The Global Change SysTem for Analysis, Research and Training (START) -Global Environmental Change (GEC) Research Project

Harare Visit to Windhoek

20-23 August 2017

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INTRODUCTION

The Chinhoyi University of Technology (CUT) research project title is "*Water and energy system, urban governance and decision-making in Harare"* and the University of Namibia (UNAM) research project is titled "*Water Security in Windhoek: governance, water demand and supply, and livelihoods in the context of urbanization and climate change*". One of the GEC CUT objective is to compare the dynamics of the water-energy and associated climate change risk and vulnerability assessment identifies for Harare with that identified for the other FRACTAL cities (Lusaka and Windhoek).

The visit to Windhoek aimed at looking at both passive and active adaptation management strategies of Windhoek in order to compare the risks and vulnerabilities in the energy and water sector with Harare. This would provide lessons from the City of Windhoek's adoptive measures and recommendations for increasing awareness and adaptation capacity of the Harare City. Dr. Chipo Mubaya and Dr. Mzime Ndebele-Murisa from Chinhoyi University of Technology visited Windhoek from the 20th to the 23th of August 2017. This report provides a summary of activities that were undertaken during the Harare-Windhoek exchange visit.

DAY ONE: MONDAY, 21 AUGUST 2017

A VISIT TO THE NAMIBIA ENERGY INSTITUTE

The Harare team together with Dr. D. Muchadenyika (FRACTAL Research fellow), Kornelia Iipinge (FRACTAL Windhoek Embedded Researcher) and Julia Pelaez Avila (MSc at UCT) visited the Namibia Energy Institute (NEI). Ms Fenni Shidhika (NEI Researcher in the Centre for Renewable Energy and Energy Efficiency) and Mr. Shihepo (Project Coordinator for the Energy Efficiency Building Project) hosted the team.

Ms. Fenni welcomed the team and introduced the NEI that is a part of the Namibia University of Science and Technology (NUST) and its vision *to be a leading institute for energy research and development in Africa and beyond*. NEI has 4 Centres namely: (1) Centre for Renewable Energy and Energy Efficiency (CREEE); (2) Centre for Electricity Supply (CES) (3) Centre for Oil and Gas (COG) and (4) Centre for Nuclear Science (CNS). NEI Strategic Goals:

1. Collaborate with industry, government, development partners and academic institutions in transformational research projects and educational outreach for new approaches to the world's energy opportunities.
2. Catalyse the transition to advanced sustainable energy exploration, generation, distribution and utilization, through coordinated research and development, capacity building and project management.
3. Provide a forum for constructive debate to facilitate innovation, development, deployment, and dissemination of energy technology knowledge and good practice.
4. Enhance public understanding of energy resources and technologies and their role in society, in order to address the barriers that hinder increased use and access to modern energy technologies.

Ms Fenni Shidhika highlighted the following projects and programs (among others):

1. Heka Projects
2. Southern African Solar Training and Demonstration Initiative (SOLTRAIN)
3. South Africa- Country road map and implementation plan

4. Solar Revolving Fund (SRF)
5. SADC Centre for Renewable Energy and Efficiency (SACREE)

Ms. Fenni also highlighted that the Ministry of Mines and Energy, under which the Institute falls under has a number of research and monitoring projects that they work on through Research partners (University/ies student projects). In addition, the Ministry is currently working on a regulatory framework (technical management issues) to centralize electricity supply which includes both renewable and non-renewable sources. Currently, the Electricity Centre Board (ECB), regulates electricity distributors in Windhoek and other regions. She also pointed out that there was some co-dependence in terms of energy supply to the city given that the major power plant is in the North of the country as well as the conflicts with Botswana over the use of the Okavango for water and energy supply.

Mr Shihepo explained the history and establishment of the Concept house which is an ongoing project that showcases a closed system which does not rely on externally produced energy but local renewable energy at source. The Concept house houses a central data logger which records both internal and external climate (temperature, humidity etc.) in order to reflect the efficiency of the system. The major source of electricity is solar power whose excess is fed back into system grid. Thus far, the concept is working well in winter by warming internal temperatures through the ground but does not work so well in summer in cooling internal temperatures. This is mainly as a result of the fact that the underground buckets which should collect water to be used in the cooling system are dry in summer. All the materials used in the Concept House are locally sourced and include perforated bricks that are used as conductors, windows that are double glazed and light as well as spongy material and underground buckets which are used to collect water for cooling circulation.

Figure 1: The constrction of the Concept House at NEI

Figure 2: Mr Shihepo explaining the concept of the energy efficiency building projects

DAY TWO: 22 AUGUST 2017

VISIT TO THE WINDHOEK RECLAMATION PLANT

The Harare team together with Kornelia visited the Gammas Water Works were Mr Petrus Nendongo took the team to the new Windhoek Goreangab water reclamation plant where they met with Mr. Thomas Honer the General Manager of the Windhoek Goreangab Operating Company (Pty) Ltd (WINGOC). Mr Honer took the team on a tour around the plant and explained on the various operations. WINGOC has a partnership with the City of Windhoek that reclaims waste water to potable water for the City of Windhoek. The City then blends it with other surface water sources and groundwater for it to be distributed to the residents of Windhoek. The City of Windhoek's Department of Infrastructure, Water & Technical Services is responsible for the supply, distribution and quality of potable water as well as the collection, reticulation and treatment of sewerage water.

There are four main sources of water supply to the central area of Windhoek: surface water obtained from the Von Bach, Swakoppoort and Omatako dams owned by NamWater. In addition, groundwater abstracted from municipal production boreholes; reclaimed water recovered by suitable treatment from both the New Goreangab Water Reclamation Plant (NGWRP) and the Old Goreangab Water Reclamation Plant (OGWRP) (see Figure 3).

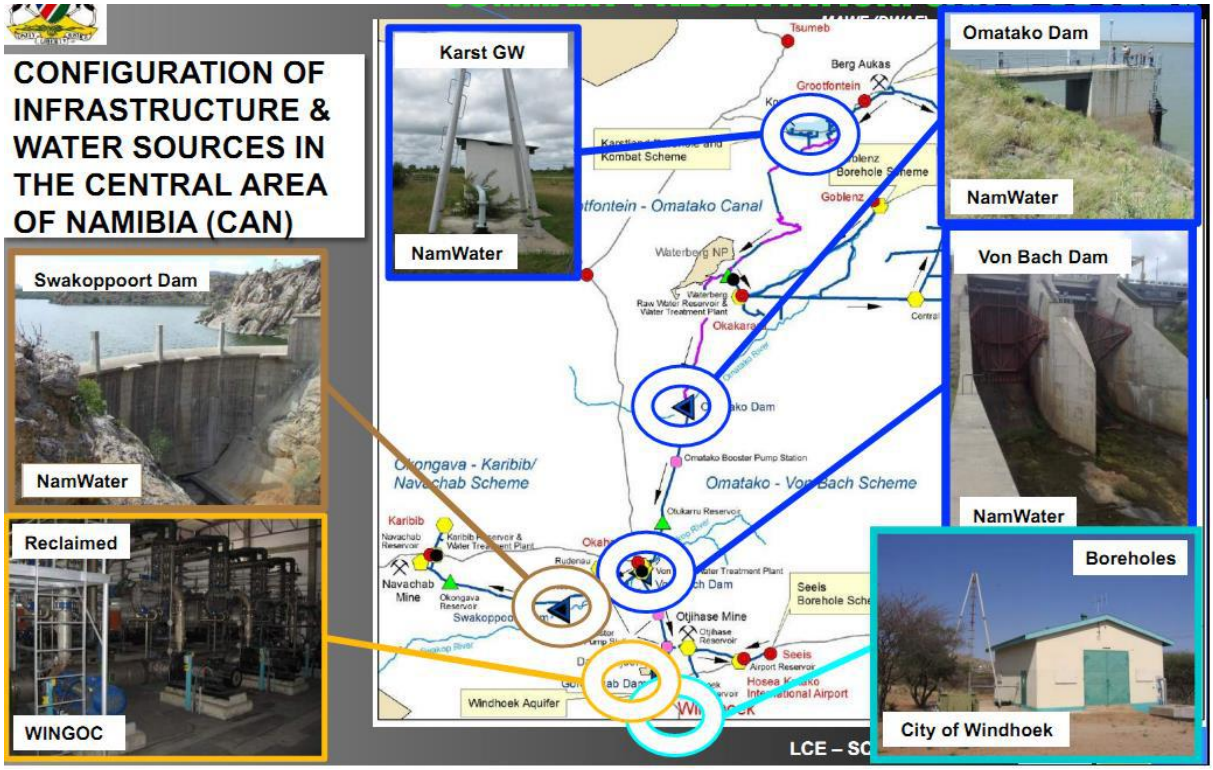

Figure 3: Water sources and infrastructure in the central area of Namibia (CAN) Source: Hugh, 2015

A. The history of WINGOC

Namibia is the most arid country in Southern Africa. Windhoek, the capital of Namibia, has an average annual rainfall of around 370mm, while the average evaporation rate is 3400mm. The nearest perennial river, the Okavango, is 700km from the city on the north-eastern border of the country. Windhoek is therefore continuously facing serious water challenges. In 1968 the Goreangab Water Reclamation plant was built by the City of Windhoek to reclaim water directly from domestic sewage effluent. Over the past 30 years the process was improved and the plant capacity extended to 2.9mm per annum.

Due to the fact that all naturally available water sources in and around Windhoek have been fully harnessed, the New Goreangab Reclamation Plant was completed in 2002 and comprises the latest available proven water treatment technology. This was done in order to ensure the total utilization of available effluent from domestic wastewater to ensure the security of water supply for the future. The new plant has been based on extensive experience (30 years), research done locally, and on input from international experts to assure the compliance to the strictest water quality guidelines applied internationally.

B. Process of the water reclamation plant

Successful direct reclamation as practiced in Windhoek is based on the practice of diverting industrial and other potentially toxic waste water from the main domestic waste water stream. The domestic waste water is treated to produce an effluent of adequate and consistent quality which is further treated to produce safe potable water. In addition, it is important to continuously maintain a multiple-barrier treatment sequence as a safeguard against pathogens and other potentially harmful and unwanted contaminants.

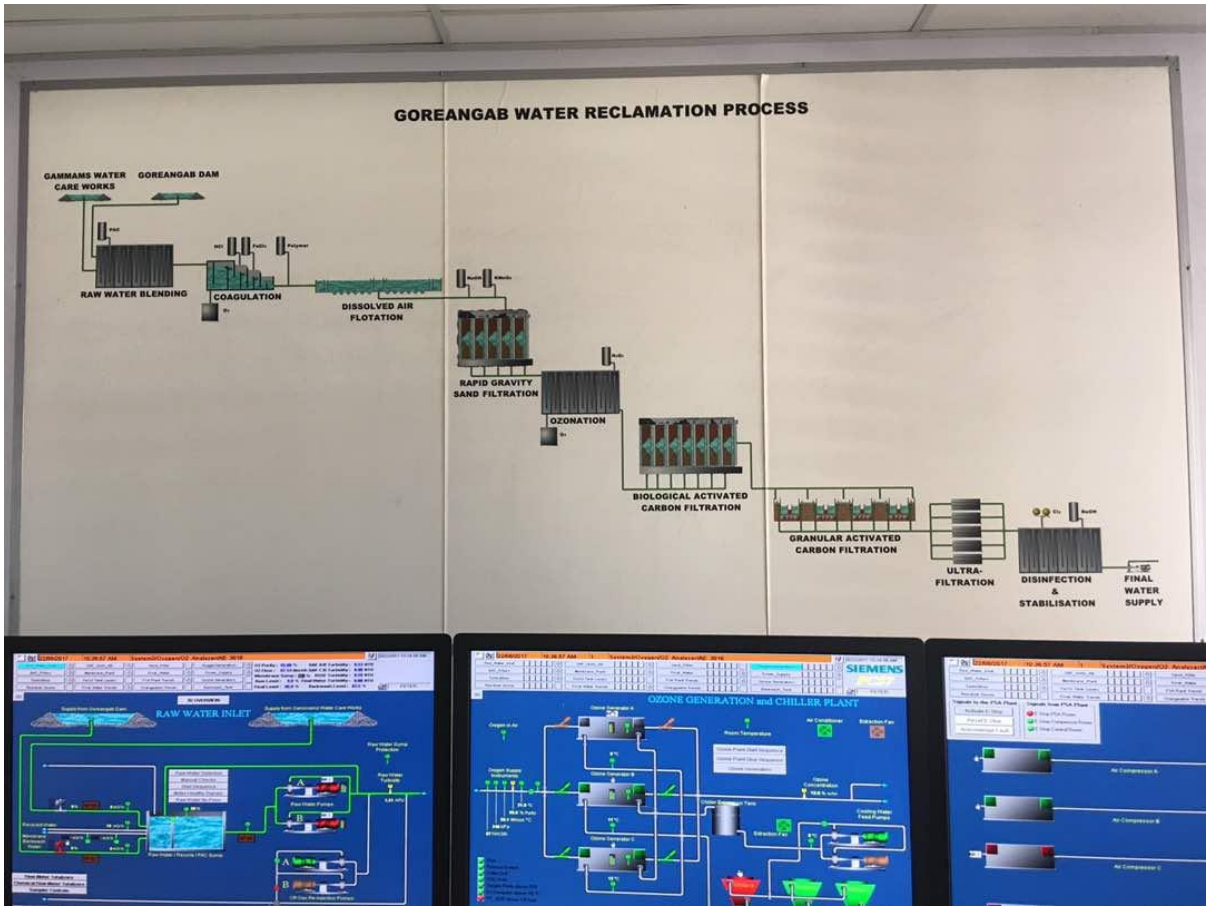

Figure 4:The water reclamation process and steps

Figure 5: The different process/ steps of the water reclamation plant

In order to ensure successful direct reclamation, the multiple-barrier approach ensures that at least two (in many cases three and more) effective removal processes are in place for each crucial contaminant that could be harmful to human health or aesthetically objectionable. Intensive bio-monitoring programs and other tests are carried out on reclaimed water, and no negative health effects have been detected a result of the use of reclaimed water since 1968.

Figure 6: A comparison of the Gammas raw water and the final product from WINGOC

Figure 7: Mr Honer explaining to the team on the various operations at the water reclamation plant

MEETING WITH FRACTAL TEAM

The Harare team met with Prof. John Mfune (Windhoek Principal Investigator (PI)) and Kornelia Iipinge (Windhoek Embedded Researcher) at the University of Namibia, Windhoek Main Campus. Prof. Mfune gave an overview of the Windhoek GEC research project. He explained the three components of the project, were data collection has started and highlighted the following points below:

A. Water Governance

Case study of Ujams Water Treatment Plant that treats waste water from industries in the Northern Industrial part of Windhoek. The water treatment plant is operated by Ujams Wastewater Treatment Company (UWTC) and owned by the City of Windhoek. The research is aimed at understanding the decisions making processes and the role players involved.

B. Impact of drought on water resources used for supply to the City of Windhoek

This component of the study will address the following specific objectives: -

- Quantify the severity and duration of drought in Windhoek.
- Determine if water supply sources and assumptions in Windhoek is sufficient and appropriate to meet the growing water demand and how climate change and urbanization affect this process.

C. Water Security and Livelihoods in Windhoek: modelling synergies and hotspots of water demand and supply in the context of climate change and urbanization

Data collection has been completed and analysis of the data is ongoing. This component of the study will address the following specific objectives: -

- Assess the synergetic links between livelihoods and water security, and subsequent food security amongst different social groups in the City of Windhoek.
- Investigate the spatial distribution of hotspots accumulating from water supply and demand

D. Challenges faced by the Windhoek team:

- Difficulties in getting the effluent data for component on water governance.
- Financial processes for the project.
- High non-responsive from effluent neighbourhoods for component on water security.
- City restructuring for the embedding of the embedded researcher.

Overview of the CUT START GCE Project

The Harare team also gave an overview of their GEC project entitled water and energy systems, urban governance and decision making in Harare. The principal investigators for the Harare GEC project are Dr Ndebele-Murisa and Dr Mubaya with two embedded researchers who are undertaking their MPhil studies as part of the GEC project.

The objectives of the project are as follows:

1. Investigating the water-energy nexus for the city of Harare including critical decision-making institutions and key thresholds for decision making at all scales from household to national scales;

2. Conduct a risk and vulnerability assessment for Harare
3. Compare the dynamics of the water-energy nexus and associated climate change risk and vulnerability assessment identified for Harare with that identified for other FRACTAL cities (Lusaka, Windhoek);
4. Investigate the issues of co-dependence derived from the mutual use of Kariba dam for water and hydropower;
5. Explore potential adaptation options based on best practice from both cities and joint operations of Lake Kariba.

Data collection for the project has been completed and this involved conducting interviews with key informants from the water and energy sectors in the city of Harare. Data collection also involved household questionnaires in high, medium and low-density suburbs of the city and data analysis for the project is ongoing. Climate and water flow data for Harare will also be analysed in order to investigate the trends over time.

The Ministry of Environment, Water and Climate (MoEWC) is responsible for climate change adaptation and decision making in the water sector. The Ministry of Energy and Power Development (MoEPD) and the Zimbabwe Energy Regulatory authority are the major players in climate change adaptation in the energy sectors. Although climate change adaptation strategies are being crafted at the national level (MoEWC), climate change adaptation has received minimum attention at the local level (Harare City Council) with no adaptation strategies in place.

DAY THREE: 23 AUGUST 2017

A VISIT TO THE WINDHOEK CITY COUNCIL

On the last day of the visit, the Harare team together with Kornelia visited City of Windhoek Council at its Head Office. They meet with Mr. Olavi Makuti, the Environmental Planner in the Department of Economic Development & Community Services. Mr. Makuti pointed out that the City Council of Windhoek is responsible for the provision of the following municipal service: bulk water supply, electricity, service land, develop and maintain road infrastructure, policing and emergency management, parks, and sports infrastructure. The City of Windhoek's Department of Infrastructure, Water & Technical Services is responsible for the supply, distribution and quality of potable water as well as the collection, reticulation and treatment of sewerage water. Whilst the Department of Electricity is responsible to provide, operate and maintain a secure and reliable electrical infrastructure to the City's residents in an efficient and safe manner

An interesting governance aspect that was noted was that unlike the City of Harare, the City of Windhoek Council is responsible for energy provision in the city. In contrast, the Zimbabwe Electricity Supply Authority (ZESA) is solely responsible for electricity supply, in Harare.

REFLECTIONS:

- Cross cutting themes between Harare and Windhoek hinge around water scarcity, supply and demand as well as energy supply (currently low)
- Efforts and projects around renewable energy supply for both cities and countries are comparable but contribution of overall energy sources and electrification rates (19 and

45% rural and urban Namibia respectively with a 50% target for sourcing from the mini-grid that was set for 2015) are different between the two cities

- Issues of co-dependence for Windhoek were highlighted in terms of conflicts with Botswana over the sharing of the Okavango as well as the fact that the largest desalinization plant in is owned by a private company while both water and energy sources are external, far (from Windhoek) and shared
- An interesting difference was noted in governance structures in that Windhoek City buys water from NamWater as well as energy from NamPower and then sells these as services to residents but under government regulated rates. In contrast, though the Zimbabwe National Water (ZINWA) Authority is responsible for overall management of all raw water forms in Zimbabwe, Harare City is solely responsible for the treatment, supply and therefore charging and collection of rates for potable water and the Zimbabwe Electricity Distribution Company (ZEDC), a subsidiary company of ZESA is solely responsible for energy supply and regulation of rates in Harare and Zimbabwe from the main grid
- Lessons learnt and applicable for Harare City include the Public-Private Partnership (PPP) model employed by the City for the Goreangab Water Reclamation Plant which runs very efficiently. This provides a good case study of Morton Jaffrey Waterworks in Harare under the FRACTAL Innovation Fund
- Windhoek City Researchers hailed the success of the Embedded Researcher model taken by Harare City Team as they were facing some challenges in engaging Windhoek City in that manner, given recent and ongoing changes in the City Staff compliment and governing structures
- There is therefore good scope to conduct some comparative analysis of the two cities in terms of water, energy and governance structures as well as decision-making processes post GEC projects
- More forum for city visits and learning should be encouraged across FRACTAL