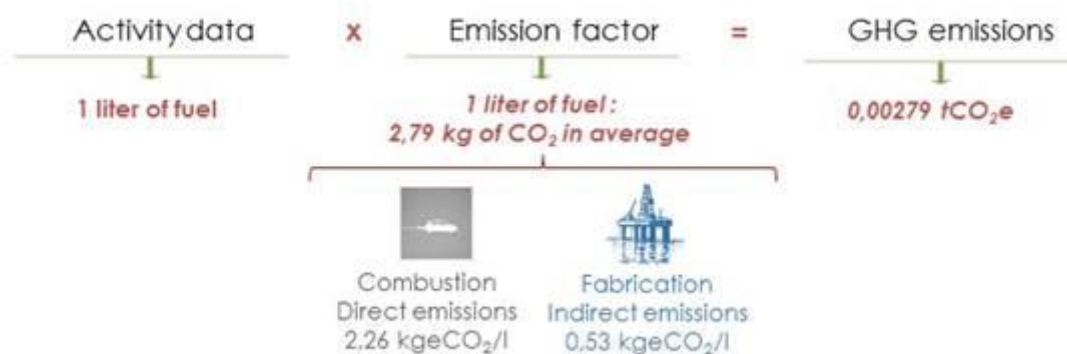
4. The energy and GhG balance of KCCA

4.1. The GhG emissions balance of KCCA

The GhG balance is the result of the collection of sectorial data on which different emission factors have been applied (kgCO₂equivalent per unit). For the energetic GhG emissions, the whole energy balance (next chapter) has been converted into GhG emissions through the use of the related emission factors. For the non-energetic GhG emissions, the available sectorial data have been used and converted.

- ▶ **Activity data** is a quantitative measure of an activity (liters of fuel, kg of waste, kWh of electricity, kg of food, M3 of wastewater...)
- ▶ An **emission factor** is the GhG emissions equivalent to a unit of activity

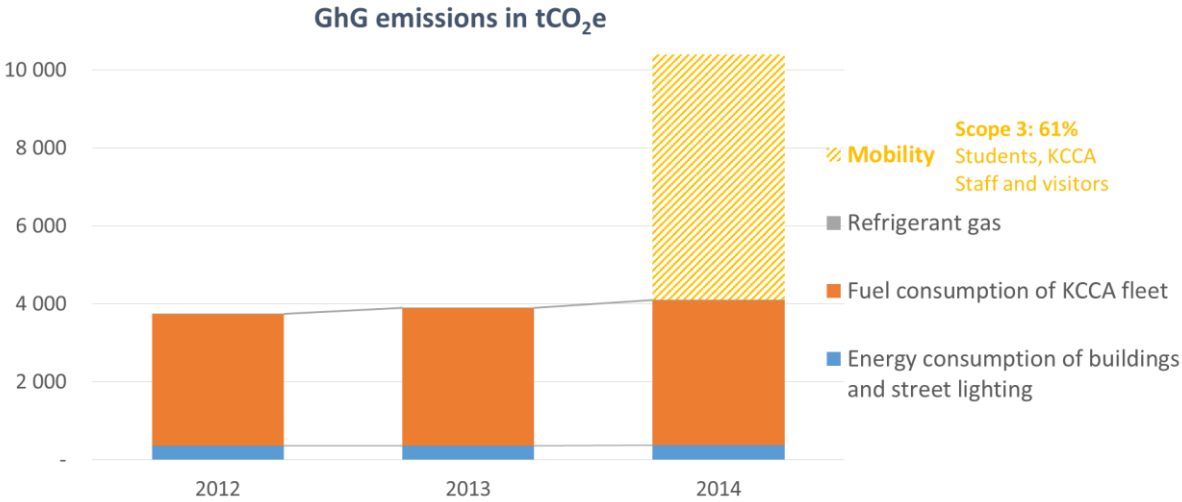
Example for fuel consumption:



There are different greenhouse gases in the atmosphere (see table below) which have different global warming potential (GWP) and lifetime in the atmosphere. To simplify the

understanding of the GhG balance results, the different gases are all converted into CO2. We will then talk about “tCO₂ equivalent or tCO_{2e}”.

GHG	GWP (100 years) = tCO _{2e}	Lifetime in the atmosphere (years)
CO ₂	1	100
CH ₄	25	12
N ₂ O	298	120
HFC	[124 - 14 800] (depending on the substance)	a few weeks to thousands of years
PFC	[7 390 - 12 200] (depending on the substance)	a few weeks to thousands of years
SF ₆	22 800	3200



INDICATORS - 2014

- 4 100 tCO_{2e} without visitors, student and staff travel (scope 3)
- 10 400 tCO_{2e}
- 7 kgCO_{2e} /resident (2,7 kgCO_{2e} without scope 3)
- 300 000 kWh of electricity consumed by buildings, street lighting
- 1 438 500 liters consumed by the fleet
- 912 500 000 km travelled by students
- 3 400 000 km of Staff travelled
- 39 Air Conditioning Systems

The graph above shows the results of the first GhG balance elaborated on the KCCA perimeter (functioning and activities). **The global volume of GhG emissions has increased by 9% between 2012 and 2014. It is characterized by a very high proportion of GhG emissions from fuel consumption. The energy consumed by the buildings is very low in comparison, especially if we include the street lighting where there is no consumption at the moment thanks to the energy supplied by the photovoltaic solar panels.**

The low use of air conditioning by KCCA has a positive impact on the balance. This is due to the preference of KCCA for using alternative ways such as natural ventilation, renovation and construction of buildings using some equipment or following standards that avoid to systematize AC. For the coming years, it is recommended to keep on that way and to formalize this approach in a specific standards guidelines for KCCA.

In addition, the study has proposed to also assess the induced emissions from transport. These emissions are not the direct emissions generated by the car fleet of KCCA used by the staff but the emissions generated by the “visitors” - other people that KCCA staff like students going to school, inhabitants going to health centers or to the City Hall for administrative purpose, etc. This indicator (scope 3) is interesting because it interrogates the location of the public facilities and the need to go further in the dematerialized strategy of KCCA like the program eCitie.

The repartition of GhG emissions induced by travels is as follow:

- student’s travels: 50%
- fleet of KCCA: 36%
- staff of KCCA home-to-work travels: 9%
- others visitors: 5%

The high amount of CO₂ emissions is due to a high number of students (69,125) who travel a lot (about 160 days of school per year, which means about 11 000 000 travels per year).

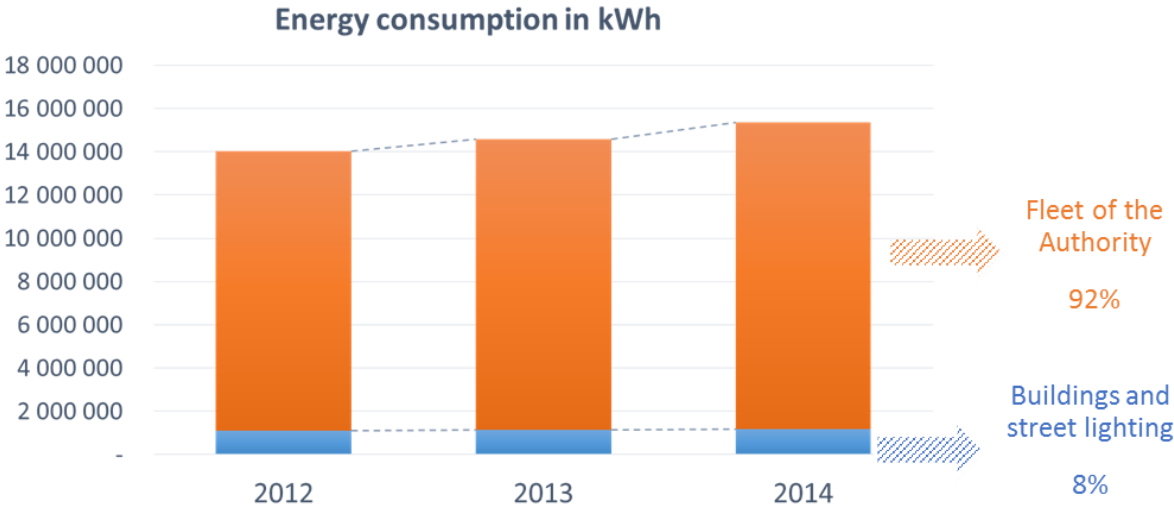
In conclusion, looking at the results, the most important part of the GhG balance is due to transport (car fleet and any other needs for transport from staff related to their professional activities). The emissions from buildings and facilities is low but could increase in the coming years.

It is important to keep in mind that if this **KCCA GhG balance** is addressing the direct emissions of KCCA and a part of its induced emissions, **an important volume of GhG emissions inventoried in the Territory GhG balance (next chapter) is induced by the decisions taken by KCCA for example in the fields of Physical planning, Mobility or Waste management. Depending the options taken by KCCA to render its public services, the level of GhG emissions of the territory can be more or less high.**

If we include the direct GhG emissions of KCCA and a small part of its induced emissions (transport of visitors), the following indicators can be estimated:

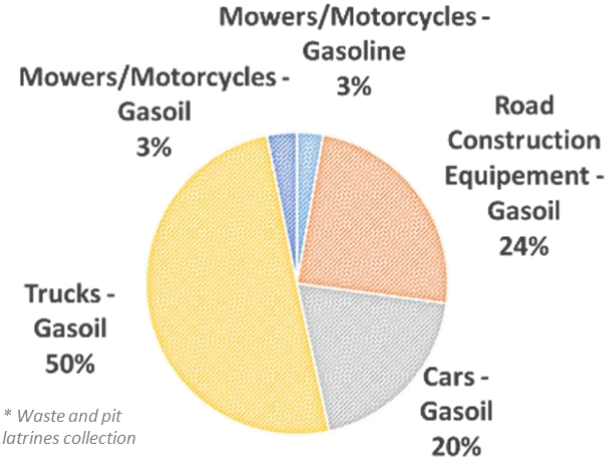
- **0,39% of the energy consumed in Kampala**
- **0,28% of the GhG emitted in Kampala**

4.2. The energy balance of KCCA



The graph above shows the results of the first energy balance elaborated on the KCCA perimeter (functioning and activities). **The global volume of energy consumed has increased by 10% between 2012 and 2014. It is characterized by a very high proportion of fuel**

consumption due to the use of the car fleet which represents around 92% of the total energy consumed. 50% of the fuel consumption is related to the waste and pit latrines collection and 24% to the road construction activity.

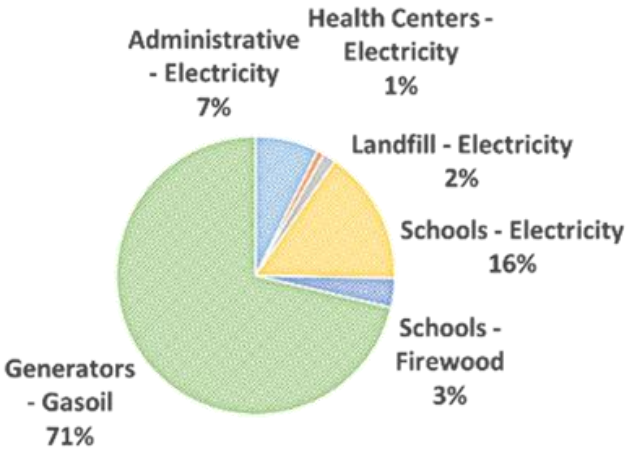


INDICATORS - 2014

- 1,400,000 liters of gasoil consumed by the fleet
- 40,200 liters of gasoline consumed by the fleet
- 723,000 liters consumed for garbage and pit latrine collection

If we look at the figures of the transport, different leverages are identified and are developed in the next part of the present study like for instance the optimization of the waste and pit latrines collection, the change of the composition of the car fleet, the management of the use, the realization of an Internal Mobility Plan.

The energy consumptions of the buildings and facilities are mainly composed by gasoil (71%) and by a smaller part of electricity from the grid. This consumption is mainly due to the generators which use gasoil for electricity production. These generators are supposed to be used mainly as back up in case of electricity distribution networks breakdown. Regarding the important amount of consumptions by the generator, it is recommended to improve the monitoring and the follow-up.



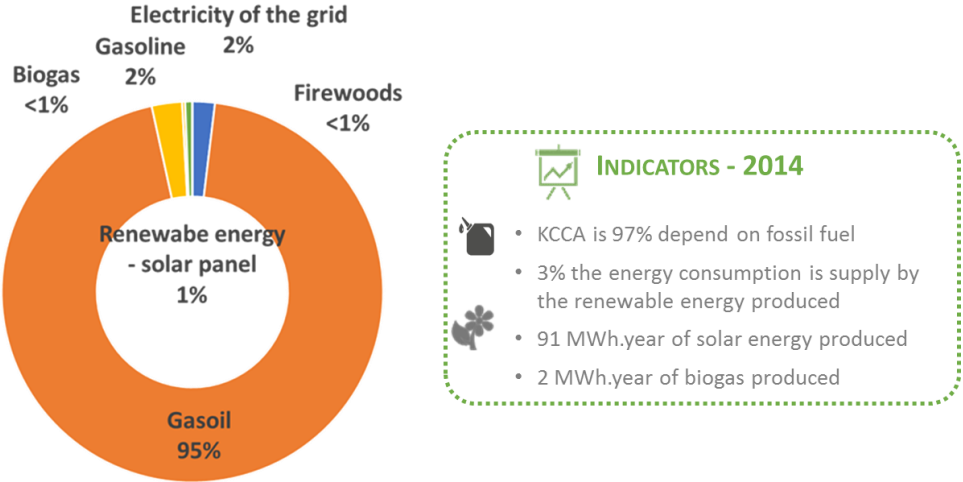
INDICATORS - 2014

- 293,750 kWh of electricity
- 484 gCO_{2,e}/kWh of electricity
- Electricity consumption of the City Hall: 42,600 kWh of electricity
- Average electricity consumption of each school: 2,300 kWh

For this first energy balance, the exercise has been limited due to an insufficient precision of the data or due to missing data. There is a need for developing a specific and more robust reporting on energy and water consumptions of the public buildings and facilities. This can be done by a more formalized internal organization between KCCA services and the development of metering systems. Some data would facilitate the reporting such as the energy consumption per building and per activity, a better integration of the schools (even if they manage by themselves their invoices) and the health centers, an inventory of the

buildings and facilities surfaces with indication on the source of energy consumed/produced, the monitoring of A/C³⁹ equipment (type of refrigerant gas, annual recharge per unit).

If we look at the mix of the final energy consumption of KCCA, 97% is supplied from fossil fuel and then only a low part of this mix is composed by renewable energies. This is a way of improvement for the coming years.



As mentioned before, 94% of fossil fuel consumption is due to the fleet of KCCA, including 48% from waste and pit latrines collection and 23% from road construction activity. Then, to improve the indicators, KCCA has to work on sobriety and energy efficiency measures, on the use of buildings and car fleet and on the renewable and energy recovery potentials. It will be interesting to work on specific and separate indicators for buildings and for transport in order to be more focused on each sector and to take into consideration the respective forecasted increases.

We consider in the renewable energy consumptions of KCCA the part of renewable energy from the national mix supplied by the electricity national grid. But this has a low impact as the electricity consumption from the national grid only represents 2% of the global energy consumption of KCCA.

Renewable energy production of KCCA

In addition to the renewable electricity part from the national grid, KCCA is consuming the energy it produces. This part is growing today and the Kampala Climate Change Action aims at scaling up the existing pilot projects.

The main source of renewable energy today is the use of solar energy for the street lighting. This part is still growing because KCCA aims at developing street lighting in Kampala and already took the decision to use solar energy for it.

Some pilot projects are tested like the biogas recovery in one school or the use of solar eco-stove in one school and at the Wandegaya market kitchen.

Firewood is classified among the renewable energy because of its neutral carbon cycle (the tree is capturing the CO₂ it releases when it is burnt) but this issue is sensitive because of the inefficient way to use this source of energy. The firewood is an efficient source of energy

³⁹ See annex 1 for details. R410a has been considered. Estimation of gas loss from *Bilan Carbone*[®] - *utilitaire Clim_froid_V7* (France: 0,25 kg of refrigerant per kW of capacity; Leakage rate of 15% per year.)

when its final use is made through efficient devices. Any stove, oven or chimney that use firewood has to be optimized in order to recover the whole energy produced through the combustion process. When stoves or chimney are not closed hermetically, they release a huge part of the heat produced. Then, for the same volume of firewood burnt, there could be a gain 7 times higher by using a more efficient device. The other impacts concern the cost of the volume of firewood (the more the device is efficient, the less you consume) and the emissions of particles in the air.

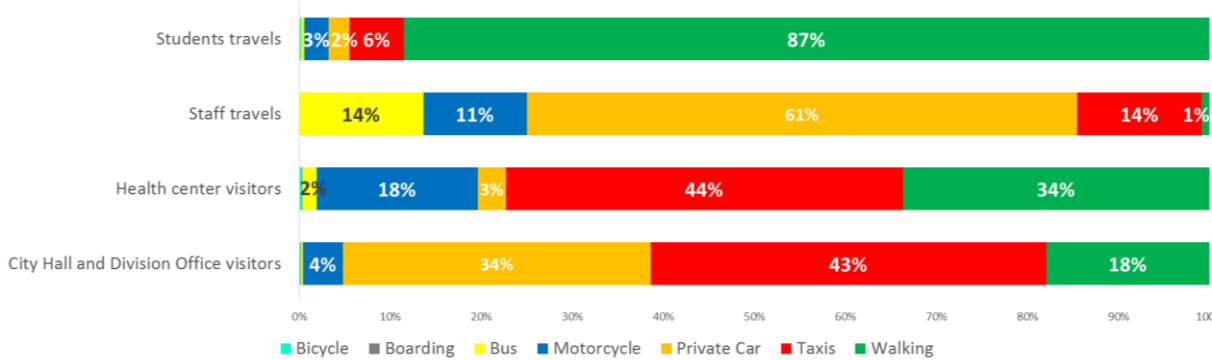
It is also important to remind that national statistics classify charcoal and firewood in the biomass sector which is correct if charcoal is not coming from an extractive activity (here, the charcoal is produced from firewood). But this must not hide the importance for the Kampala Climate Change Action strategy to address the final use of these energies (make it more efficient) and its consequences (make it less polluting) – including deforestation which is a direct consequence of how firewood and charcoal are consumed today.

Transport

As transport has a significant impact on its GhG balance, KCCA has decided to launch its very first travel survey to assess the GhG emissions induced by the location of KCCA public buildings and facilities. This survey has to be taken with precaution. The results will be consolidated in the future but this first assessment will allow to fix a first set of measures in the action plan. Four surveys have been launched:

	Survey duration	Number of answers	
Staff of KCCA travels - home-to-work	3 months	119	1,190 employees
Students travels- home-to-school	1 month	46,156	69,125 students
Health Center visitors	2 months	19,954	68,670 visitors
City Hall and Division Office visitors	2,5 months	4,044	15,441 visitors

Following these surveys, the distribution per mode of transport is as follows:

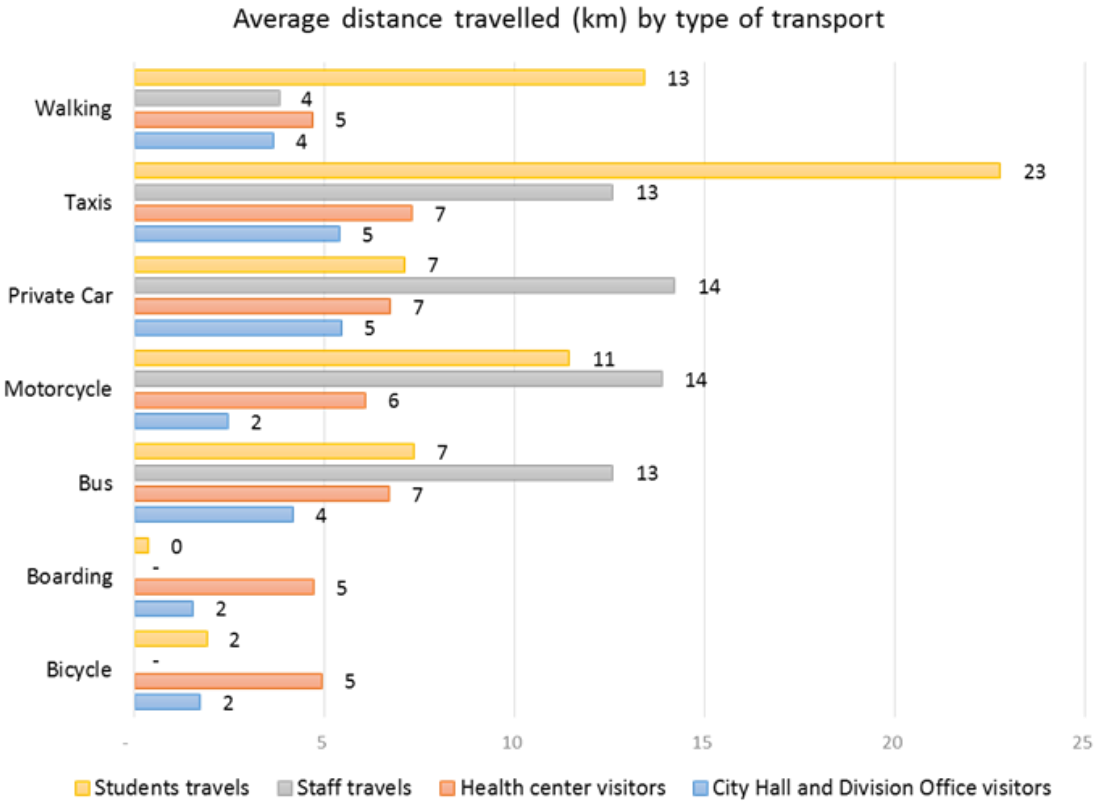


The first perimeter to address is the staff travels because KCCA can propose and support alternative measures to individual motorized car. Some of these measures can be extended to the other sectors where complementary measures will have to be developed considering the different kind of visitors.

The core measures regarding mobility are common with the recommendations that can be made at city level, such as the development of public transport, the BRT project, the regulation of Matatu and Boda boda, the improvement of roads and the support to bicycle and pedestrian.

If KCCA wants to mitigate the current trend of GhG emissions due to transport, there is an urgent need to make more attractive the alternative modes of transport. But in the current context, it is difficult for instance to promote cycling if there is no improvement on the roads and on security. So the best way to proceed is of course to sensitize the population and the staff to the benefit of alternative solutions but to start first on the conditions of their development. The average distance per travel is as follows:

	Average distance per trip
City Hall and Division Office visitors	3 km
Health center visitors	6 km
KCCA Staff	8 km
Students	9 km



This survey must be updated next year. It could be completed by a qualitative survey that would improve the understanding of the choices made by staff and visitors for transport. That will help the design of a specific action plan – especially for schools where the km/student is very high and staff.

5. The energy and GhG balances of Kampala & Greater Kampala Metropolitan Area

5.1. The energy and GhG balance of Kampala

5.1.1. Introduction & Background

Kampala City is the largest city in Uganda. It is the capital city of Uganda. The administration of Kampala City is under the Kampala Capital City Authority (KCCA). It is composed of the five City Divisions. These are Central Division which is the main business division, Kawempe Division, Lubaga Division, Makindye Division and Nakawa division.

The area under administration of the KCCA is about 196 km² with an estimated population increase from 1.2million in 2012 to 1.516 million in 2014. The population growth of Kampala City is estimated at 2% per annum. The number of households was 418,787 and the household size was 3.48 (2014 national census). The distribution of population by residence decreased from 5.7 % in 2005/2006 to 3.7% in 2012/13.

It is estimated that over 65% of the national GDP is generated within the Kampala region. This implies that most of the energy is consumed in the city; consequently, the anthropogenic emissions are concentrated here. It is important to identify the major emission sources so that appropriate mitigation actions can be taken to reduce emission, this will also pave way for low carbon development path.

5.1.2. Energy Profile for Kampala City

The main forms of energy used in Kampala are biomass (charcoal, wood fuel, agricultural wastes), petroleum products (gasoline, diesel and LPG) and electricity. Since Kampala is the hub of economic activity, most of the electricity generated in the country (58%) is supplied to Kampala city. Biomass is mostly (82.3%) used in households for cooking. It is estimated that about 55% of the vehicles are within Kampala. The energy profile for Kampala City is as shown in Table 1.

Table 1: Energy Profile for Kampala City (TJ) 2012-2014

Energy Source	2012	2013	2014
Biomass	18,611	19,733	20,840
Petroleum	17,438	17,125	18,465
Electricity	2,724	2,982	3,227
Total (TJ)	38,772	39,840	42,532

In 2014, the dominant form of energy was biomass (49 %) and was closely followed by petroleum fuels (43.4%). The contribution of electricity is still low at about 7.6%, but is

increasing gradually. Most of the electricity is used in the industrial sector followed by household sector. Biomass is largely used in the households.

5.1.3. Energy Consumption in Kampala City

The energy supplied to Kampala City is consumed by the following sectors: energy production, the industrial sector, tertiary, residential sector, freight and transport sectors. The energy consumption is mostly in the form of diesel or heavy fuel oil by energy producers to generate electricity. The generation of electricity by energy production sector, increased from 491TJ in 2012 to 499TJ in 2014, which is less than 1%. But the ratio may increase depending on the availability of power in the national grid within the next two years.

The contribution of the industrial sector as percentage of total energy consumption increased from 4.7% in 2012 to 7.8% in 2014. Biomass and electricity are the major forms of energy contributing 55.6% and 41.1 % of the total energy consumption respectively in the industrial sector. The tertiary sector is composed of institutions and commercial sectors. The most important form of energy is biomass. The energy mix for tertiary sector in 2014 was 63.1% fuel wood, 31.5% charcoal and 5.3% was electricity. Kerosene was the least used fuel amounting to less than 1% of the total fuel. The energy consumption in different sectors is as shown in Table 2.

Table 2: Energy Consumption by different Sectors (TJ) 2012-2014

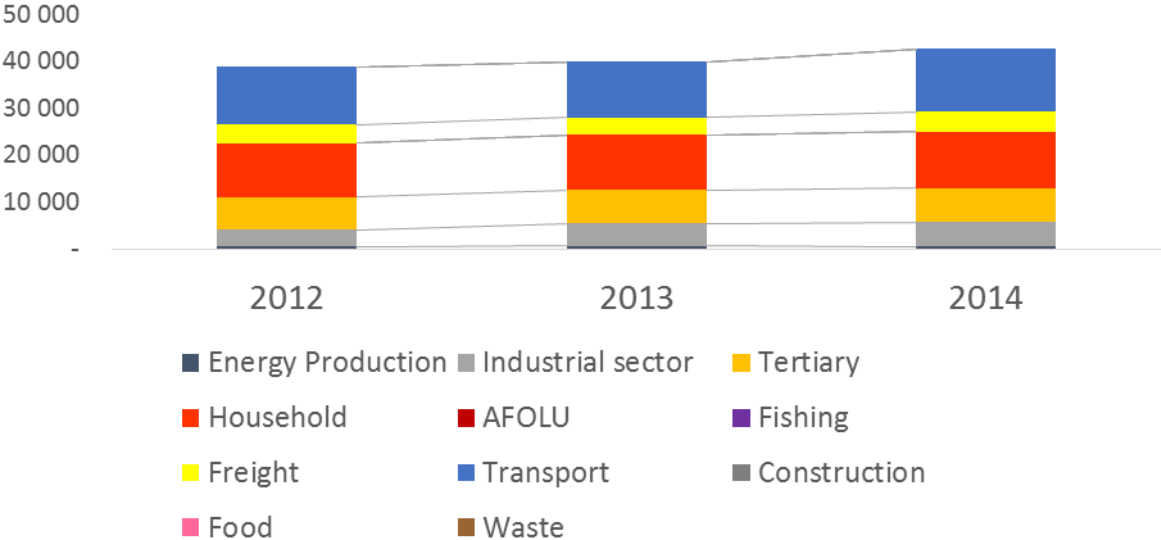
Sector (TJ)	2012	2013	2014
Energy Production	491	603	499
Industrial sector	3,584	4,748	5,117
Tertiary	6,905	7,136	7,335
Household	11,438	11,669	11,969
AFOLU	-	-	-
Fishing	18	19	18
Freight	4,071	3,799	4,190
Transport	12,261	11,823	13,370

Kampala households have more diverse sources of energy for cooking and lighting. Households using electricity for lighting were at 78.4%, while 5.8% used lantern and 5.2% used tadooba (wick lamp), the rest uses other sources of energy. The energy use for cooking in households was 80.2% for charcoal. The use of kerosene and firewood for cooking was 7.6% and 2.1%, respectively. The use of electricity for cooking is 2.1%. It is very low because of the high electricity tariff (Uganda National Household Survey, 2012/2013).

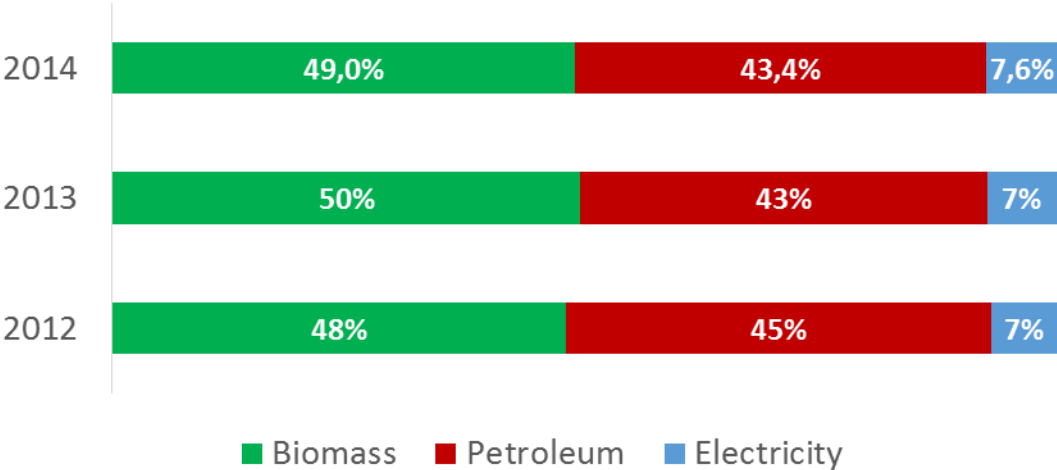
The household sector was the second largest consumer (28.1%) of the total energy in Kampala City. The most favourable fuel is charcoal which constituted 72.2% of the total energy, while wood and electricity contributed 19.8% and 5.7% respectively. Charcoal has advantage because it is relatively cheap and has a high energy content. The high usage of charcoal is a major concern to the environment.

The predominant fuel in the freight sector was diesel fuel used by the trucks, railway and smaller capacity vehicles. The distribution of the fuel is: 88.3% and 11.7% for diesel and petrol respectively. The transport sector is the largest consumer of energy (31.4%) in Kampala City. The dominant fuel is gasoline. The most common means of transport are by private car, commuter taxi (matatu) and motorcycle taxis (bodaboda). It is estimated that there are about 6,000 matatu and over 100,000 bodabodas operating in Kampala. The number of buses is negligible. There is limited use of energy by fishermen around the landing sites in Kampala City.

Energy consumption by sector (TJ)



Energy mix



5.1.4. Energy Supply in Kampala City

The main sources of biomass and electricity supply are outside Kampala region. Charcoal is mostly supplied from the Central and northern parts of Uganda. Hydropower is the dominant source of electricity and it is supplemented with thermal power plants. Electric energy supply to the national grid, hydropower contributes about 90.5%, cogeneration (sugar factories,

Kinyara and Kakira sugar factories) 6.7% and thermal plants 2.8% (UETCL, 2015). All petroleum fuels are imported. In 2012, the 50 MW Aggreko Uganda Limited thermal electricity, which was located in Kampala City, was decommissioned. The main electric energy suppliers are the independent power producers to the national grid and auto-generators, those who produce energy by using generators for their internal use.

The largest hydropower plant [which is?] (600MW) will be commissioned in phases starting in around 2020, while Insimba hydropower plant (183MW) may come on line in 2018. Currently the energy generation by hydropower is below the demand. It is most likely that thermal power will be back to supplement the electricity demand and some imports may be made from the neighboring countries. Kampala City will still be the dominant user of modern energy in the foreseeable future. The electricity tariff is most likely to increase up to the year 2018. The falling price of oil may not be enough to lower the electricity tariff in the near future. The development of petroleum sector will have great impact to the country assuming that the development efforts are maintained.

5.1.5. Projected Energy Demand in Kampala City

In the Business as Usual Scenario, there will be a general increase in energy demand in all sectors. The energy demand in Kampala City will increase due to the projected increase in economic activity. Most of the increase is anticipated to occur in the period 2020 to 2030. There will a generate increase of 48.3% in energy demand over the decade. The use of biomass will increase by 15.9% over the decade. The most important fuels will be petroleum and electricity. The increase in petroleum and electricity will increase by 78.7% and 68.2% respectively, in the same decade.

The energy mix in 2030 will vary depending of the energy demand supply options. There will be an improved power pool system. There are issues such as energy security which may also affect the energy mix. As the country continues to develop, petroleum will be the main source of energy accounting for 54.2%, while biomass and electricity will contribute 37.2% and 8.7% respectively. The contribution of electricity will be lowered because most of the upcoming industries will be located out of Kampala City.

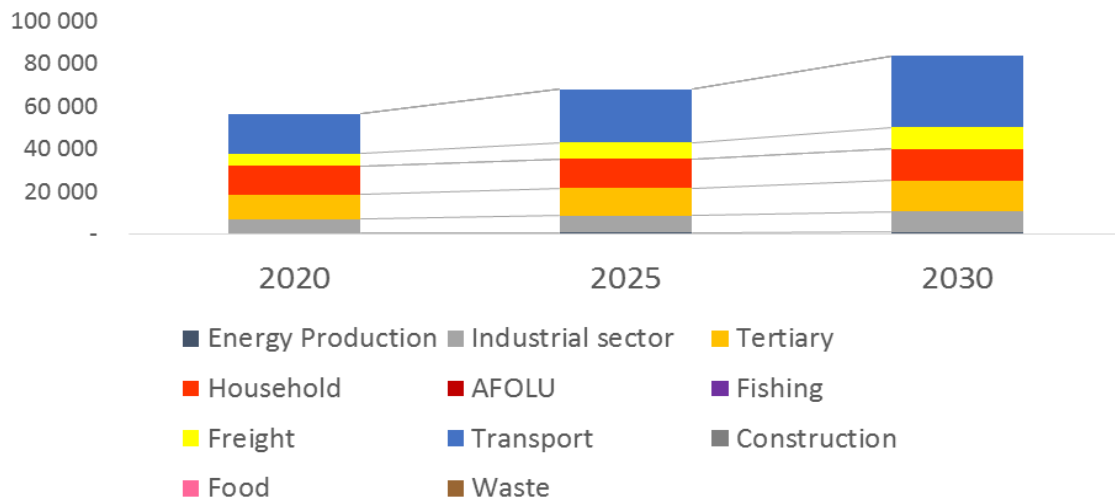
5.1.6. Projected Energy Demand in different sectors

The auto-energy generators will continue to depend on diesel as the main source of energy. The projected energy consumption will be 1,176 TJ. Energy produced by auto generators will be for internal use. The contribution to the total energy will be negligible. The projected energy demand is as shown in Table 3.

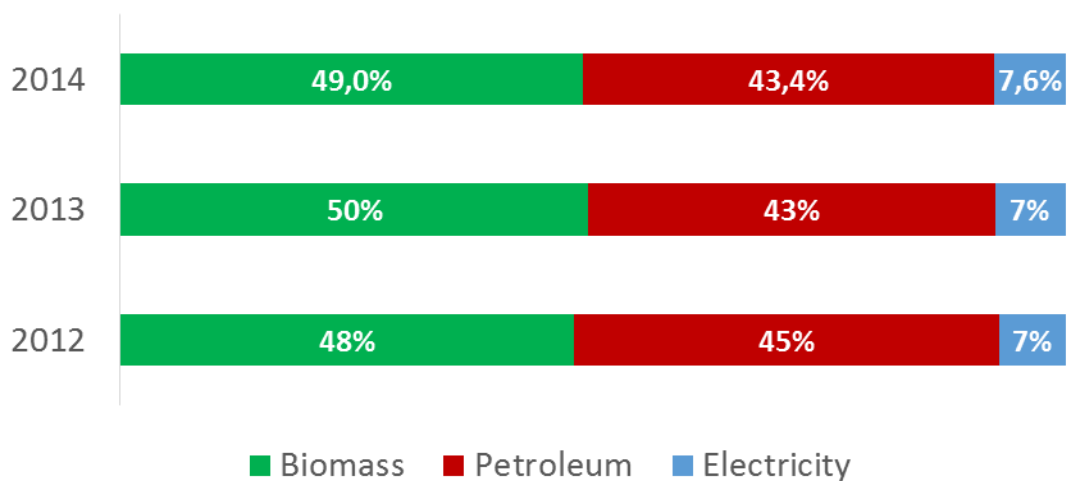
Table 3: Projected Energy Demand in TJ (2020 to 2030)

Sector (TJ)	2020	2025	2030
Energy Production	669	900	1,176
Industrial sector	6,491	7,865	9,598
Tertiary	11,491	12,691	14,058
Household	13,460	13,921	14,901
Fishing	22	28	134
Freight	5,706	7,621	10,182
Transport	18,585	24,861	33,363

Energy consumption by sector (TJ)



Energy mix



In 2030, the projected energy demand in the industrial sector will be about 11% of the total energy demand. There will be an increase in the consumption of fuel for industrial boilers, electricity and LPG. The demand of biomass will reduce gradually in the industrial sector, but there will be a gradual increase in the agricultural waste use in this sector. The tertiary sector is projected to contribute 17.3% of the energy demand. There will be increase in electricity demand and there will be a gradual decrease in the demand of biomass and kerosene. The household energy demand will contribute 17.7%. There will be an increase in the demand of LPG and electricity. There will also be a gradual decrease in the demand of biomass and kerosene.

The energy demand for the freight sector will increase because of the expected movement of freight for construction material and merchandise. Energy demand in freight sector will

contribute 12.2% of the total energy demand in 2030. Transport sector will be the largest contributor (40%) to the overall energy demand in 2030. Most of the vehicles will be found within Kampala City. The fuel demand will be increasing due the expected increase in the disposable income within Kampala City.

5.1.7. Emissions in Kampala City

The study began with a literature review. The documents reviewed included the work on the inventory for Kampala and Great Kampala Metropolitan Area (GKMA), which was done in 2013. The base year for the study was 2012. The main guideline used for the computation in the present study is the Global Protocol for Community (GPC)-Scale Greenhouse Gas Emission Inventories 2014. The GPC establishes credible emissions accounting and reporting practices which has been accepted internationally. It was used to develop an emissions baseline emission in this study.

Most of the industrial and commercial activities take place within Kampala City. It is for this reason that the highest concentration of the anthropogenic emissions is expected to be within Kampala City. The sources of emissions covered in this study were divided into eleven sectors including: Energy production which includes emissions from all equipment which generate energy, such as thermal powered generators used to generate power and sold to the national grid, and diesel generators in industries. The industrial sector, covering emissions from energy use in the industries as a result of fossil fuel and biomass combustion. There are other emissions from use of refrigerants in industries. These refrigerants are normally used in cold rooms and refrigerated environment for industrial processes. The tertiary sector includes commercial subsector, education and research institutions and government institutions. The main sources of energy are electricity and biomass energy, while the use of fossil fuel is limited.

The residential sector is composed of urban and peri-urban households. The emissions sources are mostly from charcoal combustion for cooking in the households. The main sources of anthropogenic emissions are from the use of kerosene and LPG use for lighting and cooking. There very limited mechanized agriculture in Kampala City but a limited keeping animal by grazing and poultry business. A portion of Kampala City at Lake Victoria shores has landing sites. The main activities at the landing sites include transport by boats and fish handling. Kampala and GKMA are the main centers of economic activities.

The freight is transported mostly by railway and trucks. Transportation of passengers and private transport is done by light vehicles and a limited number of buses. Both freight and passenger transport systems the emissions are on the increase.

Most of the waste generated in Kampala City is organic waste. The waste emissions are from the landfill, industrial liquid and solid waste, sewage liquid and waste water. Direct emission is from combustion of fuels in a given activity, while indirect emission is the use of electricity generated from thermal systems.

5.1.8. Non Energy Emission

Industrial Processes and Product Use (IPPU) is a sector that covers greenhouse gas emissions occurring from industrial processes. Due to the low level of industrialization, the emissions in this sector are not significant. The non-energy emissions are mostly from industrial process, the use refrigerants in the different sectors and use of fertilizers in agriculture. There is negligible cultivation carried in Kampala City. Refrigerants are used in the household, commercial and industrial sectors. There was no sufficient data to calculate emission from refrigerants in

Kampala City. The emissions from the industrial process are mostly from the production of cement and lime produced outside Kampala City. There are only two factories which produce cement in Uganda. Those which produce lime are outside the Kampala City. Most of the food such as meat and fish is not processed.

5.1.9. Stationary Combustion

Energy production through combustion are often referred to as stationary combustion, comprises of emissions from fuels combusted by energy-producing sectors. This subcategory includes emissions from the generation of the electricity and combined heat and power generation. Petroleum fuels are used by Independent Power Producers to generate electricity and sell to the national grid. There are also several companies with generators which are used internally and during load shedding.

Manufacture of solid fuel (charcoal) is considered as an energy production sector. Production of charcoal is mostly done using traditional methods with low efficiency. The efficiency of the traditional kilns is estimated at 10-12%. Charcoal is mostly used in the urban households. There is significant emission from this sector. The emission in this sector is covered under scope 3.

5.1.10. Mobile Combustion

The other broad categories of emissions are mobile combustions. These include all mobile transport which can also be divided into various types. The most common types of transport are on road, off road (agriculture) railway, aviation and waterborne. Transport can also be divided into two categories freights and general transportation such as of people. The computation of the emissions in this sector is similar in approach to the stationary combustion.

5.1.11. IPPU (Industrial Product and Product use)

There are also other sources of emissions from industries which can result from non-energy related industrial processes and product uses. These sources of GHG occurring from industrial processes, product use, and non-energy uses of fossil fuel, shall be assessed and reported under the IPPU. The production and use of cement and lime are examples. The cement and lime are used in construction infrastructure such as building and roads in cities. Since the cement and lime production is outside the city boundary it will be considered under scope 3.

Cities are centers of construction activities. There is increasing demand for commercial and residential buildings, expansion of the infrastructure such roads, flyovers, packing yards and utilities. The data, which are needed for computation of GHG are square meters of the infrastructure construction, but in most cases these data are not captured except for very few commercial and residential buildings. The most common materials used in construction are steel, cement and lime. The emissions in this case fall under the non-energy industrial processes.

5.1.12. Agriculture, Forestry and Other Land Use (AFOLU)

This sector is wide because it deals with anything that involves land management that is not considered under energy, industries and waste treatment. The key greenhouse gases of concern are CO₂, N₂O and CH₄. Plant biomass is the main conduit for CO₂ removal from the atmosphere. The uptake of CO₂ through photosynthesis is referred to as gross primary production (GPP). About half of the GPP is respired by plants, and returned to the atmosphere, with the remainder constituting the net primary production which is the total production of biomass and dead organic matter.

The sources of GHG from the Agriculture, Forestry and Other Land Use (AFOLU) sector which is produced through a variety of means, including land-use changes that alter the composition

of the soil, methane produced in the digestive processes of livestock, and nutrient management for agricultural purposes. There are activities such as promotion of urban agriculture, will increase the missions in the cities but is good business practice. The emission in this case is Scope 1 in boundary emission due to agricultural activities. Due to the high population density in cities, extra food should be brought from the areas outside the city but they are not processed in most cases. The Kampala City land is limited and value of land is increasing rapidly. The land for agriculture is decreasing while the built up area is increasing.

5.1.13. Methodology

This section covers different approaches used in the calculation of the GHG emissions in the eleven sectors considered in this study. In nearly all cases Tier 1 was used because of lack of national emission factors and limited data. Emission factors were obtained from the default values provided in the 1996 IPCC, 2006 IPCC Tables, EMEP/EEA, Air Pollutant Emission Inventory guidebook 2013, and other sources, together with associated uncertainty range.

The computation of GHG emission, Tier 1 is used because it is the simplest calculation method. Moreover it requires the least data, and it is likely to provide the least accurate estimates of emissions. However higher Tiers can only be used when there is sufficient data. Applying a Tier 1 emission estimate requires the following information for each source category; data on the amount of fuel combusted in the source category and the activity data. The activity data in the stationary and mobile combustion is the energy consumption. The data can be obtained from the national statistics.

Emissions from livestock are associated with enteric fermentation and animal waste management. The major GHGs emitted in this subsector are Methane (CH₄), Nitrous Oxide (N₂O) and other Nitrogen Oxides (NO_x). The 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines provides a framework in developing the GHG inventory for the agriculture sector. The activity data for livestock includes the type, number of animals and manure management systems employed to take into account the specific emission levels of each category.

There are two approaches of assessing GHG emissions under forestry and other land use. The first approach is based on information on carbon gain, less carbon losses (Gain-Loss Method). This method requires information on annual biomass stock increments, biomass losses, losses due to disturbance and carbon loss in soils. The Gain-Loss Method is flexible in that it can use both detailed data (Tier 2 and Tier 3) and coarse data (Tier1) where country specific detailed data is not available. Since many countries lack detailed data on land use and biomass stocks, the Gain-Loss Method is the default methodology. In this study carbon loss method was used.

The second approach is known as Stock-Difference Method where carbon stock changes at time t₂ are compare with the stock at t₁ and the difference divided by the years between the two inventories gives the annual stock change. This method is not applicable to Kampala City because of lack of country specific data.

Industry Cement production method was used for calculating CO₂ emissions directly from cement production although it is not consistent with good practice. There is lack of data on carbonate input national clinker production and import data. Therefore the estimated emission was made based on the cement production data.

Methane (CH₄) is emitted during the anaerobic decomposition of organic waste disposed in waste disposal sites. The organic waste decomposes at diminishing rates and it takes long time before it decomposes completely. The First Order Decay (FOD) method (Tier2) was used to compute GHG emissions in the waste sector. It produces time independent emission profile that reflects the true pattern of the degradation over time. The use of FOD required the

current as well as historical data of the waste quantities. It is a good practice to use FOD because it more accurately reflect the emission trends.

5.1.14. The Scope

Emissions are categorized into three scopes named as Scope 1, Scope 2 and Scope 3. The Scope 1; covers GHG emissions that occur within the territorial boundary of the Kampala City which is administratively limited to the 196 sq. km surface area including the water body. Thus, the emissions are from both mobile and stationary combustions in all sectors within Kampala City. Scope 2 covers the indirect emissions that occur outside of the city boundary as a result of activities that occur within the city. In this case it mostly from the electric power generation which is the outside city boundary such as Electro-Maxx in Tororo and Jacobsen in Namanve. The GHG emissions are produced directly by the combustion of fuels or indirectly by the use electricity from the grid. Scope 3 is any other indirect emissions considering the emissions that occur outside of the city boundary, as a result of activities of the city. These are emissions from activities such as charcoal production and cement production.

5.1.15. The Emission in Kampala City

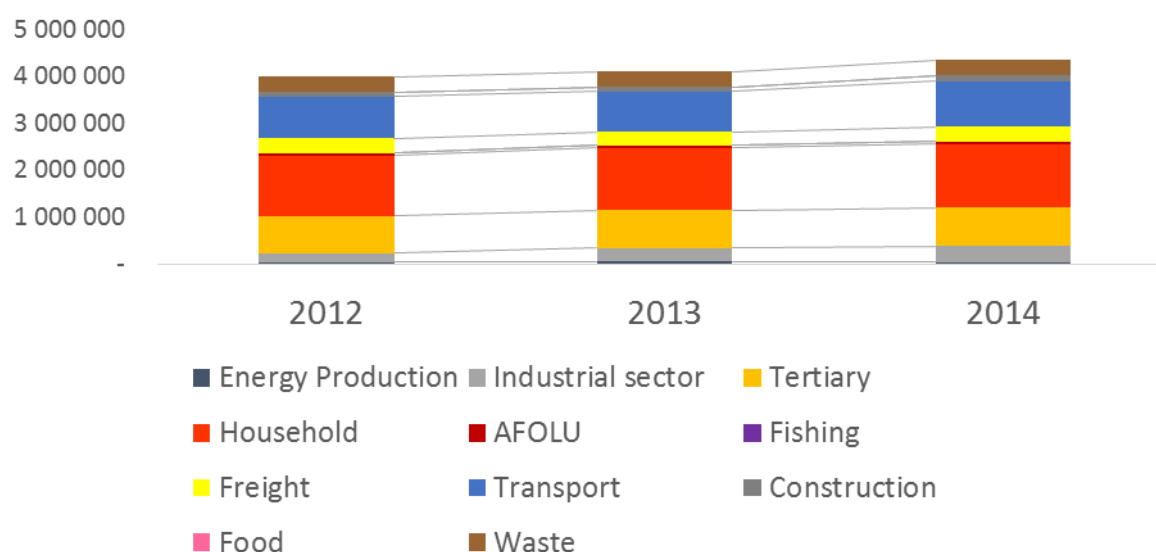
The Global Protocol for Community-Scale Greenhouse Gas Emission Inventories (GPC) was used in this study because it can provide transparent and globally-accepted framework to consistently identify, calculate and report on greenhouse gases. This report includes emissions released within the Kampala City boundaries as well as those occurring outside the city as a result of activities taking place within the city as defined by the scope. The details of the scopes were explained in methodology.

The greenhouse gases under consideration are CO₂, CH₄ and N₂O. These are the GHGs, which must be reported. The results are given in terms of CO₂ eq after conversion using the global warming potential data. The main sources of CO₂ and N₂O are fuel combustion from stationary and mobile equipment, while CH₄ are mostly from wastes and enteric fermentation in animals. The emission in Kampala City is as shown in Table 4.

Table 4: The Emission in Kampala City (Tonnes CO₂ eq.) 2012-2014.

SECTOR (tCO₂e)	2012	2013	2014
Energy Production	36,494	44,864	37,133
Industrial sector	187,176	291,818	336,590
Tertiary	790,260	811,291	830,187
Household	1,291,339	1,319,419	1,345,734
AFOLU	55,608	56,585	57,516
Fishing	1,245	1,323	1,254
Freight	305,424	284,913	314,140
Transport	888,351	856,014	967,534
Construction	103,945	103,715	123,020
Waste	327,774	328,774	329,406

GhG emissions by sector (tCO₂e)



The emissions were calculated based on the methodology provided in the IPCC 2006 inventory guidelines and other internationally acceptable methodologies based on the sector under consideration. The emission computation is based on the activity data and default emission factors. In the Business as Usual Scenario the GHG emissions in the energy sector increased from 3.987 million tonnes of carbon di oxide equivalent (CO₂ eq.) in 2012 to 4.34 million tonnes CO₂ eq. in 2014. That represents an increase of 8.9 % of the emissions from 2012 to 2014. As the country develops, the emissions will atomically increase.

Since most of the electricity is from hydropower, the emissions from energy production are less than 1% of the total emissions in 2014. The emissions from the industrial sector were 7.8% of the total emission. For the freight and transport sectors, the contribution of the emission was 22.3% and 7.2% respectively of the total emission. The AFOLU contribution was 1.3%. That is due to the limited agricultural activities in Kampala City. For the waste and construction sectors the emissions contribution was 7.6% and 2.8% respectively.

5.1.16. Projected Emissions in Kampala City

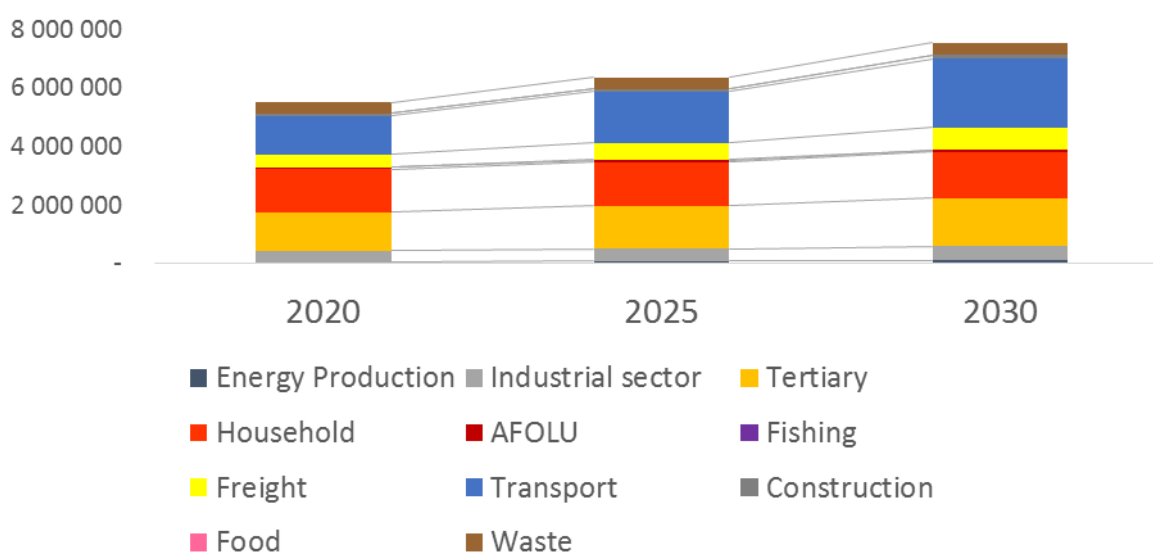
The country is expecting to develop rapidly during the period 2020 to 2030. It implies there will be an increase in the emissions in all the sectors except a few. The total emissions will increase from 5.49 million tonnes CO₂ eq. in 2020 to 7.48m tonnes in 2030, which represents about 36.2% increase over the ten years. The trends of the emissions are as shown in Table 5. The contribution of emissions from energy production to total emission will increase slightly from 1.0% to 1.6% over the period 2020-2030. The increase in emissions will be over 106% over the same period. The contribution of the emission source will be from auto generators. Although there will be increase in emissions in the industrial sector by 23.5%, the contribution of emissions from the industrial sector will decrease from 7.1% to 6.5%. The projected emissions from the different sectors are shown in Table 5.

Table 5: The emissions from different sectors tCO₂ eq.

SECTOR (tCO ₂ e)	2020	2025	2030
Energy Production	57,307	82,271	118,111
Industrial sector	391,482	434,842	483,513
Tertiary	1,301,631	1,420,247	1,549,926

Household	1,476,582	1,507,205	1,596,927
AFOLU	64,333	68,979	71,881
Fishing	1,497	1,930	2,348
Freight	430,660	575,067	768,115
Transport	1,305,742	1,745,970	2,342,314
Construction	91,196	105,880	119,365
Food	-	-	-
Waste	370,002	395,945	425,995

GhG emissions by sector (tCO₂e)



There is a general increase in the emissions in the tertiary and household sectors 25% and 7% respectively. The contribution of the tertiary and household sectors decreased from 23.7% and 26.9% to 20.7% and 21.4%, respectively. The emissions in AFOLU sector will decrease because of the increasing built up areas and gradual reduction in urban farming as the land value will be increasing. The contribution of fishing to the Kampala City inventory is negligible. The highest increase of emissions will come from the freight and transport sectors with an increment of 79.4% and 78.4%, respectively. The increase in income will increase mobility. The contribution of the emissions from freight and transport sector will increase from 7.8% and 23.8% in 2020 to 10.3% and 31.3% respectively. This implies that these sectors which will need mitigation measures to reduce the emissions. With the increasing population, there will be a corresponding increase in the waste generation. The contribution of the waste to the total emissions will decrease from 6.7% to 5.7%.

5.1.17. Uncertainty

There is uncertainty in the inventory, which rises from various sources. In most cases there is limited baseline data in all sectors. The data on biomass consumption is based on extrapolation on the work done over ten years ago. The level of uncertainty associated with stationary combustion activity data in commercial, institutional and residential is 10-15%. There is no data of the vehicle fleet. The uncertainty in mobile combustion is $\pm 10\%$. The

uncertainty in waste sector due to use of default factors is $\pm 10\%$. There is limited data in infrastructure the uncertainty may be ± 25 . The emission in this sector is small when compared to other sectors. At times data given by different organization do vary. Since most of the emissions are from mobile and stationary combustion, the uncertainty can be $15 \pm 5\%$.

5.1.18. Mitigation options

Kampala City currently relies on biomass as the major source of fuel. Due to the ongoing development at National level and Kampala City in particular, there is increase in the use of petroleum fuel mostly in the transport sector. The use of thermal power generation is common when there is urgent demand for electricity. It is not sustainable. The best option is to start with energy efficiency in all sectors. Use of energy efficient stoves in institutions and households can reduce energy consumption by 20-40%. Improvement of road infrastructure in Kampala City coupled with good driving practice can reduce energy consumption by over 20%. Fuel switching to low carbon intensity fuels at household level may not be feasible in near future. In transport sector the fuel switching to blended fuel is feasible. It will reduce gasoline consumption by 5-20%, depending on the availability of ethanol. The use of biodiesel may take longer before it can be implemented because there will be need of continuous feedstock and infrastructure to produce biodiesel. Uganda will be depending on biomass as one of the most import fuel. Biomass has a lot of benefit. There is need to promote forestation and afforestation projects to supply biomass for energy in Kampala City.

The use of mass transit system such the BRT project will also reduce fuel consumption substantially. There are on-coming projects such Standard Gauge Railway and light rail system using electricity. The commencement date of these projects is not well defined. The government is investing heavily on road and energy infrastructure. The use of thermal power plants will be limited. There are possibilities of generating electricity from wastes and solar energy at large scale, with installed capacity over 10MW.

5.1.19. Conclusion

In 2030, Business as Usual Scenario, the transport sector will be the leading sources of GHG emissions contributing 31% of the total emission and followed by freight sector 10.2%. The waste sector contributes 5.7%. There are sectors where most of the emissions can be reduced. The mitigation options should take these sectors as high priority. Although the tertiary and residential sectors contribute 21.6% and 21%, most of the emission is biogenic. If the biomass supply is not sustainable, there could be another challenge in emissions. KCCA should work in collaboration with the line ministry to get collect data specific to Kampala City. UBOS is one of the most important institutions to work with. There is a need to develop data management systems for Kampala City.

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5.2. The energy and GhG balance of Greater Kampala Metropolitan Area

5.2.1. Introduction and Background

The Greater Kampala Metropolitan Area (GKMA) is composed of Kampala City and some areas carved out of Mukono and Wakiso districts. The GKMA is the geographic extent as defined in the Kampala Physical Development Plan with area coverage of 941.2 km² and with an estimated population, which has increased from 2.83 million in 2012 to 3.23 million in 2014. The population growth of GKMA is estimated at about 6.8 % per annum (2014 national census). The number of households increased from 731,635 in 2012 to 835,422 in 2014, with a household size 3.48. The population growth rates from areas carved out of Mukono and Wakiso is about 10%. It is estimated that over 70% of the national GDP is generated within GKMA. It implies that most modern energy such petroleum and electricity is consumed in this region; consequently, the anthropogenic emissions concentrated within this region will increase. The population is flowing from Kampala City and other areas to GKMA because the cost of land is relatively cheaper than in Kampala City.

5.2.2. Energy Profile for GKMA

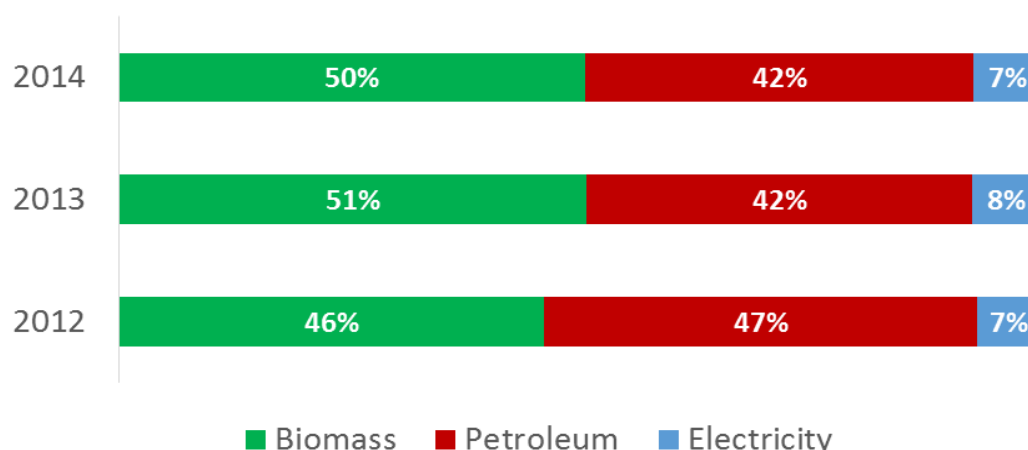
The main forms of energy used in the GKMA are biomass (charcoal, wood fuel, agricultural wastes), petroleum products (gasoline, diesel, LPG and aviation fuel) and electricity. GKMA is the expanded Kampala City. Most of modern energy is supplied to this region. It is estimated that about 58% of the electricity is supplied to this region. The energy profile for Kampala City is as shown in Table 1. It is estimated that about 65% of the vehicles are within Kampala.

Table 1: Energy Profile for GKMA (2012-2014)

Energy Source	2012	2013	2014
Biomass	26,359	29,238	32,295
Petroleum	26,664	23,944	26,699
Electricity	4,045	4,368	4,753

Biomass is a very important source of energy. In 2014, biomass contributed 50% of the total energy. Petroleum and electricity contributed 42% and 7.5% of the total energy consumption in GKMA, respectively. The modes of transport and energy use in energy generation contributed to the high ratio in the use of modern fuels. Biomass is the most favourable for urban household. Most the electricity is used in the industrial sector.

Energy mix



5.2.3. Energy Consumption in GKMA

The energy consumption in GKMA increased from 2012 to 2014 by 12%. There is a general increase in the energy consumption in all sectors except energy production. The contribution of the energy production to the total energy consumption decreased by 56% from 2012 to 2014. This is due to the increased power supply from hydropower stations. In 2013, energy production from fuel consumption by the major thermal power plants was 15TJ. This was lowest recorded over the last decade. Some industries use generators for their internal electric energy supply. But there is an expected increase for the next three years, when Isimba hydropower will be commissioned. The contribution of the industrial sector energy consumption increased from 8.2% in 2012 to 10.5% in 2014. That was due to the increased industrial development within GKMA.

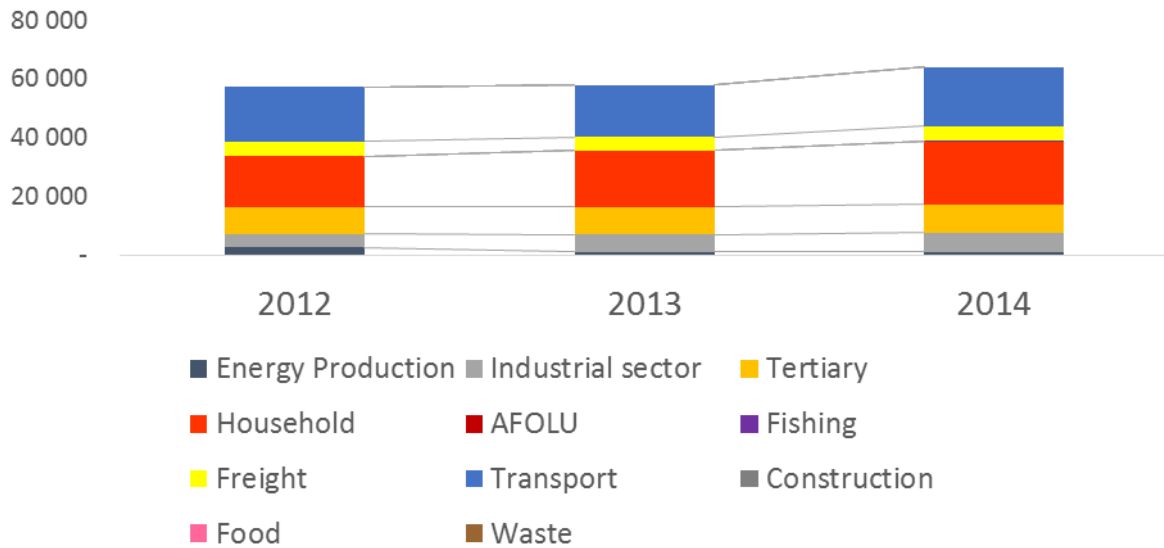
The increasing population in this region created a demand for services such as education and commercial services. The energy contribution from the energy consumption increased from 15.8% in 2012 to 15.1% in 2014. In the household sector the most developed fuel is biomass, the contribution of this sector to the GKMA total energy consumption increased from 30.4% in 2012 to 33.3% in 2014. Table 2 shows energy consumption in GKMA.

Table 2: Energy Consumption in GKMA (TJ) from 2012 to 2014

Sector (TJ)	2012	2013	2014
Energy Production	2,499	920	1,091
Industrial sector	4,691	6,079	6,576
Tertiary	9,037	9,357	9,632
Household	17,428	19,251	21,415
AFOLU	2.2	2.1	2.3
Fishing	27	29	27
Freight	4,914	4,580	5,074
Transport	18,695	17,581	20,179

Most of the petroleum fuels are used in the transport and freight. There is general increase in the energy consumption in these sectors. There was a slight decrease in the contribution of the freight and transport sector in energy consumption. The contribution of freight and transport sectors decreased from 8.6% and 32.6% in 2012 to 7.9% and 31.5% in 2014, respectively. The contribution of energy from other sectors such as AFOLU and fishing is negligible.

Energy consumption by sector (TJ)



5.2.4. Energy Supply in GKMA

The main sources of biomass and electricity supply are outside Kampala region. Charcoal is mostly supplied from the Central and northern parts of Uganda. Hydropower is the dominant source of electricity and it is supplemented with thermal power plants. Electric energy supply to the national grid, hydropower contributes about 90.5%, cogeneration (sugar factories, Kinyara and Kakira sugar factories) 6.7% and thermal plants 2.8%. All petroleum fuels are imported. There were two thermal power plants in GKMA.

In 2012, the Aggreko 50 MW Uganda Limited thermal electricity was decommissioned. The only one operating today is Jacobsen 50 MW thermal plant. The Electro-maxx is located outside the boundary of GKMA. The main electric energy suppliers are the independent power producers to the national grid. The auto-generators are those who produce energy by using generators for their internal use. The contribution of the auto generators is small.

The largest hydropower plant Karuma (600MW) will be commissioned in phases starting in around 2020, while Insimba hydropower plant (183MW) may come on line in 2018. Currently the energy generation by hydropower is below the demand. It is most likely that thermal power will be back to supplement the electricity demand and some imports may be made from the neighboring countries.

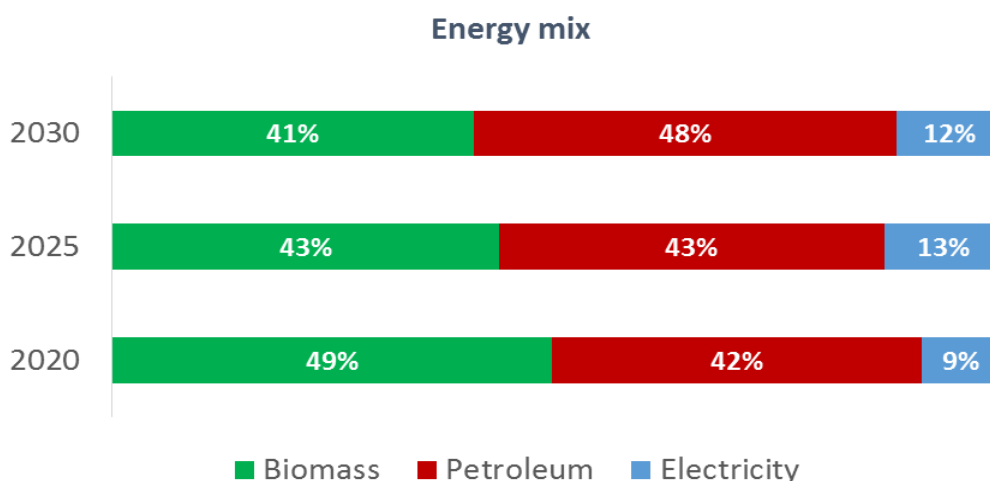
GKMA will still be the dominant user of modern energy in the foreseeable future. The electricity tariff is most likely to increase up to the year 2018. The falling price of oil may not be enough to lower the electricity tariff in the near future. The development of petroleum sector will have great impact to the country assuming that the development efforts are maintained.

5.2.5. Projected Energy Demand in GKMA

Biomass is a very important source of energy and it will continue to be so in the foreseeable future. There will be gradual reduction in the use of biomass. The contribution of biomass to the energy mix will reduce from 49% in 2020 to 41% in 2030. The energy profile for GKMA is as shown in Table 3.

Table 3: The Projected Energy Profile for GKMA

Energy Source	2020	2025	2030
Biomass	43,469	48,832	57,910
Petroleum	36,591	48,839	67,906
Electricity	7,873	14,779	16,809
Total	87,933	112,450	142,625



There will be increased use of modern fuels over the decade. The contribution of petroleum and electricity will increase from 42% and 9% in 2020 to 48% and 12% in 2030, respectively.

5.2.6. The Projected Energy Demand in different sectors

According to the Uganda's vision 2040, Uganda is expected attain low middle-income status in the period 2017 to 2032. This means that Uganda will begin a new phase of development by 2020. The projected energy demand will increase from 87,933 TJ in 2020 to 142,625 TJ in 2030. This means that the energy demand will increase by about 62% over the decade. There will be a little change in the contribution of energy used to produce electricity. The energy use in industry will increase by 73% over the decade. It implies that Uganda will be entering into a new phase of industrial development. The projected energy demand in GKMA is as seen in Table 4

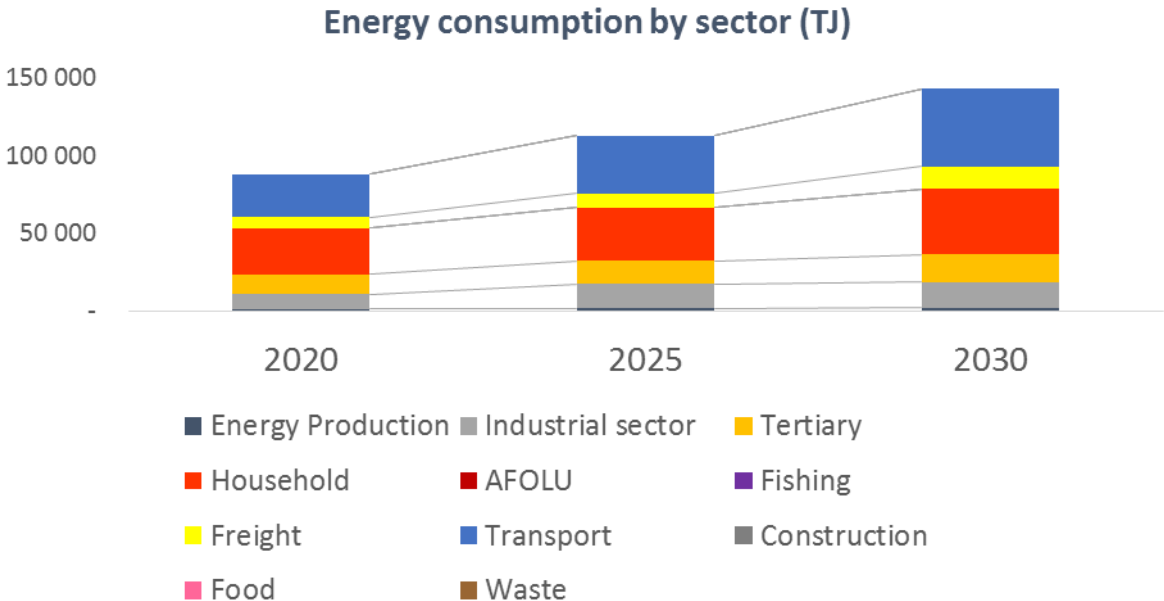
The auto energy generators will continue to depend on diesel as the main source of energy. The projected energy consumption will be increased by 68% over the decade. The contribution to the total energy will be negligible. The projected energy demand is as shown in Table 4.

Table 4: Projected Energy Demand in TJ (2020 to 2030)

Sector (TJ)	2020	2025	2030
Energy Production	1,610	1,965	2,701
Industrial sector	9,467	15,590	16,402
Tertiary	12,688	14,779	17,492
Household	29,830	34,075	41,913
Fishing	2.56	2.53	2.66
AFOLU	32	42	51
Freight	6,760	9,055	14,178
Transport	27,542	36,974	49,975

The contribution of energy used by the tertiary sector will reduce from 14 % in 2020 to 12% in 2030 of the total energy consumption. There will also be a reduction in the ratio of household energy contribution, which will be from 34% in 2020 to 29 % in 2030.

The overall changes in energy consumption in tertiary and household sector will increase by about 1.4 folds over the decade. The ration of energy used in the transport and freight sector will increase from 8% and 31% in 2020 to 10% and 35% by the year 2030. The transport and freight sector will have the highest overall changes in energy consumption. The energy consumption in freight and transport sector will increase by 2.1 folds and 1.8 folds respectively over the decade.



In 2030, the projected energy demand in the industrial sector will be about 11 % of the total energy demand. There will be an increase in the consumption of fuel for industrial boilers, electricity and LPG. The demand of biomass will reduce gradually in the industrial sector, but there will be a gradual increase in the agricultural waste use in this sector. The tertiary sector is projected to contribute 12% of the energy demand. There will be increase in electricity demand and there will be a gradual decrease in the demand of biomass and kerosene. The household energy demand will contribute 29%. There will be an increase in the demand of LPG and electricity. There will be gradual decrease in the demand of biomass and kerosene.

The energy demand for the freight sector will increase because of the expected movement of freight for construction material and merchandise. Energy demand in freight sector will contribute 6% of the total energy demand in 2030. Transport sector will be the largest contributor 35% to the overall energy demand in 2030. Most of the vehicles will be found within GKMA. The modern fuels demand will be increasing due the expected increase in the disposable income within GKMA.

5.2.7. Emissions in GKMA

The study began with a literature review. The documents reviewed included the work on the inventory for Kampala and GKMA, which was done in 2013. The base year for the study was 2012. The main guideline used for the computation in the present study is the Global Protocol for Community (GPC)-Scale Greenhouse Gas Emission Inventories 2014. The GPC establishes

credible emissions accounting and reporting practices which has been accepted internationally. It was used to develop an emissions baseline emission in this study.

Most of the industrial and commercial activities in the country take place within GKMA. It is for this reason that the highest concentration of the anthropogenic emissions is expected to be within GKMA. The sources of emissions covered in this study were divided into eleven sectors and these are: Energy production which includes emissions from all equipment which generate energy, such as thermal powered generators used generate power and sold to national grid, diesel generators in industries. The industrial sector, covering emissions from energy use in the industries as a result of fossil fuel and biomass combustion. There are other emissions from use of refrigerants in industries. These refrigerants are normally used in cold rooms and refrigerated environment for industrial processes. The tertiary sector includes commercial subsector, education and research institutions and government institutions. The main sources of energy are electricity and biomass energy, while the use of fossil fuel is limited in this sector.

The residential sector is composed of urban and peri-urban households. The emissions sources are mostly from charcoal combustion for cooking in the households. The main sources of anthropogenic emissions are from the use of kerosene and LPG use for lighting and cooking. There is very limited mechanized agriculture in GKMA but a limited keeping animal by grazing and poultry business. A portion of GKMA at Lake Victoria shores has landing sites. The main activities at the landing sites include transport by boats and fish handling. GKMA is the main center of economic activities.

Railway and trucks transport most of the freight. Light vehicles and a limited number of buses transport passengers and private travels. In both freight and passenger transport systems emissions are on the increase.

Most of the waste generated in GKMA is organic waste. The waste emissions are from the landfill, industrial liquid and solid waste, sewage liquid and wastewater. Direct emission is from combustion of fuels in a given activity, while indirect emission is the use of electricity generated from thermal systems.

5.2.8. Non Energy Emission

Industrial Processes and Product Use (IPPU) is a sector that covers greenhouse gas emissions occurring from industrial processes. Due to the low level of industrialization, the emissions in this sector are not significant. The sources of non-energy emissions are mostly from industrial process, the use refrigerants in the different sectors and the use of fertilizers in agriculture. There is negligible cultivation carried out in GKMA. Refrigerants are used in the household, commercial and industrial sectors. There was no sufficient data to calculate emission from refrigerants in Kampala City. The emissions industrial processes are mostly from the production of cement and lime produced outside GKMA. There are only two factories, which produce cement in Uganda. Both are outside the GKMA. Most of the food such as meat and fish is not processed.

5.2.9. Stationary Combustion

Energy production through combustion are often referred to as stationary combustion, comprises of emissions from fuels combusted by energy-producing sectors. This subcategory includes emissions from the generation of the electricity and combined heat and power generation. Petroleum fuels are used by Independent Power Producers to generate electricity and sell to the national grid. There are also several companies with generators, which are used internally and during load shedding.

Manufacture of solid fuel (charcoal) is considered as an energy production sector. Production of charcoal is mostly done using traditional methods with low efficiency. The efficiency of the traditional kilns is estimated at 10-12%. Charcoal is mostly used in the urban

households. These are significant emission from this sector. The emission in this sector is covered under Scope 3.

5.2.10. Mobile Combustion

The other broad categories of emissions are mobile combustions. These include all mobile transport, which can also be divided into various types. The most common types of transport are on road, off road (agriculture) railway, aviation and waterborne. Transport can also be divided into two categories freights and general transportation such as of people. The computation of the emissions in this sector is similar in approach to the stationary combustion.

5.2.11. IPPU (Industrial Product and Product use)

There are also other sources of emissions from industries, which can result from non-energy related industrial processes and product uses. These sources of GHG occurring from industrial processes, product use, and non-energy uses of fossil fuel, shall be assessed and reported under the IPPU. The production and use of cement and lime are examples. The cement and lime are used in construction infrastructure such as building and roads in cities. Since the cement and lime production is outside the city boundary it will be considered under Scope 3.

Cities are centers of construction activities. There are increasing demand for commercial and residential buildings, expansion of the infrastructure such roads, flyovers, packing and utilities. The data, which are needed for computation of GHG are square meters of infrastructure constructed, but in most cases these data are not captured except for very few commercial and residential buildings. The most common materials used in construction are steel, cement and lime. The emissions in this case fall under the non-energy industrial processes.

5.2.12. Agriculture, Forestry and Other Land Use (AFOLU)

This sector is wide because it deals with anything that involves land management that is not considered under energy, industries and waste treatment. The key greenhouse gases of concern are CO₂, N₂O and CH₄. Plant biomass is the main conduit for CO₂ removal from the atmosphere. The uptake of CO₂ through photosynthesis is referred to as gross primary production (GPP). About half of the GPP is respired by plants, and returned to the atmosphere, with the remainder constituting the net primary production, which is the total production of biomass and dead organic matter.

The sources of GHG from the Agriculture, Forestry and Other Land Use (AFOLU) sector which is produced through a variety of means, including land-use changes that alter the composition of the soil, methane produced in the digestive processes of livestock, and nutrient management for agricultural purposes. There are activities such as promotion of urban agriculture, will increase the missions in the cities but is good business practice. The emission in this case is Scope 1 in boundary emission due to agricultural activities. Due to the high population density in cities, extra food should be brought from the areas outside the city but they are not processed in most cases. The GKMA land is limited and value of land is increasing rapidly. The land for agriculture is decreasing while the built up area is increasing.

5.2.13. Methodology

This section covers different approaches used in the calculation of the GHG emissions in the eleven sectors considered in this study. In nearly all cases Tier 1 was used because of lack of national emission factors and limited data. Emission factors were obtained from the default values provided in the 1996 IPCC, 2006 IPCC Tables, EMEP/EEA, Air Pollutant Emission Inventory guidebook 2013, and other sources, together with associated uncertainty range. The computation of GHG emission, Tier 1 is used because it is the simplest calculation method. Moreover it requires the least data, and it is likely to provide the least accurate estimates of emissions. However higher Tiers can only be used when there is sufficient data. Applying a Tier 1 emission estimate requires the following information for each source

category; data on the amount of fuel combusted in the source category and the activity data. The activity data in the stationary and mobile combustion is the energy consumption. The data can be obtained from the national statistics.

Emissions from livestock are associated with enteric fermentation and animal waste management. The major GHGs emitted in this subsector are Methane (CH₄), Nitrous Oxide (N₂O) and other Nitrogen Oxides (NO_x). The 2006 Intergovernmental Panel on Climate Change (IPCC) Guidelines provides a framework in developing the GHG inventory for the agriculture sector. The activity data for livestock includes the type, number of animals and manure management systems employed to take into account the specific emission levels of each category.

There are two approaches of assessing GHG emissions under forestry and other land use. The first approach is based on information on carbon gain, less carbon losses (Gain-Loss Method). This method requires information on annual biomass stock increments, biomass losses, losses due to disturbance and carbon loss in soils. The Gain-Loss Method is flexible in that it can use both detailed data (Tier 2 and Tier 3) and coarse data (Tier1) where country specific detailed data is not available. Since many countries lack detailed data on land use and biomass stocks, the Gain-Loss Method is the default methodology. In this study carbon loss method was used.

The second approach is known as Stock-Difference Method where carbon stock changes at time t₂ are compared with the stock at t₁ and the difference divided by the years between the two inventories gives the annual stock change. This method is not applicable to GKMA because of lack of country specific data.

Industry Cement production method was used for calculating CO₂ emissions directly from cement production although it is not consistent with good practice. There is lack of data on carbonate input national clinker production and import data. Therefore the estimated emission was made based on the cement production data.

Methane (CH₄) is emitted during the anaerobic decomposition of organic waste disposed in waste disposal sites. The organic waste decomposes at diminishing rates and it takes long time before it decomposes completely. The First Order Decay (FOD) method (Tier2) was used to compute GHG emissions in the waste sector. It produces time independent emission profile that reflects the true pattern of the degradation over time. The use of FOD required the current as well as historical data of the waste quantities. It is a good practice to use FOD because it more accurately reflects the emission trends.

5.2.14. The Scope

Emissions are categorized into three scopes named as Scope 1, Scope 2 and Scope 3. Scope 1 covers GHG emissions that occur within the territorial boundary of the GKMA, which is administratively limited to the 941.2 sq. km surface area including the water body. Thus, it includes emissions from both mobile and stationary combustions in all sectors within GKMA. The Jacobsen (50MW) thermal plant in Namanve is located within GKMA. Scope 2 covers the indirect emissions that occur outside of the city boundary as a result of activities that occur within the city. In this case it mostly from the electric power generation, which are outside city boundary such as Electro-Maxx in Tororo. The GHG emissions are produced directly by the combustion of fuels or indirectly by the use electricity from the grid. Scope 3 is any other indirect emissions considering the emissions that occur outside of the GKMA boundary, as a result of activities of the GKMA. These are emissions from activities such as charcoal production and cement production.

5.2.15. The Emissions in GKMA

The emissions in GKMA will increase due to the increase in population and industrial development. The total emission will increase from 6.5 million tonnes in 2012 to 6.9 million tons in 2014, which is about 6.4% over the two years. There was a decrease in the contribution of

the energy production sector due to the improved hydropower supply. The contribution of the energy production reduced from 3.1% in 2012 to 1.1% in 2014. The contribution of the industrial sector increased from 3.3% in 2012 to 5.3% in 2014. That is due to the increased industrial development in the region.

Table 5: Emissions from the different sectors

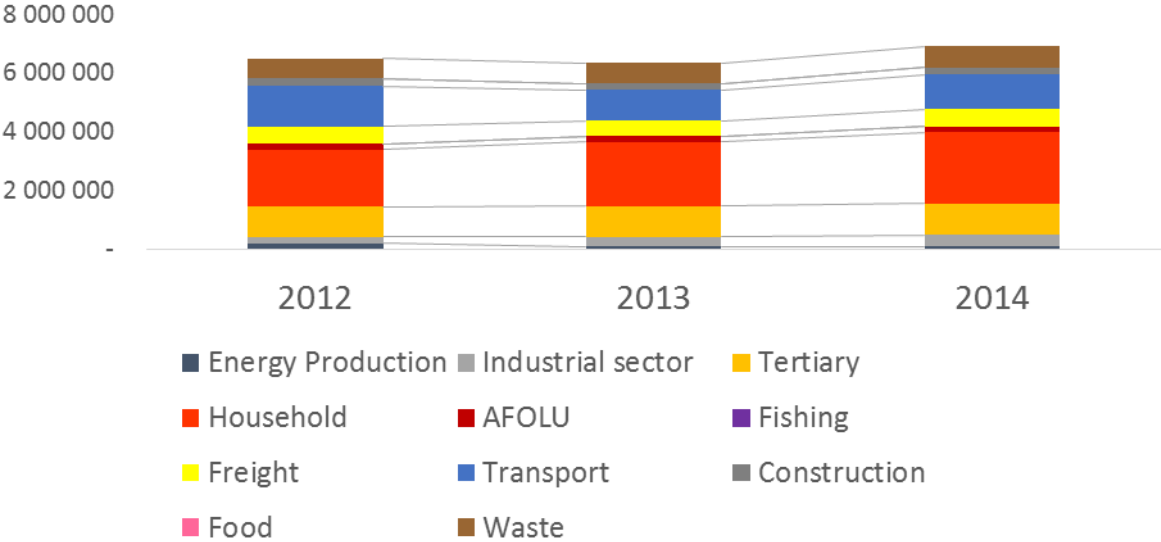
SECTOR (tCO ₂ e)	2012	2013	2014
Energy Production	191,617	68,472	82,253
Industrial sector	216,011	336,189	391,887
Tertiary	1,025,516	1,053,427	1,078,730
Household	1,949,860	2,174,633	2,416,688
AFOLU	204,425	201,297	197,723
Fishing	27	29	27
Freight	582,377	541,696	597,949
Transport	1,385,384	1,031,265	1,164,399
Construction	248,211	232,626	245,138
Food	-	-	-
Waste	677,400	700,750	724,100

In the tertiary sector the emission contribution increased from 15.8% to 16.65% over the same period. In the household sector, the contribution increased from 30.1% in 2012 to 34.3% in 2014. In the AFOLU sector, there is small increase due to energy use. Generally there will be a decline in contributions to the emissions. The contribution increased from 3.15% in 2012 to 3.17% in 2014.

The fishing and food sectors there they are negligible. Although there was a general increase in emissions in the transport and freight sectors, the contribution of these sectors decreased from 21.4% and 9.0% in 2012 to 8.5% and 16.3% in 2014 respectively. The contribution of the construction sector reduced very slightly, thus from 3.8% in 2012 to 3.7% in 2014.

The increasing population and industrial development will generate more waste. The contribution of the waste sector to the overall emission increased from 10.5% in 2012 to 11.5% to 2014. This implies that mitigation measures will in the residential, transport, fright and tertiary sectors.

GhG emissions by sector (tCO₂e)

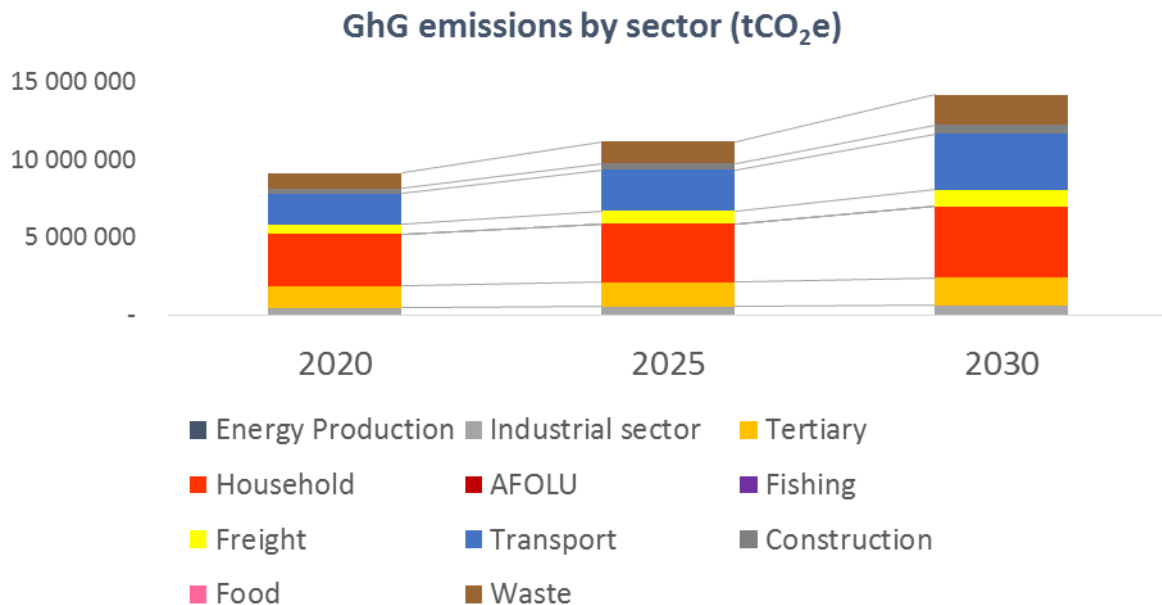


5.2.16. Projected Emissions GKMA

The availability of modern energy is important for national development. Since Uganda will be moving from lower income country status to a higher status, the emission in the energy sector will also increase. The emission is projected to increase from 9.1 million tonnes CO₂ eq. in 2020 to 14.16 million tonnes CO₂ eq. The overall emission will increase by 55% from 2020 to 2030. The projected emission is as shown in Table 5.

Table 6: The Projected Emission Tons CO₂ eq. 2020-2030.

SECTOR (tCO ₂ e)	2020	2025	2030
Energy Production	47,043	45,417	57,965
Industrial sector	453,280	527,482	614,178
Tertiary	1,404,926	1,578,651	1,774,858
Household	3,319,634	3,718,179	4,523,726
AFOLU	190	188	198
Fishing	2,246	2,895	2,895
Freight	604,766	810,599	1,088,029
Transport	1,961,557	2,634,809	3,563,262
Construction	336,852	428,865	557,459
Food	-	-	-
Waste	1,002,400	1,393,850	1,933,800



The contribution of the tertiary and household sectors will decrease from 15.4% and 36.3% in the 2020 to 12.8 and 31.9%, respectively. The increase of emissions from the tertiary and residential will be 26% and 36%, respectively over the same period. The transport and freight sectors contributions to the overall emissions will increase from 21.5% and 6.6 % in 2020 to 25.2% and 7.7 %, respectively. The emissions from the freight and transport sector will increase

by 80% and 82, respectively over the decade. The contribution of emissions from the waste sector will be 13.7 % of the total emissions in 2030. There will be an overall increase in the emissions from the waste sector by 93% over the decade. The sectors with high emissions are transport, freight and waste sector. These are the sectors where mitigation will be priority.

5.2.17. Uncertainty

There is uncertainty in the inventory, which rises from various sources. In most cases there is limited baseline data in all sectors. The data on biomass consumption is based on extrapolation on the work done over ten years ago. The level of uncertainty associated with stationary combustion activity data in commercial, institutional and residential is 10-15%. There is no data of the vehicle fleet. The uncertainty in mobile combustion is $\pm 10\%$. The uncertainty in waste sector due to use of default factors is $\pm 10\%$. There is limited data in infrastructure the uncertainty may be ± 25 . The emission in this sector is small when compared to other sectors. At times data given by different organization do vary. Since most of the emissions are from mobile and stationary combustion, the uncertainty can be $15 \pm 5\%$.

5.2.18. Mitigation options

Kampala City is currently relying on biomass as the major source of fuel. Due to the ongoing development at National level and Kampala City in particular, there is increase in the use of petroleum fuel mostly in the transport sector. The use of thermal power generation is common when there is urgent demand for electricity. It is not sustainable.

The best option is to start with energy efficiency in all sectors. Use of energy efficient stoves in institutions and households can reduce energy consumption by 20%-40%. Improvement of road infrastructure in GKMA coupled with good driving practice and putting restriction on the age of second hand vehicles imported can reduce energy consumption by 25%-30%. Fuel switching to low carbon intensity fuels at household level may not be feasible in near future.

In transport sector the fuel switching to blended fuel is feasible. It will reduce gasoline consumption by 5-20%, depending on the availability of ethanol. The use of biodiesel may take longer before it can be implemented because there will be need of continuous feedstock and infrastructure to produce biodiesel. Uganda will be depending on biomass as one of the most import fuel. Biomass has a lot of benefit. There is need to promote forestation and afforestation projects to supply biomass for energy in Kampala City.

The use of mass transit system such the BRT project will also reduce fuel consumption substantially. There are on-coming projects such Standard Gauge Railway and light rail system using electricity. The commencement dates of these projects are not well known. The government is investing heavily on road and energy infrastructure. The use of thermal power plants will be limited. There are possibilities of generating electricity from wastes and solar energy at large scale, with installed capacity over 10MW.

5.2.19. Conclusion

In 2030, Business as Usual Scenario, the transport sector will be the leading sources of GHG emissions contributing 31% of the total emission and followed by freight sector 10.2%. The waste sector contributes 5.7%. There are sectors where most of the emissions can be reduced. The mitigation options should take these sectors as high priority. Although the tertiary and residential sectors contribute 21.6% and 21% respectively, most of the emission is biogenic. If the biomass supply is not sustainable, there could be another challenge in emissions. The GKMA should work in collaboration with the line ministries to get collect data specific for GKMA. UBOS is one of the most important institutions to work with. There is a need to develop data management systems for GKMA.

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6. Additional information on sectors

6.1. Energy

6.1.1. The levels of responsibility

"The unbundling of Uganda Electricity Board led to the creation of three successor companies namely: Uganda Electricity Generation Company Limited (UEGCL), Uganda Electricity Transmission Company Limited (UETCL) and Uganda Electricity Distribution Company Limited (UEDCL)".

- **UEDCL** is the owner of the electricity distribution network up to 33KV. The network was handed over to Umeme limited on the 1st March 2005, under a concession arrangement. Umeme Ltd is wholly owned by CDC Globeleq of UK. UEDCL was privatized by the Government of Uganda (GoU) through a 20 year concession by bringing on board Umeme Ltd, a private investor, in the electricity distribution and supply business
- **UEGCL** is wholly owned by the Government of the Republic of Uganda. UEGCL's key role is to carry on the business of electric power generation and sale within Uganda or for export to neighbouring countries; build, operate and maintain Electricity Generation Plants; monitor the operation and maintenance of its Concessioned Assets – Nalubaale and Kiira Power Stations; provide Technical Support as and when required by the Government of the Republic of Uganda through the Ministry of Energy and Mineral Development; organize, support, encourage and maintain training facilities in technical and related fields.
- **UETCL** is a Public Limited Company which was incorporated on 26th March 2001. The Company operates under policy guidance of the Ministry of Energy and Mineral Development. It has the operational mandate that is divided into the Single buyer business and Transmission system operator. It therefore undertakes bulk power purchases and sales, import and export of energy, operation of the High Voltage Transmission Grid and plays the national system operator role."

KCCA is not the authority in charge of the energy distribution networks management. For electricity, this is the responsibility of the national agencies and companies under the supervision of the Ministry of Energy. But regarding its responsibility in the fields of physical planning and landscape policy, KCCA has a significant role to play with the national authorities to integrate and articulate physical and energy planning.

Indeed, for instance, every new constructed area will generate an additional need for energy. Then two main solutions occurs (in addition to the energy performance of the built facilities itself): the connection to the grid or a combined solution between the connection to the grid and the resort to renewable energies. We know that the electricity supply is facing breakdowns and requires serious investment to be strengthened which gives the advantage to the second option. To be efficient in the decision making process, it is important to consider upstream this issue and to work hand in hand to integrate energy and physical planning. This is inherent to the Smart City and Smart Grids approaches.

An Energy Master Plan at the City level would be an opportunity to conceive a general energy supply and demand Strategy.

6.1.2. A significant influence of Kampala in the national GhG and energy balance

In 2012, Uganda had to import energy in the amount of 1,187,672 TOE (different petroleum products) while the amount of exports (only electricity) amounted to 8,514 TOE (Ministry of Energy, Balance 2012). If we do not consider fuel for transport (which sector is

consuming most of the fossil fuel imported), the main resources are coming from hydropower and biomass – two resources that can be affected by climate change.

According to the NDP I (2010-2015) and NDP II 2015/16-2019/20 the peak power demand is rising about 22.7% per annum. The end user tariff for domestic consumers is one of the highest in East Africa.

“On the distribution side, the country continues to experience significant power supply shortages, low rates of access to electricity and high levels of power losses, all negatively impacting the country's socio economic growth” - Uganda National Climate Change Policy.

The national capacity production for electricity has been significantly developed over the past years. The Ugandan electricity consumption per capita is twice lower than the average in Africa which represents a low emission level per capita. But this will change with the continuation of the demographic and the economic growths.

In addition, looking at the current very inefficient uses of energy (wood energy, charcoal, candles or kerosene lamps for lighting) the related GhG emissions will continue to increase, degrading in parallel the indoor and outdoor air quality which affects public health.

In Kampala, the use of local renewable energy sources is very low at the moment. The main part of the electricity consumed in Kampala is provided by the national grid. The national energy mix is mainly sourced by hydropower which is good for GhG mitigation but it does not avoid the breakdowns of the electricity supply in Kampala and the price's increase.

We know that energy needs will continue to rise and that local production is insufficient. This is true for electricity, the energy used for cooking and fuel. KCCA, all economic activities in Kampala and the residents are dependent on import flows and price fluctuations in addition to generating greenhouse gas emissions. Any measure to develop clean energy production should be encouraged in Kampala. This requires complementary programs supporting the development of energy-efficient equipment's and equipment using renewable energy.

Different sources of energy are naturally present in Kampala. Potentials to recover and to valorize energy from wastewater or waste are also important and can play a significant role in the future to satisfy the new needs and to reduce the outside energy dependence.

It is crucial to consider all these local potentials before exploring and expanding the share of the fossil energies to satisfy the expected demand for energy in the coming years. Uganda is not yet a very intensive country in terms of energy consumption per capita, there is then a strategic objective to keep it low thanks to these local potentials supplier of green jobs.

The City level can significantly contribute to that objective by developing renewable energy projects at local level but also in developing a very dynamic policy of energy demand control towards local stakeholders and inhabitants. Experimentations in the fields of smart grids could be interesting even if there is no clear view at the moment of potential opportunities.

Energy is the core issue of the Strategy. Centralized energy production and energy distribution networks management are managed at national level but not at KCCA's level. Nevertheless, KCCA can be an energy producer on its own building and facilities. The Authority can also develop, with public and private sectors, important local production installations from renewables. The national feed-in tariff system aims at supporting the development of renewables.

“Renewable energy in the context of the REFIT is defined as electricity which can be generated from energy resources such as water power, wind power, solar energy, geothermal energy, biogas and landfill gas combustion, and biomass cogeneration.

The Key principles of Feed-in-Tariffs in Uganda are: Improved energy security, Reduce environmental impacts, Economic growth and stimulation, Diversified electricity supply mix,

Investment security for developers, Industry competition, and reduced transaction costs. “– Uganda Renewable Energy Feed-in-Tariff (REFIT) Guidelines 2013

Then, the main energy vulnerabilities concern energy supply dependence, energy networks reliability, energy price's increase and energy access for all regarding the high growth of the City. An Energy Master Plan prepared hand in hand with the related ministries would be a good option to make the city more resilient to energy vulnerabilities, programming investments in production capacities and combining energy and physical planning activities. In the mobility sector, regarding the fuel consumption increase and the related GhG emissions, the Non-Motorized Transport policy and the Bus Rapid Transit project could significantly reduce some of these energy vulnerabilities.

During his opening remarks, Mr. James Banaabe, the Commissioner for Energy Efficiency and Conservation at the Ministry of Energy and Mineral Development outlined the importance of energy efficiency for the country and provided the government's policy on energy efficiency and conservation. The Policy aims at promoting energy efficiency through improved use in energy intensive sectors such as transport, industry and commerce, households and institutions, and agriculture. He stated that since expenditure on energy constitutes a large proportion of the country's Gross Domestic Product, in order to achieve sustainable energy use, it is necessary to emphasize the effective and efficient use of energy. Partnership for Clean Fuels and Vehicles, Kampala 14 May 2015 workshop.

6.1.3. The place of charcoal and firewood

Kampala City is heavily reliant on wood energy and charcoal as a main source of energy for households who use it particularly for cooking.

The 2012/2013 Uganda National Household Survey Report⁴⁰ indicates that in Kampala 78% of the households use electricity for lighting and **80% of the households use charcoal for cooking often transported from distant areas leading to depletion of the national tree cover**. This causes significant GhG and particles emissions in the transport from the outside to the city center. It also reduces the local CO₂ storage capacity as the trees are carbon sinks. At home or in small shops, the misuse of wood energy and the non-performance of the equipment's are generating wood over-consumption which accelerates the reduction of carbon sinks.

The air quality is impacted by the particles emissions affecting public health. Improvement in the use of biomass has to be considered as a priority through the development of more efficient installations and the development of alternative source of energy.

The production of briquettes or the use of eco-stove including volcanic stones are contributing to this objective. For instance, KCCA in collaboration with the ministry of energy is piloting a project that is converting waste from 10 farmers practicing zero grazing into biogas for cooking. Youth groups have also been supported by initiatives such as the YLP and CDD to start briquette making enterprises that will reduce the use of charcoal and cutting down of trees.

In the short term, it will be very difficult to remove charcoal from households because of the current social organization of this “market” (formal and informal) that provides local jobs and then revenue. The financial needs for any new equipment procurement can also be a barrier for modest households and small traders. These social stakes must be considered on the long term seizing the opportunity of green activities development.

⁴⁰ Uganda Bureau of Statistics (UBOS). (2014). Uganda National Household Survey 2012/2013. Kampala Uganda; UBOS.



Eco-stoves for the Wandegeya Market Kitchen

KCCA has decided to support the development of Eco-Stoves in the city. 220 burners have been installed in the Market. Instead of firewood or charcoal, they use volcanic stones that can be re-used during 2 years.

They can be coupled with a solar photovoltaic panel to maintain longer the heat inside the stove and bring electricity for other use (lighting the kitchen, battery charger). This technology has social, economic and environmental benefits for the user, the guests and the local economy.

6.2. Agriculture

The city currently relies heavily on the hinterland for its food supply. Often the bulk of staple foods is transported very long distances to the city. Thus not only contributes to the City's increased carbon footprint but also makes the city vulnerable to food insecurity.

“Work force engaged in the sector stands at 73% at national level. In terms of environmental conditions, Uganda is gifted with fertile soils, regular rainfall and biodiversity. Agriculture thus provides a substantial contribution to the GDP, employment, export trade, food security and household incomes and hence eradication of extreme poverty” – Ministry for Water and Environment.

“Although there are no reliable figures on size of land under crop production in Kampala, it is estimated that approximately 40% of the undeveloped land in the City is utilized for crop production. However, most of these agricultural operations are poorly organized resulting into low productivity and low incomes. The most recent livestock census indicates that 21.8% of the households in Kampala rear at least one type of livestock or poultry and 47 farmers are practicing aqua-culture” – KCCA Strategic Plan.

Besides, the agriculture sector in the country is still traditional, rain-fed, and the energy use is still low. This makes it vulnerable to climate change impacts thereby affecting food supply to the city, and translating in higher prices especially as national adaptation systems are not yet developed.

In Kampala, food is produced from very small scale farming. Demand is growing high and stocks will reduce in the future. Developing **urban agriculture** is a way to develop local employment and to reduce the city dependence to the food production from the outside. It is also a way to reduce the transportation impacts (GhG, particles, fuel) and the costs. The production is mainly organic and may use local compost. It is important to support the organic production and to banish chemical fertilizers and pesticides (which are polluting and GhG emitters), or GMO when alternative eco-solutions exists. The use of fertilizers and pesticides is currently low which limits the impacts on climate change, preserves the quality of agriculture (especially organic agriculture) and guarantee good health conditions.

If we look at energy potential, there is a high potential to produce or to recover energy from green waste, crop residues and from livestock.

KCCA and Government are leading a study on the valuation of biogas from farming.

KCCA in collaboration with the ministry of energy is piloting a project that is converting waste from 10 farmers practicing zero grazing into biogas for cooking.

Thus agriculture is a very important cross-cutting issue regarding health, environment and physical planning – especially in a growing city with a growing population and a high consumption of space.

Developing urban agriculture provides an opportunity to promote new food management systems that improve food security, cheap and quality goods, and methods. It is also an opportunity - whether centralized place or private land plots within residential areas – to reduce the sprawl of construction and to improve infiltration of rainwater into the soil.

Through its competencies in terms of physical planning and economic development, KCCA can mobilize different leverages to promote these initiatives.

Different examples of actions from national and local levels:

- *NAADS Programme (UGX 1.2b): 3,108 beneficiaries between 2011-14. KCCA set up the Kyanja agricultural resource center with a modern Pig breeding unit and a research center. Demonstration unit on recycling of nutrients through composting of organic waste is in the process of being setup at the Kyanja Agricultural resource center.*
- *Small Scale Enterprise Development Grants (UGX 3.5b). This program looks at providing startup capital to youth groups that demonstrate capacity to create employment*
- *Community-Driven Development Grants led by the Gender Directorate. 230 projects have been funded (UGX 5m/project, UGX 1.3b was disbursed). The survival rate is 78%.*
- *Community Driven Development project is expected to run alongside the already existing ones like NAADS*
- *Job Stimulus Package (national)*
- *Employment Services Bureau (UGX 1.0b)*
- *Repair empty stalls in Markets (UGX 1.0b)*
- *The national Youth Livelihood Program: loans at 0% interest rate refundable dedicated to project leader aged 18-30 (UGX 1b, 97 projects)*
- *Markets and Agricultural Trade Infrastructure Improvement Markets (national program): construction of 6 markets in the City.*
- *KCCA in collaboration with the ministry of energy is piloting a project that is converting waste from 10 farmers practicing zero grazing into biogas for cooking*



Urban Agriculture Policy

KCCA plans to roll out a number of programs that will facilitate residents and especially youths to start viable agriculture and livestock enterprises, build their capacity to grow and sustain them as well and link their products to markets – In line with the Vision of Uganda 2040. Introduction of modern and appropriate urban farming technologies in the City including the use of green houses for growing of vegetables or vertical planting.

- ▶ Improving food production for better nutrition and social welfare at household to district level
- ▶ Facilitating the provision of adequate, safe and wholesome agri/fish products to inhabitants without degrading the environment.
- ▶ Promoting modern agricultural eco-technologies ideal for urban farming;
- ▶ Establishment of value chains linking farmers to the urban markets
- ▶ Establishment of a bulking warehousing facility for processing, packaging and marketing farmer's products
- ▶ Establish hydroponic fodder production units for provision of cheaper livestock feeds for urban farmers
- ▶ Strengthen and scale up operations at the **Kyanja agricultural resource center** for training and demonstration purposes;
- ▶ Introduce high value animals and crop varieties -some of the enterprises to be demonstrated and which the youths will be supported to adopt include; greenhouse farming, hydroponics vegetable and fodder production, aquaculture, piggery, poultry, mushroom production, kitchen gardening and briquette making;
- ▶ Mobilize and organize farmers into producer associations and facilitate their ability produce in bulk, quality assure, share information and experience; and bargain for better prices
- ▶ **Kitchen gardening production:** KCCA support the setting up of vertical spaces to establish garden (vegetables). 100 groups of 20 members (2000 people in total) are involved. The experience is promoted at the Information Center.

6.3. Waste

6.3.1. The mandate

In Uganda waste management is regulated by the Ministry of Water and Environment (MWE) and the local government authorities. KCCA is responsible for the collection, the transport and the disposal of solid waste generated in the City.

The informal sector is important in Kampala. The waste collection was unavailable for a part of the population before 2015 but this has change with a new organization (delegation to the private sector) and a total coverage of the city with the implementation of commercial ratepayer collection services. Significant progress have been reached these last years thanks to joint cooperation of NEMA and KCCA.

At the moment, the amount of solid waste generated overwhelms the capacity of collection and disposal – knowing that less than a half of the total waste generation was not collected until now. The non-collected waste is dumped or is burned.

Premised on the polluter pays principle as articulated in the Solid Waste Management Ordinance (2000), KCCA commenced on increasing private sector and civil society involvement through the framework of the Kampala Solid Waste PPP Project. This is being realized through the procurement of bidders for the collection & transportation component and the landfill construction and operation component. Eight (8) have been shortlisted for collection and three (3) for the landfill operation.

Benefits being realized from the integrated approach to date: 1. Establishment of a private solid waste collectors association & consortium to bid for collection; 2. Formation of a civil society solid waste management consortium 3. Zoning of the city with an emphasis on equity. The zones are calibrated to have the affluent and informal settlements served. Each selected company will have an affluent and a non-affluent area. A tariff grid has been established.

6.3.2. The policy

By 2015, the waste is then collected by the private operators on behalf of KCCA for households and the waste collected by other private operators for other waste generators are dump is the landfill. KCCA has one major waste disposal facility, **the Kiteezi landfill** in Mpererwe which is overloaded. An extension of the landfill has been procured and the authority is looking for a new site to open a second landfill.

For households, KCCA has defined 7 waste collection zones covering the whole city that will be served by a private waste collector affected to each zone. Through inspections, KCCA encourage developers to have licensed solid waste companies to collect waste generated for proper disposal.

KCCA has over the past three years undertaken a number of measures to improve on solid waste management that have included:

- Increase in garbage collection by over 100% from a monthly average of 16,000 tons in April 2010 to over 33,500 tons by June 2014;
- Distributed over 700 litter bins in the Central Business District, schools and Hospitals to promote responsible solid waste management;
- Procured 8 garbage trucks (these included three (3) compactors with a capacity of 20 tons and five (5) skip loading trucks with a capacity of 10 tons each and a servicing capacity of eleven (11) skips) and 55 garbage skips to further improve garbage collection;
- Initiated street sweeping and cleaning program to improve garbage management;
- Procured 6 additional acres of land to increase the capacity to current land fill in Kiteezi;

- To further enhance garbage collection, KCCA has developed a comprehensive **Solid Waste Management Strategy** (Reducing, Reusing, and Recycling) that includes utilization of the waste resource. Energy production and recovery is targeted through this integrated strategy.

Sensitization will be very important ("Bring on truck"). KCCA develop containers for communities. They are closed to reduce the smell especially in informal settlements where it is hard for trucks to go. An important sensitization plan will start by the end of 2015.

In public markets, KCCA is collecting waste and gives containers. When the trucks arrive, actors have to come and put their waste into it. In private markets, they have to recruit their own private companies (obligation). The collection is still mixed, no separate collection.

An **Annual Sanitation Forum** is organized once a year with all actors and NGO of Kampala. This help to make everyone understand who is responsible for what.

6.3.3. The energy and GhG component

In the national GhG inventory, GHG emissions from waste were 33 Gg of CH₄ of which 30.8 Gg were from solid waste and 2.7 Gg were from wastewater (1.2 Gg from domestic waste water and 1.5 Gg from industrial wastewater). The main GhG emitted is methane which has a 21 higher Global Warming Potential than CO₂. Emissions from the waste sector increased by 71.9% from the year 1994 and to 2005 and by 38.0% from 2000 to 2005 at national level. "In the waste sector, it was noted that the level of waste composting is expected to increase to between 10% and 15% as composting is taken up by more municipalities.

"There is high solid waste generation in urban areas of approximately 0.56 kg/person/day. The urban solid waste is mainly composed of vegetable / organic matter (83.6%) and waste paper (10.9%). These mainly originate from household, business premises and offices. Other materials include: wastes plastics (1.2%), waste metals (0.3%) and glass / cullet materials (0.1%) while other miscellaneous materials such as broken pots, enamels, containers other than plastics and metals constitute 3.9 percent". – Second National Communication to UNFCC

In Kampala, the volume of GhG emissions from waste varied from 327,774 tCO₂e to 329,406 tCO₂e between 2012 and 2014. The business as usual scenario expects an increase to 370,002 tCO₂e in 2020 and to 425,995 tCO₂e in 2030.

"It is estimated that Kampala's average waste generation is 1kg per capita per day. It is estimated that about three quarters of waste generated is organic in nature, with plastics (12%) and paper and board (11%) making up the next largest categories. The small remainder includes glass, textiles and metal"– KCCA Strategic Plan 2019

Everyday approximately 1000 tons of waste are dropped in the Kiteezi landfill (14km from Kampala) which represents less than 50% of the waste production. The amounts deposited at the Kiteezi landfill doubled from 16,000 in 2011 to 32000 tons per month in 2014. Around 75% of waste dumped at Kiteezi are bio-waste.

- 360,459 tons of solid waste was collected with about 60% collected by KCCA. This gives an average of 32,769 tons/month, from 29,543 tons/month in June 2012 indicating an increment of 11% over the period; □

It is further estimated that two thirds of waste is disposed by means other than the landfill site (which is getting filled up). These other means include burning of refuse, illegal dumping of waste by refuse collectors or building contractors, household dumping of waste into storm water channels, sewers or public areas, and incineration of waste. These disposal practices

manifest themselves in health problems, blockage of drainage systems, air pollution, odors, and degradation of the urban environment.

The main energy issues of the waste management activities are related to the waste collection circuit, the performance of the vehicles fleet and the waste treatment options.

For the collection circuit and the fleet, the stake is focused on fuel supply, price increase and energy efficiency of the vehicles. The optimization of the mileage for the collection is also a leverage.

For waste treatment, it concerns the GhG emissions generated by the landfill due to the open sky disposal and the absence of methane valorization. Besides, the most of biggest part of waste at household level is organic, which is a source of methane and hence GHG emissions.

The capture of the methane from the landfill could be a huge source of revenue and jobs and a way to significantly reduce the contribution of the waste sector to the GhG balance of Kampala. For the new landfill, the energy potential can be studied from the design of the site. For the existing one, a specific survey could benchmark the most appropriate solutions to reduce the current environmental impacts and to develop energy recovery. Then investment to mitigate the GhG emissions and to recover energy in the current landfill and in the new one have to prioritized.

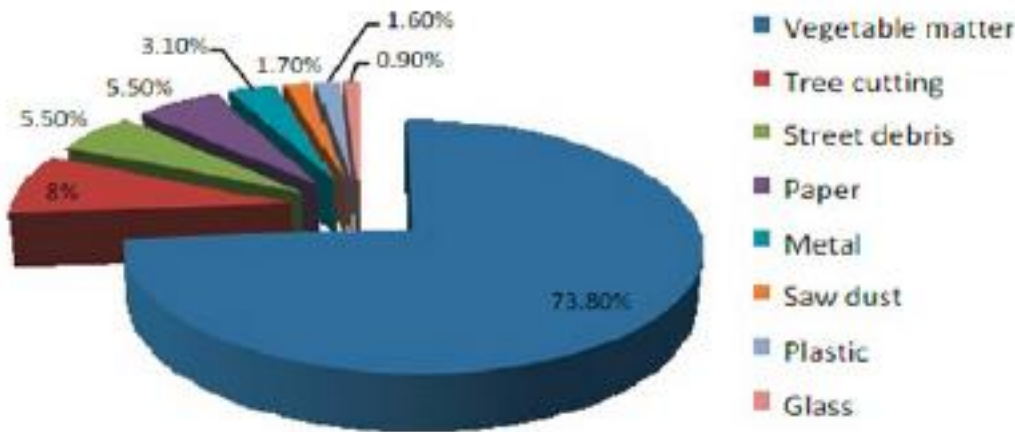


Figure 24 Composition of Solid Waste Collected
Source: Madinah et al, 2014

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With the banishing of plastic shopping bags (kaveera), the GhG emissions should be reduced. These bags may be replaced by alternative solutions produced locally from natural or reuse materials. The same for instance if the Authority decided to banish disposable plastic flatware and plastic glass from public events.

KCCA supports CBOs that are engaged in recycling through the Community Driven Development (CDD program).

There are private companies that own incinerators to destroy mainly hazardous waste and these are licensed by National Environmental Management Authority (NEMA) to operate. They also conduct audits to track performance. Industrial and medical waste are going to Nakasongola incinerator.

⁴¹ World Bank, Promoting Green Urban Cities, Uganda Kampala, 2015

6.3.4. The potential for green activities related to waste management

A significant improvement in the management of the whole chain of value of waste management can create positive impacts in terms of green activities development and job creations. There are indeed important potentials in the sector of waste through **prevention and reduction, reusing and recycling, recovering**.

The success of green jobs development is depending of joint-action between national entities, local authority and the private sector. Until now, there is no industrial ecology logic or circular economy approach in the sector of waste management.

KCCA and the private operator have started to install **public garbage with sorting of rubbish** into different type of recycling. This is going in the good sense and could support the development of the related recycling industry which are currently missing.

The sector can offer a wide range of job profiles because next to the necessary engineering capacities there is a need for social, education, animation or mediation profiles. There is a strong need to **develop sensitization and education measures** Waste is still considered as a problem (which is the case) but not as a potential (which could be the case). For waste to be regarded as a potential (resource), prevention and education campaigns can foster change in behaviors and new business development in the sector.

6.4. Water and wastewater

6.4.1. The mandate

The mandate for water production and water supply is **managed at national level**, not by KCCA. While the mandate is at National level, Local governments like KCCA should have a streamlined way with how the communications, electricity and water lines are laid that would not spoil the existing infrastructure. Furthermore, **the development of these different networks is correlated to the physical development of the city and to the increase of the standard of living. Spatial planning is the responsibility of KCCA and it is therefore essential to improve the integration of national policies and local policies**, particularly regarding the water supply of the city and rainwater management.

Water supply and sanitation are recognized as key issues under the National Poverty Eradication Action Plan (PEAP). The 1995 Constitution of the Republic of Uganda instructs the Uganda Government to take all practical measures to promote a good water management system at all levels and defines clean and safe water as one of its 29 objectives.

- *Promotion of the provision of a clean, safe, and sufficient domestic water supply to all people*
- *Promotion of the orderly development of water and its use for other purposes, such as irrigation and industrial use, among others, in ways that minimize harmful effects to the environment*
- *Pollution control and promotion of safe storage, treatment, discharge, and disposal of waste that may cause water pollution or other threats to the environment and human health.*

“The Directorate of Water Resources Management, under the water regulation and together with the National Environment Management Authority (NEMA) under the National Environment (Standards for Discharge of Effluent into Water or on Land) Regulations, provide a regulatory platform for enforcing regulations on wastewater discharge.

The Sewerage Services Department (SSD) under Kampala Water is responsible for operation and maintenance of the sewerage network, treatment plants as well as making new sewer connections and/or extensions in Kampala. “

6.4.2. A cross-cutting issue

In the past decade, the potential of the wetland to remove nutrients and pollutants has been greatly reduced due to continued pressure by human settlements, industrial establishments, and drainage channels for crop production (Wetland Management Department, 2008). Despite recognition of the wetland's value, half of the wetland has been modified with only the lower parts remaining in fair condition. There is an increasing concern to conserve and restore the ecosystem services and products of the Nakivubo swamp.

NWSC on behalf of the Government of Uganda developed a long term sanitation development Program for Kampala City in 2008 which is clearly elaborated in the Sanitation Master Plan for the City of Kampala. Under the Kampala Sanitation Master Plan, four decentralized satellite sewage treatment plants located in the following four priority drainage areas of metropolitan Kampala are to be constructed:

- ▶ Nakivubo Wetland to serve the central business district of Kampala City Center, Naguru, Nakawa, Kyambogo, Mbuya, Bugolobi and Kitintale
- ▶ Kinawataka Wetland to serve the eastern parts of Kampala
- ▶ Lubugi Wetland to serve the North and North Western parts of the Greater Kampala
- ▶ Nalukolongo Wetland to serve the West and South-western parts of the Greater Kampala mainly targeting the Nalukolongo Industrial area and neighbouring areas.

These are all supposed to protect Lake Victoria where treated and not-treated water is discharged. The impacts on the **quality of the Lake Victoria water** are already important. The urban development and/or ecosystem degradation is affecting/preventing the wetlands from playing their natural key role (dust is also released and goes onto the Lake affecting its functioning).

According to the Strategic Plan 2019 of KCCA, Sewerage Corporation and other agencies undertake the following:

- ▶ Construction and operationalization of more free public toilets in the City. KCCA is proposing to construct a total of 50 public toilets across the City;
- ▶ Construction of VIP toilets in City Schools and Health Centres;
- ▶ Extension of Pipelines, Improvement and re-dimensioning of secondary and tertiary sewers to increase capacities for the next 20 years;
- ▶ Overhaul the sewerage system in the City and improve the Sanitation through Condominium Sewerage system (SICoS);
- ▶ Increase the number of homes/persons accessing national piped water and sewer grid from the current 7% to at least 45% with emphasis given to areas of maximum impact. Slum areas, having the highest population density in the city, and yet being largely unserved.

The activities of water production, distribution and treatment are the responsibility of national public agencies (NWSC) although KCCA is very concerned through its competencies like public health, environment protection, urban planning, private water sanitation (public building, schools) and roads (under which networks are installed).

A large proportion of Uganda relies on groundwater sources. This decline is attributed to land use change, climate variability, land degradation, upstream deforestation and poor watershed management. – Second National Communication to UNFCC

Then in the context of its mandate, KCCA can develop a better linkage between the necessary cross-cutting approach of water / wastewater management and the energy and climate issues – especially in its physical planning and engineering activities. As explained, all utilities have potentials to be part of the energy master plan of the city. What is seen today as a constraint that affect environment can be turned into a positive component of the green

city development. Cooperation with the relevant institutions is nevertheless one of the necessary condition to achieve this goal.

Improvement of coordination and cooperation between national authorities and KCCA services in the design and the implementation of the policies is highly recommended. This concerns the overall approach that aims to protect the natural functions performed by the environment (wetlands), conservation of water resources, reduction of water leakage from distribution networks, sensitization of all stakeholders in water quality and conservation, innovation in wastewater treatment methods. As KCCA is also responsible for urban planning, the authority has a key role to play in supporting⁴² the development of the water distribution networks, wastewater collection and water treatment.

Kampala Water - Lake Victoria Water and Sanitation Project (KW-LV WATSAN Project)



National Water and Sewerage Corporation is implementing the Kampala Water – Lake Victoria Water and Sanitation Project (KW-LV WATSAN Project). The project is being implemented through funding from GoU and a consortium consisting of KfW, AFD, EU-ITF and EIB. The project aims at providing long-term solutions to the water supply challenges of Kampala. The project is based on a long-term rehabilitation and extension strategy for the water supply system of Kampala (2003, updated 2010) and is closely linked to the on-going and future implementation of the Kampala Sanitation Master Plan (2004). The overall strategy aims at meeting Kampala's water demand for the year 2035. It includes a systematic and phased approach to reduce water losses and operational costs while protecting the watershed, improving sanitation conditions and serving the poor. (NWSC)

6.4.3. The facilities

About 67% of the population in Kampala is served with safe water.⁴³ Most of Kampala's population is not connected to the sewer lines. The lack of comprehensive piped sewerage network, adequate wastewater treatment and the subsequent discharge into the wetlands and Murchison Bay are key drivers of degradation and loss of ecosystem services. Only 10% of the population, primarily in the Central Business District and affluent areas, is served by the sewer system. 20% use septic tanks and the remaining 70% rely on on-site sanitation⁴⁴.

The SSD currently operates two Sewage Treatment Plants (STP) in Bugolobi (old one) and Lubigi (new one) - the former being a conventional treatment plant while the latter is based on Waste Stabilization Ponds (WSP).

The Lubigi STP has a combined capacity to treat 5,400m³ wastewater a day. It receives and treats wastewater from the piped network as well as fecal sludge that is brought by private cesspool emptier trucks.

The Bugolobi STP on the other hand, has a capacity to treat 33,000m³ of wastewater a day and receives piped sewage mainly from the central business district extending to parts of Old

⁴² See KW-LV WATSAN Project <https://www.nwsc.co.ug/index.php/contenthome/item/161-kampala-sanitation-programme-lake-victoria-protection-phase-project>

⁴³ UN Habitat, (2009). Climate Change assessment for Kampala, Uganda - a summary.

⁴⁴ Promoting Green Urban Development in African Cities, Kampala Uganda, Work Bank 2015

Kampala, Mengo, Katwe, Nsambya, Kibuli, Mbuya, Nakawa, Naguru, Bukoto and Kamwokya.

Wastewater generation has been estimate at 7.62million m³/year with nearly half of this from Kampala City alone. Water discharge permits are given on the condition that a wastewater treatment plan is installed.

In 2012, 90% of the collected wastewater of Kampala was discharged without any treatment. The use of pit latrines is very widespread. KCCA is responsible for the collection and the transport to the treatment facility of the content of the pit latrines (fecal sludge). This volume will seriously increase in the coming years.

6.4.4. The energy and GhG component

The current predominant method of wastewater treatment in Uganda is the use of open waste water stabilization ponds (WSPs) where the wastewater is treated under anaerobic conditions producing methane, which is released directly into the atmosphere - which is the case at Bugolobi in Kampala (WWTPs). "The sludge from primary and secondary sedimentation is treated in open anaerobic digesters, thus releasing biogas into the atmosphere. The main constituent of biogas is methane which has a 21 times higher global warming potential than CO₂". In the national GhG inventory, GHG emissions from waste were 33 Gg of CH₄ of which 30.8 Gg were from solid waste and 2.7 Gg were from wastewater (1.2 Gg from domestic waste water and 1.5 Gg from industrial wastewater).

With the population growth and the need to cover the whole territory with water distribution networks and wastewater treatment systems (centralized and decentralized), energy consumption and GhG emissions should raise.

Waste discharge and wastewater treatment are sources of GhG emissions. Depending on the technology used to treat the water, energy consumption can vary. Energy efficiency and energy recovery can be developed in the new, the existing and the renovated sewage treatment plants. These measures apply on the technology to be used to treat the water and the functioning of the STP itself.

Through collaboration with National Water Sewage Corporation, at inspections, samples are collected and analyzed. From results KCCA is able to know the BOD and COD in relation to the standards of compliance. No-compliance to these parameters will represent inefficiency of the Waste Water Treatment Plant and management will have to take action.

KCCA Inspects industries that release waste water. If they do not meet the standards, nuisance notices are issued. Through public private dialogue, there is change in compliance management of waste water and other related practices eg solid waste management.

The sludge from households that is resulting from the wastewater treatment is sent to drying beds and sold to farmers. The supply of wastewater sludge in Kampala will increase considerably due to the implementation of the Kampala Sanitation Master Plan but at the moment, the offer is higher than demand so the unsold untreated sludge is sent to the Kampala landfill.

Water supply, in certain circumstances and depending on the topography of the territory, is using energy (pumping, blowing and moving). For instance groundwater supply can consume more electricity than surface water supply due to the pumping requirements if not enough gravity.

Water supply and wastewater treatment needs energy but can also be a source of energy (energy recovery, energy generation). This is what has been experienced at Kansanga School with the production of biogas from the fecal sludge.

Wastewater – including pit latrines collection and treatment - is also a source of non-energetic GhG emissions depending on the collection and the treatment systems implemented. These sectors are considered as high priority by KCCA and will be developed significantly. Then there is an opportunity to improve the integration of energy potentials and GhG emissions mitigation in the design of the forthcoming projects. This design must include a strategic vision of the location, the kind and the size of the treatment system to be developed.

Water production and distribution	Wastewater collection and treatment
<ul style="list-style-type: none"> ▪ Use efficient pumping and distributing systems 	<ul style="list-style-type: none"> ▪ Optimizing the collection system
<ul style="list-style-type: none"> ▪ Capture energy from water moving down 	<ul style="list-style-type: none"> ▪ Choose the best combination including high environmental quality treatment, energy efficiency and energy recovery for each step
<ul style="list-style-type: none"> ▪ Detect and repair distribution leaks 	<ul style="list-style-type: none"> ▪ Improve efficiency of aeration equipment and anaerobic digestion
<ul style="list-style-type: none"> ▪ Develop metering systems 	<ul style="list-style-type: none"> ▪ Energy self-production for auto-consumption (cogeneration, solar panel...)
<ul style="list-style-type: none"> ▪ Conservation of the natural resource 	<ul style="list-style-type: none"> ▪ Recycle water
	<ul style="list-style-type: none"> ▪ Protect the natural functions of the environment

Tracking leaks of the water pipelines and sensitizing people to efficient use of water are ways to protect the resource, to reduce the water pumping and supply operating costs (including energy consumption).

The potential of improvement in terms of sanitation and potable water supply is still very important across the city. They should be a source of job creation given the important need for water distribution and water treatment investments in the coming years. Energy and climate change are requiring new skills and knowledge in the sector to plan and to design the infrastructures of tomorrow and to develop efficient equipment's. It also refers to urban and geographic skills in terms of integrated planning and management of the land.

Public conveniences improvement

Plumbing, drainage and maintenance works have been carried out at KCCA Public toilets. UGX 416 million was spent on reconstruction, maintenance and running expenses for public toilets. A total of 4193 cesspool trips were made in the five divisions. With support from WaterAid, CIDI and AEE, 7 VIP latrines, 2 water based toilets and 10 Ferro cement tanks have been constructed in some pro-poor schools.

Improving drainage channels

In the continuation of its investments (construction and maintenance), Kampala Capital City Authority received funds from the World Bank to implement the Second Kampala Institutional and Infrastructure Development Project (KIIDP 2). Part of the funds are to be used to improve the priority drainage channels that are central to reducing the occurrence of floods in the worst affected areas in the city. KCCA contracted a consulting company to undertake feasibility studies and detailed designs of the priority drainage channels. These include Lubigi located in Kawempe and Lubaga divisions; Kansanga & Ggaba located in Makindye division; and Kinawataka located in Nakawa Division. In order to integrate environmental and social considerations into the design, environmental, social and resettlement action plan studies are also being undertaken.

- See/confirm pilot action by NWSC & Makerere to produce pellets from sewage sludge
- See Kenyan experience through the "Kenya National Domestic Biogas Programme" (development of a commercially viable, market-oriented biogas sector and dissemination of 8,000 domestic biogas plants in rural areas in Kenya)

6.5. Transport

Transport is one of the most exposed sectors with a high exposure to the increase in fuel prices. 75.5% of the national petroleum consumption comes from transport sector which also represent 67% of the direct GhG emissions of the energy sector in Uganda. 100% of oil is imported and the temptation to exploit fossil resources in the Uganda soil is high but this option is not sustainable because of its impacts on the local biodiversity, on green tourism and on the national and local GhG balances. Furthermore, the long term objective in Uganda and in Kampala is to reduce the use of individual motorized transport to favor non-motorized mobility, green and public transport. It also aims at reducing the impacts on air quality and traffic.

Although Ugandan motorists have observed a slight reduction in fuel prices due to the drop of international oil prices, it is not sustainable to think that an economy can just wait for international fluctuation to make motorist happy with the fuel price. Uganda is still vulnerable with international events (oil & gas markets, war conflicts...).

The centralization of the economic activities in Kampala involves many transport streams in the city boundaries but also beyond in the urban area of the Greater Kampala. Without an organized and planned scheme for mobility, coordinated at national and local level, the situation will remain the same. Massive investments in roads are ongoing and leading by both Ministry and KCCA. They are already and will contribute to relieve the traffic flow but this will be completely efficient when a joint policy will be implemented in parallel to promote connectivity, transit option, land use mix and density.

The sector is still exposed to the lack of a logistic and freight strategy based on a good structuring and connectivity of an upgraded road network. A freight and logistic strategy for Kampala is a serious option to consider. Developing a specific platform with the relevant private and public stakeholders would help the design of such strategy.

It is necessary to emphasize the importance of communication and coordination between the different levels of authorities, ministries, relevant national sectoral agencies, KCCA. These actors have different mandates, different fields of competences and different levels of investments. But they are all complementary, hence the importance of having continuous communication and of working together on upstream land planning activities. In transport matters, it is always about planning, integration and cooperation especially in fast growing cities such Kampala where projects are rising everywhere.

Improving vehicle fuel efficiency greatly contributes to the achievement of this objective. The baseline survey showed that the average vehicle fuel efficiency in Uganda was getting worse with time, mainly from the fact that the country was importing older vehicle over time. For example, the average age of diesel vehicles imported into Uganda in 2005 was 10 years and in 2014 this was 18 years. This meant that Uganda was not taking advantage of on-going global improvements in vehicle fuel efficiency. Partnership for Clean Fuels and Vehicles, Kampala 14 May 2015 workshop.

The potential of activities in the fields of eco-mobility are important (public transport, bike, car sharing, urban logistic...) but the current stock of jobs (regular or informal) provided by the existing transport solutions is also important (boda-bodas, matatu, repairing, recycling...). To succeed in changing the operating mobility in the City, wide consultations with actors will be needed. Both action on supply and demand sides have to be managed simultaneously.

6.6. Industry

Uganda's industrial sector is the second largest sector after agriculture, knowing that agriculture is the first supplier of industry (meat, fish, milk, coffee, grain milling, tea). Textiles, sawmilling and chemical products are also part of the industrial sector. **80% of the**

country's industrial sector is located in Kampala.

Any industrial process is consuming energy and the exposure to the price and to the supply of energy is very high. 15% of the national petroleum consumption comes from industry.

Energy savings, energy recovery and renewables can generate money savings, improve the chain of values and reduce the impacts of the activity on the environment. It helps to comply with UNFCCC expectations for the covered industries and with UN Global Compact for the enterprises engaged in a corporate sustainability / social responsibility policy.

Industrial activities are vulnerable in many ways by the impacts of climate change. The raw materials used by the industry come from sectors highly exposed to climate change (agriculture, fishing). Security of supply (of goods and energy) is an important stake.

The establishment of industrial sites is also a major issue in terms of impacts on the environment, exposure to climate risks (floods, fires, droughts) and impacts on road traffic.

Under its jurisdiction over land use, KCCA has the opportunity to work on an industrial development scheme to attract a new kind of industry and to improve the location of the existing production sites.

It can also promote joint actions between industrials. It would be interesting to conduct an outreach program with the industrial sector for energy efficiency and climate change. The idea of creating a community or a business club for exchange about good practices and to support joint actions must be developed. These actions are related to industries that are currently in Kampala but it is important to consider that the strategy is also about developing the green economy sector in many areas (waste, water, transportation, energy production...) which implies opportunities for new local industries. A specific program between national and local authorities should be developed to support the emergence of the green economic sector especially the industry and to make Greater Kampala an attractive destination. The national and the local strategies for climate change both create opportunities which should benefit the local economic sector.

6.7. Economic activities

As developed in chapter 3.2.7, Kampala has been gifted by the Ugandan beautiful climatic conditions and is influenced by a "green and blue" geographical environment that favours the development of different economic activities. However, this environment is very fragile, sensitive to climate change and to urban sprawl. When Kampala is affected, a bigger part of the economy is also affected because the city is a national crossroads and a road junction with neighbouring countries. Having a climate resilient and environmental vision of the city development aims at making the economic activities more respectful and better integrated into their environment.

Regarding the economic and the demographic growths we expect an increase of the energy demand and of the related GhG emissions from the economic sector. The objective is not to limit the economic development but to make it more efficient meaning that the energy intensity (unit of energy consume per unit of production) of the economic sector must improve with the current levels.

The need for greener products and services will growth in the coming years, induced by the impacts of the international regulatory frameworks but also by the emerging demand related to the improvement of living conditions. There is a multitude of co-benefits: improving the natural state of the local environment, seizing the opportunities providing by the emerging sectors to develop job in the local economic sphere, reducing the economic vulnerability to energy prices and breakdowns of households and economic actors, attracting international investments, empowering local communities...

Reducing the energy and climate vulnerabilities of an economy is a way to boost a part of this economy by supporting the development of green activities (products and services).

Therefore, **the resilience of an economy to climate change impacts is not only a defensive strategy but a proactive strategy** as it helps to reinforce the attractiveness of the city and to develop innovation.

The absence of a public transport service, of a structured road network and of a transit, freight and logistic strategy in Kampala implies high energy consumption, GhG emissions, air quality degradation, risk exposure (injuries, floods...) and time-money loss (traffic jam). Then the complex issue for transport has to be treated as a priority.

For the wholesale sector, retail trade and markets, the energy consumption is highly variable due to the heterogeneity of the activities. It is difficult to define common energy vulnerabilities. Comparing with industry, there is no process activity in these sectors and so energy consumption is mainly due to functioning (shop lighting, air cooling, cooking, electricity...) and to the environmental performance of the buildings. If we look at markets and malls or business centers, the energy consumption can be important (AC, food conservation, shop window lighting, mobility...). The part of energy in the **operating costs** can then be important and the exposure to electricity breakdown is also a reality.

Developing **joint actions** with the support of local relays such as professional Organizations and associations would help to showcase and multiply the best practices.

It would be relevant to start a survey to estimate the potentials and the existing green activities and green jobs in Kampala. Another survey to characterize the existing local training offer would help to assess the need for development of new one and the kind of cooperation to develop.

Objectives of the Strategic Plan – Business space restructuring: *“KCCA will promote balancing the predominance of the City Center with modern, employment growth centers that have the capacity to support the growth of small and medium enterprises, light and large scale industrial zones capable of achieving requisite economies of scale and agglomeration. KCCA will support the creation of urban growth centers in the peri urban areas of the city to create buffers for employment catchment that would help to decongest the city center. With the overall goal of inclusive and sustainable economic growth.*

Through the development of business centers and public markets KCCA can influence the energy performance and the climate resilience of the accommodations. It can decide to dedicate some of them to the green economy by attracting specialized SME, R&D, clusters...

6.8. Forestry and land use

*While still a city of trees and gardens, Kampala has lost much of its urban vegetation cover to development. Kampala has not implemented structured open space or urban forestry plans. Due to development, the lowland forests in KCCA were almost eliminated between 1983 and 2004.*⁴⁵ World Bank

Biomass is still the most important source of energy in Uganda and Kampala in particular. According to the Ministry of Energy, 90% of the total primary energy consumption in Uganda is generated through biomass: firewood (78.6%), charcoal (5.6%) and crop residues (4.7%) in 2012.

It is also very important to consider for a country such Uganda that forest is a very strong asset regarding the natural capture of carbon. Reducing the primary forest, or the absence of a forestry management system for wood energy production, could have significant negative impacts.

⁴⁵ ⁴⁵ Promoting Green Urban Development in African Cities, Kampala Uganda, Work Bank 2015

The forest plays a very important role in the process of adaptation and mitigation of climate change. It promotes the capture and storage of CO₂. It is also an important resource for local biodiversity and for the development of a structured wood energy industry that maintains environmental integrity. The forested areas are sometimes highly exposed to urban sprawl but they nevertheless provide a buffer space and protective role against certain risks. They should thus be considered sensitive areas, resource providers, and having a major role in land use planning. **The forest is thus exposed both to the "human pressure" and climate change that affects both the composition of the forest and its biodiversity.**

KCCA aims at planting around 500,000 trees in the City. Then attention has to be paid to the kind of trees and their origin but also to the place where they are to be planted. Planting trees is a way to develop the resilience of the City to climate change (evapotranspiration that helps to regulate temperature, shading areas thanks to the urban canopy...).

Wood energy is considered as a zero carbon source because the GhG emissions (mainly CO₂) from wood energy consumption is equal to the CO₂ captured during the growth of trees. Nevertheless it is important to consider that the burning of wood is emitting GhG emissions but also particles that pollute the air quality. Then, on the demand side, using wood energy is relevant when it is used in a clean way (efficient combustion device with low smoke emission, combined system with volcanic stones, eco stoves...). And in that way, there is a very huge market potential for these products.

On the supply side, as mentioned above, the way the supply chain of wood energy is structured makes the use of this source of energy more or less efficient. Indeed, forests are with oceans the two main ways to capture carbon emissions. They significantly contribute to the regulation of the climatic system. The more we reduce the forest surface, the more we reduce our capacity to stock the CO₂ and then the more GhG emissions are going into the atmosphere. The uncontrolled exploitation of the forest and the urban sprawl are two threats to consider. Looking at the current use of wood energy in Kampala, some significant improvements can be made by structuring the forestry sector although this mainly concerns areas beyond the city boundaries.

In the National GhG Inventory, this issue is assessed through what we call the Land Use Land Use Change and Forestry sector (with 6 categories: forests, grassland, cropland, wetlands, settlements, other lands): "all lands more than 1 ha in area, with a tree canopy density of more than 30% and height of more than 5 metres (or potential to attain 5 meters at maturity)". It shows that the urban sprawl and the crop land is increasing at the expense of the decreasing area under forest. It also underlines the contribution of fires (intentional and unintentional) of farming residues, wood stock, bush...

"Degradation of Tropical High Forests and woodlands outside gazetted areas has traditionally been the main source of emissions followed by clearing of forests for agriculture (forest to cropland conversion). With proper interventions on both the demand side of biomass (e.g., reducing heavy reliance on wood fuel) and its supply side (e.g. afforestation) the LULUCF sector could turn from being a net emitter to a net remover of GHG" – Second National Communication to UNFCCC.

"Local circumstances like high population growth and urbanization translate into increased charcoal demand indirectly causing deforestation and forest degradation. *The situation is amplified by lack of alternative fuels and/or lack of affordable efficient cook stoves [...] Mitigation in LULUCF lies not only in increased law enforcement and afforestation but also in managing direct and indirect drivers of forest degradation and deforestation which fall outside the realm of the forestry sector [...] Uganda needs to build institutional capacity of all key government agencies that directly or indirectly manage the forestry sector. The institutional capacity of local governments should go beyond developing by-laws and*

ordinances that control vices like bush burning but also have capacity to curb bush burning [...] Subsidizing or help start improved technologies (quality) of wood to charcoal transformation; Subsidizing or help start technologies (quality) / innovations that will lead to switching from wood fuel; Subsidizing or help start efficient, clean cooking stoves (quality). Use carbon financing POAs for Small artisanal manufactures as a strategy to subsidize this intervention; Subsidizing or help small holder afforestation programmes; Incentives or disincentives depending on the use of green products..." - Uganda Second National Communication to UNFCCC October 2014

6.9. Fisheries

Fishing is one of the most important sub-sectors in Uganda's agricultural sector that is largely artisanal, based on inland capture fisheries from lakes. Fishing activities are located along the shores of Lake Victoria in Kampala and Greater Kampala which are very sensitive natural area.

"Kampala is bordered by Lake Victoria and has an estimated population of about 1,200 people directly involved in fishing and located at the three landing sites at Portbell, Ggaba and Munyonyo. Fishing as a potential economic sector has not been fully exploited. Over this planning period efforts shall in improving the fisheries sector in the City" - Kampala Strategic Plan.

The sector is not very exposed to energy vulnerability because the use of energy remains low due to the local traditional structure of the activity. Regarding the objectives of development expected from KCCA long term economic strategy, the mitigation of potential future GhG emissions and energy consumptions have to be taken into account in the impacts assessment of the strategy. (See Fish Ordinance 2006)

"According to CRMAS 2012 Lake Victoria's navigation infrastructure is particularly vulnerable to variations in water levels due to the shallowness and low topographical gradients of the Lake. There is evidence on the impacts of droughts. In 2006, the shoreline retreated up to 50 m affecting shipping and fishing industries as ships could not get to the port. Among other things, this affected tourism to the islands." - CDKN

During the last decades, the "ecosystem" of the Lake has significantly hanged – kind and organization of activities, quality of the water (oxygen depletion...), loss of fauna population, shores arrangements, etc. The reasons are diverse, over fishing, species introductions, and change in the land use, population growth and urban sprawl, pollution from various activities from Greater Kampala surroundings (...) In that context, the potential impacts of climate change on the quality / availability of the water and on the lake economic activities would be an extra "burden".

Climate change is today a component of the environmental observation of sensitive areas. There is a need to reinforce the observance of the impacts of climate change on the lake (direct impacts on the lake and indirect impacts due to human activities).

This will benefit to other sectors such as waste management, health and sanitation, physical planning or wastewater treatment...

KCCA is experimenting the fish farming (cage farming in Ggaba). A fish farming demonstration center 'China-Uganda Friendship Agricultural Technological Demonstration Center' has open. It trains local farmers in fish raising techniques and includes a fish hatchery and feed factory.

6.10. Tourism

"Kampala's tourism potential in terms of urban, fresh water sports and leisure activities, cultural and religious tourism, is significant but has not been exploited, marketed and its

supporting infrastructure is still very limited. The vast bulk of Ugandans are not aware of these facilities, while at the same time the tourists and visitors to Uganda just travel through Kampala, generally staying in the City for a given period of time and not taking time off to visit these interesting sites. Apart from the business sector in most cases the tourists are not attracted to Kampala (National Museum, Lakefront, historical and cultural sites, Festival...) itself but rather to the country's natural assets elsewhere.” – The Strategic Plan of KCCA

The main energy issues for the tourism sector is the cost of energy and the reliability of the energy supply. This applies for the touristic accommodations and for the related green tourism activities and sectors such as transport. This sector contains interesting potential to develop more efficient buildings, environmental friendly approach, bioclimatic and the use of renewable energy.

The main vulnerabilities of the sector to climate change that require adaptation measures are also related to accommodation's performance and the location and the robustness of infrastructures. As described in chapter 3.2, extreme climate events, heat waves, floods are all affecting the touristic activities when they occurs.

The mitigation and adaptation measures are closely related in the tourism sector. For example, the use of air conditioning, which consumes a lot of energy and GhG during heat peaks, can be a relevant but harmful adaptation measure to the mitigation component. This is why it is interesting to work in the tourism sector to share experiences about solutions that may be common to many institutions.

Traffic jam and air quality degradation are contributing to reduce the attractiveness of the City as a touristic destination although there is a lot to visit and discover in Kampala. They are barriers for ecotourism. Eco-activities and green tourism are very attractive nowadays. The growing demand for that kind of tourism can indirectly benefit to the green economy. In partnership with sectorial stakeholders, a **green tourism strategy** could be developed with a diverse range of actions like for example in one hand a support for the touristic industry to develop an environmental approach, to identify energy savings and to seize renewables energy opportunities and on the other hand a support for the development of green(er) activities and a communication and marketing plan.

The attractiveness of the city is very linked to the conditions of the city development. Everything that is implemented through the landscape policy, the beautification of the city, the public transport and traffic policy [...] is directly benefiting the tourism sector. The image of KCCA being a “green and sustainable” city is progressing thanks to these investments and will benefit the business and individual tourism in Kampala which has still important potential for development.

CHAPTER 3. STRATEGIC OBJECTIVES

1. Being an example as a Capital City

Vision

In line with its core values (Client care, Integrity, Team work, Innovativeness, Excellence), KCCA is taking commitments through the Strategy to integrate energy and climate issues in the City sustainable development and its internal functioning. Although the weight of KCCA in the GhG balance of Kampala City is rather low, the Authority must be an example acting first where it has responsibilities and on its own impacts. Being more efficient in consuming resources and implementing greener solutions is helping people to understand the meaning of the Strategy and contributing to show concrete example.

A specific governance is designed to involve all the stakeholders and to mobilize the staff of KCCA in the implementation and the continuous improvement of the Strategy.

Impacts

- ▶ GhG emissions mitigation
- ▶ Energy and money savings
- ▶ Local energy production increase
- ▶ Better resilience of public buildings and facilities
- ▶ Reduce the environmental footprint of KCCA
- ▶ Improve internal monitoring systems
- ▶ Contribute to support the green sector to emerge

Leverages

- Staff training, capacity building activities, study visits and partnerships
- Public assets and properties: energy and water management, climate adaptation measures, environmental performances, energy recovery and efficiency, renewable energies
- Car fleet optimization and performance. Internal eco-mobility plan for staff. ICT
- Street lighting, traffic lighting
- Green public procurement policy
- Integration of the energy and climate component in every sectorial budget
- Partnerships and cooperation in the fields of climate change and energy efficiency with other cities in Uganda and worldwide (EAC, Africa, Europe...)
- A specific governance that includes the stakeholders who make and live the City

1.1. Governance

1.1.1. Principles

Governance refers to the rules, processes and behaviors that affect the exercise of project management and the conditions of the implementation of this project or policy. If we consider the fundamentals of sustainable development, this definition can be completed by the following notions:

- ▶ **Continuous improvement:** improving the initial situation of a community and/or of a territory in the light of sustainable development objectives by improving year after year the working methods and the contents of the action plan. Which implies to implement the process and the tools that will help the management review, the follow-up and the assessment;
- ▶ **Transversal approach:** the Kampala Climate Change Action is covering different sectors, the different competencies and activities of KCCA and the 3 pillars of sustainable development (environmental/economic/social) which implies a transversal governance. The policy is not a separate policy but a policy that must be taking into account by each sectorial policies of the Authority. Each has a contribution to bring to the Kampala Climate Change Action Plan;
- ▶ **Participation of local stakeholders** such as institutions, other local authorities, elected officials, technicians, population, NGO, economic sectors, funders... The purpose is to learn from and to work with them to address in the best way the stakes and the opportunities. It also refers to the introduction of new control modes or more flexible regulation and ethical, based on an open and informed partnership between different actors and stakeholders;



- ▶ **Steering organization** which defines the dedicated governance entities allocated to the project, their role and their responsibilities (elaboration, implementation, assessment, reporting and follow-up). It also specifies how this scheme is integrated into the organization chart of the authority. Moreover, Top Management, Directorates and services are all already much mobilized in different projects, committees, workshops, etc. Thus it is important to optimize their participation. The best way to achieve this is to integrate the steering of the Strategy in the existing governance scheme. As the Strategy is a transversal program involving every Directorates and is related to the general strategy of the Authority (meaning, the Strategic Plan 2019), it is important to link it to the Strategic Plan and to put it under the Top Management supervision

- ▶ **Shared Assessment** to measure the relevance of actions in the light of different point of views, expertise and experiences (sectorial experts, end-users, partners...) issues and goals, and measure the effectiveness of allocated resources and implemented actions. This also contribute to the KCCA objective to improve transparency.

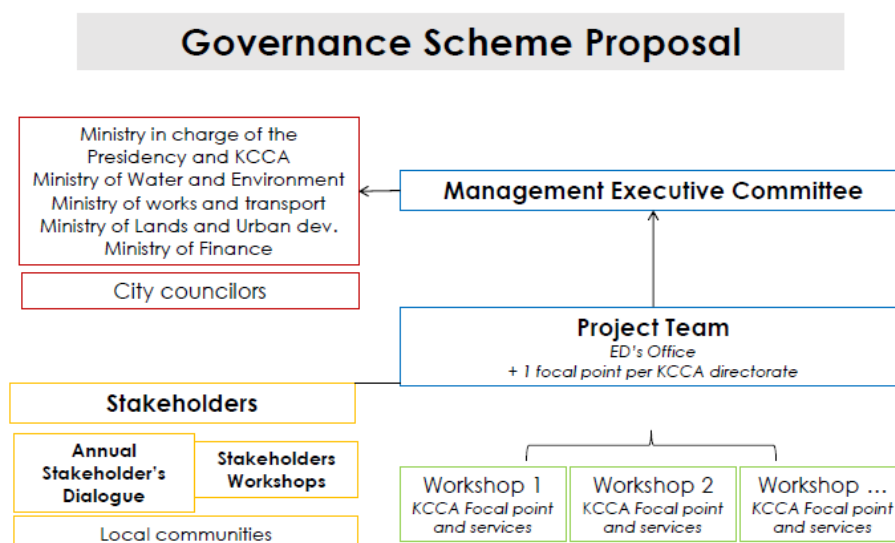
1.1.2. The proposed governance scheme

KCCA is headed by an Executive Director (ED) and a Deputy ED, ED's Office - which is in charge among others of the Strategic Plan 2019 and the Kampala Climate Change Action - 10 directorates subdivided into services and 5 City Divisions headed by 5 Urban Division Mayors and 5 Division Urban Town Clerks.

Two specific committees are supervising and managing the City development: the Technical Planning Committee (incl. City Divisions) (TPC) and the Management Executive Committee (MEC).

The Kampala Climate Change Action Strategy is under the direct supervision of the Top Management and managed by the Strategy Management Unit of ED's Office. Until now, the follow-up of the main steps of the elaboration process is made by MEC and TPC. The same organization is in place for the follow-up of the Strategic Plan 2019.

The Kampala Climate Change Action Strategy construction is based on a participatory approach that involves different stakeholders. A temporary governance scheme has been designed for the purpose of the construction but it has to go beyond this and been made sustainable after the adoption of the Strategy. A projected governance scheme could be as follow:

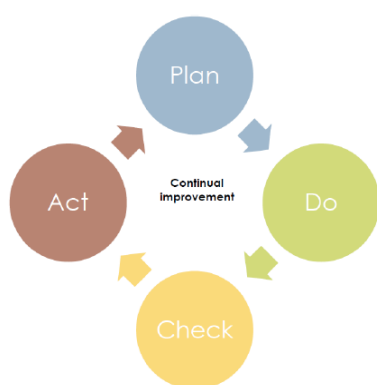


- ▶ The scheme shows the involvement of the MEC as the steering organ of the Strategy with a direct link to the relevant Ministries. Mrs MUSISI as **Executive Director** of KCCA and Mrs TUKAHIRWA TUMUSIIME as **Deputy Executive Director** are directly leading the Kampala Climate Change Action Strategy and represent KCCA inside and outside the City regarding the fields covered by the Strategy.
- ▶ The coordination of the **project team** is located at ED's Office with at its head, Mr Edison MASEREKA supported by Mr KYUKYU in charge of the Strategic Plan 2019 and Mrs Janat KAJARA. Mr LUKOOYA BATEGANYA from PH&E Directorate and Mrs NTAMBI and SAJJABI

in charge of energy and public facilities are part of the project team with one focal points in each Directorate.

- ▶ All the KCCA Directorates have been involved in the conception of the Strategy through **8 internal thematic workshops** composed with public servants mobilized for their expertise and experience. It is important to keep these workshops and to perpetuate them in order to follow the implementation of the action plan and its annual improvement.
- ▶ The **Annual Stakeholder's Dialogue** is gathering together public and private stakeholders that are concerned by climate and energy issues in Kampala. This event is an opportunity for the stakeholders to learn more of the local stakes, to receive an update of the implementation of the action plan and to give KCCA the benefit of their knowledge, expertise and experience to improve continuously the Strategy.
- ▶ The **local communities** and the **inhabitants** of Kampala are the first beneficiaries of the Kampala Climate Change Action Strategy. They are also part of the solution to make Kampala a more sustainable City because collective and individual behaviors are impacting and/or improving the current state of the environment. Their involvement in the Strategy is the only guarantee to make it inclusive and appropriate.
- ▶ Regarding the high development of the City, the urban sprawl, but also the fact that climate and energy issues do not stop at the City boundaries, it is highly recommended that KCCA works closely with **the cities of Greater Kampala**. All the work that has been done during the elaboration of the Strategy is embracing the perimeter of Greater Kampala. Then the different deliverables issued from the Energy and Climate Profile can be shared with them in order to involve them in the governance of the Strategy and to develop partnerships and joint-actions.

1.1.3. The proposed quality management system



The quality management system of the Strategy is based on the well-known Wheel of Deming (Plan – Do – Check – Act) meaning that the adoption of the Strategy is not an end but a continuous improvement. Staff and stakeholders who have been involved in its design will continue to be part of the process during its implementation, its assessment and its update.

The Strategy has been developed under the supervision of ED's Office (Strategy Management and Business Development) with the support of the HR Department to mobilize the staff and the project team. The role of HR Department will be enlarged to the sensitization and the training of the staff but also to the implementation of the

internal environmental friendly approach. The role of supervision played by Ed's Office will be perpetuate. It will design and implement a quality management system as shown in the chart below following a regular agenda where top management, staff and stakeholders are informed and mobilized.

The annual Stakeholder's Dialogue, the internal workshops, the steering committees will be the different moments of participation. The dialogue with the inhabitants is strategic and will be part of the process. It will be designed on a made-to-measure approach depending of what has to be shared and what is expected. The Strategy aims at improving the living conditions in Kampala. To well address the objectives, the expression of the people is essential as much as KCCA has to make its best efforts to deliver the information in a proper

way.



The table of the Workshops below shows how much the Kampala Climate Change Action Strategy is a transversal policy dealing with cross-cutting issues and mobilizing all the Directorates. These transversal workshops make people from different backgrounds and responsibilities coming together breaking the verticality of the organization and widening the vision. They will continue to play a key role in the follow-up and the improvement of the Strategy. An annual review of the action plan will involve them.

The question of improving the coordination of energy issues between the different Directorates in charge of the public properties and assets management, the energy and water consumptions and the car fleet is important for the follow-up of the energy and GhG balances which determines the distance with the quantitative objectives. The coordination within the project team is important as well as the development of a common tools box (list of indicators, etc.).

1.2. Human resources

1.2.1. The mobilization of the staff

Involvement and cooperation with stakeholders is a condition for a robust Strategy. However the first circle of expertise is inside the Authority administration in each of its Directorates and Services. They design and implement the public policies. They face the day-to-day realities of public services delivery and know so well the expectations of the beneficiaries.

Moreover, KCCA as a public institution is also a source of energy consumption and GhG emissions. So, with the aim of being an example, KCCA itself is targeted by the Strategy and must implement mitigation measures including working with HR department on staff sensitization and training.

This is why, in the context of the Strategy, Directorates and services have been all mobilized through different series of internal thematic workshops with the following objectives:

- ▶ Raising awareness of the staff, developing capacity building
- ▶ Sharing visions across directorates, having everybody on board
- ▶ Working on best practices in Kampala, Uganda and abroad
- ▶ Defining the state of the art, a vision on how to go
- ▶ Identifying strengths, weaknesses, opportunities and threats per thematic
- ▶ Identifying what the Authority is doing and the gaps

- ▶ Assessing the impacts of action and non-action

More than 16 workshops have been organized to work on the energy and climate profile of KCCA as follows:

N°	Directorates Thematic (at least 2 sessions of each)
1	Physical planning, public and private housing, urban planning
2	Public building and facilities + Launch of GhG / energy balances
3	Mobility
4	Water, Waste management, Energy (production, distribution, renewables, efficiency, recovering...)
5	Human resources, IT and public procurement, governance, budget
6	Green economy, employment, R&D, education, youth dev, gender
7	Climate change vulnerabilities (adaptation)
8	Communication, cooperations, participation

After the adoption of the Strategy it is highly recommended to organize one series of workshops every year in order to make the review of the strategy action plan and to keep the dynamic of the transversal work as recommended in the quality management system above.

1.2.2. The crucial role of human resources

Human resources Department is at the core of the Strategy because they are responsible for the employee's recruitment, management, training and behavior at work.

Regarding, the size of the City, the number of inhabitants and the competencies of the Authority, the number of public servants is very limited: 10 directorates, 395 employees. Temporary terms and casual contracts are also signed depending the specific needs and circumstances. KCCA is facing a fast local development and is assuming more and more responsibilities and projects. This ambition requires staff reinforcement through recruitments. The lack of staff is a serious issue that affect can management, public services delivery and enforcement.

In order to understand the energy and climate issues, the contents and the philosophy of the Strategy but also what is expected from everyone, it is fundamental to improve the knowledge of staff through sensitization, training and capacity building activities. It is essential to empower the staff but also the Top management with these subjects, to give them the most appropriate information to take the right decisions and to integrate these issues in the planning and the design of activities that will make the projects more resilient and less intense in GhG emissions. It is also a way to mitigate the own GhG emissions of the Authority induced by its functioning.

Human resources are at the core of the Strategy because they deal with values, collective and individual behaviors, team and capacity building which are essential to develop an environmental-friendly ("eco-friendly") approach in KCCA.

The employees need to understand the ins and outs of the Strategy to get involved. They need to understand the issues, the stakes for Kampala, the Vision of the Top management, what is expected from them and how they can proceed. They need practical examples, capacity building activities and time to think/work together.

During the internal workshops, participants have expressed the need for a better understanding of what climate change is, how it is related to energy, health, social inclusion, education and sustainable development in general. They have a strong interest in the subject and need assistance to move forward to concrete action.

The concept of Climate Change appeared to be relatively new to the staff and its terminology was quite complex. Staff need a little more time to gradually get on board and to internalize the strategy. They needed more engagement to determine how their internal work, roles and responsibilities relate with Climate Change in terms of promoting low Carbon Development and Resilience to Climate Change.

There was need to define the Strategy in simpler illustrations and with practical examples which relate to the day to day activities of individuals at the workplace, at home and within the communities. Being the organs that transmit information to the people and particularly the communities, they (staff) emphasized the need to identify the real issues of concern show how they had been identified and finally determine the messages and approaches that would be used to involve the communities.

As a way forward, the communication strategy that has been prepared will address the information needs/requirements that should be incorporated to ensure all targeted categories effectively access information on the Strategy. The strategy has a core element of staff capacity building that will be utilized to train and sensitize key staff of KCCA both at the centre and divisions about the strategy, why it was developed and what their role is. This will increase staff awareness on the subject matter, promote their commitment and ownership of the elaboration process and integration into their normal duties.

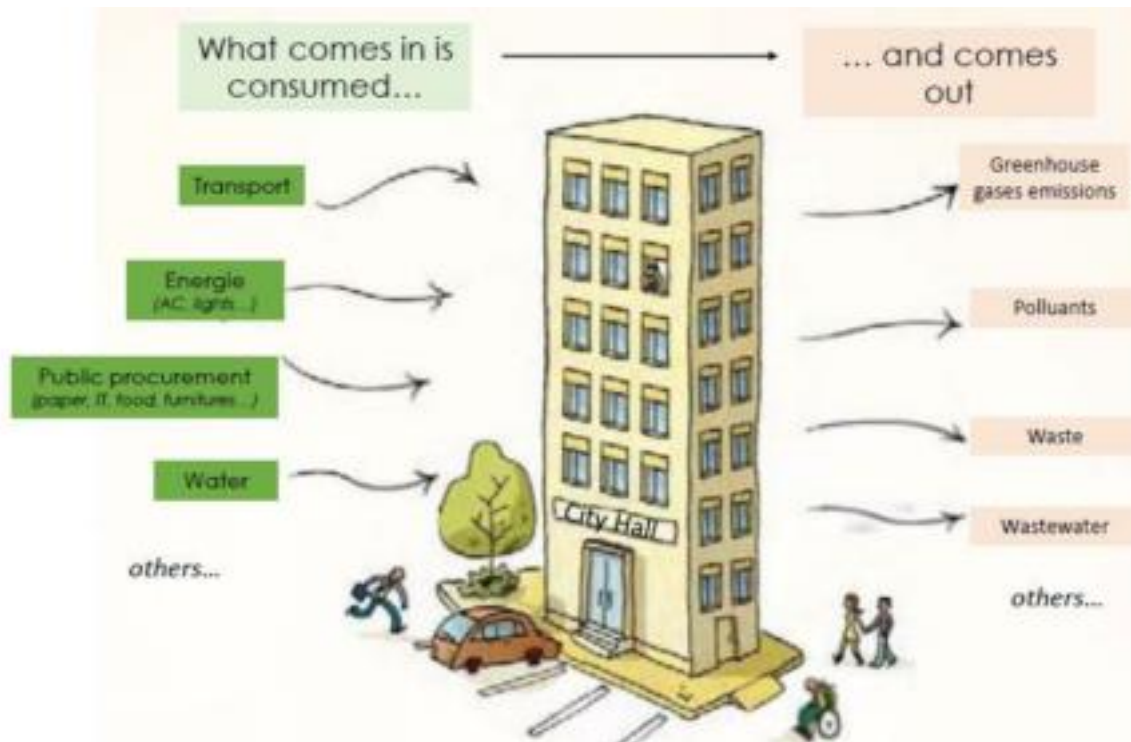
They have also expressed their satisfaction of having the opportunity to attend transversal workshops to discuss cross-cutting issues with colleagues that they usually do not have enough time to meet with. Time is missing in the administration because of limited resources and heavy agenda but this time is highly necessary to plan the City development.

1.2.3. An eco-friendly approach based on a quality management system

The main roles of the human resources regarding the Kampala Climate Change Action Strategy is on the one hand to support the project team in the implementation of the internal process by mobilizing employees and on the other hand to be part of the quality management system that will help to mitigate the GhG emissions due to the internal functioning of the administration and to adapt the working conditions with regards to climate change impacts.

Regarding the GhG balance of KCCA that inventories the impacts of the internal functioning of the Authority, there is an opportunity to dedicate a central part of the quality management system to the internal environmental issues. This is relevant for the current impacts but also regarding the development of the City and of the KCCA responsibilities (increase of the activities and of the assets). KCCA can develop an eco-friendly home-made approach or decide to test a pilot approach based on the international standards ISO family related to environment (ISO 14 001 for instance). The sectors to be covered are: mobility, energy, water, waste, public procurement, biodiversity.

As shown in the picture below, the main purpose is to move from a compensation approach to a prevention approach proposing smart measures upstream that will avoid to mitigate environmental impacts in the end.



The eco-friendly approach (City Hall and 5 City Divisions) will:

- ▶ improve the environmental performance of the Authority, prevent potential pollutions and conserve natural resources (energy and water savings, sorting of waste, eco-mobility, rational use of furnitures...);
- ▶ enhance compliance with international and national standards ;
- ▶ increase the efficiency of the internal functioning and reduce costs ;
- ▶ enhance employee exemplarity by increasing their awareness on environmental issues and responsibilities ;
- ▶ support to be an example according to the Core Values of the Authority ;
- ▶ enhance the Authority' image with public, institutions, investors, supporting partners, etc.

To achieve the objectives of the strategy, there is a need to improve the way the services are functioning. The working habits, the internal organization, the way people use energy, the way they move in the city, the amount of waste they generate, the kind of furniture they use and so on. The greenhouse gas emissions balance of KCCA (perimeter 1: buildings, facilities, car fleet, services) reveals the amount of GhG emitted each year. The Kampala Climate Change Action Strategy addresses this perimeter first and everyone is a part of the mitigation scenario taking into consideration that the volume of activities is growing fast inducing GhG emissions, energy and water consumptions, waste generation...

The IT Department is already working on the KCCA server's optimization and has implemented a virtualization policy. They have also reduced the number of individual printing and scanning devices in order to make them collective. The development of internal networks is on progress to improve the sharing of information. Regarding the huge stake of floods or traffic jam in Kampala and its impacts in terms of environment, time and money losses, solutions such as **web-conference** have to be developed as a priority (avoid the use of car). It also becomes necessary to develop the **WIFI** in all public buildings and to encourage the use of e-solutions. KCCA has implemented the **eCiti** solution for online payment (local hotel, business licenses, local service tax, markets, rent and rates, property rates) – which is a **pillar of the KCCA ICT Strategy**. So, that kind of innovation has to serve also the functioning of the administration – including digitization policy of administrative documents, e-procurement and e-public tenders.

Sometimes the environmental initiatives of this kind can be seen by employees as restrictive. Employees may not see their value or they may think that they are additional tasks. It is therefore important, to start this approach as voluntary, based on good practices and good will. The use of the game or festive events may help initiate positive approach and make it attractive. It is thus recommended that iconic days are used, such as World Environment Day (5th June), energy week (COP in December) or others for events with employees where the top management is also involved. It is also possible to organize competitions of good ideas between KCCA' services. The valorization and the support of best practices in the fields of the Strategy, personal initiatives, recognition system, and good ideas collection need to be encouraged.

1.3. Budget, public procurement

1.3.1. Integrating the energy and climate component in every sectorial budget

As any public policy, the Kampala Climate Change Action Strategy must have its own budget. But most of the measures of the action plan refers to sectorial actions that must be managed and implemented by different Directorates which implies that the elaboration of the **budget must be prepared collectively**.

The budget of the Strategy gives a **general idea**. For instance, it is easy to link the solar street lighting investment with the budget of the Strategy. The budget to develop the collection of waste is managed by the Directorate in charge of the service – service that will have a positive impact on the GhG balance of KCCA. The same for the BRT project. It is not a **specific** investment of the Strategy but a **contributive** one. So we can mention it as it is in the budget report.

Each Directorate is a part of the budget. Its formalization will allow to estimate how KCCA is investing through its different Directorates and to identify the different ways for **sectorial funding** in addition to the specific international and national programs in line with the Kampala Climate Change Action Strategy.

1.3.2. Monitoring the budget, the costs and the revenues

As KCCA will monitor its energy and GhG balance, it will also **monitor the related operating costs**. This activity will help to assess the evolution of the consumptions with the development of the City and then the related costs.

The measures of the action plan aims at mitigating the consumptions and the costs. The general philosophy is to finance the measures by the savings they induced and by exploiting the local potentials. But regarding the **low consumptions** of KCCA today and the **forthcoming ones** that will be induced by the development of the activities of KCCA, savings will not be enough and investments will be required.

The Authority has decided to **reinforce the environmental component** in its decision making process for any new project. That is the case for specific investments completely financed by KCCA such as the solar street lighting development, the biogas recovery at school or the public building renovation but also for the BRT project, the waste collection management or the physical planning activities.

Since last years, KCCA is increasing the share of its budget coming from **local revenues** collection. Its capacity to generate its own budget is the basement of the sustainability of the

public services delivery. In the context of the ongoing revenue collection policy, the City can study how to integrate environmental components that could favor greener options for instance in the fields of land use and mobility.

KCCA expect to seize the opportunity of **green funding mechanisms** to support the budget of the Strategy. These programs are launched at different level, are of different natures and proposed different forms of supports. Sectorial programs are also more and more integrating an important environmental component that eco-condition the support.

Clean energy projects can also be a source of revenue. In Uganda, the **Feed-in tariffs** system supports the development of renewable energies. Depending on the source of energy (different tariffs), the producer can sell the energy to the network (grid). This is not only beneficial to big producers but also to households or local authorities that have implemented renewable energy installation on their building for instance and can sell the energy they produce (entirely or partly if they auto-consume part of it). This provides a source of revenue that compensates the capital costs and a part of the operating costs. It also reduce the KCCA exposure to the increase of energy prices and to the breakdown of energy distribution networks.

The World Bank is developing a **Capital Investment Planning (CIP) Technical Assistance** project for KCCA based on two main priorities:

- ▶ At the project level, conduct and train local technical staff in the conduct of cost estimates, carbon emissions forecasts, and resilience cost-effectiveness analysis;
- ▶ Provide technical assistance and advice to carry out an analysis of proposed investments and alternatives (modifications to project designs and project locations), resulting in a selection of preferred low carbon, resilient capital investments, and complete sets of data to evaluate the projects for prioritization.

It will contribute to identify different leverages for funding and developing the capacity of KCCA to generate prudent investment through public and private public partnership financing. Mechanism such as the **Energy Performance Contracting (EPC)** and the **Public Private Partnership (PPP)**⁴⁶ are options.

1.3.3. Developing a green procurement policy

The green procurement policy refers to the purchase of products and services that have no or limited impacts on the environment. This concerns the direct purchase of KCCA but also the selection of contractors and the setting of environmental requirements in the contract. Green public procurement is central in the internal eco-friendly approach of KCCA.

The price is not the sole criteria of selection. Technology, quality, duration of life, maintaining and operating costs, use of resources, impacts on environment, natural resources and health, benefit for the local economy, recycling or re-using opportunity are criteria to consider. **A set of environmental criteria can be defined and considered during purchase and contractual activities.**

KCCA can formalize a **specific framework for the green procurement policy** based on the experience of the Authority which has already implemented some pilot actions. The idea is to

⁴⁶ Energy Performance Contracting (EPC) is a form of 'creative financing' for capital improvement which allows funding energy upgrades from cost reductions. Under an EPC arrangement an external organization (ESCO) implements a project to deliver energy efficiency, or a renewable energy project, and uses the stream of income from the cost savings, or the renewable energy produced, to repay the costs of the project, including the costs of the investment.– Joint Research Center, European Commission

PPPs are typically medium to long term arrangements between the public and private sectors whereby some of the service obligations of the public sector are provided by the private sector, with clear agreement on shared objectives for delivery of public infrastructure and/or public services A long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.– The World Bank

extend this policy widely to every purchase and contractual relation.

Energy and climate components can be introduced in any **contractual relation** between KCCA and a third-party from the moment that there is a contract. The Authority "shares" the objectives of its eco-friendly policy with any of its contractors and sub-contractors. Since the Authority pays for the service rendered by the contractors, it is one way to make it less expansive and to make the contractors understand the core values of the Authority. It is also important to consider that in any delegation of public services, there is the possibility that public assets are included. So, at the termination of the contract, the Authority take over its assets that are supposed to be well-maintained. Lastly, the contractors is supposed to act "on behalf" of KCCA, which means that it has to promote the image / identity of the Authority.

In the same vein, KCCA can develop **eco-conditioning** criteria in the grants or in any funding support brought by the Authority to a third party. Depending of the performance of the submitted proposal, with regards to energy performance or climate resilience, KCCA can choose to deliver a bonus or to condition its support. This can be applied in many areas. This is easy to implement and can be combined with a **specific financing program** (direct grants, incentives) at the addresses of energy end-users in Kampala (such as households, farmers, SME...).

KCCA understand that the local market is not completely developed and structured to supply a wide range of environmental products and services. Thanks to the weight of public procurement, KCCA expect to support the appearance of new behaviors in the way to render services and the appearance of new market opportunities for green products.

For public buildings and facilities, the "**global cost**" approach must be systematized in the conception of the budgets. Like for the Impact Assessment Studies, the direct and indirect costs must be taken into account including comments on the positive and the negative externalities induced by the project. Board of directors and other steering committees in the Administration should observe and integrate some criteria in their decision making process.

The Life Cycle Analysis is also an approach to consider during the elaboration and/or the assessment of any project. It is a systemic way of assessing the overall environmental impact of a product, a service, a company or a process. Its aim, following the logic of "life cycle" is to understand and compare the pressure of a product/service on resources and the environment throughout its life cycle, from extraction of raw materials until its end of life treatment (landfill, recycling ...). This will be helpful to update and to mitigate the GhG and energy balance.

The Global cost and the Life cycle analysis approaches can be introduced into the **public procurement policy** of KCCA and into the **public tenders** issued by KCCA.

We can also consider as a part of the green procurement policy, the dematerialization policy of KCCA which consists for instance in developing **ICT solutions** and **e-services (see 1.2.3)**.



eCitie

eCitie is an electronic system to collect local revenues. It enables the taxpayer to make payment wherever and whenever he wants. This now concerns local hotel, business licenses, local service tax, markets, rent and rates, property rates. Beyond the financial benefits for KCCA, this system reduce the mileage that taxpayer should do to satisfy their obligations. It is also in line with the 0 paper policy followed by KCCA.

1.4. Energy, water and GhG management

1.4.1. Lessons learnt from the KCCA GhG and energy balance

The City plays different kind of roles in energy and waters matters: it is at the same time an energy consumer, an energy producer and then a supplier, a local investor in the local green economy through public procurement, and of course a demonstrator to motivate third-parties to invest.

As indicated in the definition of the perimeter 1 related to the internal functioning and the activities of KCCA, energy and water consumptions and the related GhG emissions are coming from public building and facilities, public car fleet (individual transport, waste and pit latrines collection, street cleaning...), street lighting, water supply and treatment, etc. The management and the follow-up of these consumptions are not centralized which is not efficient in terms of economics and strategy. It is important for the Authority to have a general integrated overview with focal points that report the data and suggest optimization in a continuous improvement approach.

The whole GhG balance is developed in Chapter 4 of the present report. It shows the distribution of the GhG emissions only due to the activities of KCCA (perimeter 1).

Between 2012 and 2014, the global volume of GhG emissions for the perimeter 1 has increased by 9% with more than 80% of the GhG emissions generated by the fuel consumption of KCCA's car fleet.

Indeed, the part of the GhG emissions due to public buildings (administrative, health centers, schools) and street lighting is still low. The new street lighting installations are using solar energy with an almost 0 carbon direct and indirect emissions. The public buildings are not consuming energy for heating but a low part for air conditioning (emissions from energy consumptions and from the use of refrigerant gas) and cooking (especially schools even if the result is not yet reflecting the entire impacts of firewood and charcoal).

If we take into consideration the indirect GhG emissions induced by KCCA activities, then mobility is occupying a quite more important place because of the travel of staff (from home to work and vice versa), residents (from home to KCCA for administrative formalities, or to reach an health center) and students (from home to school and vice versa). In the context of the Kampala Climate Change Action Strategy, a first survey has been made to assess the use and the impacts of mobility of these publics. It almost double the volume of GhG emissions.

That is why developing School Mobility Plan, Administrative Mobility plan (incl car sharing), dematerialization procedures, etc, can have a significant impact of the GhG balance.

If we look at the energy balance of KCCA, the review is the same, 92% of the energy consumptions of KCCA is coming from the car fleet of the Authority (cars, buses, etc). Buildings and street lighting only represent 8%. The volume of energy consumption has increased by 10% between 2012 and 2014. 50% of the fuel consumptions is related to waste and pit latrines collection.

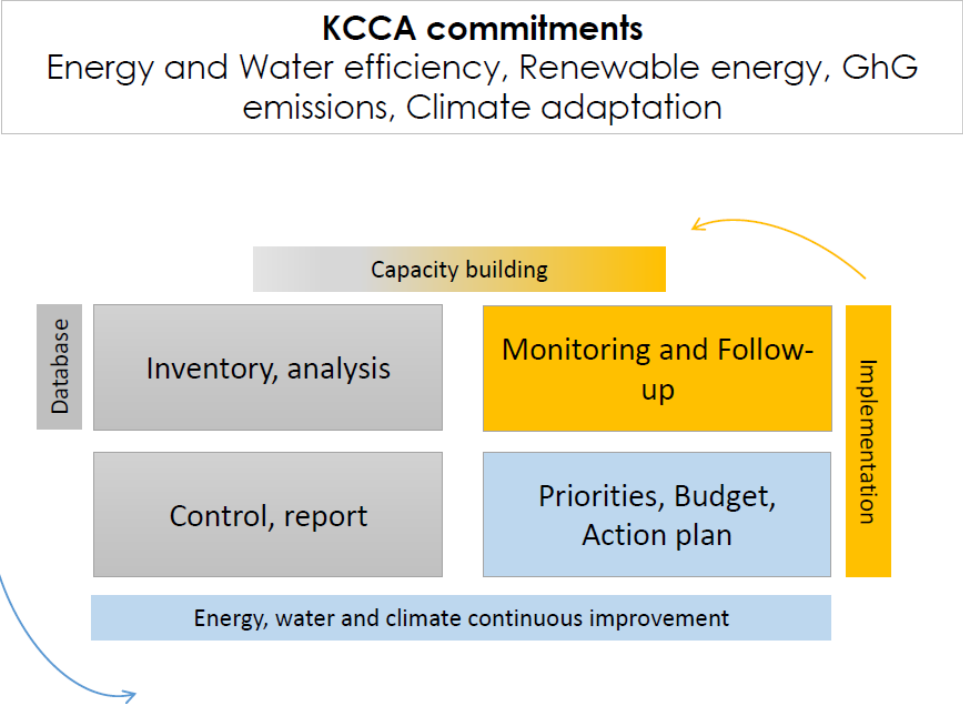
The part of renewable energies in the energy consumption is quite low if we consider all the energy consumptions (incl fuel for transport). Only 3% of the whole consumption is coming from renewables knowing that the biggest part is coming from the national grid, not from KCCA own installations. There is then a huge potential there for thermal and electric sources of renewable energy (including energy from energy recovery and valorization).

If KCCA is low GhG emitter (0,28% of the territorial GhG emissions of Kampala) and a low energy consumer (0,39% of the energy consumed in Kampala by all the end-users), this state could vary significantly in the future with the increase of public buildings and facilities own by KCCA and the development of its competencies. We can also add on the financial exposure to energy prices increase. That is why it is the good time now to take commitments with regards to energy efficiency and renewable energy to implement a **Municipal Energy and Water Information and Management System**.

The main leverages to mitigate energy consumptions and GhG emissions are among others:

- Energy savings
- Energy efficiency (performant equipment, substitution of fossil fuel by renewable energy...)
- Energy generation from renewable energies
- Energy recovery from waste or wastewater for instance
- The optimization, the organization and the performance of the car fleet
- Eco-mobility plan for staff, students and visitors
- Optimization of the public utilities service delivery
- Optimization of waste (reducing, reusing, recycling, recovering, optimization of the collection circuit, ...)
- Capacity building activities and sensitization campaigns for public buildings and facilities users / visitors

Most of these leverages also apply to water management. The energy and water management of public buildings and assets does not have to forget to treat the question of climate vulnerabilities (exposition of the public assets and of the people to natural events)



1.4.2. Energy and water management

The first experience of elaborating a GhG and energy balance at KCCA level reveals that KCCA is already doing a lot in terms of energy efficiency and renewable energy but the internal organization between directorates, the management of data and the inventory of the public properties (including buildings, facilities, equipment's, fleet, etc) are not yet robust enough. Action has always been prioritized over quality management system which is

consistent with the taste of KCCA for being as much operational as possible. But now that the City has taken commitments to mitigate energy consumptions and GhG emissions, it is important to consolidate the internal management of energy, water and waste.

In line with the general recommendations on the governance of the strategy, it is important to designate specific **focal points** (referents) within KCCA that will be in charge of the follow-up and of the reporting to the project team. 3 strategic focal points are already identified: Mr **Jeremy NTAMBI** (Head of operations), Mrs **Judith AMULEN** (energy manager) and Mr **John-Paul SAJJABI** (energy and car fleet manager).

With the Kampala Climate Change Action Strategy, KCCA should now be able to follow-up and to update easily its balances. Then, after the identification of the focal points, KCCA will define the quality management system that will allow to follow-up, control and inventory the data but above all to structure the public assets and properties management. For instance:

Inventory, analysis:

- List of all public buildings and facilities (including schools, health centres and public markets if they are owned by KCCA)

- Database and/or software to store all the information related to the buildings and facilities including:

- ▶ *Localization, surface, usage*
- ▶ *List of technical installations especially the ones producing and/or consuming energy (+ precision of the usage of energy and water)*
- ▶ *Materials and construction techniques*
- ▶ *Calculation of key figures on energy consumption (electricity, heat, cold) , GhG / greenhouse gases and water consumption / energy capacity subscriptions*
- ▶ *Analysis of the potential of energy and water savings and efficiency*
- ▶ *Analyse of the potential for renewable energy generation*
- ▶ *Identification and justification for immediate corrective actions*
- ▶ *Inventory of the last maintenance and/or upgrading operation for each building and facility*
- ▶ *Data are adjusted with regards to climate mean*
- ▶ *Indications for a renovation program*
- ▶ *Exposition to climate change impacts (the building is exposed to floods, urban heat island, soil movement...)*

Control and follow-up:

- The persons in charge of the collection and of the follow-up of energy and water are identified. The same for data providers within the administration.

- Energy / water figures and invoices are stored in the database when they are available (after checking and payment)

- Meters and sub-meters are more and more implemented to control the energy and water consumptions (double checking for the invoice control and detection of unusual situation)

- Production of an annual reporting to assess the progress and to update the operation planning (maintenance, emergency measures, investment...). Communication is made to ED's Office

- Update very year the energy and GhG balances of KCCA

Planning:

- Definition of different criteria to support the decision making process (budget and return on investment, visibility, feasibility, easiness, opportunity, innovativeness, short/mid/long term...)
- Formalization of a renovation program including: type of measure (emergency, structural, energy and/or water savings and/or efficiency and/renewable and/or recovery and/or substitution, climate vulnerabilities reduction, etc), global costs, expected savings (energy, GhG, M3 water...), financing mechanisms...
- Update of the GhG and energy scenario

The water management is a real issue in Kampala. It concerns the availability of the resource, its quality, its distribution and consumption. The question of rainwater is different from the surface and the underground water resources but it is very related (see Chapter Smart public utilities). Indeed, collecting rainwater is a smart way to reduce the use of water coming from the distribution network for instance to clean the roads or to water the green spaces. It reduces the stress on the natural resource and the related GhG and energy consumptions induced by the production and the distribution of water.

Public health is a competence of KCCA and there is a lot to do in the water sector. A part of the population in Kampala is still not delivered by drinkable water and for those who are (including public places) the contamination of the reservoir occurs sometimes. So, in parallel of the quality control, it is important to develop:

- the access to drinkable water using efficient technologies to produce and distribute it (see Chapter Smart Utilities). Regarding public buildings and facilities, the objective is to have the whole public assets delivered by drinkable water;
- the fight against the leaks mainly concerns the distribution networks in the City (managed by the national authority) but it also concerns the internal water pipelines and the leaks of specific equipment. KCCA has to track the leaks as well as it is tracking the energy saving potentials. The equipment with smart devices which would help to use less water has to be examined (water frother, metering system, water breaker...)
- the rain collection for external use.
- In terms of sensitization to develop smart behavior for people occupying or visiting a public building, the messages on rational use of water can be added to the messages on rational use of energy
- The water of the green spaces can come from the rainwater collection but also by the practice of the differentiated management of green spaces and the smart choice of local sober species
- The use of fertilizers and pesticides has to be banished from the city practices for health issues (contamination of the air, the soil and the water)
- A set of indicators must be defined to follow-up the progress

1.4.3. Standards for construction and renovation

We have seen that KCCA has a key role to play in the construction of the low-carbon and climate resilient Kampala through its competencies in the fields of physical planning (in the limits of the national regulation framework). The way the city is organized and developed is influencing a lot the volume of GhG emissions, energy consumptions and pollution. The smart combination of urbanization, multi/inter-mobility, environment conversation or public utilities delivery makes the city more or less intense in carbon and resilient to climate change.

At the lower level, the way the buildings stock (households, trade and retail buildings, cultural and leisure infrastructures...) is laid out and constructed has also a significant influence. The national legal framework and the rules implemented by KCCA apply on any project of construction or renovation in the city. They mainly set a minimum of environmental performance under which the project is not permitted. Then it is complicated for KCCA to fix

its own standards above this limit without the consent of the regulatory authority. But when it is about the public buildings and facilities owned by KCCA, then the Capital City has the liberty to design its projects as it wishes including high environmental criteria.

In both cases, the Authority must refer to the national legal framework for physical planning and construction as well but can take some initiatives. Moreover, it is the role of KCCA to showcase best practices and demonstrators to encourage the public and the private sectors to follow. It also plays the role to support the local green economy, the innovative solutions and the frontrunners companies.

The GhG emissions and energy balance issued in 2015 is the starting point, "the year 0". The Authority has for the first time an exhaustive overview of the current state of its energy consumptions and GhG emissions. This "year 0" helps to make some scenario of evolution and then to estimate what could be the balance of KCCA in few years.

To mitigate and reduce the energy consumptions and the GhG emissions generated by the existing public buildings and facilities of KCCA, the authority can play on energy efficiency measures such as the replacement of old and non-performant equipment or the installation of smart device, fuel substitution, building renovation and restructuration, renewable energies, energy recovery etc. Global costs has to be calculated to estimate the return on investment and the working conditions benefits but there is no doubt

By now, the forthcoming issue is the potential increase of energy consumptions and GhG emissions due to development of new public buildings and facilities. For them, there is an opportunity to integrate an environmental approach from the design of the project to its implementation.

To get KCCA out of the business as usual scenario and to install it into the voluntary scenario, there is a need for the renovation of the existing assets and a need to **adopt high environmental performance and quality standards for all the new buildings and facilities.**

KCCA has already experienced some projects like in Kansanga School with the biogas unit which has removed the use of firewood for cooking or the renovation of the City Hall with the installation of sensors to control the lights or the use of lightwell.

This last element refers to the **bioclimatic principles** which aim at the definition of the balance point between a building construction, the natural surroundings, the local climate and the behaviour of its occupants. This will contribute to minimize the need for energy resources, to protect the environment and to improve the indoor living conditions. There are then 3 main elements: the geographical context, the comfort and the architecture including the use of eco-materials and a low impact building site.

It is no longer the architecture that makes the context but the contrary. The natural elements are fragile and essential. They have to be protected from the urban sprawl and the impacts of the urbanization especially when the density of population is important. But above all, they can influence the living conditions at neighbourhood and house level. They can even be part of the architecture. The sun can bring free heat and light, the vegetal can bring shade and humidity, the wind can bring cold, noise and dust, etc.

KCCA could develop its own **guidelines for public construction and renovation** with high environmental standards and energy and climate components.

The question of systemizing the **integration of renewable energies** into the design of any new projects of construction or renovation is crucial. As mentioned, KCCA has already implemented some installations in schools or in public markets but there are still potentials to exploit. In line with the Chapter of this report dedicated to the Smart Utilities, it is

recommended to realize a precise survey on renewable energy potentials for implementation on the existing stock of public buildings – in addition to their integration into the KCCA Guidelines.

1.4.4. Street lighting

The development of the street lighting is an ongoing strategic policy lead by KCCA which well illustrates its wish to develop an attractive, secured and green city. Beyond the sole installation of the solar street lights (new ones and in replacement of decommissioned), it will be important to structure the internal organization and to allocate the related resources in order to follow the development plan, to assess the results, to organize the exploitation and the maintenance that can benefit to the local communities in terms of jobs.

KCCA will then formalize its strategy into a Street lighting Master Plan, detailing the city coverage per type of road, the technical specifications, the energy production/consumption, the cost of maintenance (including injuries), the environmental impacts (GhG, light pollution, cycle life of product...)



Solar energy for street lighting

KCCA has decided to develop the street lighting across the City to improve the conditions of mobility and security and to cut on the electricity monthly bill of Ugx200m. Decision has been taken that each new street light point will be supplied by solar energy. In October 2015, 170 photovoltaic solar panel has been installed (250 W to produce 90 MWh each year). KCCA has decided to add 700 solar street lighting points before the end of the year for a global amount of 3 million dollars on its own budget.

KCCA has embarked on a quick decommissioning exercise of old street lights and replacing them with solar powered lights in some sections of the city.

This action present different benefits: the use of a free energy source, the continuous lighting during potential national electricity grid network breakdown, the promotion of these technologies for the private sector and an encouragement to the local economic fabric to invest in green growth potentials.

1.4.5. Mobility of the staff, the visitors and car fleet

As revealed by the GhG and energy balance, mobility is the main source of GhG emissions and energy consumptions of KCCA. Indeed, the part of mobility in the energy balance reach 92% of the whole consumptions. The share is almost the same in the direct GhG balance. If we take into account the indirect emissions induced by the travels of visitors, students and staff, then the share of mobility is almost doubling because the share of indirect GhG emissions from mobility represents more than 60% of the whole GhG balance of KCCA.

For the direct GhG emitted by the car fleet of KCCA, different measures can be implemented such as the pooling of the fleet, the energy and GhG performance of each car bought by

the Authority, the substitution by cleaner fuel and the production of its own biofuel, the change of carburation, the efficient maintenance, the control of the use by the employees, the parking policy and the eco-drive training.

It is important to note that within the scope of the direct emissions, every mean of motorized transportation owned by KCCA is counted even the ones used through a public service delegation contract (for instance, the collection of waste which is delegated to a third party).

For the indirect GhG emissions, mainly due to the transportation of visitors, students and staff (not business travel but travel from home to the office location), **it all depends on the location of the place to go and of the availability of alternative transportation to individual motorized car**. To mitigate these indirect emissions, the development of public transportation and soft mobility solutions could have significant impacts (see Chapter 4.4).

The second leverage concerns the location of the public accommodations. The best illustrations are schools and the City Hall. During holidays, there is less traffic jam in Kampala because people are leaving the City but also because they reduce the distance made by car every morning to drop the kids (see travel study Chap 4.1). The allocation of kids depending their place of living and the construction of schools closer to the sites with a high density of residents is a way of improvement. The same for the visitors to the City Hall who come to settle administrative formalities. The decentralization of the administration offices across the City but also the dematerialization of the administrative formalities (eCitie) could have significant impacts.

The third leverage could be the implementation of **Eco-Mobility plans** per employers and/or per location (multi-employers). Indeed, these plans propose for every employees a package of measures that is supposed to help them to reduce the use of individual motorized car. For example, the organization of the car sharing between employees, the establishment of a car pooling site for journeys between home and the workplace, or for business travels, the development of video conferencing, teleworking, reimbursement of public transport subscription, the provision of bike, the priority access to parking spaces for carpoolers or for ecological vehicles, the establishment of showers for bike users ...

Last but not least, **ICT solutions** can also be very helpful because they can help to reduce significantly the need for transportation by introducing e-solutions. eCitie is the best example of solutions that avoid to move to City Hall to settle administrative formalities. Some of them can be done online now. The development of web-conference or high speed WIFI connection at City Hall can also avoid staff travel especially during traffic jam hours or floods.

1.5. Education

1.5.1. The central role of education

“Formal education is not a function of local government. KCCA can, however, strengthen its current role in education and learning, by making a number of critical investments in educating and skilling its workforce, but also by opening up the economy to ensure that those who hold lower levels of skill can also access livelihood opportunities. In Kampala City whereas there are 81 primary schools and over 200 secondary schools. ” – Strategic Plan 2019

The impact that human beings have on the environment depends on their understanding of the functions it provides for them and thus their ability to adapt their behavior. From a young age, children need to understand their relationship to the environment and learn to adopt the right moves.

Some lessons are provided by the educational community through school programs. Other lessons are provided by school activities where children are educated and where they practice activities related to the protection of the environment. School is the place where all begins. In the context of the Strategy, the education approach has to go beyond the circle of schools to involve all the actors playing a role in education.



From the beginning, the roadmap identifies the youth as a central target of the Kampala Climate Change Action Strategy. The strategy is made for them in a long term vision. As expected by the supporting program Africa4Climate (Expertise France), it is important that youth, young artists, education centers, local community are involved in the elaboration process of the Strategy. They have proved their high mobilization during the annual Kampala Festival where they have put all their creativity to make it attractive and understandable by the visitors. Exhibitions showing environmentally

friendly solutions such as producing electricity, cook or grow plants have been installed around an eco-constructing pavilion and a stage where artists, often students, came to sing or to fashion show. These different formats of communication allow to deliver positive and concrete messages.

This emulation is possible when children are educated at school on the environment and when the school allows them to form associations or to develop projects. They choose the right words to deliver messages and are certainly most listened compared to the experts who are used to address messages to informed persons.

1.5.2. The energy and GhG balance

Another aspect of the importance of the education sector concerns directly the energy and greenhouse gas balance of KCCA. There are about 81 schools in Kampala. 8 of them are directly managed by KCCA which owns the building and the ground.

Schools consumed the energy they need mainly for cooking and electricity. They uses wood energy with low efficiency and sometimes low respect for the environment.

Education is made at national level. KCCA proposes extra-curricular activities. 6 pillars compose the education policy of KCCA with one of them is dedicated to environment. The implementation of the actions is followed by an inspector. KCCA allocates some grants to schools on behalf of the government. Schools that do not belong to KCCA manage by themselves their **energy consumption** and their **energy bills**. At the moment, there is no specific energy policy for schools at KCCA level such as common **energy management system, potential studies, awareness campaigns or investment programs**.

KCCA has developed two pilot projects in two schools. A school is equipped with a biogas plant that values fecal waste into **biogas** which is then used for cooking instead of firewood. The energy bill is seriously reduced and the air quality in the school has significantly increased. Another school was equipped with an **eco-stove** using volcanic stones and a **solar panel**. The same positive effects have been observed. These approaches are very interesting as pilot projects and deserve to be enlarged to the other schools. Solar, biogas and eco-stoves can

bring significant improvements for the school, the students and for the GhG balance of KCCA.

Other initiatives also exist such as the creation of Environment Clubs, the planting of trees, the collection, the banishing or the sorting (plastic) of waste (green, yellow and blue bins), annual championship. Every last Friday of the month, children clean up all the school.



Biogas recovery at school

KCCA has implemented a bio-digester in Kansanga School which recovers biogas from the fecal waste of the pit latrines. This biogas is used to produce energy for cooking. The estimated amount of biogas produced is 36 m³ per month, which corresponds to about 2.6 MWh produced annually. This action presents different benefits: it turns a waste into resource, it is available on site and reduce the external energy supply, it reduces the particles emissions from firewood or charcoal used for cooking, it improves the management of operating costs

KCCA plans to develop other projects of that kind. **The land issue** is however important because if KCCA has no land, the investment can be risky in the long term. There is a need to **work at national and local level on a common action plan for schools** to make them more energy efficient and climate resilient. **Developing a more natural and respectful environment for schools is a no regret action and the best support to make children eco-citizen.**

Another strategic issue regarding the GhG balance is the **mobility**. A specific survey on mobility use has been launched during the GhG balance process. It indicates that most of the students are going to school by walking which is good (knowing that sometimes, the walked distance is very long due to the limited budget of families). But it also reveals that in most cases, students use different ways of transport for one journey and it includes motorized transport. Indeed, parents drop kids at a short distance from the school and the rest is made by foot. The survey is not yet exhaustive and need further investigation. The question of the **localization of the schools** is a part to develop because it may affects the congestion and then the energy consumptions and the air quality. The need for public transport reintroduction can be linked to the introduction of **public school bus**.

In line with the question of **air quality**, it is recommended to limit the sportive activities (when outside of the school) among the traffic such as running race. The impact of bad air quality on health is quite higher when practicing physical activities in the middle of the affected area. In relation with the recommended action of air monitoring at city level, it is suggested that schools are equipped with sensors that could assess in real time the level of air quality.



Kampala Employment bureau

KCCA has through the Directorate of Gender Production and Social Service, introduced the Kampala Employment Bureau at Senzibwa road, Nakasero, to help in Youth reskilling and provide an organized platform for matching job seekers and hiring institutions
KCCA has open job centers

Supporting enterprise creation

KCCA gives grants to youth and local communities to start an enterprise. The template for assessing applicants to the grants includes environmental questions. Priority is given to action that have positive impacts on the environments (briquettes, organic restaurant, firewood

2. Communicating with and engaging local stakeholders

Vision

Communication is a prerequisite for action. Energy issues and climate change are now visible but often poorly explained. Residents and stakeholders are struggling to create their own links between the phenomenon, the impacts and the actions to implement. It is therefore essential to develop a public education around climate change based on communication and participation, in addition to driving education policy at national and local levels.

The inclusion of these topics in the community discourse is important, especially during the implementation of new public policies. KCCA must rely on local opinion leaders to adapt the messages and to relay the information in the most appropriate possible ways using the existing platforms. The integration of stakeholders in the governance of the Kampala Action Climate Change Strategy is a way to achieve this objective (see Chapter 4 / 1.1).

Communication and participation will support the elaboration of a tangible Strategy which will also improve the visibility and the attractiveness of KCCA for partnerships at local and international levels.

Impacts

- ▶ Increasing the number of people sensitized who feel concerned by climate change and energy issues
- ▶ Reducing the volume of GhG emissions in Kampala thanks to behavior changes and to a better access to practical solutions
- ▶ Improving the visibility of Kampala policy at national, continental and international levels to attract financial and technical partners
- ▶ Increasing the number of signatories of the Commitment Charter

Leverages

- Understanding the target groups sensitivity to climate change & energy issues - concepts
- Knowing the different audiences /target groups /relays to adapt the messages, the language and to select the most appropriate platforms and media
- Talking about local short term impacts, promoting local best practices and solutions, developing arguments (public health, green jobs, quality of life...) to make it more personal and tangible for local stakeholders and communities
- Organizing communication and participation through specific annual plans
- Having a specific toolbox for communication and participation activities
- Working closely with the 5 City Divisions and the local leaders
- The Annual Stakeholder's Dialogue and local communities' platforms (see Chap 4/1.1)

2.1. Communication and participation

Communicating and engaging local stakeholders is at the core of the Strategy. Its success relies on inhabitants and stakeholders outreach and on their incorporation into the design and the implementation of the Strategy. A good communication improve relationships and builds partnerships. “You build relationships when you understand your audience and speak to their values and priorities” (ICLEI USA)

As revealed by the GhG diagnosis, KCCA activities are only directly responsible for less than 1% of the global GhG emissions of Kampala. Then the Strategy must target people who are part of the issue but also of the solutions because they are GhG emitters and/or because they hold an expertise which can contribute to mitigate the impacts. Moreover, the Strategy is made for the people living and/or working in Kampala which implies that their presence will ensure the Strategy is inclusive and well-address the priorities of the communities.

The difference between communication and participation is important but the two are closely linked because they serve each another. **Communication** is generally a one-way process which aims at sharing information to raise awareness, giving practical indications and promoting action. **Participation** is a two-ways process which merges top-down and bottom-up approaches to install dialog between stakeholders. For instance, communication may help to sensitize people on the benefits of alternative source of energy to fossil fuel. Participation may help to understand the barriers they face to adopt them and to design the most appropriate solutions.

Regarding the Kampala Climate Change Action Strategy, both communication and participation are taking place in the elaboration and implementation processes. They are used before, during and after the project design.

Before: designing the methodology and the roadmap, implementing capacity building activities

During: sharing the diagnosis, collecting opinions and proposals, co-producing the vision and the action plan, disseminating information and showcasing concrete achievements

After: following the implementation, assessing the results through feedbacks and updating the action plan

Communication is helping to **raise awareness** on the local climate change issues, to **promote the best local practices**, to **inform** about specific programs and events and to **deliver** the main policy results.

Participation is helping to **gather** the different stakeholders (inhabitants, NGO, private and public enterprises, institutions...) in order to **share** the stakes, to **co-define** a common strategic vision, to **co-design** the action plan and to assess the progress.

A communication plan and a participation plan have been developed during the elaboration process of the Strategy. They will be updated to suit the implementation phase of the strategy.

For both, the definition of the targets, and of the roles and objectives per target, is important because the way to address and to engage with different audiences is unique to each. Indeed, there are a wide range of stakeholders beyond the inhabitants, for instance: institutions, staff, business owners, community-based organizations and leaders, contractors, experts, NGO, local political leaders, neighborhoods associations, program funders, students, volunteers, R&D and education centers, media, religious groups. Some of these stakeholders are not only targets but supporters such as the media which can be considered as an outreach relay too. So the definition of the targets, of the objectives for communication and participation and of the roles is crucial. Different audiences can be motivated by different things (for instance being informed and/or being involved) knowing that generally communication aims at arousing interest and participation aims at involving.

“Establishing a relationship with these stakeholders groups will help to leverage resources, create opportunities to discuss the costs and benefits of mitigation actions and potentially develop new and innovative ways to build community resilience” (Climate Smart Communities).

2.2. Adapting communication to favor participation and action

As mentioned, there are as much ways to communicate that there are different targets, each operating in a context of its own. For instance, the way to deliver a message to a business owner will differ slightly from a message delivered to an inhabitant. Even among the same audience (inhabitants or SME for example), there is no homogeneity because the size (SME versus big firms) or the sociological criteria (inhabitants in slum or in favored neighborhood) may vary.

The KCCA Strategy aims at communicating and involving all the local stakeholders which implies to adapt the communication and participations plans. The translation of messages into an **appropriate and accessible language** is important. The choice of communication tools is also strategic because people have not the same equipment and practices (TV, newspaper, magazines, radio, website, social media, community events...). Moreover, in countries such as Uganda, it is highly recommended to take into account the **social organization** of local communities. Understanding the way people interact within their communities and with the different kind of media is the first step of the communication action plan design.

It is important to integrate upstream residents and stakeholders. This is the best way to help them understanding the issues, to make them feel involved and to keep them in the dynamics of implementation. After receiving the message, they must understand it, understand what is expected, the role they can play and the benefits at individual, community and city levels.

The current stakes in Kampala are related to the city development story. The city is growing fast and everyone can measure the impacts of such development. The same can be observed with climate change, impacts are tangible nowadays. Most of the time, what people are missing is the connection between the stakes, the impacts and the solution to bring. **The objective of the strategy is to create these links with an adequate language based on a story-telling approach including concrete example of impacts and solutions.**

Some people may feel overwhelmed by the issues that are often described as catastrophic or too distant. Being a development project and more particularly a project to build a greener city for the benefit of all, it is important to deliver a **positive message** to the different targets. The creation of a **specific brand** is also important for allowing the staff and the stakeholders to make easily the links. To promote behavior change and increase collaboration and cooperation, communication and participation must be adapted. Efforts must be concentrated on the general audience which is not as much expert as some public and private stakeholders

In relation with the Chapter 4/1.2, all the remarks above also concern the KCCA staff at two levels: the integration of energy and climate issues in their work and the way to integrate these issues in the discussions they have every day with their own contacts. KCCA staff and community leaders are facilitators of the general outreach and of the participation.

Having everyone on board and observing behaviour changes is a long run. The communication and the participation plans are currently designed to come along with the elaboration process. The critical project milestones have been defined with specific

communication and participation activities. The same must be achieved during the implementation phase.

The general messages have to be repeated, especially at moments where people are more receptive such as for instance during the international day for environment in June, during UNFCCC Conference (COP) at the end of year or during a climate event because the media coverage is already in place. It is essential to leverage existing meetings and other communication opportunities. The same for participation activities that must first penetrate the existing platforms before designing new ones.



At the recent COP21 conference of UNFCCC in Paris (France 2015), the Executive Director of KCCA Jennifer Semakula Musisi was the guest of the Africa4Climate project roundtable: *"Innovative and collaborative approach towards a national/subnational implementation of low-carbon climate-resilient development strategy"* with the Vice-president of the Metropolitan Authority of Lyon (France) and le Groupement Intercommunal des Collines (Benin). She shared the Kampala experience and the commitments of KCCA giving to the audience concrete

examples of green solutions implemented by the City and the citizen. COP21 was also the opportunity to attend another side event with the Uganda Authorities to illustrate the joint implementation of climate policies.

KCCA is very active in promoting the City commitments and achievements abroad. The city acts on a voluntary basis within the framework of international agreements and governmental objectives. She pays particular attention to raise Kampala among the developing cities the most volunteered in the fields of low carbon and climate resilient development what is attractive for potential long term partnerships.

During COP21, Kampala Capital City Authority gained admission to the Global Fund for Cities Development (FMDV).

2.3. Playing integration at KCCA level

Thematic workshops have been pre- arranged in 2015, during which specific information was generated for the development of the Strategy. The information obtained provided an overview of the current status regarding Climate Change as a concept, how it should fit within the activities of the Directorates, the gaps, strengths and opportunities to exploit. Subsequent meetings have been organized to consult KCCA staff particularly from the Directorates of Public Corporate Affairs, Gender and Community Services and with one NGO- Ecological Christian Organization (ECO). The purpose was to consult them as well to generate ideas for the development of the communication and participation strategy.

During this internal baseline survey we noted that the communication function within KCCA is fragmented with each Directorate having their representative but with overall responsibility falling in Public and Corporate Affairs under ED's office.

The PCA department is overstretched by many events with limited staff who basically have to micro manage as priorities arise. This means that taking on additional tasks is a juggling act where priorities always win.

For this reason it is recommended to build capacity within the PCA department and internally in KCCA via a climate change task force (with representation of committed personnel from each Directorate) to both map integration opportunities and develop mechanisms for documentation of activities either planned or undertaken.

During the elaboration process, key activities within the KCCA work plan have been identified as opportunities to:

- *raise public awareness on climate change issues*
- *engage potential stakeholders as partners*
- *showcase innovative examples of good practices already being done locally*

These include the annual city **KAMPALA FESTIVAL** in October which is a huge corporate partnered event attracting millions of people each year. During the 2015 edition, a series of dynamic activities have been organized to ensure maximum participation and visibility during the event. This again is following the integrated model with active participation by a wide range of actors. Such a process is critical to establish long term commitments which support sustainability.

Smaller events such as **BARAZA** community dialogues and **KAMPALA GOES GREEN** monthly environmental protection could also be used once staff has received more CC awareness training. Similarly raising internal awareness has been proposed by simple weekly messaging via the **INTRANET** system to scale up interest and knowledge. The intention is to keep motivation high and encourage more staff to come on board to drive the actions forward. This will come in addition to a series of **TRAINING** events to be delivered by specialist partners.

On the direct Communication front an internal brainstorming session (VIPP- Visualization in Participatory Planning) has been held to assess current climate change knowledge, explore perceptions and examine potential messages. This has allowed to develop an appropriately focused **brand** - which has been done by a partner and inaugurated during the 1st annual stakeholder's Dialogue in October 2015 – to create a specific **video** on Kampala achievements, to add a CC page to the **website**, to start tweeting and to update social media with event and activity details. **Mainstreaming or integration** of service delivery has mostly been used in public health but not so much in other sectors, even though several donors do adopt this methodology. Therefore we are working to join them on board as partners for the **long term strategy** implementation which is why involving as many critical active actors early is essential for long term strategic positioning.

As KCCA is committed to building a better city for a sustainable future, the authority is building on what small actions everyone can do to lead by example. This approach will enable to engage people at the level they are already and allow KCCA to invite them to promote good practices which will mitigate climate change and promote adaptation initiatives. The first open call for this is via a public competition where winners could be presented with awards at the annual Kampala Festival.

This approach promotes everyone to be part of the solution rather than be in conflict and add to the problems. As Climate Change involves new thinking and working it is essential to guide people gently into this process to gain their commitment rather than opposition. If this is not done carefully the strategy can remain like main paper concepts on the shelf in the office but not applied into daily working and home practice.

This is a very dynamic and ambitious project and KCCA is dedicated to seeing it through, however key milestones need to be earmarked to both motivate and encourage continued commitment. It is with this in mind that the activities were scaled up to align with KCCA critical events not only to improve visibility but to dramatically expand access for participation both internally and externally.

2.4. Community involvement and civil society

Community involvement and civil society is a strength in terms of the KCCA administration and management structure. Community involvement is ongoing in the five divisions and there are already ongoing sanitation/hygiene related activities such as waste reduction and environmental friendly/energy saving initiatives are being implemented by women groups, youths, CBOs and individuals through the Community Demand Driven (CDD) subprojects. Eco-friendly practices e.g. making briquettes, improved charcoal stoves, collection of plastic bottles and establishment of tree seedling nurseries for commercial gain are being done, although informally out of self-drive and with minimum external support.

The weakness is that there has not been a deliberate coordinated programme to integrate such initiatives in the division development plans and neither has there been a specific bottom up planning process directed towards addressing carbon emissions. Desired practices such as eco citizen actions, home control mechanisms, monitoring eco consumption, ecological footprint calculations and establishment of awareness creation platform are gravely lacking. **Recommendation, as part of the strategy development and implementation, attention should be put to initiating and promoting closer linkages and cooperation with civil society actors,** development of appropriate citizen actions and to get them to focus more on engaging communities to participate other than policy advocacy. Communities should also be mobilized and sensitized through deliberate well-coordinated programmes so that they can participate meaningfully, with motivation and for systematic monitoring/reporting and assessment of changes.

The communities to target will be the people residing in the five divisions of Kampala Capital City Authority and the immediate neighborhood. By definition, a community is a group of people living in a defined area by boundaries and sharing common norms, values, beliefs and local leadership.

In this case, the community shall include the following: Councilors, Community Based Organizations(CBOs), Faith Based Organizations, Churches, Mosques, Local Drama Groups, Local residents (household members), Landlords, market vendors, Women groups, Youth groups, VSLAs groups (Village Savings and Loan Associations), parish development committees (PDCs), Community Resource persons-VHTs (Village Health Teams), volunteers, Peer educators, CDAs and Health Assistants. The school children will be considered as part of the community and will be targeted while in school. Since these categories are diverse, different approaches will be applied to get them to participate. The diagnosis report will guide on the kind of activities that communities will carryout to contribute to mitigate emissions.

At inception (start up), the community leaders specifically the LC1 chairpersons, parish/LCIII Councilors and technical staff will be contacted through meetings to explain the strategy and project plan. These persons will participate in focus group discussions to provide their opinion about Climate Change. This is to buy them in and thereafter, the residents will be mobilized through the existing leadership structures and platforms.

[Meetings with household members](#) at village level could be conducted to explore their thoughts about Climate Change. Communities could be sensitized about Climate Change issues and why they need to get involved. Participants will propose appropriate actions they can take up, based on their understanding of Climate Change and how it impacts on their lives.

Specific dialogue events can also be organized to involve people to discuss simple ways through which people can be encouraged to take action.

Places of worship such as churches and mosques will be utilized as channels for sharing the Climate Change message and what should be done. The leaders will be approached individually and briefed about the need to sensitize the people.

Use of Local radios: For instance Bukedde, CBS, and other popular ones will be utilized for talk show program on climate change.

Special message on Climate Change: a TV program can also be aired on commemoration days such as World environmental Day, Energy Week, World water day, World toilet day, sanitation week, and other occasions like the KCCA festival week to educate the public and to also mobilize them for action.

The women, youth and savings groups are a good structure to ally with. They already have an advantage of being structured and working collectively which is a great opportunity to integrate Climate Change into their activities. During their meetings, a slot to talk about Climate Change and its linkages to poverty, economic growth, and other concerns should be obtained. As people come up with ideas to develop economically, socially and politically, they should also integrate an eco friendly approach and have the right information. Community outreaches should be organized once in a year to discuss climate change matters. Community social/resource maps/seasonal calendars can be used as tools to engage people to participate and to evaluate Climate change effects on their growth.

Community and school drama on CC: Interested Community members and groups can be trained to come up with simple skits with a message on climate change. This can be a form of entertainment as well as an educational event.

School children as change agents: while at school, the children shall acquire Climate Change knowledge through the school health clubs and will pass on this information to the parents and other family members. They can support the demonstration of compost pits, recycling of waste where applicable and trees/fruit planting. The Science teachers who are usually part of the community should be trained in the relevant knowledge on Climate Change and provided with simple guidelines and IEC materials to promote children's involvement. Materials can be developed with assistance of KCCA education directorate

Use of SMS messages on climate Change: Brief SMS messages can be developed and sent by phone e.g. plant a tree, sort your garbage, save water, power use and others which are appropriate. This can be worked out with support from the KCCA communication department. This arrangement can also promote access to information and participation of the public.

The Parish Development Committee: These committees comprise of councilors and influential opinion leaders at parish level. This structure should be utilized to mobilize communities & CBOs to include Climate Change into the parish development plans and activities. Since they carry out the planning and needs identification for the LC1 level, Climate Change should become part of the priorities to be considered.

Community Resource persons. These include the Village Health Teams, other extension workers/volunteers, Peer educators, CDOs & Health Assistants. This category provides extension support services to communities at village level. They carry out community mobilization, sensitization, training and follow up for community development initiatives. Their involvement contributes to effective participation and awareness creation to the grass root population. For sustainability, the extension team will be of great help to the divisions in training communities and volunteers to carry out community based monitoring and reporting.

The existing community advocacy groups.

Within the communities are community advocacy groups advocating for improved services in water supply, drainage maintenance and hygiene and sanitation. These groups should be encouraged to integrate Climate Change matters into their activities.

Establish demonstration sites in the communities:

Work with interested households to pilot some technologies e.g. bio-gas generation especially where zero grazing or ecological sanitation is being practiced. Urban agriculture (fruit & vegetable growing) briquette production and value addition. That will improve community livelihoods and promote their participation.

Use KCCA existing programmes to enhance response to Climate Change: KCCA has routine activities such as the monthly clean ups in its 5 divisions, the annual festival and other activities contributing to improved environmental health conditions. The message of climate change should be integrated into the current initiatives and support extended to actors promoting waste res-use, reduction and recycling. All these initiatives should be documented as best practices for future use in mobilizing communities, educating the public, involving schools, the private sector and business groups.

In summary, examples of existing initiatives of KCCA that should be enhanced include Community monthly cleanup exercises, Community Barrazas, The Kampala City Festival.

9 key principles of consultation

1. **The dialogue has an impact on the decision making process.** To make the dialogue attractive, the participants' work must necessarily have an impact on decision making. The exact modalities (eg consideration of proposals with explanation of what was chosen and what did not and why ...) must be specified early in the process.
2. **The consultation has clear goals but must remain open to various proposals.** The objectives of the dialogue have to be specified upstream and widely disseminated to potential participants. A consultation process involves a problem that has no predefined solution. Policymakers must be prepared and open to consider all proposals from stakeholders in response to this problem, even if they are in tension with their own expectations.
3. **The interest of the participants to participate.** Participants get committed according to their own will and in full knowledge of the facts.
4. **All stakeholders are represented** in the consultation process. All actors involved in the subject matter, or their representatives, are legitimate and must be invited to participate in the dialogue, so that a diversity of views to be represented in the debates.
5. **The consultation process should be transparent.** In a dialogue, there are always one or more final decision-makers who are responsible for the decision. The different levels of underlying dialogue consultation contribute to the decision in the sense that they allow the development of proposals. But the Authority keeps control of the final decision. Nevertheless, participants must be informed about how their contributions will be taken into account in the development and execution of the final decision. Participants must be informed of how the consultation process will unfold. They must know who does what when, and how decisions will be made. Each participant must clearly lie within the process leading to the development of proposals, that is to say at what point it can contribute and how.
6. **The neutrality and the quality of the animation** conditions the successful outcome of the consultation process. The animation is a wholly function that calls a neutral posture regarding the issue to be discussed. It aims to bring the various participants on an equal footing regarding their contributions to the debate. The animation does not only give the opportunity to the participants to express themselves, it must also ensure that all participants actually expressed during the process.
7. The consultation is a process that is both **iterative and adaptable**. The process of consultation is built step by step. In practice this means that the phases of the originally planned process can evolve with new needs (including those of the participants) that arise along the way. The approach remains open to feedback of the participants.
8. The consultation goes through a stakeholder **access to the resources**. All participants must have a guaranteed access to various resources mobilized as part of a dialogue to enable them to participate effectively in the consultation process.
9. The mobilized **resources** must be consistent with the stakes of the consultation.

The consultation has several purposes. Between general mobilization to work long-term vision and focused discussion on specific topics, the use of dialogue takes place at different times and take different forms. For example: defining a common vision, examining the desirability and the feasibility of a project, setting up objectives, designing a project or a policy, creating partnership, improving articulation between different structures and/or different projects...

3. Landscaping a more resilient low carbon Kampala

Vision

The General Policy of the City and the Strategic Plan 2019 set up the objective to make Kampala a Vibrant, Attractive and Sustainable City taking into account the quality of the environment through spatial planning and mobility.

With high rates of economic growth, population growth, sprawling urbanization coupled with a deficit in utilities infrastructure, there is (and will be) a high pressure on energy consumption and GhG emissions that is not compatible for the sustainability of the City. Reliance on motorized transportation will continue to grow with use of fossil fuel. Transition to low carbon is a long-term measure, which should be taken seriously by adhering to the strategic plan. A transition from project-oriented development to programming is critical to make the city sustainable attractive and resilient.

The potential for the low carbon and climate resilient development of Kampala is important but will have to be supported by targeted spatial planning and a better strategic integration of mobility and physical planning. The physical planning and mobility sectors will have to be integrated to promote an enabling environment that can support population growth, business establishment and green growth.

Impacts

- ▶ A combination of integrated sustainable infrastructures, spatial planning and market-based instruments is required to increase efficiency in construction and use to reduce GHG emissions in already built-up areas of Kampala region.
- ▶ Minimizing resource intensity use and leverage local ecosystem services.
- ▶ Reducing the fast sprawling in hinterlands that affects the major they play with regards to environment conservation, public health and local development
- ▶ Reducing the share and the impacts of individual motorized transport
- ▶ Adapting the city to climate change by exploiting the different contribution of urban nature and urban agriculture
- ▶ Improving air quality and reducing impacts on health
- ▶ Making Kampala a more attractive city for tourism and green economy

Leverages

- **Integration between sectors** (physical planning, mobility, energy & climate, public health) and between actors at every levels
- **Accessibility** in Kampala is a challenge with the few roads and routes as well as limited options for transportation. Thus improving accessibility is a key option
- The limited roads lead to a problem of poor **connectivity** between neighborhoods and across the city. Thus connectivity is another option for Kampala
- Kampala is also characterized by sprawling fast into the hinterlands. This is augmented by the land market and private investment into properties. There is an opportunity of **limiting the size of the urban extent** through the Metropolitan Planning Authority to **protect ecological zones and agricultural zones** in the expanded region of Kampala, Mpigi, Wakiso and Mukono districts
- Although Kampala region is characterized by mixed uses, a more deliberate and planned **land use mix**, integrated to leverage low energy dependence, reduced transportation trips, ecosystem services at localized scale are necessary for increasing land use mix;
- **Increasing transit options** is a key option for Kampala, which relates to mobility, the infrastructure and transportation systems that enable low carbon transit systems
- **Increasing density in tandem with land use mix** is critical for limiting urban sprawl but also reducing trips that increase emissions.
- **Increasing green space and other carbon sinks** through protection of ecosystems in and around while enhancing and restoration of degraded ecosystems. This contribute to make the city more resilient to climate change in case of natural disasters but not only. The protection of ecosystems and the local biodiversity is crucial to satisfy the vital needs of the population (agriculture/food for instance, quality of water...). The greening of the city through the planting of trees and the creation of open public spaces can also help to develop the **urban canopy** which is a natural protection against sunlight and high temperature in case of heat waves

Implementing a package of these options can reduce energy use and GHG emissions across sectors as well as create the underlying conditions necessary to increase systemic efficiencies

3.1. The process towards a smart city

There are several dimensions of a Smart City. These include low carbon development, resilience to disasters, enhanced ecosystem services, efficient infrastructure, transportation and timely provision of information on condition of public services, innovative use of Information Communication Technology for service delivery, interface between city authority and public, real time provisos of information on infrastructure status and services status.

Different cities define a 'Smart City' in its own way depending on which combination of these dimensions most addresses the critical city service needs. Whereas some cities the definition is based on usage of ICT for public service provision or information dissemination for action, other cities have formulated strategic actions for greening and carbon neutral development as part of going smart. **The physical planning and mobility sectors will have to be integrated with other sectors for a smart growth and development. Bringing together the linked infrastructure for Mass Transit transportation, energy use in all sectors, ecosystem services enhancement and socially inclusive development in Kampala is potentially the definition of a smart Kampala. ICT and infrastructure would be the conveyors of the smart Kampala.** Strengthening and developing the knowledge and the competencies of local authorities in the fields of integration through capacity building activities will be a necessity for building a smart city.

Physical planning is a process with a set of activities that yield a plan or planning framework on the basis of which urban development would be pursued or guided. Physical planning is thus distinguishable from other sectors, which are service provision oriented. One of the few services offered by Physical Planning at KCCA is development control through which developers submit plans for approval. The bulk of physical planning work is the process of formulating the guiding frameworks for development control and other services provided in the city. Physical planning is thus the KCCA sector that would be appropriate for integrating horizontally (within KCCA departments and units) and vertically (without KCCA with other agencies) to formulate and implement a low carbon development and climate resilient strategy or Go Green strategy. Physical planning takes the spatial context and within the space for infrastructure and mobility planning. Mobility currently within KCCA is largely through non-motorized transportation as per the recent transportation survey but also private and public transportation. This is both a challenge and an opportunity. A challenge to improve and establish efficient transport systems accessible for all reducing reliance on private motor transport towards mass transit transport. An opportunity because transportation being in deficit and in its infancy, this can be an entry point or lever for low carbon transportation system in Kampala. This can be achieved through s a number of strategies;

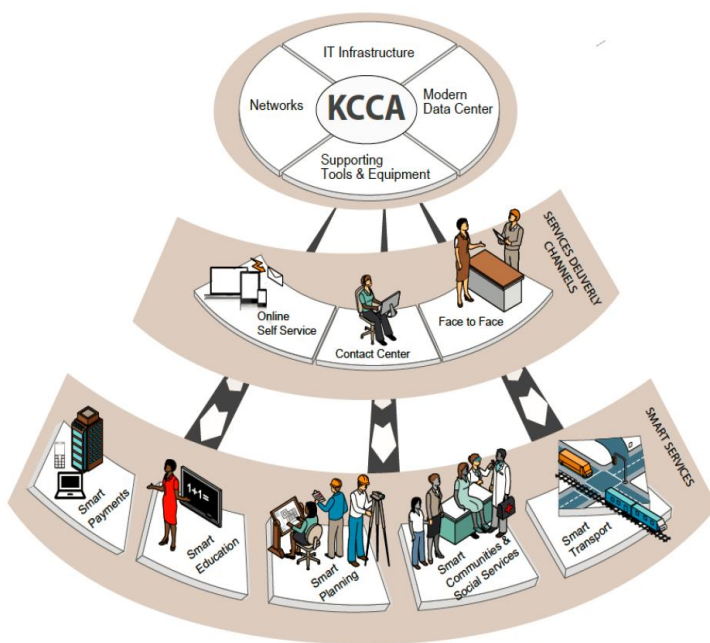
- ▶ **Improved connectivity** by opening secondary and tertiary roads in the city to reduce emissions associated with traffic congestion but also enhance permeability within the city. This is already taking place within KCCA but requires to be extended within the **Metropolitan Region**. Coordination and collaboration with neighboring jurisdictions will be crucial and the coming in being of the Metropolitan Planning Authority is a lever for attaining this strategic action. Improving connectivity and mobility should be seen as a short term measure implementable in the near future within the extended region
- ▶ **A strategic move towards mass transit transportation systems that is integrated based on multi-modal transportation.** This would include, Bus rapid Transit, Light Rail, Park and Ride services, Non-motorized systems with terminals linked to within city destinations such as shopping malls, civil offices, sports facilities, industrial parks and residential neighborhoods. A phased approach to implementation of a comprehensive mobility plan is necessary
 - ▶ In addition to an integrated transportation system, a move towards zero carbon transport systems through fuel switching and use of renewables energies is a

step forward to a long-term strategic plan of action for the city. This could start with hybrid buses to slowly move towards biofuels and solar energy buses. The currently ongoing pilots of waste-to-energy, biogas in institutions could offer platforms for learning about renewables and energy mix in transportation

- ▶ **Private car transportation is unavoidable in the foreseeable future of the city**, thus construction of free ways and highways will be part of improvement of the transportation system. This is already underway with the Entebbe Expressway. **Introduction of HOV's lanes, car pooling incentives, car share and designated bus lanes for mass transit is a key strategic action of the integrated transportation system in the city.** Design and construction of freeways should take this into consideration for long term planning and improvement of mobility
- ▶ Establishment of an **Air Quality monitoring and assessment system** in real time is another strategic point for transportation and planning. Air quality monitoring would determine when, which type of vehicles to access what areas depending on the spatial distribution of air quality levels. Heavy goods vehicles would have to strategically be redirected away from air quality sensitive areas such as the CBD and residential neighborhoods
- ▶ **Transportation infrastructure** and its construction is one aspect but the use and rules of use are very important. Road infrastructure, signage, light and sound signals, lane marking, parking marking, kerb improvement are all important as part of the rules of use for efficiency. Then the enforcement would have base if all these are in place. To improve mobility, the rules would have to be enforced and adhered to targeting proper use other than penalties.
- ▶ **Planning and leveraging high-density zoning for connectivity and mass transit systems.** There are already residential neighborhoods, which are dense but also poorly connected. Transit routes should target bringing multi-modal transport systems to these neighborhoods while connecting to other neighborhoods, business areas and industrial parks.
 - ▶ Several roads do not effectively inter connect like Gayaza road and Bombo road and Hoima road. And in the south, roads that would connect between Entebbe road, Ggaba road and Salaama road and improve permeability
- ▶ **Planning for alternative transport routes** as a short-term measure to reduce emissions though the net emission reduction from this is low. Kampala is characterized by few alternative routes in and out of the city congesting the existing trunk roads that it is difficult to tell what time periods are peak or not. Mass transit transportation is the long-term measure for reduction of emissions and improvement of mobility. This will require a system of terminals and routes some of which may have to be located in the metropolitan towns an average of 50 – 60 km from Kampala
- ▶ Aiming to reach a “smart cities level” is correlated to a **move toward compact cities** because compacted cities generated more likely reduced emissions. This can be achieved by monitoring of Household population, floor area ratio, building floor area ratio, jobs, commercial zones, blocks, by blocks, by commercial and even within the dwelling unit.
- ▶ When it comes to land use again you can see through a GhG emissions analysis if you have separated uses - which is a tradition in physical planning although it is now changing - you are most likely going to intensify energy use and make the city being a higher GhG emitters. Mix uses reduce a lot of energy that would go into trips by people spread as well within the different places

- ▶ The constraints for mobility in KCCA are due to limited connectivity, accessibility of some neighborhoods but also the limited routes and conditions of the transportation infrastructure.

The growth in population of Kampala and the neighboring districts is increasing demand for infrastructure and services. There is a narrow window of opportunity to shape urbanization trajectories of the region to prevent infrastructure lock-in. **The continued growth in urban population will require large-scale urban and infrastructure development, but this should drive the transition from fossil fuel to modern energy resources.** This is already happening with the decentralization of sewerage infrastructure and services, water system for the small towns around Kampala like Kajjansi, Entebbe, Mukono, Lugazi and Matugga. **The longevity of urban infrastructure and momentum of urban growth presents a window of opportunity** that will be narrowing over time to shape urbanization that will prevent emissions lock-in. The Metropolitan Planning Authority presents a good platform for city-regional planning that encampuses four districts around Kampala such that infrastructure development should take into account the reduction or avoidance of emissions.



According to the KCCA Strategic Plan 2019: A 'smart city' can be defined as a city that uses Information and Communication Technology (ICT) as an enabler to the services that a city delivers in dimensions such as smart payments, smart planning, smart transportation, smart environment, smart education, smart communities and social services and smart governance. ICT is now central to how people communicate, interact, make decisions, and do business. To realize this KCCA will in phase one seek to develop KCCA as a smart institution based on the model below

3.2. Connectivity

The challenge of connectivity in Kampala is manifest in time of travel from different parts of the city to others as well as costs of travel and cost of maintenance. For example in a study by Ministry of Works and Transport within Kampala, Ggaba route had the highest travel time of 3.1 minutes/km while Entebbe had the least of 1.7 minutes/km. The high travel time on Ggaba is attributed mainly to the heavy traffic on that route while Entebbe route had the least travel time because it's a long route with the largest percentage of the route having less traffic so drivers normally move at high speeds on that part.

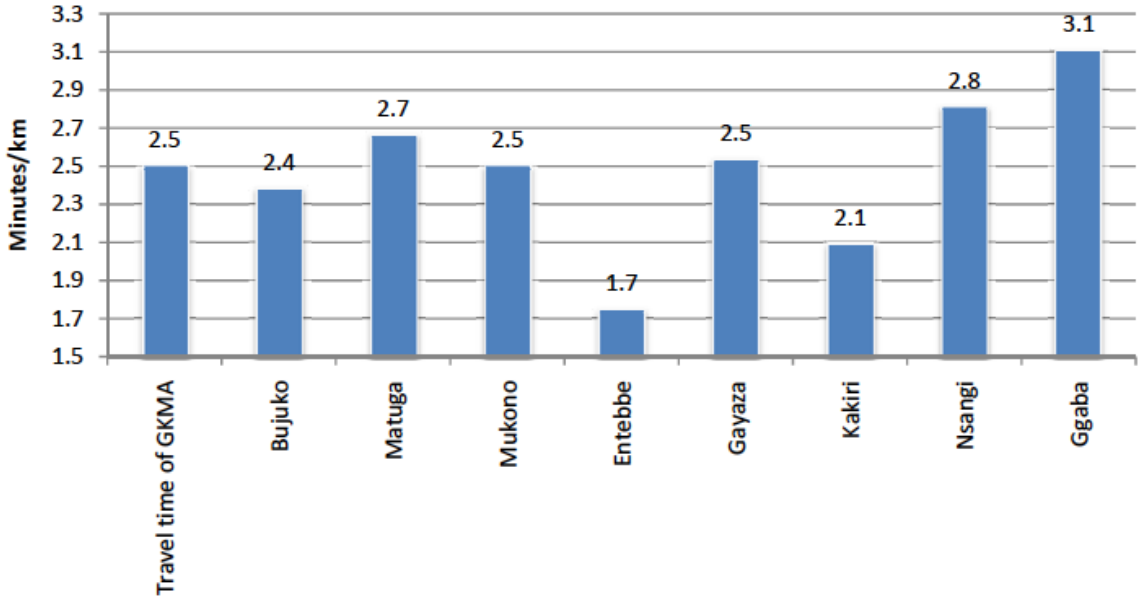
The average travel time of GKMA is therefore 2.5 minutes/km. This is by far inefficient and translates into high emissions as private cars spend more time with engines running on the road. Connectivity is critical and the radial type of roads in and out of Kampala require

connectors to ease movement since private cars and emissions will be unavoidable in short to medium term period of the strategy.

The delay tie across routes is also high from 10 to 45 minutes on a single trip across the city and this also translates into high emissions.

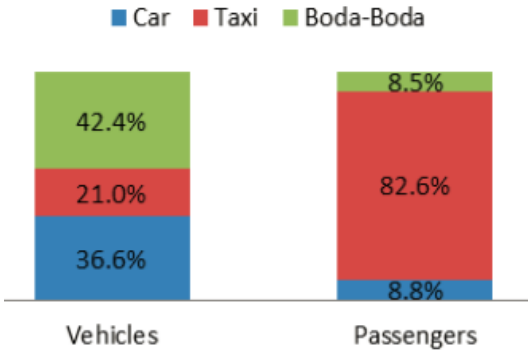
1.1.AVERAGE TRAVEL TIME FOR PRIVATE CARS

The average travel time is the time travelled per kilo meter



Mode Share	2002 - 2012
Light Transit	5.7%
Mini Buses	12.6%
Buses	5.4%
Trucks	9.2%
Motorcycles	15.7%

Source: UBOS, 2012



MATUGA KAMPALA ROUTE

(1 hr and 9 minutes-total delay time in the morning)



Congestion points extracted from main route



Reasons for Congestion

The in-bound delay time in Bwaise area is about 20 minutes in the morning. This is partially due to the existence of the Nabweru road junction within Bwaise Town.

Delay time at the bypass is about 9 minutes cause by the nature of the round about which is a dual carriage and yet the inlet is a single carriage. So the influx is more than it can handle because drivers are flexing to enter



Delay time at Wandegaya is approximately 12 minutes and its largely attributed to traffic lights

Source: Ministry of works and transport, 2012, Report on the Average travel time and vehicle cost in Greater Kampala Metropolitan Area (GKMA), Policy Planning Unit, Kampala

3.3. Growth and expansion

Urban growth and expansion is a major problem in Kampala which spatial planning needs to address at a strategic and city-regional level. **Spatial planning for mitigation options requires policy instruments to KCCA and Government to incentivize GHG abatement.** These policy instruments fall into four key categories: 1) regulation and zoning; 2) taxation and other financial sources; 3) land-based policies; and 4) targeted infrastructure. These policies will be more effective when implemented as a suite to achieve mitigation simultaneously.

Major mitigation potentials are expected from an integration of multiple criteria including **increasing density, mixture of land use, transportation modes diversification, and regional connectivity**, which are all related aspects that can subsequently generate positive and unique synergies for pursuing low carbon transit pathways and for seizing diverse environmental, health and other type of co-benefits. Policy packages related to transit could reduce Vehicle Travel Miles, maintain mobility and reduce direct GHG emissions at a regional level. Yet, combined/integrated policies, regulations and market-based mechanisms can be tailored to regional/local specificities and conditions such as neighbourhood size, income levels and distribution, development trajectories. More empirical analysis and data collection will be required to elaborate how these instruments can contain growth and expansion of the city.

The implementation of various spatial densification and reconfiguration strategies is on-going and with the implementation of the Kampala Physical Development Plan, densification can be pursued. As a growth management policy densification may include public acquisition of

land for open space; regulatory mechanisms such as rate of growth controls (caps on development), adequate facilities ordinances, upzoning, greenbelts, urban growth boundaries, urban service boundaries; incentives such as development impact fees, infill and redevelopment incentives, brownfields redevelopment, split rate or site value taxation. Policies to protect open space include public acquisition; regulatory policies include downzoning, exclusive agricultural or forestry zoning; incentive programs include transfer of development rights, conservation districts. Implementation and state or metropolitan scale of coordination is critical to outcomes.

KCCA is already engaged in different actions related to climate mitigation and adaptation but only within its boundaries. With the support of Expertise France/AFD, KCCA is elaborating a low carbon development and climate resilient strategy. It is proposed that KCCA should generate a **cadastre** plan where we can identify a) the existing energy network in Kampala, b) the energy production sites in Kampala, c) the data that will be issued from the national census where habitants indicate what they consume. To facilitate decision making process, it could be very interesting to work on a Solar Cadastre for Kampala. This will help to identify the potential on every building and facilities in Kampala (among them, KCCA's ones). This cadastre can be used by KCCA services but also by local firms, local NGO and citizen. The **GIS project** can provide the leadership on this. Among the measures to implement in order to tackle climate change and reducing the fossil fuel dependence (and GhG emissions), the development of renewables energy is a strategic issue. This development concerns the whole territory but at the first row KCCA buildings and facilities. Regarding the sun shining potential in Uganda /Kampala, solar energy (thermic and photovoltaic : both have to be considered) has to be prioritized. All these can be part of the urban growth and expansion plan to contain urban development and tap the energy resource base.

In building and housing, whatever the sector, KCCA can through its responsibilities in the fields of physical planning, land use, construction/rehabilitation authorizations, significantly support the development of renewables. KCCA can promote and suggest the use of renewables or minimum energy efficiency for building projects submitted for permit. KCCA can also define in the City Physical planning documents some specific areas where energy performance criteria are required. As for transport, it is important to consider energy networks as a structural issue in the development of the City. **Energy performance and networks have to be integrated into the City development planning as smart city component. Municipal or metropolitan Energy Planning is highly recommended** to concretize the energy and climate objectives of the LCDCR Strategy.

3.4. Transit option

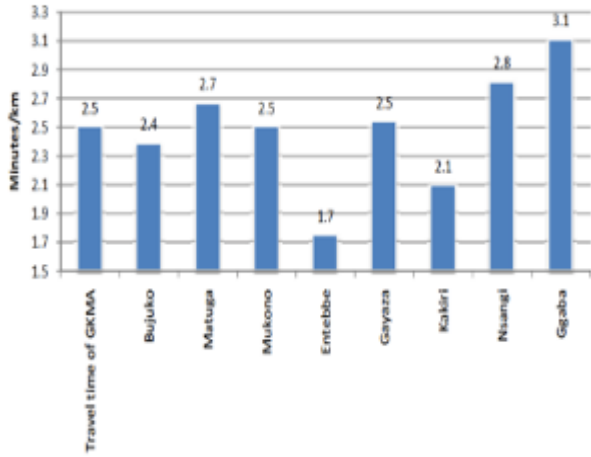
"Transit-oriented development" (TOD) is a concept to guide development and strategic infrastructure investments around key transportation nodes and corridors. Characterized by medium to high-density, compact, accessible, mixed-use, pedestrian-friendly development, TOD aims to offer diverse living choices and **enable residents to be less automobile dependent and utilize public transit more**, which in turn reduces VKT and GHG emissions. While originally coined and applied as a set of urban design principles, it is now adapted as a core part of sustainable development strategies and is being practiced in many cities from Copenhagen to Singapore as a **means of reducing the dominance of private automobile use and shaping human settlement patterns that are public transit-supportive**. When combined with principles of "green urbanism", including increased land use mix and increased densities, **"Green TOD"** can further reduce carbon emissions and energy consumption.

The **National Transportation Policy** and the **National Development Plan** recognize the important role of transport sector in the social and economic development of Uganda. The

Government of Uganda takes transport as one of the main priority areas envisioned as the engine for socio-economic development. In reference to the eight National Development Plan (**NDP**) goals, the Government is committed to the implementation of the transport policy with active private sector participation. This implies that private sector will play a major role in providing public transport through competitive system. A key policy strategy is the preservation of existing infrastructure assets through road maintenance. The other key strategic action is **the decentralisation and support to local administration to enable the local governments assume full responsibility for transport in the districts and municipalities**. Mass Transit systems such as Bus Rapid Transit is important in invoking this strategic action of enabling transit while reducing emissions. In this line, **Kampala Capital City Authority is collaborating with The World Bank and UNRA to conduct a feasibility study for a Bust Rapid Transit systems (BRT)**. The BRT is envisaged to increase ridership and improve transport access to different social groups within the city region. This BRT system is planned to integrate transport modes. The emphasis is on high-capacity buses running on 9 key routes (or lines) that are 'fed by' and 'deliver to' appropriate NMT infrastructure and other transport modes as well as facilities. The aim is to increase coverage and access to public transport using mixed modes of buses, walking or bicycling, and to also use walking or bicycling. The BRT will also be fed in by transport comprised of mainly the minibuses or taxis. There is recognition of environmental and de-congestion objectives of the BRT which implies **planning of the pedestrian and bicycling facilities along and or in connection to BRT lines**. In BRT, Universal Design principles are the norm for the buses, the bus stops (stations) and the surrounding pedestrian infrastructure. The associated facilities can include bicycle parking as well as car parks for park and ride system to encourage more people use mass transport services.

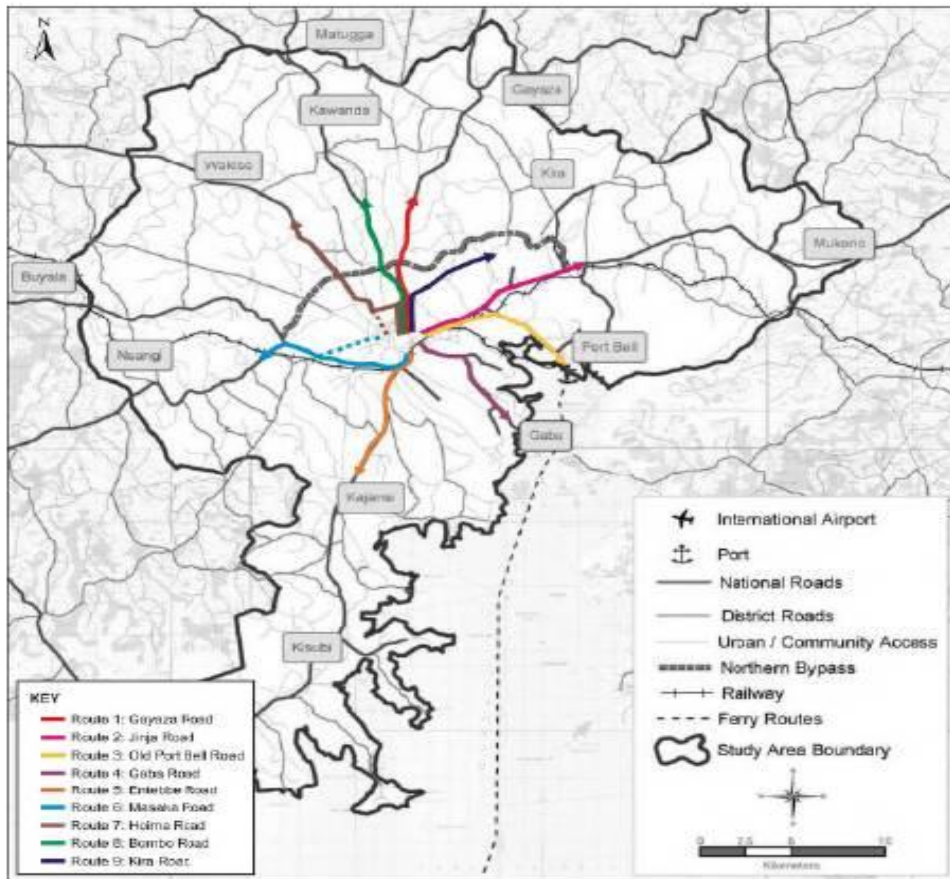
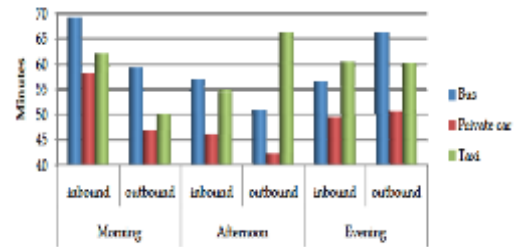
Ongoing action: Regulation of bus fares to encourage a switch in commuter behaviour from taxis to buses. Introduction of bus lanes where feasible. Gazetting and enforcing of bus stops and shelters to enable easy boarding and alighting. Introduction of an automatic fare control system to reduce fare leakage and monitor travel behaviour to better plan for the road usage/Construction and fare pricing. KCCA plans to introduce BRT, passenger train services and city buses for the Northern and Southern Zones in Kampala city.

The city region's average passenger demand forecasted in next 20 years is 236,045 passengers per day. Using the base year 2012 per capita emissions, total emissions from increased transportation will be Mt 42,960. The emissions will come from continued and increasing amounts of use of fossil fuels of diesel, petroleum and oil for the commuter vehicles. This is also based on the 2011-2012 transportation survey and GHG inventory that both indicated **dominance of non-motorized transport but forecasted increase in use of motorized transport of commuters, motor cycles and private cars. The BRT can target to reduce the emissions by 20 – 30%.**



AVERAGE ANNUAL OPERATING COSTS PER KILOMETRE (UGX)

	Taxi	Buses	Pioneer	Trucks	Saloon	Motorcycles
Fuel	426	971	787	750	221	138
Maintenance	30	80	12	53	23	37
Tires	14	42	21	51	12	13
Total	470	1,094	820	855	256	188



Source: Planned BRT routes in Kampala

Under KIIP2, KCCA is to signalize 15 junctions and also install cameras on several junctions which will be used to control traffic. The information collected/captured shall be relayed to

the traffic control center for analysis. Establishment of a **traffic control center** where information received from the cameras shall be analysed and the traffic monitored. Real-time information shall be relayed to various social media platforms and radio stations. With the establishment of functioning bus services, travel information shall be clearly displayed on bus shelters or readily given to tourists at the payment booths/kiosk which sell tickets.

3.5. Land use mix

Municipal authorities have led urban climate change policy responses within a context of multilevel governance. Often in the absence of formal authority or specific competencies, municipalities have used their self-governing and enabling modes of governance to develop and implement spatial plans and climate policy. These approaches, coupled with the nature of available funding and growing interest in the opportunities of addressing climate change in private and third sector organizations, have led to a new wave of strategic interest in governing climate change in cities and an important role for partnerships and project-based or 'experimental' forms of urban response. **There is strong evidence that addressing climate change has become part of the policy landscape in many cities and that municipal authorities have been able to reduce their own GHG emissions piloting different land use mixes at multiple scales.** There is more limited evidence that urban climate change policy has achieved wider mitigation goals in terms of reducing GHG emissions at the urban scale, creating new logics and practices for urban development that **realize climate change objectives alongside other urban goals, and achieving widespread 'transitions' to low carbon urban development.** In Kampala land use mix is already underway and the newly established **Metropolitan Authority will play a key role** is determining the mix of uses and the scales at which effective mix will reduce emissions. From with KCCA, it is important to consider the following;

- ▶ enlarge the Physical planning committee otherwise the (Technical Review Team) to staff from engineering (upstream transversal approach)
- ▶ Add an energy and climate section in the "construction or renovation" permit documents
- ▶ Develop energy and climate standards for Kampala
- ▶ To conduct a renewable energy study for every project in some areas of the City (for households but also for business facilities) - the ones that are concerned

As for the Metropolitan Authority, its mandate is as below;

- (1) The Metropolitan Authority shall be responsible for—
 - developing Physical Development Plan for the Capital City and the metropolitan area;
 - handling and addressing planning issues within the Capital City and the neighboring districts of Mukono, Mpigi and Wakiso;
 - planning major transportation, infrastructure and other utilities in conjunction with other relevant bodies;
 - planning recreation parks, tree planting, green corridors and other environment areas;
 - overseeing and monitoring the execution of the Metropolitan Authority Development Plan;
 - approving the Capital City, municipal and town structure plans; and
 - beautification of the Capital City and the metropolitan area.
- (2) The Metropolitan Authority shall have power to veto physical plans or activities that are inconsistent with the Metropolitan Authority Development Plan, the metropolitan structural plan or land use policy.
- (3) The Metropolitan Authority shall ensure that land use in the City and the metropolitan area follow designated plans, irrespective of the tenure of land.

(4) The Metropolitan Authority shall prepare comprehensive and integrated development plans incorporating the plans of the lower urban councils.

(5) The central Government shall be responsible for the construction and maintenance of all roads and streetlights in the Capital City; trunk and gateway roads; subways; flyovers; cycle ways and walkways; drainage; transport ways; and rails.

(6) Where land is required by the Authority for public use or public health including expansion of roads, constructing new roads, water and sewerage systems and demolishing buildings to construct new structures, compensation shall be made by the central government in accordance with article 26 of the Constitution and the Land Acquisition Act.

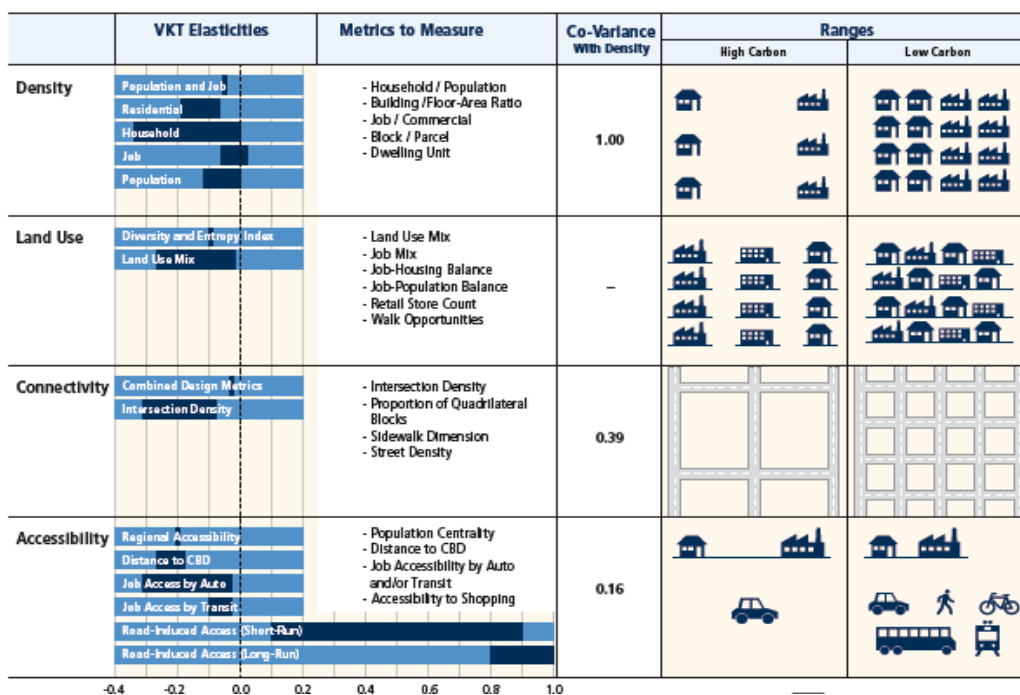
(7) The Metropolitan Authority shall submit quarterly reports and annual reports to the Minister, with a copy to the Minister responsible for physical planning.

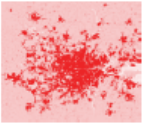
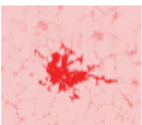

(8) The Minister shall lay before Parliament, the annual reports submitted to him or her under subsection

This a an opportunity to undertake low carbon development planning and regional scale with transit routes, infrastructure, decentralized environmental infrastructure, protection of agricultural land, forests and ecosystems and urban growth management.

3.6. Density

Kampala is characterized by high density though this is not evenly distributed. Lower and middle-income neighborhoods have high densities compared to high-income neighborhoods. But the density has one feature of single storey buildings occupied usually by one of a couple of households. **High rise residential buildings are only starting to emerge with the growing hotel and apartment segment of the housing market in Kampala.** Higher density and increase Floor Area Ratio per land unit is needed for promotion in the city by developers. As a strategic action, **development control should encourage high-rise buildings.** This would increase housing units and smoothen the rental housing market, which at the moment is so varied and skewed. This has benefits of compact development, reduced trips, energy consumption when combined with energy policies for renewables and local level ecosystem services.



Features		Time Scale Effects	Spatial Implementation Scale	Bundled Policies at Different Scales	
Spatial Planning	Density	Higher density, zoning, pricing parking; urban containment; measures for the built-environment; redevelopment	long		
	Land Extent (form)	Policies to define exclusive agricultural/protected areas at hinterlands; urban conservation areas; green belts	long middle		
	Land uses	Mixed-used zoning; reduced fiscal disparity; affordable housing requirements	long middle short		Regional
	Connectivity (grain design)	Particular relevant for new developments; applicable to re-development of districts and retrofitting; "complete streets" (for increasing their functionality) and their expansion, if needed	long middle		
	Regional Accessibility	Job-housing balance; close access to services; regional planning that connects subcenters through fast efficient public transport corridors and multiple modes; development fees	long middle		City
Systemic Integration	Transit	TOD; mixed transit and infrastructure planning concurrently with planning and integrated urban management	long middle		
	Waste	Urban mining, reuse + recycling; "zero waste" generation policies; bioenergy production; extended producer responsibility	middle short		Neighborhood
	Water	Water conservation policies, water infrastructure improvement/maintenance	middle		
	Food	Urban-periurban/local agriculture, if applicable	middle short		
Policies for Low Carbon Cities (Mitigation Strategies)					



Source: KPDP 2012

The KCCA (2012) on updating Kampala Physical Structure Plan estimates that in 2011 the City had 800 000 housing units with an average area of 55 m². The aim was to increase this to 1.5 million by 2022, each with 70 M² and to 2.2 million in the long term each with 78 M². For roads, the Kampala Upgrading Structure Plan which states that the 2012 network of roads in the City amounted to 1 976 km of which 1 241 km were paved. The plan if fully realized is to extend this by 2022 to 2 153. CDKN

3.7. Green space, biodiversity and carbon sinks

The urban bias against biodiversity in cities has been perpetuated by the longstanding conceptualization of urban land uses as non-primary, largely separated spatial units that relate to each other in a complementary manner. Even when such is the transformation of natural landscapes and an imposition of artificial landscapes, **little regard is often given to biodiversity** in terms of flora and fauna that comprise vegetation, small to medium sized animals as well as underground biodiversity that remains on the usually conserved or landscape designed surfaces.

But this also relates to the public awareness about biodiversity in cities. In Kampala which is rapidly urbanizing, the opportunities of economic growth increase the land value leading to a very conspicuous pattern of transformation of natural landscapes replaced by high rising buildings, commercial entities, road infrastructure and industry. The pattern and nature of this transformation often disregards nature and again, other than the designed landscapes for aesthetics (which is in itself a good thing), ecological elements that would enhance or maintain biodiversity are not provided for in the planning standards.

Thus there is little incentive for the public to recognize and value biodiversity in cities such as Kampala. This is true also for the municipal authorities, which despite having recognized environmental land use in the 1994 Structure Plan of Kampala, the Valued Environmental Components (VECs) were limited to wetlands and lakeshore. Little has been done to conserve the wetlands, tree cover on hilltops while small to medium sized animals such as monkeys, rodents and reptiles are either eliminated or transferred to the Uganda Wildlife Authority.

Kampala's wetlands have been severely reduced in size and function due to encroachment and pollution. Nakivubo Wetland, the most dominant in the urban area, has been significantly degraded. More than 50% of the wetland has been modified by channelization in the central city and by encroachment of residential and industrial development as the wetland flows toward Murchison bay⁴⁷.

In Kampala's over 100 years of existence as a city, the Impala, an animal that grazed the hills and after which the name of the city derives has disappeared completely. Though there has been an effort to conserve the species in established conservancies, these medium sized animals are not found in cities as part of the landscape. Some of these animals like monkeys, have adapted to the urban 'jungle' and found a way of living with humans though with challenges. Thus the disappearance of medium-sized animals in the city and within its immediate hinterland is not a coincidence but a systematic erosion of biodiversity in the locale due to habitat loss and change but also due to deliberate clearance and hunting.

Urban greening in Kampala will be critical for low carbon development and resilience building. There is a plan for planting 500, 000 trees in Kampala as part of the greening. Kampala City Council Authority is in the process of embarking on planting 500,000 trees in Kampala. The species are yet to be determined as this has to be elaborated by the Landscaping Unit of the city authority. **The planting of trees** is part of an effort to 'green' the city which greening was conceived initially as getting more tree coverage in the city that is already considerably green but now **has been expanded to low carbon development and energy balancing. The loss of trees is at an alarming rate especially on hilltops and lowland areas** in this tropical landscape known for dense vegetation and tree canopy. The city is located in an area, which previously had natural land cover dominated by tropical rain forests that are habitat for primates. The remnants of these forests still habit primates but these animals have moved or have been killed through time as built up areas intensified. **The**

⁴⁷ ⁴⁷ Promoting Green Urban Development in African Cities, Kampala Uganda, Work Bank 2015

greening activity is part of the effort to build climate resilience in the city envisaged for multiple benefits. Green cover would enhance aesthetics, reduce flash floods that are common in the city through increased infiltration, sequester Greenhouse Gases but the unforeseen possibility is the return or increase of the primate population in the city as habitat are recreated.

In the process of greening, there are competing issues. The desire to identify with global initiatives of reducing emissions by sequestering Greenhouse Gases is motivated also by existing resource envelopes from which finances can be tapped by the city authority. Thus the selection of tree species is likely to be influenced by those with a high uptake of Greenhouse Gases. The other competing motivation for greening is the production of food by practicing urban agriculture. Though this can provide food, urban agriculture tends to promote crops with high value niches. Yet at individual plot level the motivation of aesthetics through landscaping in urban spaces whether residential or otherwise. Yet this is also an opportunity if the authority recognizes the role that individual developers can do on their plots of land to plant the trees. Since most land is held and owned by individuals, it is prudent that the approach to planting systems involves the developers. A good number of hilltops are still covered by trees with some hilltops clear of trees though these can be replanted. Tree planting will enhance the habitats and ecosystem services. This process can be pursued through the following;

- The city is in an area that receives **substantive amounts of rainfall** ranging from 1200 to 1500 mm annually. With the established correlation between rainfall amounts and vegetation so the trees planted will enhance ecosystem services and biodiversity.
- City authority-initiated greening is plausible but may not be sufficient to achieve the targeted number of trees. Involving the **developers** either through incentivizing tree planting or inclusion in development standards tree coverage on plots will most likely achieve the target in a more efficient way.
- Tree species for planting are critical that the inclusion of **fruit-trees for productivity** is important because it will also enhance biodiversity of insects for pollination and species along the food chain.
- **Lowland areas and hilltops** are appropriate areas for increasing tree cover and habitats for biodiversity. There are co-benefits of focusing on these areas for increased tree coverage and enhancement of carbon sinks. And if connected through vegetative corridors can enable biodiversity thrive in the city. Hilltops in Kampala and lowland areas covered mostly by wetlands have a co-benefit of regulating hydrology of the city another ecosystem service which has been reduced through land cover change.
- **Incentivizing** tree planting will be critical for Kampala to achieve the target. Incentivizing can be in different forms. Municipal charges for development can be discounted with a clear tree-planting plan as part of the development. Providing seedlings and where appropriate subsidies for purchase may also be another form incentive for the developers to engage in greening.
- Greening also needs to be taken **further from just trees** to greening the city infrastructure, buildings starting with KCCA institutional buildings, greening private developments, greening transportation, greening institutional processes, greening transportation and greening infrastructure through eco-infrastructure like wetlands for water or sewerage treatment.

“KCCA plans to escalate the City beautification efforts as a way of creating a green chain of spaces and provision of more public open spaces in the city. Further efforts shall be in reclaiming the City wetlands water catchment area as a means of tackling the current drainage challenges and redesigning them into more useable areas for more community parks, walkways while sustaining the ecological value and habitat.”

4. Developing smart utilities and community services

Vision

The utility services are a determinant factor of the city development. They bring the primary services to the population and contribute to reach better standard of living conditions. In a very fast growing city like Kampala, there is still an important pathway to deliver the services in every neighbourhood.

In the continuation of the investment made these recent years, KCCA is aiming to make better linkage between utility services development and energy climate issues. Energy, waste and wastewater management have all potentials for reducing their environmental footprint and for exploiting measures that contribute to the green development of the City. These sectors have to be transformed to become green solutions providers.

The Kampala Climate Change Action Strategy must contribute to a better access to water, wastewater treatment and sustainable energy by the poorest. It has to protect them and bring them benefits.

Impacts

- ▶ Develop the knowledge of the Authority on the risks and potentials
- ▶ Improve the resilience of utilities infrastructures and services to climate change
- ▶ Increase the part of the energy consumed in Kampala that is produced locally
- ▶ Exploit the potentials of energy recovery and GhG mitigation
- ▶ Improve waste management through prevention, reduction, reusing, recycling, recovering, landfill improvement
- ▶ Improve the living conditions and health
- ▶ Create good opportunities for employment and green jobs
- ▶ Integrate a cross-cutting approach of utility services in the development programs and systemize the energy and climate questioning

Leverages

- The development of a better cross-cutting vision of utility services in the physical planning activities and in the workplan of each directorates
- Improve the coordination and the cooperation with national authorities and public agencies
- The integration of energy and climate objectives in every contract between KCCA and a third party (public service delegation, PPP...)
- The cooperation between R&D centers and the economic sector
- The city energy masterplan to inventory and develop the potentials
- The waste management policy from prevention to valuation
- The development of greener and more adapted solutions for wastewater treatment

4.1. What we consider as utilities

For the purpose of the Energy and Climate Profile, we will refer to public utility as **a service delivered to a large public by a public authority either directly or through a public service concession to a private operator**. Generally, the following are considered as a public utility: electricity, gas, water, water treatment, waste management, telephone service and other essentials services. They have (or can have) in common parts of their value chain (prevention, collection, production, supply, treatment, distribution, networks, recovery...). A public utility is mainly a basic service that should be delivered to all to improve livelihoods in the perspective of a fair, healthy and sustainable development. In the context of Kampala, we will consider energy, water and water treatment, waste management as public utility services.

4.2. The place of the local authority

Utility services are often decentralized at city or metropolitan levels but in the Ugandan context, it is not the case for KCCA. Indeed, **energy supply, water supply and treatment are centralized at national level, and then are not managed by KCCA**. On the contrary, **waste management is the Authority's responsibility**.

The Authority is a sub-national level of governance, in the between of national institutions and citizen. Thus, any impacts of these sectors on the daily life of inhabitants affect the operations of the Authority including its image. This "asymmetry" in the governance of the public utilities does not help the efficiency of urban services, finance and environment. UN-Habitat has since 2007 recommended decentralized service delivery and improvement in the role of local authorities. For inhabitants, NGOs, private SME, international partners, it is not easy to understand who's responsible for what and to develop projects as the level of decision making are separated.

*"The principle of subsidiarity constitutes the rationale underlying to the process of decentralization. According to that principle, public responsibilities should be exercised by those elected authorities, which are closest to the citizens. It is recognized that, in many countries, local authorities are dependent on other spheres of government, such as regional or national governments, to carry out important tasks related to social, political and economic development. In many areas powers should be shared or exercised concurrently among different spheres of government. These should not lead to a diminution of local autonomy or prevent the development of local authorities as full partners."*⁴⁸– UN HABITAT.

In the case of Uganda and regarding the KCCA Act, national Institutions and KCCA are working hand in hand to exploit all opportunities.

Even in case of "no mandate", the local authority is concerned with utility services through its action in the fields of community services, employment, epidemiology and disease control, public health, water protection, physical planning, road networks. For instance, in case of work on water distribution networks, the national agency (NWSC) needs the intervention of KCCA which is responsible for road management (networks being under the roads). In case of water pollution, KCCA must take measures to inform and protect the population. Through its physical planning responsibility, KCCA plans and controls any construction or rehabilitation programme but has not all the abilities to develop its own standards guidelines.

"The sustainable city necessarily requires widespread and secure access to basic services for all, by combining shared and regulated governance and a strengthening of the competences and responsibilities of local authorities." PFVT⁴⁹

⁴⁸International Guidelines on Decentralisation and Access to Basic Services for all

⁴⁹ Access to basic services for all and support for decentralization process. PFVT

4.3. Linkage between utilities and climate change

With high ratios of economic growth, population growth, urbanization but also taking into consideration the low development of the existing utilities' infrastructures, there is and will be higher and higher pressure on energy consumption and GhG emissions that is not compatible with the sustainability of the City.

Regarding the Kampala Climate Change Action Strategy, the objective is to identify the stakes and to assess the opportunities to make public utilities a master piece to achieve the city objectives. It will help to clarify the level of governance, responsibility and action in these sectors.

To build a Smart City, where public utility services are a strategic component, the local authority needs to collaborate with the stakeholder in charge of the service. To that end, strengthening the dialog and developing the knowledge and the competencies of local authorities in these fields is advised.

The utilities can participate significantly to the achievements of the Strategy objectives by reducing their environmental footprint and exploiting their potentials. Indeed, beyond their impacts, utilities can bring solutions.

Energy network can be reorganized at local level and pilot operations such smart grids could be tested. Water distribution networks, wastewater collectors and sewage treatment plants can produce and auto-consume a part of the energy they need. Public buildings, facilities or schools are all potential sources for energy production and auto-consumption. The potential of biogas from waste treatment can be a significant source of energy.

"These services are interdependent and provide the foundation for the construction of urban sustainability" – UN-HABITAT

The sustainable city therefore requires pooling urban networks [...]

"The creation of a basic service network requires a heavy investment, which is amortized over the long term. Moreover, their recurrent management and maintenance costs impose substantial operating costs. They take up a large area of land and have a significant financial, social and environmental footprint. They are part of a common problem which requires looking at the links between strengthening their governance and their financing [...]. These services are interdependent and provide the foundation for the construction of urban sustainability.[...] Living in the city means having access to this service provision." PFVT⁵⁰

It has been decided that even if KCCA is not responsible for some of the utility services, the Strategy has to deal with them through direct, supportive or joint-implementation measures. A local public policy that integrates utility services into a cross-cutting strategy is clearly relevant for KCCA in the context of its ambition for a low-carbon and climate resilient local development.

The LCDCR Strategy deals with energy and GhG objectives in which each utility has a potential whether in terms of production, efficiency, energy savings, recovery or valuation. A Local Energy Master Plan would help to gather all these potentials, to confront them with the objectives of the Strategy and to produce a specific action plan.

⁵⁰ Access to basic services for all and support for decentralization process. PFVT

5. Supporting the green economy

Vision

Regarding the exposure of the economy (activities, actors, assets) to climate change impacts and energy issues (reliability, costs, dependence) but also the local potentials for green growth, this strategic objective aims at 1) making the economy more resilient to climate change, 2) assisting the local economic fabric in its ecological transition, 3) supporting the emergence of new green activities in Kampala by offering an appropriate environment for green business and developing synergies between actors from different backgrounds, 4) giving priority to energy efficiency measures and renewable energy in the sectors that are boosted by the city development (transport, waste, construction, tourism, water, agriculture...), 5) giving priority to marginalized communities, 6) ensuring that the local training offer matches with the needs, 7) dedicating the public procurement to the green economy.

Kampala ambitions to be a haven for green growth businesses and innovation. This strategy must be inclusive and completely integrates into the climate resilient and low carbon city development scheme.

Impacts

- ▶ Mitigation of energy consumptions and GhG emissions (territory balance)
- ▶ Reduction of the climate vulnerabilities of activities, actors and assets
- ▶ Improvement of the competitiveness of the economy by a lower energy bill
- ▶ Synergies between research, innovation, development and trade at city level
- ▶ Increase the local skills, empower and develop SME
- ▶ Increase of the number of jobs in the green economy activities

Leverages

- The City Economic Development Strategy
- The market infrastructure development plan
- The artisan / business parks and the business space restructuring
- The urban agriculture policy
- The urban and marine tourism
- The public procurement
- The cooperation between KCCA, R&D centers, Schools and University, Ministry
- The development of knowledge, skills and experiment through education and research's
- The information and the advice of economic actors
- The implementation of joint-action (collective) and pilot projects
- The positioning of KCCA as a destination for green business
- A strong promotion of KCCA Strategy at international and regional levels to attract partners, funders and investors

5.1. Adapting the economy to energy and climate issues

"Improving energy efficiency and decoupling economic development from energy consumption, particularly of fossil fuels, is essential to sustainable development. Therefore strategic energy planning does not only reduce emissions but also increases productivity of businesses, lowers costs (for both business and households), enhances competitiveness and thereby ensures job security. Besides, strategic energy planning through energy efficiency and diversification of energy sources creates new opportunities and jobs for the economy"- United Nations

As detailed in the diagnostic part of this report, the local economy is in Kampala already confronted with major energy issues such as the energy supply security (reliability of the distribution networks, net energy (electricity, fuel, wood, charcoal) imports from beyond the city boundaries, exposure to climate change impacts), energy efficiency (rational use of raw materials, efficient equipment, virtuous behavior ...) and the rising price of fossil fuels. The strong population growth and the healthy economic growth imply that energy consumption will continue to rise without energy intensity improvement (unit of energy consumed for producing one unit) if nothing change.

The success of the energy transition for Kampala is to satisfy the forthcoming local energy needs in the long run by reducing energy vulnerabilities of residents and economic actors. This will require energy intensity improvement permitted by more efficient behavior, local investments in renewable energy production capacities, innovations for energy recovery where it is not yet recovered (waste, waste water, biomass) and awareness of all stakeholders. The energy history of Kampala has "not yet started". The choice in the local mix to satisfy the coming needs and the related green decisions to be taken upstream will determinate the energy future.

All these measures will benefit the local economy that has the capacity to offer these new products and services. The role of KCCA will be to mobilize and raise awareness to energy and climate issues of all the economic sectors, to identify the existing green companies as well as the potential of new firms' openings, to create networks of exchange on practices and cooperation, but also to support the emergence of the green growth sector by better linkages between different spheres such as education, research and development.

"Because of the generally conducive climatic profile, the country is well endowed with fresh water resources that provide livelihood to over 40% of her population in form of fishing, transport, hydroelectric power as well as tourism. However, the recent events of the last few years have clearly shown that Uganda's climate is changing and that it is threatening the natural resource base thus adversely affecting Uganda's social and economic development" – Ministry of Water and Environment

Current and future impacts of climate change affect and will affect the local economy (See survey *"Economic Assessment of the impacts of Climate Change in Uganda, Case study 1: economic assessment of climate change in Kampala urban area"*⁵¹).

Firstly because a part of the Kampala's economy is based on the environment and natural resources of the territory such as fishing, urban agriculture or tourism. On the other hand because climate change impacts disturb the proper functioning of the local economy. It is therefore strategic that KCCA identifies the sites that are at risk to protect them, which is particularly true for industrial sites in sensitive areas and transport infrastructures.

The green economy aims also at making the city more attractive for investment through public services delivery, secured and conserved environment. The landscape and the public transport policies will contribute to that objective in a city where life is flourishing but not enough organized to support the emergence of a new economy.

⁵¹ *"Economic Assessment of the Impacts of Climate Change in Uganda, Case study 1: Economic assessment of climate change in Kampala urban area", Baastel, Makerere University*

The first steps to consider are then to sensitize the local economic fabric to the energy and climate issues and to integrate in the economic policy a wider place to the green sectors.

5.2. Characterizing and reorienting the local economy towards green growth

The International Labour Organization is giving the following definitions:

Green economy as *“one that results in improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities.” In this connection, a green economy can be thought of as one which is low carbon, resource efficient and socially inclusive.*

“Green jobs are central to sustainable development and respond to the global challenges of environmental protection, economic development and social inclusion”

Jobs are green when they help reduce negative environmental impact ultimately leading to environmentally, economically and socially sustainable enterprises and economies. More precisely green jobs are decent jobs that:

- Reduce consumption of energy and raw materials*
- Limit greenhouse gas emissions*
- Minimize waste and pollution*
- Protect and restore ecosystems*

KCCA has decided to anchor green growth at the heart of his political vision. There is a strong will to develop climate resilience, energy and environmental performance in the economic development of the city.

In the framework of the Kampala Climate Change Action Strategy, the objective is to integrate the environment into all sectoral policies of KCCA creating positive effects on the local economy. In other words, the effects of this strategy are to serve the people and the economic players in Kampala, with a strong focus on employment and social inclusion. Thus, when developing its policies, KCCA must include an environmental component and then question the solutions and procedures that will be most favorable to businesses and local job seekers

Areas related to eco-construction, bioclimatic, eco mobility, waste management (3R), renewable energy and energy efficiency, circular economy, freight and logistic (...) will all be "boosted" by the time when there will be a new regulatory framework and a higher public demand for green products and services. Today, KCCA is clearly declaring that Kampala ambitions to welcome green growth investments and investors. The city is willing to be a welcoming and attractive place for them.

In conjunction with the relevant authorities, it is recommended to KCCA to launch a first diagnosis of the current activities and actors that are related to green economy. This has not to be limited to economic activities but extended to training offer, innovation, research and development, funding. This will help to assess the current composition of the sector, the weaknesses and the gaps, and then to start a dialog with the actors of this emerging sector. A dedicated platform to green growth, in the framework of the Stakeholder's Dialogue and beyond, should be launched.

It is essential to assess the current offer in terms of in-service trainings and initial training to be sure that the local job markets will correspond to the offer. Depending on the results, a specific roadmap has to be constructed with the participation of all the relevant organizations.

The existing KCCA Strategic Plan 2019 can improve the focus on green economy, green jobs & climate change finance. It can be more related with the Kampala Climate Change Action Strategy:

- Promoting an enabling environment that can support **business establishment** and growth
- Creation of opportunities for **employment** generation and development of necessary **skills** needed in the current and future job market
- Tackling major inhibitors that limit the city's opportunity as an **investment destination**
- Promotion of **informal and small enterprise sector** empowerment
- Development of specific programs that target the **marginalized communities** within the City

5.3. Working with and making linkages between the different spheres of the economy

KCCA has a mandate to develop and structure the local economy which is very diverse, changing and unstructured. This can be achieved with a better integration between national and local levels.

In the framework of the Kampala Climate Change Strategy, KCCA will generate a positive impact on the local economy, asking for more green products and services procurement. It will also ask the companies in relation with each of the KCCA directorates to adopt measures that will help to reduce their environmental footprint in the environment. This will go through contractual measures (including eco-conditionality of the public support to economic activities) but also spontaneous ones thanks to the Free Commitment Charter proposed during the Stakeholder's Dialogue.

Then, the second focus is the emergence and the support to the development of new sectors in line with the Strategy (waste, transport, energy, tourism, agriculture, water...). By supporting innovative green measures on its own assets and promoting the best private practices, Kampala can be the starting point to a wider development of Ugandan green companies in the country and the eastern region. The current needs regarding energy and climate issues have to be converted into a strong and sustainable demand to trigger investments from the private sector. Instead of increasing the demand for foreign goods and services, there is an opportunity to make Uganda and Kampala a/the land for green growth products and services production.

This green strategy has to benefit the local workforce and the marginalized communities. Most of the potential jobs are not high qualification jobs and are then easily accessible with a minimum of skills to be developed along with the experience. Green space management, building construction, waste management, renewable energy maintenance and installation (...) are offering a wide range of jobs open to different levels of skills. It would also bring an opportunity to convert informal sectors into formal.

KCCA is welcoming industry, SME, R&D platforms, education and training centers that usually work independently from each other. Looking at the "cluster" approach which does not really exist in Uganda, there is a huge potential to reap the benefits of better cooperation between actors from different backgrounds. The role of KCCA in the development of Business Park could be focused in the creation of a green business park where actors operating in the fields of the green economy could be welcomed and work together. The whole chain of values of the creation of activity would be gathered at the same place. For SME, being together on the same place brings the advantage to increase visibility and the capacity to offer combined solutions. The question of the environment to support entrepreneurship is crucial.

KCCA has already experienced some pilot projects and must continue to do it. It is not only a question of investing but also testing solutions that have been experienced in other places

around the world to see how they can be adapted before dissemination taking into account the local social and economic characteristics. KCCA can be a playground and a showcase for players in the ecological transition.

The City can also welcomed international events, specific exhibitions, forums and conferences around these subjects.

Then the two first levels of intervention regarding the KCCA mandate and the Strategy is to sensitize the local economic fabric, to support exchange and joint-action platforms and to create an appropriate environment for green investments.

CHAPTER 4. FRAMEWORK OF THE ACTION PLAN

1. Being an example as a capital city

1.1. Governance

1. Design of a specific governance for the follow-up, the reporting and the improvement of the Strategy. This governance scheme is declined at different levels (strategy to implementation) and defined the different kind of participants (top management, directorates, and stakeholders). The Strategic Plan 2019 of KCCA provides the strategic objectives of the City Development. It is recommended that the Kampala Climate Change Strategy is aligned with the Strategic Plan (to facilitate the visibility, the readability and the consistency for external stakeholders)
2. Design a specific quality management system for the follow-up of the Strategy (planning, steering, annual review, data collection, assessment, reporting, improvement)
3. Designation of the relevant referents (focal points/climate change task force) within each Directorate to compose the project team and to perpetuate the 8 enlarged internal workshops organized on an annual basis for the Strategy review. These (network of) referents produce an annual reporting on achievements and propose new ideas to be discussed during the annual workshops
4. Publication of an annual progress report . This report is published and shared with the stakeholders and the citizen platforms
5. Developing an in-house data inventory system for energy, GhG emissions and sectoral data related to the activities of KCCA. This will help the assessment of the projects and the conception of the public policies.
6. Local communities and NGO participation Strategy including a stakeholder's mapping
7. Organization of an Annual Kampala Climate Change Action Stakeholder's Dialogue (with plenary sessions and thematic committees)
8. Creation and signature of a Stakeholder's Commitment Charter
9. Regarding the high development of the City, the urban sprawl, but also the fact that climate and energy issues do not stop at the City boundaries, it is highly recommended that KCCA works closely with the cities of Greater Kampala through a specific network and/or a specific working group. These cities can partner with the Kampala Climate Change Action Strategy and be part of it developing specific joint-actions with KCCA.
10. Suggest the opportunity of the creation of a cities climate network between cities who's States are members of the East African Community
11. Putting in place a committee of climate change experts - researchers in meteorology and climatology - and in collaboration with the Uganda National Meteorology Authority (UNMA), to improve scientific knowledge on the future climate of the city. This could also include to develop localized climate forecasts to refine, where possible, future simulations especially in terms of changes in precipitation and events/extreme weather hazards in Kampala.

1.2. Human resources

1. Formalizing and implementing an environmental eco-friendly approach within the Administration that will help to mitigate the GhG emissions and environmental impacts and to adapt the working conditions with regards to climate change. This approach must cover all the KCCA services and must be formalized. Energy and water consumptions, building performance, waste management (prevention and sorting), public procurement, eco-mobility, furniture's consumptions (paper...) are the main sectors to be covered. The sensitization module will help to implement the approach. The approach will concern the

<p>central administration (City Hall) but also City Divisions, schools, health centers, public markets and business centers, Library, Information centers, sport and recreation structures, protocol management). Assessing the progress every year during the KCCA Strategy review.</p>
<p>2. Building a sensitization session dedicated to climate change and energy issues for staff. This training session can be enlarged to sustainable development as a whole and propose concrete illustrations of local stakes and positive implemented solutions. Any new employee at KCCA should attend this training session presenting the environmental policy in the context of the Vision and the Core Values of KCCA. Internal trainers among the staff can be trained to make the session for their colleagues or KCCA can partner with an education center specialized on these fields who could do it.</p>
<p>3. Encouraging best practices study visits, capacity building activities and environmental training sessions in the KCCA annual training program that will help the staff to develop their comprehension and their skills in these matters and in relation with their job – especially for key services</p>
<p>4. Realizing a Manual for employees introducing KCCA, the Vision and the core values, the environmental policy at work and the solutions implemented</p>
<p>5. Integration of the KCCA Core Values and of the KCCA environmental policy (eco-friendly approach) in the Appointment letter and Job description of the staff. Assess the progress and collect propositions during annual HR individual interview.</p>
<p>6. Green ICT solutions: visio/tele-conference, WI-Fi, Cloud, dematerialization...</p>
<p>7. KCCA Staff Mobility Plan to reduce the share of individual motorized business travel in the KCCA GhG balance: car sharing, IT Solutions, bike renting, tele-working...</p>
<p>8. Annual "Go Green Day" to sensitize employees, promote best practices, innovative idea competition...</p>
<p>9. Sort of waste in the public offices</p>

1.3. Budget, public procurement

<p>1. Formalizing the annual budget dedicated to the Strategy and the contribution of each Directorates: operating and external costs, investments, resources and fundings...</p>
<p>2. Capital Project Development Forms mainstream energy efficiency, emissions reduction and climate resilience in all KCCA capital investments (Capital Investment Planning Technical Assistance, Work bank)</p>
<p>1. Capacity building activities in the funding mechanisms related to green policies. Benchmark of opportunities at international, regional and national levels.</p>
<p>2. Facilitating the access of KCCA to the green funds dedicated to climate change adaptation (BAD, green funds, ...)</p>
<p>3. Developing a short guidelines of environmental criteria to assess global costs and environmental externalities of projects in the decision making process</p>
<p>4. Introduction of environmental criteria in the contractual relations between KCCA and a third-party such as contractors, suppliers, subvention appliers (eco-conditioning)</p>
<p>5. Designing a public green procurement policy: diagnosis, guidelines, set of environmental criteria per kind of furniture, products and services, indicators</p>
<p>6. Survey on the local potential fiscal leverages that could support the implementation of the Strategy</p>

1.4. Energy, water and GhG management

1.	Nomination of focal points within the Directorates in charge of the follow-up of the energy and water figures and of the reporting to the project team for the GhG & energy balance update
2.	Municipal Energy and Water Information and Management System:
	<i>-Inventory of all the public buildings and facilities (incl generators) + diagnosis on usage, production and consumptions, surfaces... (see 1.4)</i>
	<i>-Database and/or software to store the information and to facilitate management, operations, follow-up ... (see 1.4)</i>
3.	Formalized action plan to develop energy/water savings/efficiency measures and equipment's in the existing building and facilities
4.	Sensitization program on smart behaviors at the attention of all the occupants of public buildings and public facilities
5.	Study on how to adapt the ISO 14 001 or ISO 50 001 to the KCCA context for the energy and water management
6.	Creation of a specific department of energy to manage energy issues related to the KCCA perimeter (design of the operations on public buildings and facilities, car fleet, street lighting, energy management system, collection and treatment of data, ...)
7.	Improve the integration of the public assets properties policy/management with the energy policy/management . Create a working group to design the eco guidelines, to develop the database and to prepare the quality management system
8.	Developing metering and sub-metering systems for energy and water
9.	Robust system of GHG accounting at the city level to help inform and track progress

1.5. Standards for construction and renovation

1.	KCCA eco guidelines for its construction and renovation operations on public buildings and facilities with high environmental performance standards and energy climate components. This eco guidelines provides method and performance criteria for operations at building and plot level.
2.	Feasibility study for a pilot bioclimatic project
3.	Feasibility study for a pilot 0 carbon and/or positive energy project
4.	Survey on renewable energy, energy recovery and energy substitution potentials of the public assets and properties (administration, schools, health centers, City divisions, public markets, car fleet...) owned by KCCA (through direct investment or partnership – for instance renting of roof for solar panels, solar eco-stoves in markets...)
5.	Scaling up the pilot projects of renewable energies and energy recovery in the public schools to others (with a strong focus on how improving the air quality at school due to the current non efficient use of firewood or charcoal: a specific survey can be launched on energy substitution potentials). Upscaling the onsite biogas production pilot project of Kansanga school to other schools and public facilities
6.	Survey on innovative financing mechanism such as Energy Performance Contract, PPP, Feed-in Tariff, etc
7.	Renovating public buildings referring to high environmental quality standards including energy efficiency, renewable energy, rational use of water, bioclimatic inputs and

resilient to climate change

8. **Install** renewable energy on the public buildings and facilities (for solar energy, directly by KCCA or through roof renting)

9. KCCA shall endeavor to **promote** the use of solar energy and eco-stoves and other environmentally friendly technologies (especially in public buildings and in schools)

1.6. Street lighting

1. **Street lighting Master Plan** including the city diagnosis (existing equipment, needs...) the development plan, the specification, the economic, environmental and social impacts

2. **Use of solar energy for street lighting: Less than 15%** of the 1,200km road network (115Kms) is fitted with street lights and less than 8% of it is properly functioning. The current street light network is old and requires total revamping. Over the next 5-Years, KCCA plans to revamp the entire street lighting network and introduce a combination of solar powered lights and the modern LED Streetlight systems. Use of solar energy will reduce the power cost and address the aging infrastructure challenges. KCCA intends to rollout solar street lights through a combination of PPPs and on new road construction. The program will replace all the existing streetlight luminaires in the city and is expected to bring a net saving in energy use by over 40%, reduce carbon emissions, reduce power and maintenance cost of the City's street lighting system by over 60% and at the same time raise income through advertising. However the major challenge is vandalism, and thus specific sensitization of local communities about the importance of the project for the neighborhoods has to be implemented.

3. Report annually the indicators for the GhG and energy balance of KCCA

1.7. Mobility of the staff, the visitors and car fleet

1. **Car pooling**

2. **High environmental performance criteria** for the procurement of vehicles. Through public procurement, KCCA can defines new standards (CO2 emissions, particles emissions, fuel consumption l/km) for the acquisition of new cars and trucks (hybrid or electric vehicles).

3. **Conversion** of the carburation, substitution of fuels for the existing fleet

4. **Parking policy** for employees depending the number of car-sharer and/or the environmental performance of the vehicles

5. **Eco-drive training**

6. The realization of an **Internal Mobility Plan** to the attention of the whole staff. Such plan aims at proposing alternative solutions to the staff to avoid the use of individual cars for their personal and professional needs (carpooling, car sharing, visioconference, incentive for eco-mobility, parking policy, best idea competition award...). Now that KCCA has made its first travel survey, it is important to continue and to work with the HR department and the employees on a specific action plan.

7. Supporting the development of **Eco-Mobility plan in schools** (in concertation with the educative community) and City administrative sites and divisions

8. **ICT Policy:** Continue to develop eCitie services and the dematerialization strategy (for internal and external services=, identify new opportunities to extend eCitie concept, webconference, teleconference, ...

1.8. Education

1. Joint program (energy at school) with UG Gov and KCCA to assess the potentials for renewable energy and energy efficiency development (solar, biogas, eco-stoves, LED light...). Extend this program to waste management (including micro-budget to help the schools to be equipped with bins for waste management) and make linkage with the ongoing school water and sanitation policy of KCCA
2. " Energy management initiative at school " (network of voluntary schools) to be run by KCCA in order to harmonized the follow up of energy consumptions, share best tools and practices, develop joint programs
3. Eco-conditioning of the grants depending of the environmental performance/initiative of the school
4. Support the creation and the creativity of all the Environment Clubs at School (empowering the leaders of the clubs, improving linkages between the clubs and management)
5. Creation/generalization of a championship to promote best practices at schools with promotion and award for the winners – for instance celebrating the 5 th of June every year (International Environment Day).
6. Extend and support the waste management in all schools (3R)
7. Developing the survey "travel to school" in order to initiate appropriate measures to reduce the GhG induced by these travels (scholar public transport, car sharing, renting bike, localization...)
8. Test the Eco-School label in one or few schools in Kampala http://www.ecoschools.global/
9. In the framework of the Air quality management program of KCCA, implement the sensors around the schools
10. Stop the practice of sport (course or championship) in or close to the traffic because of impact of bad air quality on health
11. Mainstreaming CC awareness in Education Sector through institutions of higher learning where research is being done
12. Partnership and involvement in the strategy governance of Students associations and other relevant NGO to support the design and the development of the strategy, especially in the fields of young and adults sensitization, events, participation...
13. Directorate of Gender Production and Social Service has introduced the Kampala Employment Bureau , to help in Youth (50% of Kampala population is under 18) reskilling and provide an organized platform for matching job seekers and hiring institutions. This office could contribute to the promotion of green jobs and would help job seekers identify those jobs.

2. Communicating with and engaging local stakeholders

1. See measures "4.1 Governance" involving stakeholders into the governance scheme and partnerships with other local authorities
2. Developing a multi-years communication strategy declined in annual programs
3. Developing an integrated participative strategy (including stakeholders and communities of Kampala) built in the existing platforms (+ see 1.1 Governance /SH Dialogue)
4. Initiating and promoting closer linkages and cooperation with civil society actors , eco citizen actions, dialog on KCCA operations in / conception of the neighborhood, home control mechanisms, monitoring eco consumption, ecological footprint calculations and establishment of awareness creation platform
5. Developing capacity building activities to strengthen KCCA staff skills – and other relevant stakeholders – on the energy component to take it into account in the existing sectorial platforms
6. Completing the communication toolbox (logo, graphic charter, roll-up, website, brochure, video, flyer, youtube channel, regular information to radio, newspaper...)
7. Developing a knowledge platform on the web (in or out the institutional website of KCCA) with all the relevant information about the subject, the actions the programs in appropriate language for each target groups.
8. Promoting Kampala and KCCA Strategy at national and international level through a pro-active participation to events
9. Eco-Pavilion every year at the Annual Kampala Festival
10. Kampala Goes Green Campaign
11. Putting in place weather and climate observatories for generating climate information, strengthening climate early warning systems and put in place contingency plans for developing climate change–resilient health systems. To that end putting in place a climate resource centre at KCCA is essential for articulating the weather and climate change response on the territory, including collecting, monitoring and sharing of data and information observed throughout the region. This joins the proposed action for developing a wider data inventory system internally at KCCA.
12. Specific study on gender importance with regards to environmental friendly behavior and sensitization
13. Creation of an Energy and Climate Local Agency (see European model) to provide information, advise and technical assistance to energy end-users (public authorities, inhabitants, industry and SME, NGO). The agency will be a resource center, promoting good practices, informing about existing technologies, showcasing installations on site and welcoming visitors. Synergies can be found with the Kyanja Agriculture Resource Center dedicated to the promotion of urban agriculture in Kampala.

3. Landscaping a more resilient low carbon Kampala

3.1. Organization and tools

3. Develop a better integration of urban planning, mobility and engineering sectors in the governance, the conception and the implementation of the projects
4. Expansion of the technical review Team coupled with the Strategy and Business development unit taking lead on strategic planning and implementation oversight. Developing a task force physical planning + engineering, public health, strategy. (enlargement of physical planning committee to other directorates like engineering)
5. Creation of a well-planned and analyzed data repository for monitoring the integrated sectors, monitoring key indicators of resilience and sustainability at city level should leverage the existing GIS and the Finance Management systems
6. Institute accountability and track performance: within each agency, it would be useful to devise monitoring and evaluation indicators and system to track development cases, permits/licenses issued and conditions attached to them, in addition to a follow-up plan. (World bank)
7. Formalization of a landscaping policy . Targeted spatial planning that integrates sectors and functions in KCCA.
8. Development of a city cadaster , including a solar cadaster to advise people on potentials
9. Air quality inventory system and real-time information system to authorities / citizen. Developing a specific strategy on Air quality protection with a dedicated program including long term and emergency measures (energy, industrial, transportation, biomass sectors)
10. A planning mechanism that identifies the critical natural assets and prioritizes them so that there is a structure to balance development and mitigate the loss of assets, or to preserve or even enhance them (< World Bank report).
11. Develop a GIS with the area exposed to climate change vulnerabilities

3.2. Build up environment

1. KCCA Smart City Project
2. Integration of energy production, distribution and use into the physical planning strategy/documents (linkage with the proposed action " Energy Masterplan at City / Metropolitan level " (see 4.1)
3. Elaboration of eco-guidelines for promoters and developers with standards for construction and renovation projects and cross sectoral high environmental targets (energy, climate, waste, biodiversity, eco mobility, water and wastewater, air quality, waste)
4. Integration of energy and climate requirements into the construction and the rehabilitation permits / authorization for households and economic sites.
5. Develop advising activities for project leaders (see Local energy agency measure in 1.8) who submit a project for permit / approval (individuals, promoters, ...)
6. Improve the coordination and the cooperation between national and local authorities for a better respect of land use, permit delivery and the conditions attached to them.
7. Discussion with the national regulatory Authority to see how to make some improvements

in the construction regulatory framework to promote the construction of more climate resilient and energy efficient buildings and facilities
8. Annex to the permit and authorization delivered by KCCA a map of the city vulnerabilities, the eco-guidelines and a list of relevant addresses and contacts for people who want to get more information to improve their project
9. Supporting innovative project of inhabitants (pedagogic building site, auto-renovation, auto-construction with high environmental value...)
10. Testing the concept of a “ (nearly) zero carbon neighborhood ”
11. Imposing a minimum % of green surface at the plot (scale depending the location and the exposure to CC vulnerabilities), min use of renewable energy, rainwater collection, bioclimatic principles...
12. Integration in the Physical planning document of a Business Commercial Development Scheme with high environmental value
13. Integrating climate change, energy efficiency and renewable energies issues in the Environment Impact Assessment (EIA)

3.3. Wetlands restoration and conservation

1. Wetlands Conservation and Management Project (Wetland environment Audit, mainstream the Ramsar convention on conservation of wetlands, protection of vital wetlands, Public outreach and community environment management plan, monitor and enforce compliance)
2. Drainage Channel Construction and widening Project (In the next five years, KCCA plans to re-construct a number of primary channels and a number of secondary drainages (Nakivumbo, Lubigi Nalukolongo, Kinawataka and Kansanga)
3. Develop green parks integrated with ecotourism, recreation and sustainable urban drainage systems (SUDs)
4. Gazette and restoration of critical wetlands that support the city drainage system
5. Working with national authorities on law enforcement with regards to the critical settlements in wetlands area
6. Building check dams with slow release, terracing and contouring the Landscape
7. Greening of the channel banks to reduce de-silting of channels
8. Drainage - blackspots reconstructed

3.4. Urban nature

1. Developing the consideration of the role of biodiversity in the city development projects and physical planning activities.
2. Involving the developers either through incentivizing tree planting or inclusion in development standards tree coverage on plots
3. Creating a green chain of spaces (green and blue corridors) and provision of more public open spaces
4. Planting lowland areas and hilltops are appropriate areas for increasing tree cover and habitats for biodiversity. There are co-benefits of focusing on these areas for increased tree coverage and enhancement of carbon sinks. And if connected through vegetative corridors can enable biodiversity thrive in the city. Hilltops in Kampala and lowland areas covered mostly by wetlands have a co-benefit of regulating hydrology of the city another

ecosystem service which has been reduced through land cover change. Planting trees and developing the canopy helps to fight **Urban Heat Island** (issue which deserve a specific action plan) and facilitate the non-motorized mobility.

5. Continuation of **Kampala Goes Green campaign** with the planting of trees in the most relevant areas

3.5. Public transport, Non-motorized traffic and air quality

1. **Urban Mobility Planning:** developing an integrated strategy (including the existing studies of BRT and NMT) that developed and planned the intermodal concept at Kampala and Greater Kampala levels
2. **Bus Rapid Transit system** (today only one line is studied but it is recommended to develop a general **long term multi-BRT/NMT master plan** with few BRT lines connected to a related structured park+ride parkings system. This will contribute to reduce traffic congestion and to prevent cars from entering the city.
3. **Public transport:** In line with BRT implementation, developing public bus, bus-tram or tramway services with a high environment value dimension of the fleet (integrating the existing and forthcoming private collective transport offers)
4. **KCCA Non-Motorized Transport Strategy** (feasibility study available)
5. Encouraging non-motorized transport, by providing **cycle and footpaths** that are safe and shaded
6. **Cable cabin** project
7. Develop a specific strategy to organize and manage **freight and logistic** within the City
8. Control and limit the **cars entering the city** during high pick of air quality degradation
9. Working with national authorities on **cars and motorcycles environmental performance standards**, maintenance obligation and permit control. Reinforce the control of imported second hand vehicles.
10. Pilot project of **car sharing** stations supplied by solar energy
11. Accelerating the **naming of the street** and the real-time publication of updated city maps (paper and online)
12. Supporting the **development of Eco-Mobility Plan** in the Private sector
13. The optimization of **waste and pit latrines collection circuits**
14. Developing **traffic lights** and **direction panels**
15. Other: mapping of areas and facilities at risk and their consideration in the physical plan, use of an information systems based on weather forecast to manage the traffic consequently, putting in place a dedicated decision making process to manage the risk when it occurs.

4. Developing smart utilities and community services

4.1. Energy

1. City Energy Master Plan scaled at territory level involving the relevant stakeholders from the sector (production, transmission, distribution...) and end-users representatives. This Plan aims at assessing the current balance between local energy production and energy demand in order to propose an action plan that will support the development of renewable energy, energy recovery from wastewater and waste, energy efficiency measures for lighting, heating or cooking. The general objective is to build a City which energy consumption is mainly sourced by local clean and renewable energy. A Geographic Information System can be developed to produce maps (existing infrastructures, localization of potentials, energy supply options of a new to be urbanized area...). The City Energy Master Plan aims at being integrated to the physical planning strategy and documents to be sure that energy supply and networks are a strategic skeleton for the city development.
2. A general survey on local renewable energy potentials and the ways to exploit them by source, by sector, by localization (roofs, ground, process...)
3. A general survey on local energy recovery potentials and the ways to exploit them by source by the relevant sector (wastewater, solid waste, industry)
4. A general survey on the use of charcoal and firewood by households and on the related formal and informal economic activities . The objective is to find out alternative solutions that will improve energy efficiency, the development of cleaner source of energy, the air quality and health impacts. This survey must assess the socio-economic impacts of these alternative solutions and the best scenario of implementation and transition.
5. A Solar cadaster to identify the existing places (ground, roofs) with high potentials for solar panel installation (thermal or photovoltaic). This solar cadaster will be free of access for the general public, public and private organizations, private investors. Integration into the GIS system of KCCA.
6. Creation of an energy GIS System with : solar cadaster, energy consumptions, energy generation plants location and capacity, energy transmission and distribution networks, energy recovery potentials from waste and wastewater
7. In partnership with national level: Promote investment in clean energy generation under public-private partnerships; Promote, encourage and incentive co-generation by industries in the production of heat or steam and electricity from renewable biomass; Enforce building codes with the aim of reducing energy consumption and encouraging designs that maximize the use of natural daylight in buildings and other bioclimatic principles; Promote efficient firewood/charcoal stoves, solar and LPG cookers, also address the high upfront costs of acquiring these technologies through household subsidies or tax waivers; Promote private-sector investment in the bio fuel industry and study the feasibility/potential for producing bio fuel from waste for public transportation
8. Feasibility study to recover energy from waste and especially biogas recovery from the existing and the forthcoming landfills , including end-use potential (for instance for energy generation or biofuel for public transport).
9. Promotion and use of the feed-in tariff system
10. Supporting the realization of a survey dedicated to the sustainability of the volcanic stones supply chain and its economic development potentials
11. Establish a barometer of energy/fuel poverty in Kampala to inventory and follow-up the part of the population that have no access or difficult access to energy to satisfy their primary needs
12. Energy transport and distribution (networks) audit with the relevant authorities to ass and improve the reliability of the energy networks

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| 13. In line with 1.8 and 5.3 proposed actions with schools and market , work on attitude, Behavior change, and credit mechanism |
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4.2. Water management and drainage

1. Climate smart integrated water resources management (schools and hospitals)
2. The Strategic Plan 2019 is specifically addressing the issue of the drainage for the coming years through the 2002 Kampala Drainage Master Plan (40 years of implementation) and new Kampala sustainable Urban Drainage Management Program
3. Development of 20 tanks for rainwater collection on public buildings and facilities for specific uses
4. Creation of water retention areas and increasing rainfall retention and storage capacity. KCCA can promote the soil infiltration at the plot and the rainwater harvesting (already existing in some schools for domestic use and gardens). The center for agriculture is making promotion of rainwater harvesting. In the framework of the "planting tree" program, hilltops have to be prioritized when possible
5. Developing a strong communication on water demand management and promoting efficient – water consumptions products and services
6. Raising public awareness for water saving behavior especially in the tourism sector
7. Integrating water issues in the Environment Impact Assessment (EIA)
8. Lake Victoria Environment Management Project (LVEMP) and KCCA are launching the first ever environmental resource centre in Kampala to promote proper waste management practices to citizen (how reduce, reuse, recycle waste) and to develop sustainable utilization and management of aquatic resources in Lake Victoria eco-region
9. The Sanitation Programme : rehabilitation and extension of sewer pipelines; construction and operation of Nakivubo sewage and treatment works; improvement of fecal sludge management; construction of Kinawataka sewerage system; support of health and sanitation for the urban poor; engineering services and accompanying measures; land acquisition and compensation schemes for informal settlements
10. Design and follow-up of indicators with the relevant national authorities in order to assess the quantity and the quality of the water resources in Kampala. Development of a prospective scenario in Kampala.

4.3. Wastewater and sanitation

1. In partnership with the relevant authorities, survey on the energy recovery potentials from wastewater (STP, collectors, toilets, pit latrines, sewage...) – a "brick" of the expected City Energy Master Plan (project with Makerere University on toilets ?)
2. General framework and strategy for developing, depending the case, centralized and/or small scale local natural/technical treatment systems.
3. Management of the increasing volume of fecal sludge from pit latrines collected by KCCA.
4. Eco-san toilets for public use and at school
5. Working with NWSC to extend sewer lines to communities to reduce on numbers of pit latrines in place as of today

4.4. Waste management

- **The Strategic Plan 2019 proposes for the next 5 years:**

- Target to increase solid waste collection to over 90% by 2017
- Increase the number of garbage skips and waste bins across the City;
- Increase the number of garbage trucks to serve all the urban divisions
- Roll out of the planned comprehensive waste handling and disposal system that will include involvement of the private sector;
- Specify a hierarchy of collection, sorting and disposal facilities which promotes sorting at source, diversion to recycling as early in the process as possible, and minimization of collection and transport costs;
- Increased awareness campaign on waste management with a strong involvement of local communities and NGO. Based on what has been done, these campaign must be turn into a continuous sensitization strategy on waste prevention and management must be designed with the most pedagogic and comprehensive way (environment conservation, valuation of waste, sorting/separation of waste according to their categories of organic and inorganic, efficient use of skips, waste recycling, home composting, waste minimization and adherence to waste management laws). People must understand the stakes, the implications and the sense of solutions implemented. They have to be part of the annual assessment of the waste collection service and be encourage to make some proposals
- Undertake initiatives to convert the waste to energy and other uses;
- Expansion and Improved Management of the Solid waste landfills.
- Acquisition of a second solid waste landfill with high environmental specifications and clear objectives on GhG emissions, energy efficiency and energy recovery

1. Update and formalize the **Solid Waste Management Strategy into a specific action plan from education to valuation** (education, sensitization, prevention, reduction, reusing, recycling, collection, treatment, valorization)
2. Survey with national authorities and private sectors to **assess the existing recycling activities/industries/capacities to develop** downstream a wider range of sorting of waste to be collected (especially plastic, carton, glass, bio waste). Develop the **green jobs potentials**
3. Assess the potentials for **electronic waste** and cooking **oil collection** and valorization
4. Based on the existing literature, launch an operational survey on the potential of **waste management activities** that could be formally developed and that could be source of revenues for **local communities**
5. Reducing sewage and **industrial waste streams**
6. Developing the sorting of waste in public **markets, business parks and commercial malls** depending of the local capacity of recycling/treatment
7. Increasing **control and law enforcement** in waste management among producers (individuals and organizations)
8. Develop a **waste efficient composting strategy** (for households, economic actors, public spaces...).
9. Integration of an **environmental friendly approach with waste prevention and collection for every public events** such as the Kampala Festival. A guidelines has been given to vendors. They are supposed to have collection bags/containers. A team is also dedicated to clean many times a day. More efforts and new ideas could be implemented to reduce the environmental footprints of public events in public space. (eco-cup with deposit, collection at source...)

10. Develop the **scouts** (waste ambassadors)

5. Supporting the green economy

5.1. Characterizing the current structuration of the green growth

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| 1. Inventory of the local companies offering products and services in the fields of energy efficiency (products, services), renewable energy, eco-mobility, environment, waste management, construction and renovation, eco-materials, clean technology, risk management (...) and identifying the potentials businesses to be developed locally |
| 2. Inventory of the training offer (training institutions, in-service trainings, initial training) |
| 3. Assessment of the potential of green jobs from the informal sector that could join the formal sector |
| 4. Specific survey on the waste sub-sectors to assess the potentials of development (reuse, recycle) and the impacts of the sort of waste (plastic, paper/cardboard, bio-waste, electronic...) |

5.2. Reorienting the economy towards the green growth

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| 1. Promotion of the green activities and green jobs in the job centers |
| 2. Promote in the media and showcase the best practices (activity, actors...) |
| 3. Supporting the creation of SME on the fields of the green economy / helping business access capital (KCCA gives grants to youth and local communities to start an activity which can be eco-conditioned to environmental performance). |
| 4. Welcoming and/or organizing professional exhibitions (events, symposium...) in the fields of green growth activities |
| 5. Benchmark of international Smart City initiatives and their impact on the local economic fabric |
| 6. Focused survey on waste industry potentials: prevention, sorting, reusing, recycling potentials... |
| 1. Logistic and freight strategy to organize the supply of goods in the City and to reduce the environmental impacts |
| 2. Eco-conditioning of the grants and loans given by KCCA for the opening of new companies depending of the climate resiliency and the energy efficiency |
| 3. Sensitizing youth Officers (in charge of promotion and implementation of national programmes) on environmental potentials and green jobs/activities opportunities |
| 4. Sensitization and training of youth visiting the Kampala Employment Bureau to green activities. |
| 5. Promotion of environmental and energy certifications and labels in different sectors such as urban agriculture, industry, tertiary activities and products, tourism... (ISO 14001 and ISO 50001) |
| 6. Urban agriculture policy . Supporting the installation of small farming. Supporting (ruling) for organic farming. Banishing the use of chemical fertilizers and pesticides. GMO also. Training farmers (methods) and educative activities. Creation of a label "made in |

Kampala". Energy recovery (animal, vegetal, effluents), composting, no fuel greenhouses, rainwater collection
7. Green tourism policy to support the development of environmental friendly approaches, accommodation's performance improvement (energy, water, waste, eco material, biodiversity, mobility...) with volunteers actors, development of new activities related to environment (green and blue), new services in marketing and communication, development in new infrastructures (especially everything that will facilitate the access to the lake shores...). Creation of a specific platforms with sectoral representatives to share experiences, make recommendations to KCCA, implement joint-actions...
8. Developing a specific strategy of communication to promote Kampala as a touristic destination including arguments on its cultural and environmental assets. (Link with the Urban Tourism Enhancement Plan mention in the strategic plan 2019). Mapping out all tourist sites across the city to facilitate their promotion. Creation of a tourism dedicated website. Tourist and general information centers (SP 2019)
9. Sensitization of the local tourism industry to the green policy of KCCA , especially the objectives of Kampala Climate Change Action.
10. Accompanying hotels, accommodations and leisure sites in environmental management systems. Creation of an eco-label or quality charter .
11. Developing the eco-activities such as marine tourism. Improving the access to the front lake.
12. Creation of opportunities for employment generation and development of necessary skills needed in the current and future job market being mindful of inclusiveness of the lower income groups (see 5.1)
13. Development of specific programs that target the marginalized communities within the City
14. Signature of the Kampala Climate Change Action charter and commitments on objectives
15. Business eco-Club
16. Supporting collective actions (energy diagnosis, energy management, vulnerability study, mobility plan...)
17. Supporting multi-SME mobility plan
18. Developing partnership with the existing R&D centers such like the Uganda Industrial Research Institute - UIRI (run by Gov) or the Kawanda Agricultural Research Center (Directorate of Gender has drafted MOU with Kawanda research organization)

5.3. Market infrastructure development and artisan-business parks

1. Opening an eco-park dedicated to green activities that could welcome incubator, R&D, SME, education/training center... (Cluster) . Innovative SME have interests in being together and located in an same place surrounded by a community of actors which objectives are to search, support the development and trade
2. High environmental quality standards (guidelines) for the construction/ rehabilitation (upgrading) of market infrastructures and multi-purpose business parks. KCCA is targeting to construct multi-purpose business centers at Lubaga, Nakawa, Makindye, Kawempe and Central divisions. Defining specific environmental conditions before giving the opening authorization.
3. <i>(note: Proposed assembly plant for solar batteries and panels as the start of the park. KCCA intend to work with the recently established Uganda Free Zones Authority to develop the park)</i>

4. Integration of energy and climate issues in the Business space restructuring plan
5. Integration of a business and commercial development scheme in the physical planning document with a high environmental quality value
6. Business park and market infrastructure development plan into the Kampala Physical Development Plan and the landscape policy to choose and programme the best locations regarding roads junctions, transportation offers...
7. Implementing an environmental friendly management system for each market infrastructure and business park (management of energy, waste, mobility, water and wastewater, biodiversity...)
8. Supporting the renting of public and private roofs for the development of solar panel installations
9. Promoting and developing the role of " manager of business park and market place "
10. Scaling up the Wandegaya Market experience with eco-stoves to other market places to reduce the environmental impacts, to help traders to save money (volcanic stones and solar panel) and to promote the technology
11. Developing the sort of waste in the markets (2 collection/per day in CBD market, 1/per day for the other)
12. Make CBD market a showcase for ecology

- **Improving the Urban agriculture policy**

1. Integrating an energy and climate component into the Urban Agriculture Policy
2. Developing climate and meteo information systems to inform and sensitize farmers. Developing forecasting and early warning systems (ICT) to develop crisis information in case of flood's or droughts risks (for inhabitants and economic players)
3. Exploiting high potential to recover biogas from green waste, crop residues and from livestock , and/or to increase the production of high value compost
4. Enlarge the sensitization, information and demonstration activities of the Kyanja agricultural resource center to energy recovery, renewables and alternative solutions to fertilizer/pesticides
5. Opening market places close to the Kitchen gardening production supported by KCCA and producing compost from the biowaste generated
6. Promoting backyard gardens for households and pedagogic gardens at schools
7. Promoting local high quality (carbon neutral, organic...) food in restaurants and shops through a specific label and/or a guide
8. Developing certification and labels of urban agriculture activities and products
9. Developing innovation in sub-sectors such as solar dryer for mushroom. Women groups supported by KCCA programs have been trained on the use of solar dryers for preserving mushrooms
10. Experiment energy self-sufficient farming projects
11. Developing water resource protection measures, rainwater collection, changing agricultural practices to improve soil quality, biodiversity protection...
12. Organization and optimization of the local and regional chain of value of wood industry (eco-materials and wood-energy) with the national authorities and agencies
13. □ Developing urban agriculture logistic platforms

14. Banishing chemical fertilizers and pesticides
15. Developing the production of briquettes from agriculture residues, green and common wastes
16. Prohibiting the burning of waste from agriculture and others
17. Survey on the potential of papyrus (everywhere in Uganda) to use it as eco-material or as briquette (US university is working on it ?)
18. The idea of recovering nitrogen from fish feces and urine is under study. This allows to recycle the water and can be used for the production of vegetables. The products of this fish farming activity will directly benefit the local communities. The price is supposed to be better for this nutritious food.
19. Introduction of energy and climate issues into the Markets and Agricultural Trade Improvement Project (MATIP 1)
20. Developing guidelines on safe use of wastewater in agriculture (related to the urban agriculture policy) and sensitization of households

CHAPTER 5. Expression of stakeholders

(Minutes from the Stakeholder's Dialogue organized in Kampala the 14th October 2015)

Parallel Session 1: Focus on Physical Planning, Mobility, Air Quality, Public Buildings and Facilities

What is in place.

- Kampala Physical Development plan was approved and is being implemented.
- Design reviews for all proposed developments –structural review to take into account management of storm water on site

Actions and questions :

- Robust implementation of KPDP
- Planning of infrastructure at metropolitan level
- Functional metropolitan planning Authority
- Decongestion of the city through land use planning
- Need for policy on development of policy on key issues line climate change through engagement of all stakeholders.
- Inter-agency coordination related to development control issues.
- Management of air quality - Mandatory vehicle inspection

Parallel session 2: energy supply, waste management, water, wastewater and sanitation

Actions and questions :

- KCCA to come up with a robust legislation on waste management in the city. Highlighted need for strict enforcement of the current ordinances (solid waste ordinances to ensure that there is adequate management of waste in the city).
- There is need for close monitoring of waste sorting at the landfill as some of waste it is recycled back to communities and used for human consumption.
- Need to treat waste as a resource. Recycle waste, add value to it and reuse it. E.g. Ministry of energy has a bio project (bio mas, biogas) working with farmers.
- Financial and technical support to private companies to enable them recycle waste.
- KCCA in coordination with NEMA to ensure that there is adequate preservation of wetlands.
- Integrated approach to managing projects in the city with all key stakeholders on board. (Multi sectorial collaboration/management and responsibility of projects).
- Promote the culture of sorting waste in communities. This would in turn attract investors in this sector.
- Engagement of Uganda Plastic Manufacturers & Recyclers Association to ensure sorting of garbage is promoted at source. The sorting Association have in place various dust bins for different kinds of waste.
- Adopt bio digesters for management of waste with high moisture content. Bio digesters at commercial levels especially at school level.
- Initiate and enforce Polluter fees especially for high polluters.
- Promote waste management in schools and universities in order to grow responsible citizens.
- Integrated approach to waste management especially with the greater Kampala as there is a lot of waste that comes from outside Kampala city.
- Focus on energy supply. Designated timeline for converting from hydro to solar.
- KCCA to coordinate with Ministry of ICT & NITA on management of E-Waste.
- Recycling at source, recycling at Kitezi?? What is the waste characteristic in Kampala?

- Energy- what are the legislation to favor clean technology?
- Recycling as compared to burning? What are the impacts of pollution?
- At the landfill at Kiteezi, there is sorting of waste other than recycling.

Parallel Session 3 _ green Economy, Green Jobs, Food Security, Urban Agriculture & Research and Innovation

Key participants: KACITA; UIRI (Uganda Industrial Research Institute); Makerere University; Eco Group & GIZ

Actions and questions :

- Promotion of SME's to create jobs through Community Driven Development projects, Employment Service Bureau (ESB);
- Promotion of Urban Agriculture
- Green strategies in procurement.- Due diligence is taken into consideration in awarding contracts, are the contractors ensuring climate friendly strategies
- Re-using of car tyres of over 300 fleet by donating them to groups that use them to create jobs and ensure sustainability and climate preservation.
- Energy Levy through URA, should be towards green economy and finance creation of green jobs and not to the consolidated fund of Government of Uganda.
- Increase and encourage use of railway to transport goods from the coast to reduce emissions from long vehicles
- Local logistic and freight strategy
- Organizing the economic activities without negative externality on sensitive natural area
- Developing the massive use of renewable energy and the local production
- Innovating in the waste sector
- Having a business park dedicated to green economy
- Developing synergies between education, research and development, entrepreneurship, business
- Involving local communities, especially marginalized and local empowerment
- Saving energy is economically viable (leads to economic development) and creates jobs eg. Planting trees is backed by nursery beds and needs people to clean and maintain (the same for renewable energy the day the industry will be located in Uganda).
- Use of eco-stoves with volcanic rocks as a sustainable source of cooking energy for households and market places, with no fumes/particles emitted, a low operating cost and a limit to deforestation outside the city boundaries
- Ensure locally engineered solutions, so that people own it and feel part of the solution
- Alternative financing, GCF (Green Climate Fund). Tap into the resources of the GCF, GIZ is helping in building institutional capacity to demonstrate ability to utilize the GCF funds.

Parallel Session 4 : Education and communication, Citizen Engagement, Information & Dissemination

DISCUSSION FROM THE PANEL

- Focus should be at household level. Focus has to be on implementation instead of just talking about waste disposal. But how do we get communities involved. There is need

to implement model project. ie KCCA s monthly drainage participation should be emulated at household level. Eg bins for sorting the waste.

- People are already aware of climate change ie cutting of trees for firewood. They know the causative agent is cutting of trees for fire wood. There should be emphasis on the use of biomass in schools which use fire wood since a lot of money is wasted collecting fecal material. Schools should build bio gas plant to save money used to collect fecal material eg a pilot school in Makindye has a biogas plant and is being used as a pilot. There is need to scale this up.
- Tree planting in schools needs to be emphasized. Trees planted in previous initiatives have dried up because no cared for them. There is need to introduce fruit tree which can be interest public to care for them.
- In the curriculum design there should be a component of protecting the environment. Curriculum should look at how to handle waste material and how to sort biodegrade and non-bio degradable. It's been noticed that during the exercises to clean the environment done by KCCA the community is not involved. There is need to innovatively engage the Community eg through drama to get them interested. In Kampala there are waste disposal areas but the media is not aware of them. There is need to explore funding in waste management.
- There is need to bring about Student mind set change. It's possible to live in a zero waste environment. This should start with the grass roots by encouraging young people in climate change activities
- Referring to a World bank report that states that Kampala will become a slum in 10 years with the current trend of develop, it was proposed that youth should be engaged to reverse this trend
- The report also states that 9000 youth are fighting for 400,000 jobs. This can be changed if youth can start enterprise in waste recycling.
- There is a lot of abuse of rules and regulations enforcing waste disposal. The right approach should be mind set change as opposed to just enforcing rules.
- There is need to scale up the project to create eco ambassadors by recruiting in schools and ensuring mind set change in schools.
- There are 17 sustainable development goals of which 2 are on environment and 1 is on education (Goal 4). Goal 4 is most critical because it main streams all the other development goals

DISCUSSION FROM THE AUDIENCE

- Supplementation role of the of media should be explored e.g magazine in new vision called toto can be a good media
- The Media are slow to pick-up issues on climate change they should be s bombard to wake them up eg let us write articles
- In Lubaga they are looking for a role model. i.e use personalities like town clerk get to involved. People seeing such people in the drains sends a message. Councilors should get involved. Baganda love their people. There is need to engage baganda to run some of the initiatives. We can get huge results eg bulungi bwansi at kasubi attracted people
- Communication can lead to change in attitude Spoken word for the world to respond it uses poultry to send out a message. Poetry touches on the moods to change attitudes.
- Markets have people low educations levels and it would be useful to education on CC to target them eg. When cleaning they damp in drains. Water from buildings should be channeled.

- Use existing structures to go down to markets and boda bodas. KCCA is doing a lot of initiatives to sensitize the public eg Sensitization of property owners on what has to been done. The family unit is good to spread the message
- Work done by KCCA is commendable but a lot of what is being done is not being published. It has to be done.
- Team from MUK students should develop links with KCCA on an ongoing project funded by USAID which could attract funding from USAID
- High profile personalities should take lead of this initiatives on CC. Start with the cleaning their own neighborhoods ie should ensure neighbourhoods are mobilized

EDUCATION AND COMMUNICATION ACTION POINTS

- Engage all people within our places of work and at home to demonstrate practices for change.
- Designate dates for each division in Kampala for action in cleaning while disseminating information
- Improve societal connections.
- Organize contests on climate change on knowledge skills in schools. like performing and visual arts arts, essays, debates, poetry, sports, communication material development. Also mainstream into school curriculums
- Regular campaigns that links school to community like children given activities to do with their parents' home
- Also educate the market vendors, bodaboda, juakali, lorry drivers on how they can reduce their emissions etc.
- Translate information into more under stable and fun ways.
- Provide information for media platforms like Tvs, radios, newspaper
- More policies on behavioral change through awareness.
- Leading by example through practical engagement of leaders in environment community works.
- Effective communication and education both formal and informal
- Focus on changing mindset
- Invest in biogas and solar energy use in schools as this communicates important lessons.
- Linking climate change messages to economic/livelihoods like show how to earn from environmental conservation.
- Integrated partnerships for action.

List of Annexes

Annex 1 Excel documents for KCCA, Kampala and Greater Kampala GhG and energy Balance

Annex 2 Map of Kampala Climate Change Action stakeholders

Annex 3 Presentation support of the Stakeholder's Dialogue

Annex 4 Presentation supports of the COP21

Annex 5 First year communication programme, multiannual communication and participation strategy

Annex 6 List of acronyms

Annex 7 Maps of Urban Heat Islands