Resource Recovery and Reuse (RRR) Project

Baseline Survey Report - Kampala

2012

Name of city: Kampala, Uganda **See terminology in Annex**

A. Official interest in project. Please consult a responsible person in the local waste authorities who can respond to the following questions and/or refer to their policies:

1. **Is Resource Recovery & Reuse (RRR) from waste occurring in the city (waste composting, irrigation with treated wastewater, energy from waste projects)?**

   There is some form of Resource Recovery and Re-use (RRR), even though this is not practiced at scale. In Kampala, a significant proportion (approximately 60%) of food consumed in the city is grown within the city and surrounding neighborhoods. The urban farmers involved in this practice, use, among other things, resource-recovered materials. Some practice composting, and others apply organic waste materials directly (upon generation) in the gardens without first composting the material. Previously, the Kampala City Council (KCC), which is now Kampala Capital City Authority (KCCA) have supported efforts of urban agriculture, by training people in composting organic solid waste. They have also previously supported efforts in recycling and reuse of source separated human faeces and urine, generated from urine diverting ecosan toilets. Currently, Kampala Capital City Authority is implementing a project, with support from Belgian Technical Cooperation (BTC) in which there is a focus on satellite composting units to be constructed in various locations in Kampala. Recycling and reuse options for solid wastes include also, household efforts. In Kampala, some households are separating food peelings, especially banana peelings for use to feed animals (Fig. 1). This is common among urban agriculture farmers who are keeping animals as an income generating source. Another form of re-use is the production of fuel briquettes as a fuel for cooking (Figures 2, 3 & 4). The wastewater generated from Kampala ends up in some form of re-use. Downstream of local wastewater treatment plants in Ntinda/Kyambogo suburbs and Bugolobi, it is common to find farmers channeling the effluent from the wastewater treatment plants directly into their gardens. In the Ntinda ponds for example, the farmers block the flow into the last maturation pond, so that the effluent from the facultative pond discharges directly into a banana (plantain) and sugar cane plantations close to the ponds. Currently, there are efforts to produce energy from waste. The local NGO, Sustainable Sanitation and Water Renewal Systems (SSWARS) built three biodigesters in Bwaise II slum in 2007, with the support of the French Embassy. Two of the biodigesters were of 12,000 L capacity and the third was of 18,000 L capacity. These biodigesters have been in use until now, producing energy (biogas) for cooking in all of the three homes, and additionally, for lighting in one of the homes. The new Kampala Capital City Authority Public Health and Environment Management Sector Strategic Plan (PHEMSSP) 2011/12-2015/15 (under development until now, but the latest version is May 2012) suggests waste recycling and use of bio latrines to produce biogas for cooking and lighting. Consequently, within the framework of the PHEMSSP, a four stance VIP connected to a 30,000 L biodigester for producing biogas for cooking and lighting has been completed, as a pilot, at Mengo Primary School, which is located in Central Division, Kampala City. Figures 9 and 10 show the progress of construction of the biogas latrine at Mengo Primary School. With the support of GIZ, KCCA now plans to build another bio latrine for Kansanga Primary School in Kampala. In terms of the overall strategy for waste management in Kampala, the Kampala Solid Waste Management Strategy (2006) recommends, the following methods of handling solid wastes: Thermal processing technologies *e.g.* incineration and generation of electricity from incineration; biological processing technologies, *e.g.* composting; physical processing technologies, which include sanitary landfilling and landfill capping, production of refuse derived fuels *e.g.* fuel briquettes and mechanical separation. In terms of sanitation, the Kampala Sanitation Master Plan (2004) recommended conventional wastewater treatment and anaerobic digestion for the production of biogas from the wastewater sludge in the Nakivubo catchment and satellite natural sewage treatment plants in the three catchments of Lubigi, Nalukolongo and Kinawataka. Works are ongoing on the construction of the natural sewage treatment plant in Lubigi and procurement is under way for the main works in the catchment of Nakivubo. The thirty (30) year (2003-2033) Kampala sanitation master plan targets to increase the sewerage coverage from 6% in 2003 to 30% in 2033. This means, that on site sanitation using pit latrines and septic tanks will continue to be relevant even until 2033 and probably also beyond.

2. **Are the authorities in charge of a) solid waste and those in charge of b) wastewater interested in a feasibility study for RRR options and related Sanitation Safety Plans in their city? Please note which authority confirmed interest (name, position, authority; or policy citation).**

   The authorities in charge of solid wastes are interested in a feasibility study for RRR options and related safety plans in their city. Equally so, are the authorities in charge of wastewater. The persons who confirmed interest in the respective authorities are: In Charge of Solid Waste: James Semuwemba, Manager, Waste and Sanitation, Kampala Capital City Authority (KCCA); In Charge of the Wastewater: Mr. James Maitek Miiro, Senior Sewerage Manager, National Water and Sewerage Corporation (NWSC), Kampala, Uganda.

3. **Is there private sector interest in innovative resource recovery models? Who? In what? Can this be documented/verified via examples?**

   Yes, there is interest in Resource-Recovery Models. Interest and actually, also practice is already existing in resource-recycling of plastics. The company, Plastic Recycling Industries Uganda limited (PRIUL) headed by Managing Director, Mr. Alex Byarugaba is already processing plastics into pellets which are exported to China for producing high quality products (e.g. gum boots, rain coats, overalls) for sale. Figures 5, 6, 7, 8 have been taken from various stages at PRIUL. There is interest in recycling faecal sludge by the Uganda Pit Emptiers Association (PEA). They are interested in recycling faecal sludge as a way of income generation from the practice of faecal sludge emptying. Uganda Clays Limited, the largest produce of clay building products in Uganda is interested in using a product of faecal sludge as an energy source for firing their kilns as long as the product can be of a similar size and texture *e.g.* powdered or close to powdered form which would be similar to what they have been using. The materials that they would like faecal sludge to look like include saw dust, coffee husks, which they have been using for a long time in firing their kilns. Other public sector that are interested include those involved in aquaculture or fish farming, as well as chicken farmers, who are interested in using worms or larvae from vermin composting of both solid wastes and faecal sludge. The former mayor (2006-2011) of Kampala City, Al Haji Nasser Ntege Sebagala tried to promote the production of electricity from solid wastes when he was mayor. He did not achieve that. Upon leaving the office, he has continued with the dream. At the moment, he has established a company called SG Power Uganda Limited. The proprietors of this Company, led by Alhaji Nasser Ntegge Sebagala intend to build a refuse burning and power plant at Zibba in Wakiso District, Kampala to produce electricity to sell to the national grid. Zibba is located at approximately 52 km from the center of Kampala City. The SG (U) Ltd power plant at Zibba will utilize solid waste from Kampala City and surrounding municipalities. The environmental impact assessment for the refuse burning and power plant was completed and approved by the Ugandan National Environment Management Authority (NEMA) in 2011. The proprietors are now looking for the money to build the plant.

4. **Are there public complaints (e.g. newspaper reports) about uncontrolled waste reuse or actual or potential health risks (please provide any proof/documentation if yes)?**

   Yes, there are complaints, not necessarily about the waste reuse, but about the linkage of pollution of Lake Victoria to the pollution that comes from Kampala. News paper articles are referenced (Appendix 2). There is concern that the coco yams which are grown in the Nakivubo swamp that is downstream of the main wastewater treatment plant for Kampala, contain dangerous chemicals (See Appendix 2, News Paper Article 3). People in Kampala who are aware of this, hesitate to eat any coco yams sold in Kampala restaurants, for fear that they are coming from the Nakivubo swamp.

5. **What are the major constraints to waste use or waste-resource recovery relating to institutional/legal, cultural or perceptional aspects?**

   Even though there does not exist local guidelines on the waste use or waste-resource recovery, there is no hindrance to the reuse in terms of legal or institutional frameworks. Uganda is a signatory to international treaties and conventions and as such, when no local guidelines on the waste use or waste-resource recovery exist, international guidelines, foe example those of WHO can be used. Culture or perceptional aspects, can to some extent be a constraint to waste use or waste-resource recovery. However, traditionally, different forms of use of waste products generated from society have been used. For example, urine has been mixed with pepper and applied to crops to kill pests. Urine has been drunk

as therapy against drunkenness and also it has been smeared on wounds to cure them. It is common for people to grow food crops downstream of wastewater treatment plants, and to divert the effluents into their gardens. Therefore, when human excreta and other wastes are processed into a form in which they will not look like the raw material (i.e., no smells and aesthetically pleasing, i.e., looking like solid or like wastewater but which does not smell), it is possible that the waste can be used without any cultural or perception issues.

B. Project supporting policies (questions should be directed to health and relevant institutions)

6. Who is concerned about safety issues related to current formal or informal RRR activities? If anyone, which activities are of concern?

Ministry of Health, as well as the Ministry of Water and Environment; as well as the town and District (or division in case of Kampala) health inspectors who are working in the local governments. The main activities of concern are about the use of insufficiently treated human excreta (urine and faeces) from dry urine diversion toilets; and also the diversion of effluents from wastewater treatment plants to irrigate farms. However, if guidelines are followed and there is compliancy, there would be no such concerns.

7. Are authorities aware of (or practicing) the new WHO (2006) guidelines for safe wastewater irrigation, greywater and excreta use?

The authorities are aware, but there is insufficient monitoring to ensure compliance.

8. Do authorities use the WHO promoted Water Safety Plan concept or something comparable (name it) for safeguarding drinking water supply? Give the sources.

Yes, the National Water and Sewerage Corporation (NWSC) has previously participated in the development of the WHO promoted Water Safety Plan Concept, and as such they are using it to safeguard the drinking water supply. They apply the water safety Plan Concept to critical control points in the water system – for example, to the water treatment works, to the reservoirs, to pipes passing in slums where there are a lot of pit latrines, water pipes crossing channels that carry polluted sewage and water pipes that are passing close to sewer pipes.

9. Are there policies, plans and/or strategies supporting safe RRR from selected waste streams? Which ones? What is encouraged? What not? Which organizations are involved in the preparation and implementation of regulation?

Yes. The Energy Policy for Uganda. The energy policy for Uganda, Section 4.2.3 on biomass and other renewable energy sub-sector, has as a strategic objective, to develop the use of renewable energy resources for both small and large-scale applications. The following are encouraged: solar energy, geothermal energy, wind energy, energy from biomass. Ministry of Energy is involved in the preparation and implementation of regulation. The Uganda Electricity Regulatory Authority (ERA), and the Uganda Rural Electrification Agency (REA) are government organs that are involved.

The Uganda Ten Year National Strategy on Ecological Sanitation supports the recycling and safe use of human excreta (urine and faeces). It targets that by 2018, the numbers of people using ecological sanitation systems in Uganda should be 15% of the total population.

10. Please list key sector policies with RRR section.

The Energy Policy for Uganda (2002)

The Renewable Energy Policy for Uganda (2007).

11. Do any comprehensive investment or feasibility studies exist for RRR from any waste streams which went beyond a small case study?

No.

12. Aside for normal incinerators, are there special incentives, policies, or regulations that support the generation of electric or thermal energy from organic wastes (i.e., biogas or combustion/gasification of agro-industrial or domestic waste)?

Yes. The development of Energy from biomass, which includes also organic wastes is included in various policy documents for Uganda, namely, the Energy Policy for Uganda (2002); and the Renewable Energy Policy for Uganda.

C. Local partner capacity

13. Is there a local office of WHO, IWMI SANDEC, or Swiss TPH in the city to facilitate research logistics, visa, conferences etc.? (leave answer blank; this will be answered by these institutions)

Answer has been left blank as suggested above.

14. Give names and contact data of 2-3 key local organizations (NGO, university departments, research institutions, etc.) interested in RRR with likely capacity to coordinate other local institutions (multi-disciplinary teams) and host students also from abroad?

i) Makerere University, Kampala, Uganda: This is a leading University in Africa. Researchers in the Department of Civil and Environmental Engineering as well as Department of Mechanical Engineering, which are both within the School of Engineering, in the College of Engineering, Design, Art and Technology (CEDAT); and from College of Agricultural and Environmental Sciences (CAES) at Makerere University have strong interest and capacity to coordinate other institutions and host students from abroad. Details can be found at: www.mak.ac.ug. Researchers include: Assoc. Prof. Mackay A.E. Okure (mokure@tech.mak.ac.ug; +256 77 2 666 876), Dr. Robinah Kulabako (Mrs.) (rkulaba@tech.mak.ac.ug, +256 77 2 426 621), Dr. S. B. Kucel, Dr. A. Sebbit, Dr. Charles B. Niwagaba, Mr. A. Mwesigye,

ii) Sustainable Sanitation and Water Renewal Systems (SSWARS) is a local NGO that has strong interest and capacity to participate in RRR activities. Details can be found at: www.sswarsuganda.org. Key personnel include Dr. Charles B. Niwagaba (cniwagaba@sswarsuganda.org, cniwagaba@tech.mak.ac.ug; +256 77 2 335 477) (who also works at Makerere University), Mr. Francis Ndayabwe (+256 77 4 400 189).

iii) Waste Management center, located at Makerere University Agricultural Research Institute Kabanyolo (MUARIK). The researchers, who also work at Makerere University is Prof. Elly Sabiiti (esabiiti@agric.mak.ac.ug; +256 77 243 8010). Others include Dr. Denis Mpairwe (+256 77 2 439 372; dmpairwe@agric.mak.ac.ug); Dr. J. B. Tumuhairwe (jbtumuhairwe@agric.mak.ac.ug), Prof. Frank Kansiime (fkansiime@muienr.mak.ac.ug, +256 77 2 506 520). www.caes.mak.ac.ug

15. Which local authority/institutions/university/business schools or research institute could be recommended to work with the project on data generation and knowledge exchange in the areas of:

- Sanitation and sanitation safety plans: Makerere University. There is a strong team of sanitation researchers, who are also conversant with water and sanitation safety plans. They are also working with National Water and Sewerage Corporation (NWSC) in the framework of a Memorandum of understanding between the two institutions.
- Public health and risk assessment (epidemiological studies? QMRA?): Makerere University School of Public Health www.musph.ac.ug
- Environmental risk assessment: Makerere University, Department of Civil and Environmental Engineering www.cedat.mak.ac.ug, and Makerere University School of Public Health www.musph.ac.ug.
- Waste stream analysis and treatment options: Makerere University College of Agricultural and Environmental Sciences www.caes.mak.ac.ug
- RRR for energy: Makerere University, Department of Mechanical Engineering, www.cedat.mak.ac.ug
- Urban agriculture (soil fertility and irrigation): Makerere University College of Agricultural and Environmental Sciences (www.caes.mak.ac.ug) and the National Agricultural Research Organization (NARO), www.naro.go.ug

- Institutional analysis: Makerere University College of Humanities and Social Sciences (www.chuss.mak.ac.ug), Makerere University Institute of Social Research (MISR) (www.misr.mak.ac.ug); Metropolitan University Business School formerly Makerere University Business School (www.mubs.ac.ug); Sustainable Development Center (SDC).

16. **Do any (multi-)stakeholder platforms or learning alliances exist from similar waste (reuse) projects or initiatives which could be linked to for the discussion of RRR business plans and/or SSP development?**

    Not much of stakeholder platforms or learning alliances exist. However, the center for waste management at MUARIK seems to be moving towards this direction. Unfortunately, this center is new and it is just starting and thus, not much is yet developed.

17. **Do any local institutions have or had related RRR projects? Name project content or title and approx. year. Was SANDEC, Swiss TPH or IWMI involved in any of these?**

    Yes, Makerere University had, as part of the Swedish Sida/SAREC Phase I&II funding (and still has as part of Sida Phase III funding), related RRR projects. The project title was "Utilization of urban market crop wastes for crop/livestock production" and it was funded between 2001 and 2009 in two Phases I and II. In Phase III, an extension of this project was funded, with a focus on analyzing nutrient flows from market wastes. This phase of funding started in 2009 and it is to end in 2013. The College of Agricultural and Environmental Sciences (CAES) at Makerere University is also involved in a RRR project with University of Aberdeen, UK funded by DFID. This project is titled 'The Potential of Small-scale Biogas Digesters to Alleviate Poverty and Improve Long Term Sustainability of Ecosystem Services in Sub-Saharan Africa – Phase II. In all of the projects described above, neither SANDEC, Swiss TPH or IWMI were (and/or are) involved.

18. **Can ethical clearance/approval for medical research be easily obtained locally? What is the process? What are the guidelines?**

    Yes. Ethical clearance/approval for medical research can be obtained locally. The process involves submission of a proposal, which should be pre-reviewed by an Institutional Review Board (IRB). The proposal, together with an independent IRB report are submitted to the Uganda National Council for Science and Technology (UNCST), who will also review it. Based on the review, some comments can be given which should be responded to or the proposal can be accepted without comments. When approved, the fees are determined, depending on the size and duration of the project and when the fees are paid, the approval is granted. The process can take shorter, lets say 2 months when the proposal and independent report of IRB are accepted immediately without comments, or longer, up to about 6 months.

19. **List international and national airlines reaching the city regularly.**

    Royal Dutch Airlines (KLM) - Daily

    Emirates - Daily

    Quatar Airways - Daily

    Turkish Airlines - Daily

    South African Airways – Daily

    Kenya Airways – Four times daily to and from Entebbe/Nairobi

    Ethiopian Airlines – Twice Daily

    Egypt Air – Once daily

    Rwanda Air – Twice Daily

    Air Uganda – Several Flights within the region

D. Demand for RRR i.e. waste resource recovery in industry, farming, construction, etc.

20. Which waste-based products a) have already a demand by whom in and around the city, and b) which could have? Consider waste-derived fuel for cement kilns, irrigation water, nutrients, organo-fertilizer, biogas, etc., and as sectors e.g. urban and peri-urban agriculture, peri-urban agro-industry, parks and gardens, housing sector, aquaculture, forestry, cement industry, other industry.

Waste products that have already a demand are:

i) Sludge from a sewage treatment plant already has demand and it is utilized in urban and peri-urban agriculture as organo-fertilizer where it is directly applied on agricultural land before sowing; in nurseries, largely dealing with flower farming and also landscaping in parks and gardens.

ii) Effluent wastewater from wastewater treatment plants is already used as irrigation water, also to provide nutrients

iii) Animal wastes, especially cow dung is already being used in household biodigesters and institutional digesters to provide energy for cooking and lighting. Recently, biodigesters connected to latrines are being implemented, with one system at about 22 km from Kampala City, another in islands in Lake Victoria and some 3 systems within Kampala City Schools.

Waste products that could have a demand are:

i) Sludge from a wastewater treatment plant or even Faecal sludge/Septage could be applied in vermi-composting units or in valorization of faecal and solid wastes with black soldier flies, thereby providing larvae for chicken feeds.

ii) Effluents from wastewater treatment plants could be polished and utilized in aquaculture, *e.g.* fish farming.

iii) There is potential for utilization of processed faecal sludge, as long as it can be dried and presented in a pellet or powder form, to be used to produce heat for firing industrial boilers and kilns e.g. in cement industries and clay works industries.

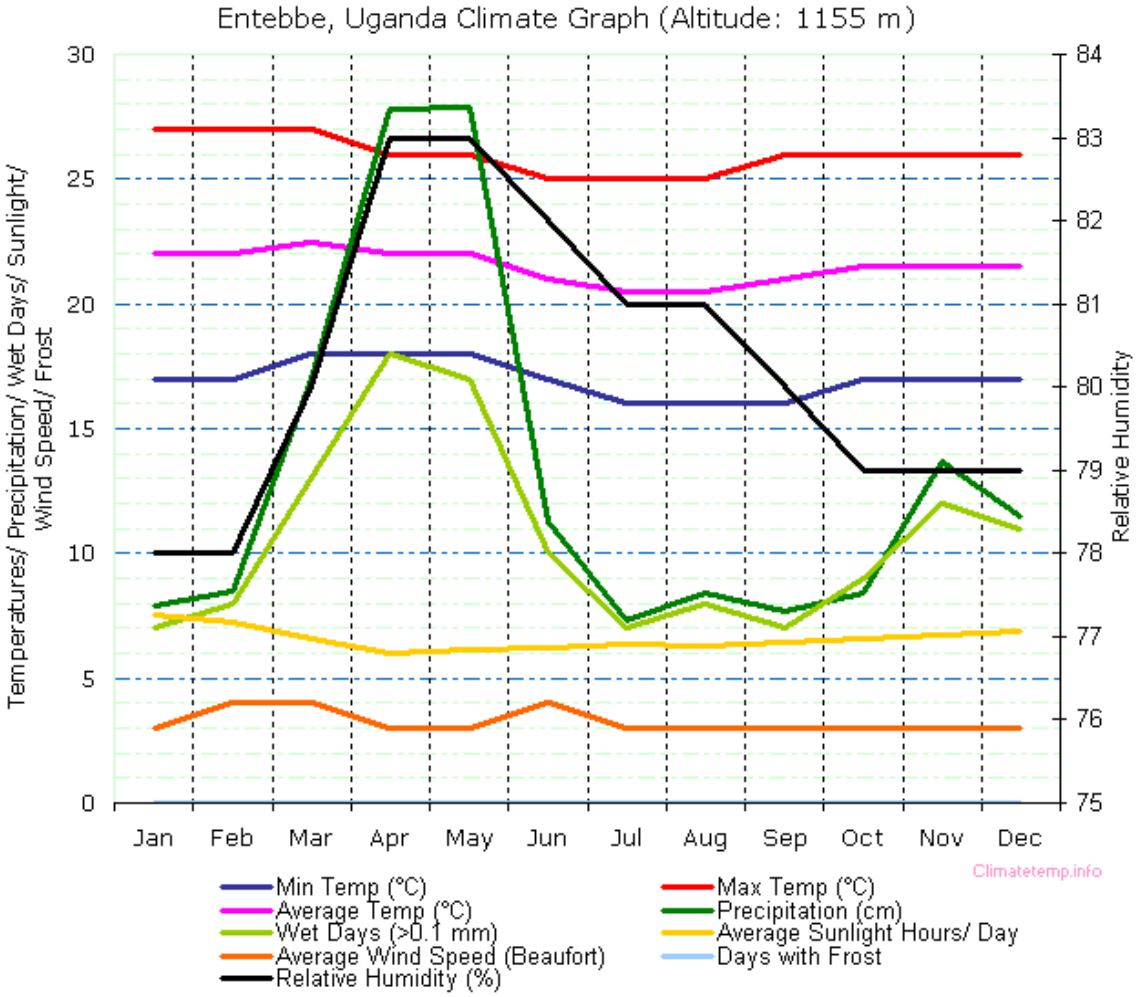
21. How big are the likely interested sectors approx.? e.g. in terms of size of (open-space) farming (number of farmer or area), number/size of industries actually/potentially interested in nutrient/water/energy?

On farming, various farm land where farmers are interested in using sludge from the wastewater treatment plant, individual large scale farms range between 100-300 hectares. Main crops grown are maize. More than 10 such farmers are available and interested in using sludge from the wastewater treatment plant. Regarding the size of industries, Uganda clays limited is the leading industry which has expressed interest in using dried sludge to provide energy for firing their products. There is no information regarding the amount of energy that they consume and they are not willing to disclose that. However, the factory is large, producing more than 100,000 tones per year of various types of clay fired products including roofing tiles, facing bricks, maxpans and various other types of bricks. It must be noted that the above are not yet using FS but they have stated the willingness to use it. For farmers, they have reservations about quality of FS and acceptance of their products by the general public; while for the clay works, the question is whether FS can be processed in the form of various other energy sources that they are using, like briquettes or powder form, and if it will have a high enough calorific value as compared to old paper money briquettes which they are currently using, coffee husks or used oil.

22. Amount of rainfall per year (how many dry seasons/number of dry months) (important for wastewater reuse)

Uganda receives on average 1574 mm (62.0 in) of precipitation annually or 131 mm (5.2 in) each month. On average there are 127 days annually on which greater than 0.1 mm (0.004 in) of precipitation (rain, sleet, snow or hail) occurs or 10.6 days on an average month. The rain season is March-May. Light rain season is November and December. Wet seasons are March –May and October-November; dry

seasons are December to February and June to August. Rainfall ranges between 500mm to 2500 mm and the relative humidity is 70% -100%. The rainfall regime allows two planting and harvesting seasons a year in most parts of the country, without the use of irrigation. The month with the driest weather is July when on balance 73 mm (2.9 in) of rain, sleet, hail or snow falls across 7 days. The month with the wettest weather is May when on average 279 mm (11.0 in) of rain, sleet, hail or snow falls across 17 days. Mean relative humidity for an average year is recorded as 80.3% and on a monthly basis it ranges from 78% in January & February to 83% in April, May. There is an average range of hours of sunshine in Uganda of between 6.0 hours per day in April and 7.5 hours per day in January. On average there are 2408 sunshine hours annually and approximately 6.6 sunlight hours for each day. On average there are 0 days annually registering frost in Uganda and in all months, there are on average 0 days with frost. Therefore, the dry months of December to February and June to August are relevant for wastewater reuse. Over the recent past, the climate has been quite unpredictable, with dry seasons taking longer, until around mid March. The wet seasons are also experiencing too much rains over a short time, for example, instead of rains in March to May, there may be too much rain in March and part of April, and very little to almost no rains in May.



23. Number, size and perennial status of streams crossing city or peri-urban area; b) are they polluted by wastewater, c) are they used for formal or informal irrigation?

A) There main stream (drainage system) of Kampala city is the Nakivubo Channel. It is conveying water all year around, even during the dry season, an indication of it having some baseflow (as it originates from under ground water springs) as well as receiving a lot of discharges in form of grey water and illegal faecal sludge discharges. The Nakivubo channel is approximately 12 km long and traverses the central business district until it empties into the Nakivubo Swamp before the water reaches Lake Victoria. It has a catchment area of about 32 km^2, a mean discharge of 0.43 m^3s^{-2} and a discharge volume of about $4.4x10^7m^3yr^{-1}$. Seven tributaries pour into Nakivubo channel, namely, Nakulabye stream, Aghakan

outfall, Owino market outfall, Fire station outfall, Kayunga stream, Kitante stream and Lugogo oustream. There is also a major discharge from the Bugolobi wastewater treatment plant. All of the tributaries pouring into the Nakivubo channel also convey some flow throughout the year, due to the reasons stated above. B) The Nakivubo channel and all the streams that pour into it are all polluted with organic matter, nutrients and pathogens. C) Neither the upstream of the Nakivubo Channel nor any of its tributaries are used for formal or informal irrigation. But it must be noted that near the end of the Nakivubo Channel, i.e., where it starts to widen and eventually becomes part of the Nakivubo Channel, farmers are growing coco yams which they sell as food in and around Kampala.

24. Would treated wastewater have a possible market? Why Yes or No. If Yes, for whom?

Yes, treated wastewater would have a market. For peri-urban and urban farmers.

25. Which farming systems (like urban vegetable farming or peri-urban pineapple or firewood plantations) are most likely to use organic waste fertilizer, and on which crops?

Potential farming systems that would utilize organic waste fertilizer include: Sugar cane and coco yams, which are already utilizing wastewater; banana plantations (plantain), as well as local vegetables, *Nakati*, *Buga*. Firewood plantations include eucalyptus plantations.

E. Ongoing reuse activities of interest for Sanitation Safety Plans (SSP)

26. Are there any public (or public-private) projects on RRR from any domestic (household or market waste; excreta, wastewater), or agro-industrial waste streams (cassava peelings, food processing waste, cotton husks, etc.) in operation?

There are ongoing CDM projects in Uganda, which are aimed at constructing municipal solid waste composting plants for the recycling of organic solid wastes; and eventually handing them to municipalities to operate and maintain. In Uganda nine (9) solid waste composting plants are already operational in the Municipalities of Mukono, Jinja, Mbale, Soroti, Lira, Kasese, Kabale, Mbarara and Fort-Portal. Three composting plants are under construction in the Municipalities of Arua, Hoima and Masindi. Five (5) municipalities of Entebbe, Mityana, Busia, Tororo and Gulu are expected to receive the municipal solid waste composting plants under the CDM project hopefully by the end of 2012. Unfortunately, there are no plans for a CDM project in Kampala as the former leadership rejected it and opted for gas capture from the existing landfill in Kiteezi near Kampala. In Kampala, the Belgium Technical Corporation (BTC) is funding projects that are aiming at local recycling, via composting through implementation of community solid waste composting systems within communities in the city,

27. Is there an informal sector active in RRR from organic waste? (which waste for which purpose)

Yes. There are waste pickers at the Kiteezi landfill, who sort out valuable items, largely plastics and metals for sale to local recyclers in Kampala. Some recycling methods are so local that they just collect all sorts of bottles from the waste stream, wash them and sell them to traditional herbalists who pack herbs for sale in the washed bottles. Others include delivery of plastics to the Plastic Recycling Industries Uganda Limited, who crush and pelletise the plastics, after which they export the raw materials to China. Other informal sector is involved in using dried faecal sludge as manure mixed with soil for growing nurseries including flowers along the road sides in Kampala.

28. Are farmers or others using any domestic or agro-industrial waste products, raw or treated? Do they pay for it? Is the use regulated or informal? If regulated, by which regulation/authority?

Yes, there are farmers and others using domestic or agro-industrial waste products, raw/untreated, partially treated and treated. See Newspaper story – New Vision 5th June 2012 on Makerere Uses Agricultural Waste to Boost Beef Production; as well as Figure 1 in Appendix 1. Yes, they pay for it. The use if informal and is not regulated.

29. Name private entities actively working on reuse (which waste, which output; how big are these firms; web link). Are there e.g. compost producers in the private sector, community based, or NGO/Research projects?

There are no private entities working on reuse, for example, composting. A Norwegian Foundation, Sustainable Sanitation Design (SuSan Design) tried on a small scale, the production of compost from organic waste materials, as well as treatment of faecal sludge using urea, but they had a small project, which did not go to scale.

30. Are any reuse-related environmental or health issues known? Are they being addressed?

Information often referred to is from literature. There is no local data to prove reuse-related environmental or health issues.

31. List all major RRR related projects (wastewater irrigation/aquaculture; organic fertilizer/composting, energy/biogas/fuel; ecosan) operating in the city over the last 5 years as well as (all) ongoing ones with their main external and local partners and if possible donor or provide web sites of those projects.

i) The Kampala Ecological Sanitation Project – It was a Sida funded project, which promoted urine diversion dry toilets with local recycling of source-separated faeces and urine. This was a three year project of USD 1.1 million to Kampala City Council that ended in 2008.

ii) The faecal Management Enterprises (FaME) Project is a European Union ERA-Net SPLASH project (March 2011 - March 2013) which aims at studying the market demand of faecal sludge, evaluating its energy content (in terms of calorific value) as well as testing its application to provide energy for industrial kilns and boilers, and then also to develop a financial flow model for the collection and reuse of faecal sludge.

32. Is there any <white elephant> project of significant RRR failure? Which, reasons?

i) The Kampala Ecological Sanitation Project was largely unsuccessful and hence can be one example of a 'white elephant' project. Most of the UDDTs that were built in slums flooded and others were dysfunctioning after a short period of time from commissioning. Slum communities are transient and even when users have been trained, they later shift and new ones start to use systems that they have no clue about. Also, social and cultural issues regarding the recycling and use of faeces and urine, lack of a sense of ownership, lack of a culture of operation and maintenance, behavior and attitude issues, lack of space where to dispose source separated faeces and urine partly caused to the failure.

33. Is there irrigation with (i) polluted water/wastewater or (ii) treated or (iii) partially treated wastewater? (any info on locations, approx. number of farmers or ha). Is the use regulated? If yes, by which regulation/ authority?

Yes, there is irrigation with both (i) polluted water/wastewater or (ii) treated or (iii) partially treated wastewater? Yes, the locations are known and these are actually the outfalls from the treatment plants – down stream of the main wastewater treatment plant of Kampala which is located at Bugolobi; and downstream of other local natural wastewater treatment systems (using ponds), which are receiving and treating wastewater from apartments spread in different parts of Kampala city. The reuse is not regulated.

34. Is there agricultural use of (i) fecal sludge or only (ii) feces or (iii) urine (fresh or treated) ongoing? (any info on locations, approx. number of farmers or ha) Is the use regulated? If yes, by which regulation/authority?

Yes, there is use of faecal sludge, mostly in landscaping and by nursery/flower farmers who are located along various streets within Kampala City.

35. Is there use of other organic waste (fresh or composted) ongoing? (any info on locations, approx.. number of farmers or ha) Is the use regulated? If yes, by which regulation/authority?

Yes, there is use of other organic wastes, especially fresh *e.g.* cowdung is thrown in flowers in the compound of Mengo Primary School, various small scale urban farmers throw fresh organic wastes in their gardens. There is no regulation of the use of organic wastes.

36. Are waste products already used for energy recovery? If yes, which waste for which purpose and which approx. scale?

Yes, some waste products are used for energy recovery. Animal manure, especially cow dung is used in biogas plants of 10,000-18,000 L capacity at household level; and of recent also, schools are adopting biolatrines, for example Mengo Primary School. The biogas produced at the homes and institutions is used in cooking and lighting onsite.

37. Are there competing uses for the waste e.g. as fuel, livestock or aquaculture feed, which compete with RRR e.g. for nutrients or energy? If yes, which waste for which purposes and at which scale (small/medium/large)?

There are competing uses for the waste, for example, at Mengo Primary School, while it is desirable to add cow dung into the anaerobic digester to increased biogas production, the teachers often carry away the cow dung, to apply in their gardens. The cow dung is competed for biogas, and also as fertilizer. The scale is really small scale.

38. Are there major sources of alternative fertilizers that are likely to be cheaper than waste based products, e.g. like nearly free farm yard manure? chicken manure?

Yes, there are other alternative fertilizers that may be cheaper than waste based products, a typical example is the nearly free farm yard manure. Chicken manure is often as expensive as other animal manure.

39. Are industrial fertilizer subsidized? Which ones, how much? Or what is the price e.g. for 50kg Urea or 50 kg NPK 15-15-15)?

Industrial fertilizers are not subsidized. DAP, NPK and CAN cost USD 1.2, 1.4 and 1.5 per kg respectively. Sewage sludge and animal dung cost USD 0.01 and 0.008 per kg respectively.

F. Waste supply and management in the city

40. Population size of the city (with year of reference) and official city area.

The resident population of Kampala, the Capital city of Uganda is 1,597,500 people (UBOS, 2010). This population doubles during the day due to people who live in the neighboring areas that travel to Kampala daily, as well as people from all other parts of Uganda and beyond that come into the city during the day. The official City Area is 197 km² (UBOS, 2010). UBOS is Uganda Bureau of Statistics, the government body responsible for all information concerning statistics in Uganda.

41. Solid waste collection coverage (percent of population serviced; year of reference)?

According to the Kampala Solid Waste Management Strategy (2006), solid waste collection rate was 35%. Recently, there have been improvements, and it is believed that the solid waste collection rate is now approximately 40% of the generated waste (Pers. Comm. With KCCA, Executive Director, 2012).

42. Solid waste collection carried out by municipality or private sector or both? Is there any source separation going on? (how many households) Or any segregation after collection?

In Kampala Capital City, solid waste collection is done by both the City Authority and the private sector. Using the Kamala Solid Waste Management Ordinance (2000), KCCA privatized solid waste collection in areas of high income earners. Here, the generators pay to a waste collection company based on an arrangement agreed upon between the parties. There are several options to choose from, a collection per day, twice a week, three times a week, five times a week, etc and the rates differ for each arrangement. The collection companies are efficient, and as long as a person has paid, the collectors move door to door, collecting the solid waste by the road side. As you can imagine, rich and middle income people live in areas that are relatively possible to reach. So, the solid waste collection company distributes bags to the clients (the generators). The generators put it outside (i.e. by the roadside), on the days that have been agreed upon with the solid waste collection company. This system is efficient and the solid waste is collection on all agreed dates, as long as the customers have paid to the solid waste collection company. Payment is to be done per month to the offices of the waste collection companies, which are not far from each collection area. An invoice is issued out to the generators when they have

delayed payment. In slums, and markets, KCCA collects the solid wastes. In markets, there are designated locations where the solid wastes are thrown in bins, normally placed by the road side, or any other accessible location within the market surroundings. In slums, the KCCA vehicles move through the slums on designated days, they hoot their vehicles as the generators bring the solid wastes to the collection vehicles. No source separation is generally done. Only a few households do source separation, especially when they are involved in some agricultural activities, thereby, making their own compost, either at home or at some garden outside of the city. Neither is source separation done after collection. However, the solid waste collectors and informal waste pickers situated at the municipal landfill normally pick out the valuable components from the waste stream for sale. In slums, and even in middle income and high income areas, some people are stubborn! They do not subscribe to the waste collection companies (in high income or middle income, despite the availability of the service which they pay for), and some people in slums also opt not to carry their solid wastes to the collection vehicle. They burn the solid wastes, in the evenings. When moving around Kampala city in evenings, it is common to see smoke in different parts of the city. It is prohibited to burn solid wastes but due to weak monitoring and enforcement, people still burn. Also, because Kampala is built on hills and valleys, some low-income and middle income communities which are located on slopes and high ground misuse their location, by conveniently throwing solid wastes in drainage channels, especially during the rains. The solid wastes are then washed downstream to the low lying areas, which are normally habited by low income earners.

43. Approximation of how much of the city is sewered (percentage of households connected to sewerage)? Approximation of how much of the wastewater entering sewers is eventually treated and to which level (i.e. primary, secondary, tertiary)? Estimated percentage of treatment plants that work as designed?

Only 6% of Kampala City is sewered. The sewer coverage is at present only in the Central Business District and some few affluent areas close within the CBD. The maximum dry weather flow of the existing central sewage treatment plant is in the range of 10,000 to 15,000 m^3/d, with flows increasing to between 18,000 to 20,000 m^3/d following rainfall. Approximately 63% of the flow reaches the plant by gravity (via the siphon systems) and 37% is pumped from the Low Level Pumping Station. The wastewater entering the Bugolobi central sewage treatment plant for Kampala is treated via primary (grit and detritus removal and primary sedimentation), and secondary processes (secondary sedimentation and trickling filter system). The secondary treated effluent then led through a natural swamp (the Nakivubo swamp) where it is tertiary treated before it is discharged into the Lake Victoria. There is only one central treatment plant. It works quite well, as designed. There are other treatment plants for localized housing units within Kampala, which use natural waste stabilization ponds. These systems are not monitored and thus, their treatment efficiency is not known.

44. How many households or estimated percentage of the city depend on on-site sanitation systems for fecal sludge storage? What kind of onsite FS systems are there in percent (pit latrines, public toilets, household septic tanks, Urine diverting dry toilets, etc.)?

Over 90% of the population of Kampala use onsite sanitation facilities. Of this population, however, a small proportion (about 3-5%) uses flying toilets. According to the Kampala Sanitation Strategy and Master Plan (NWSC, 2004a), about 17.5% of households in Kampala are connected to septic tanks. This would give a total of around 50,000 domestic septic tanks in the whole project area. Also, about 70% of households have access to their own or shared pit latrine (NWSC, 2004a). Some 40% of all pit latrine users have their own latrine and 60% share with other households. Shared latrines will usually be on the basis of several households using a central toilet provided by a landlord although it also includes larger groups of households sharing a communally owned and managed toilet. Where a latrine is shared, the average number of households sharing a latrine in the whole project area is 6.5 per stance (6.7 in Kampala District alone) and some 65% share with more than four households. The number of latrines in the project area was estimated to be over 103,000 (87,000 private latrines and 16,000 shared latrines) serving over 950,000 residents of Kampala. However, the numbers of these latrines that are actually satisfactory is probably significantly less (based on the household survey 30% of those with pit latrines expressed dissatisfaction with their facility) (NWSC, 2004b). The proportion of urine diverting toilets in Kampala is almost insignificant.

45. Who is cleaning septic tanks and latrines? Are there trucks with vacuum pump (maybe called cesspit tank operators, honey suckers, etc.)? Are they operated by the public or private sector or both? Any number of trucks available?

The largest proportion of septic tanks and pit latrines are emptied by the private sector operating under their umbrella organization – the Pit Emptiers Association (PEA). They use vacuum trucks, commonly referred to as cesspool empires. The public and private sector play a role in the emptying of septic tanks and latrines. The numbers of trucks available is known and it presented in number 46 below.

46. Is the municipality or private sector or both in charge of fecal sludge collection in the city? How many septic trucks are approximately operating across the city? Share of vacuum trucks vs. manual collection?

Yes, both the city authority and private sector are involved in faecal sludge collection. The municipality empties toilets in public institutions, like schools and to some extent, also public toilets. Some institutions, for example, the Uganda Police and the Uganda People's Defence forces own their oen faecal sludge collection vehicles. The Pit Emptiers Association (PEA) owns 27 trucks. Others are owned by Kampala Capital City Authority (5No.), Uganda Police owns 1 truck, the Uganda People's Defence Forces (UPDF) owns 1 truck and National Water and Sewerage Corporation (NWSC) owns 3 trucks. In total, these are 37 trucks operating in Kampala to clean septic tanks and pit latrines. Yes, there is manual emptying, but when this is done, the faecal sludge is not collected but rather a pit is dug on site and the faecal sludge is deposited in that pit after which it is covered by the soil removed from the pit when it was being dug. Since manual emptying is illegal, it is done stealthily and thus, no proper estimate is available on the amount of FS that is manual emptied and disposed on site.

47. Where are most on-site systems in the city? Only in slums/low-income class areas? Or also in high-class areas etc.?

Pit latrines are the predominant sanitation system, used by more than 70% of the population. They are available in slums and in middle-income areas, which are either in slums or outside the slums. Pit latrines are rarely used frequently in high-class areas. In the middle income and high-class areas, septic tanks a predominantly used. The share of septic tanks by population is in the range of 18-20%.

48. Where is the collected fecal sludge (FS) from on-site septic tanks deposited/dumped? Percentage estimates: In septage ponds, other treatment plants, in water bodies/ocean, in land depressions/environment, in farms for crop production, elsewhere (please specify)?

According to the report of WSP (2008), on average, 190m^3/day of Faecal sludge (FS) is deposited at the Bugobi sewage treatment plant in Kampala. As of last month (May 2012), the amount of FS deposited at the Bugolobi wastewater treatment plant was 250 m^3/day (pers. Comm. with Maitek Miiro, the manager of the Bugolobi Wastewater treatment plant). The amount of FS deposited at the sewage treatment works represents only about 30% of the collectable FS in Kampala. There is no data that shows where the uncollected FS in Kampala is deposited. However, a large proportion of the uncollected FS stays within the slum especially that which is generated by pit latrines. Pit latrines are normally abandoned upon filling, and when there is space, new ones are constructed. When there is no space, the people will share with neighbors where this is possible, and where it is not, they defecate in flying toilets.

49. What is the approximate FS quantity disposed of in official places per year vs. unofficial sites?

Using data from WSP (2008), the approximate quantity of FS disposed of at the Bugolobi wastewater treatment works is 70,000 m^3 per year. The sum of uncollected FS i.e. that which stays in pits and septic tanks that are not emptied is and the FS that is disposed of in unofficial places is approximately 180,000m^3 per year. However, as stated above, it is not known what proportion is disposed of in unofficial places and that which stays in pits and septic tanks that are not emptied.

50. Please provide a brief description of the major commercial activities in animal husbandry, food industry and other agro-industrial (e.g. cotton) processing sub-sectors in the city? Who are the big players providing significant processing or agro waste?

Mukwano industries is the biggest food industry dealing in packed dry food like biscuits of various types, vegetable oil production, production of soap and detergents, etc. Mukwano industries are located in Kampala City Center and they have over the recent past faced criticism regarding the pollution to both air and water from their industries. Recently, one of their major factories was closed and they are still discussing with KCCA and NEMA to have it re-opened. Others include coffee processors, but majority of the coffee processors are outside the peripherals of Kampala City. Other commercial activities in animal husbandry include abattoirs, which are also facing increasing pressure to maintain minimum hygiene standards. Over the recent past, many of them have been closed.

51. Are there any data how much organic waste the major 5 to10 companies operating in these sub-sectors generate e.g. per year?

No, that data is not available. It has to be generated by measurements.

G. Pollution and sanitation

52. What are the major environmental challenges in the city area? (waste, air/water pollution, flooding, diseases, water shortage, energy shortage, unsafe food production ,……)

The major environmental challenges in Kampala are (in order of severity – top more problematic:

i) the collection and disposal (or treatment of). i.e., in general terms, the management of solid wastes. It is now difficult to get land where to start up a sanitary landfill. Thus, future landfills or waste receiving areas may have to be located some 30 to 50 km or more away from the City Center.

ii) the provision of sanitation to the urban poor, and the management FS,

iii) the extension of sewer to cover other parts of the central business district and affluent areas,

iv) water pollution, increasing the costs of water treatment, and therefore, increasing the cost of water,

v) flooding – low lying areas flood frequently during the rainy season and they contribute to exacerbation of points vi) and vii) below.

vi) diseases, like Malaria; diarrhea, dysentery and cholera; TB and HIV/Aids

vii) unsafe food production

viii) air pollution

ix) energy shortage – this problem will soon be solved after commissioning the remaining two out of the 5 turbines of the new Bujagali hydropower dam. When the first three turbines of this dam were commissioned, the electricity load shading decreased from 12 hours in some places to just about 3 hours.

x) Water shortage – the reason why this is far is that water shortage is not frequent; and there is a relatively good coverage of the water supply subsystem throughout the city.

53. What kind of industries (e.g. beverage, chemical, textile, food,(sugar ……) are there in the city and discharging waste? Is the industrial waste treated in each case? Which one not?

Beverage – mineral water for drinking, soda and beer industries exist in various parts of the city. These industries are under increasing pressure to treat their wastewater before discharging it into the environment.

Some chemical industries also exist, for example, the recently launched quality chemicals industries, which is dealing in the production of antiretroviral drugs for HIV/Aids patients.

Food processing industries are also present in the city.

Sugar industries are not located in Kampala. The nearest sugar industry in Lugazi, which is some 30 km from Kampala City.

Industrial wastewater is treated, especially for all industries located within Kampala City, otherwise, the industries would have to be closed. However, the treatment efficiency of some industrial wastewater treatment plants may be questionable.

54. Are there any reports on the probability of chemical contamination (heavy metals) of organic and/or liquid waste streams? Could you cite related reports/papers?

Yes, there are reports and journal papers. The following reference papers can be references:

i) Oyoo Richard (not dated). Deteriorating water quality in the Lake Victoria inner Murchison Bay am dots impact on the drinking water supply for Kampala, Uganda. National Water and Sewerage Corporation, Kampala.

ii) Kimwaga, R. J., Mashauri, D. A., Bukirwa, F., Banadda, N., Wali, U.G., Nansubuga, I. 2011. Modelling of Non-Point source pollution around Lake Victoria using the SWAT Model: A case of Simiyu Catchment, Tanzania. *The Open Environmental Engineering Journal* 4, 112-123.

iii) Nyangababo, J.T., Henry, E., Omutunge, E., 2005a. Lead, Cadmium, Copper, Manganese and Zinc in wetland waters of Victoria Lake Basin, East Africa. *Bull. Environ. Contam. Toxicol.* 74, 1003-1010.

iv) Nyangababo, J.T., Henry, E., Omutunge, E., 2005b. Heavy metal contamination in plants, sediments and air precipitation of Katonga, Simiyu and Nyando wetlands of Lake Victoria Basin, East Africa. *Bull. Environ. Contam. Toxicol.* 75, 189-196.

v) Nabulo, G., Oryem-Origa, H., Nasinyama, G., Cole, D., 2008. Assessment of Zn, Cu, Pb and Ni contamination in wetland soils and plants. *Int. J. Environ. Sci. Tech. 5* (1) 413-419.

vi) Nabulo, G., Oryem-Origa, H., Nasinyama, G.W., Cole, D., Diamond, M., 2008. Assessment of heavy metal contamination of food crops in wetlands and from vehicle emissions. In: Cole DC, Lee-Smith, D & Nasinyama GW (eds). Healthy city harvests: Generating evidence to guide policy on urban agriculture, CIP/Urban Urban Harvest and Makerere University Press. Pg 111-131.

55. Have any food safety/health issues been reported due to wastewater irrigation? By whom? Citation/reference?

Yes. See the news paper article of the New vision Article of 16th July 2003. It is in the additional information that is submitted separately.

H. Energy situation (per country if not per city) – needs sector expert assistance

56. Percent of rural/urban population with access to electricity from the grid?

Percent of rural population with access to electricity from the grid is 3%

Percent of urban population that has access to electricity is about 37%

Percent of national population with access to electricity from the grid is 9%

57. Please list the institutions/companies responsible for generation, transmission, and distribution of electricity in the country and elaborate briefly on their respective roles and responsibilities, including ownership.

Companies responsible for:

i) Generation – Uganda Electricity Generation Company Ltd. (UEGCL): Uganda Electricity Generation Company Limited (UEGCL) is a limited liability company incorporated in March 2001. The Government implemented a Power Sector Reform and Privatization Policy, which resulted in the separation of Uganda Electricity Board (UEB) into Generation, Transmission and Distribution successor companies. Electricity is generated at two power Stations; Nalubaale and Kiira Power Stations. A third dam, at the Bujagali is almost complete. Three out of the total of five turbines have been commissioned.

ii) Transmission – Uganda Electricity Transmission Company Ltd. (UETCL): Uganda Electricity Transmission Company Limited (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.

iii) Distribution – UMEME Uganda Ltd. is the company that is responsible for the distribution of electricity in Uganda. Umeme Uganda Ltd is owned by Umeme Ltd, a major investment of Actis' Infrastructure 2 fund. Actis is a leading investor in emerging markets, investing exclusively in Asia, Africa and Latin America. Actis has specialist teams dedicated to private equity, infrastructure and real estate and has a track record built on growth capital and leadership in control investing across its markets. Actis has over 100 investment professionals in nine offices worldwide who currently manage funds of US$4.8bn and a portfolio of around 60 investments on behalf of more than 100 institutional investors. The Commonwealth Development Corporation (CDC) of the United Kingdom, a UK Government-owned company, is the largest investor in Actis' Infrastructure 2 fund and as such continues its relationship with Umeme indirectly through Actis. Actis is committed to promoting the sustainable growth of the private sector in the emerging markets. Its aim is to ensure that the capital raised and managed makes a lasting, tangible and positive difference by creating opportunity for the companies in which it invests, as well as their stakeholders. The firm's headquarters are in the United Kingdom, and Actis investment management team provides funding and advisory services to the Board of Directors of Umeme.

58. What entities *regulate* the energy sector? Please briefly describe their roles and responsibilities?

The energy sector in Uganda is regulated by the Electricity Regulatory Authority (ERA). Electricity Regulatory Authority (ERA) is a statutory body established in accordance with the Electricity Act 1999 (CAP 145). The Act empowers ERA to regulate the Generation, Transmission, and Distribution of electrical energy in Uganda.

The mandate of ERA is outlined in the Electricity Act and further detailed out in the 3–year Business Plan and 10-year Strategic Plan. The responsibilities of ERA out lined in the Electricity Act are as follows:-

To issue licences for
(i) The generation, transmission, distribution or sale of electricity; and
(ii) The ownership or operation of transmission systems;

a) To receive and process applications for licenses;
b) To prescribe conditions and terms of licenses issued under this Act;
c) To modify licenses issued under this Act;
d) To make and enforce directions to ensure compliance with licenses issued under this Act;
e) To establish a tariff structure and to investigate tariff charges, whether or not a specific compliant has been made for a tariff adjustment;
f) To approve rates of charges and terms and conditions of electricity services provided by transmission and distribution companies;
g) To review the organization of generation, transmission and distribution companies or other legal entities engaged in the generation, transmission and distribution of electricity to the extent that that organization affects or is likely to affect the operation of the electricity sector and the efficient supply of electricity;
h) To develop and enforce performance standards for the generation, transmission and distribution of electricity;
i) To encourage the development of uniform electricity industry standards and codes of conduct;
j) To establish a uniform system of accounts for licensees;
k) To advise the Minister regarding the need for electricity sector projects;
l) To prepare industry reports and to gather information from generation, transmission and distribution companies;
m) To prescribe and collect licence fees;

n) To provide for the procedure for investment programmes by transmission and distribution companies;
o) To approve standards for the quality of electricity supply services provided;
p) To approve codes of conduct in respect of the operation of transmission and distribution systems;
q) To acquire information and carry out investigations relating to any of its functions; and
r) To perform any other function that is incidental or consequential to its functions under this section, or as may be conferred on it by any other law.

59. Total installed electric capacity (MW) and annual electric generation (e.g. in Megawatt, MW) by fuel source? *Please include a breakdown of renewable energy generation by source.*

The total installed electric capacity is 492 Mega watts (MW). Hydroelectric power (HEP) represents 66.7% of the installed capacity. Thermal electricity is 30.5%, Bagasse electricity is 2.8%.

The breakdown of all energy sources is as follows:

Plant Name	Reference Year (2009)
Installed Capacity	**492**
Hydroelectricity	**328**
Kiira	120
Nalubale	180
Kasese Cobalt	10
Kilembe mines	5
Bugoye Tronder Power	**13**
Thermal Electricity[1]	**150**
Lugogo	-
Kiira	50
Namamve	50
Mutundwe	50
Bagasse Electricity	**14**
Kakira	12
Kinyara	2

Source: UBOS (2010)

60. Total electricity exported/imported?

No data is available.

61. Are there gaps between supply and demand? If yes, how frequent, and how are the shortfalls met?

[1] Thermal power plants were installed to take care of the demand in the short term. In the long term, a new hydropower dam, the Bujagali Hydropower station is being built. It will generate 250 MW of power. So far, three turbines have been commissioned, giving 150 MW of power. The remaining two turbines will be commissioned next month (July, 2012).

Yes, there are gaps between supply and demand. The current energy deficit is 150 MW. The shortfalls have been met by the thermal power plants. The thermal power plants will be replaced by the Bujagali hydropower station, which will generate 260 MW.

62. Average price per kWh for electricity at the wholesale level (by major generator) and then at the retail level by client type (industrial, commercial, domestic)?

The price of electricity per kWh for the various consumer categories for 2012 is attached. 1 United States Dollar (USD) fluctuates around UgShs. 2450-2500 (June 2012).

63. Are private companies allowed to generate, bank, transmit, and/or distribute energy? If yes, in both urban and rural contexts? Please elaborate on the structure of such if possible.

Yes, private companies can generate electricity and sell it to the national grid.

64. **Are there any organic waste-to-energy plants?** At the moment, they do not exist. However, SG Power (U) Ltd, a company belonging to the former Mayor of Kampala City, Al Haji Nasser Ntege Sebagala intends to develop a waste-to-energy plant at some 50 km from Kampala City. The environmental impact assessment of the plant was completed and a certificate of approval was granted by NEMA in 2011. Al Haji Nasser Ntege Sebagala together with partners are now looking for funds to implement the project.

If yes, what is the installed capacity (agro-industrial or domestic) thermal and electric, in MW? Please list ownership, kind of waste/source of fuel, capacity, annual energy generation for each.

65. **Please add information how the major organic waste-to-energy projects have been financed**? Not applicable as they do not exist.

Annex: Terminology

- **Biosolids** are stabilized (treated) excreta or the treated byproducts of domestic and commercial sewage, wastewater and faecal sludge treatment, which can be beneficially utilized as soil amendment and fertilizer after drying.

- **Business Model (in this context):** a model that contributes to cost recovery or profit from reuse, ideally supporting in this way the sanitation service

- **Co-composting**: Is the simultaneous composting of excreta with other organic waste. Alternatively, both components can also be composted separately and mixed later.

- **Domestic effluent**: **blackwater** (excreta, urine and faecal sludge, i.e. toilet wastewater) and **greywater** (kitchen and bathing wastewater)

- **Dried Sludge** is found on drying beds where biosolids from WWTPs are exposed to sun.

- **Excreta:** human faeces and urine (sometimes also called night soil)

- **Faecal Sludge**: Sludge of variable consistencies **collected from on-site sanitation systems**, such as latrines, non-sewered public toilets, septic tanks and aqua privies which store blackwater. The faecal sludge comprises of varying concentrations of settleable solids as well as of other, non-faecal matter. Faecal sludge consists of human faeces and urine (and flushing water) and has a high concentration of organic matter and nutrients. The term usually refers to fresh (watery) sludge.

- **Organic waste** - kitchen waste, plant material, human and animal excreta, agro-industrial, wood and food pressing waste

- **Peri-urban agriculture** (PUA): agriculture within approx. 30 Km around the build-up city area.

- **Reclaimed water or recycled water** is treated wastewater that can officially be used under controlled conditions for beneficial purposes (potable, non-potable)

- **Sanitation Safety Plan:** A manual to operationalize e.g. safe wastewater reuse like the Water Safety Plans operationalize the WHO Drinking Water Guidelines.

- **Septage**: A term used for the combination of sludge, scum and liquid pumped from a **septic tank** where household black water ends (on-site sanitation) if not flushed away in a sewer; Septage is largely similar to faecal sludge.

- **Sewage sludge**: **Sludge produced in wastewater treatment plants** as a result of the treatment process. It includes faeces, other waste products and the excess bacteria used in activated sludge treatment processes. The quantity of sludge produced depends on the treatment technique.

- **Sewage:** The spent and used water from a community that contains dissolved or suspended matter, including faeces and urine, and usually moves in pipes or sewers.

- **Sewerage:** a domestic drainage system involving sewers or pipes

- **Treated wastewater**: is wastewater that has been processed through a wastewater treatment plant up to certain standards in order to reduce its pollution or health hazard. If this is not fulfilled the wastewater is considered to be partially treated. What is called treated ww in low-income countries might still classify as untreated ww in high-income countries.

- **Urban agriculture** (UA): agriculture incl. aquaculture and livestock keeping within the build-up area, usually on open-spaces (backyards are not target of the study);

- **Wastewater:** All types of domestic, commercial and/or industrial effluent as well as storm water runoff, usually mixed and of different qualities, ranging from raw to diluted. The term does not imply any form of transport or treatment. It should be differentiated between raw wastewater and wastewater which entered natural water bodies (diluted wastewater, polluted stream water).