GENEWS

THE OFFICIAL UEGCL NEWSLETTER

600MW Karuma Commissioning: The Journey To Africa's Underground Power Plant

UEGCL
Generating for Generations

Issue 12 | 2025

Word From Editorial

Enock KUSASIRA
Head Communication and
Corporate Affairs

Dear reader,

Welcome to ISSUE 12 of GeNews

The commissioning of Karuma Hydro Power Plant, in September last year, was an exciting moment in Uganda. It sparked a national mood of optimism and pride as the country took an important step towards energy self-sufficiency. At the start of the week of commissioning, the public was treated to day by day online updates largely generated by enthusiasts of Karuma project .This euphoria gave birth to a robust

> *This edition sets out to celebrate the milestones as captured through the experiences of different players but most importantly, as seen through the lens of the contributing authors in this newsletter.*

media buzz that left many sections of the country sufficiently informed about the Karuma HPP. The attention of the public on the event was huge and the interest from across the social spectrum, reflected not only the significance of the event but also public understanding of the development needs of the country.

This edition sets out to celebrate the milestones as captured through the experiences of different players but most importantly, as seen through the lens of the contributing authors in this newsletter. The stories capture the excitement and pride of the staff of UEGCL, who worked with the contractor, Owners' engineer and other sub-contractors, to make UEGCL a proud contributor of 59% of the installed national grid capacity of 2050 MW. This makes Karuma HPP a national pride and a beacon of hope for Uganda's sustainable energy.

Through interviews from the leaders of the host districts of Nwooya, Kiryandongo and Oyam, we feel the palpable relief expressed through the narratives of triumph and optimism that the project brought to the communities. Whereas sections of the communities were directly or indirectly affected by the Project, the leaders of the three districts confirm through their stories that the project was worth undertaking.

This great achievement is a testament to years of commitment, innovation and close collaboration between stakeholders. We hope you will enjoy the exclusive insights into the commissioning event, expert opinions on the impact of the project including the long and tedious journey from inception to completion.

This edition therefore, is not only a recount of a national celebration, but also a mark of a new era in Uganda's Energy sector. It is a story of triumph, resilience and a pointer to a better future of progressive industrialization, supported by reliable energy.

Enjoy the reading!

This great achievement is a testament to years of commitment, innovation and close collaboration between stakeholders.

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CEO's Foreword

DR. ENG. HARRISON .E. MUTIKANGA
Chief Executive Officer

Dear Reader,

Welcome to the 12th issue of GeNews, UEGCL's bi-annual newsletter. This edition is a special one, dedicated to commemorating a monumental milestone in Uganda's energy sector—the commissioning of the 600 MW Karuma Hydropower Plant (HPP), the largest underground power station in Africa. The theme, "600 MW Karuma Commissioning: The Journey to Africa's Underground Power Plant," reflects the immense effort, resilience and collaboration that have defined this project from its inception to its operationalization.

UEGCL's role in the implementation and eventual operation of the Karuma HPP has been pivotal. As we celebrate this achievement, we also recognize the lessons learned, the challenges overcome, and the challenges soon to be overcome, such as the disruptive water weed and floating islands. The commissioning of Karuma is not just about adding power to the nation; it is about ensuring that Uganda's energy sector continues to grow sustainably, with a skilled workforce capable of managing and maintaining such world-class infrastructure. In this issue of GeNews, we reflect on the technical feats, project milestones, stakeholder collaborations, and the capacity-building that have shaped the Karuma success story. We also reflect on how this achievement positions UEGCL and Uganda as key players in Africa's hydropower landscape.

As we look ahead, our priority is to monitor and optimize Karuma's performance during its ongoing defects liability period (DLP), ensuring that it fully delivers on its intended role as a cornerstone of Uganda's energy security. Its completion signals new opportunities for expansion, innovation and regional power trade. With the continued support of all our stakeholders, we are confident that UEGCL will remain at the forefront of Uganda's energy transformation, fulfilling our mandate of Generating for Generations.

We extend our deepest appreciation to all our partners and our dedicated workforce whose contributions have made this historic achievement possible. May this issue of GeNews serve as an informative and inspiring chronicle of "the Journey to Africa's Underground Power Plant".

> *600 MW Karuma Commissioning: The Journey to Africa's Underground Power Plant*


UEGCL
PURPOSE
STATEMENT

Inside The Operations Of The 600MW Karuma Hydropower Plant

Andrew GENA
Shift Charge Engineer, Karuma HPP

A Giant Awakens

On March 22, 2023, Uganda's energy sector reached a historic milestone with the commissioning of the first unit of the 600MW Karuma Hydropower Plant. Since then, the plant has been a vital source of electricity, ensuring a steady and reliable supply to the national grid. Behind this smooth operation lies a meticulous approach to maintenance, efficiency, and innovation, all aimed at maximizing uptime and minimizing failure.

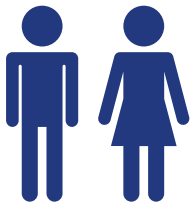
Operating a hydropower plant is a complex undertaking that requires constant attention to detail. Every failure or trip is met with

> *Operational conditions are continuously monitored, recorded, and analyzed to detect potential issues before they escalate.*

three critical questions: why did it happen, how did it happen, and what can be done to prevent it from happening again? This rigorous analysis has significantly reduced failure rates and increased overall reliability. Operational conditions are continuously monitored, recorded, and analyzed to detect potential issues before they escalate. By adopting a data-driven approach, every component of the plant is kept in peak condition.

At Karuma HPP, maintenance is not just a routine task but a carefully structured system designed to prevent failures before they occur. Preventive maintenance ensures that small issues do not develop into major breakdowns. Scheduled inspections, lubrication, minor replacements, and routine servicing extend the lifespan of equipment. Reliability-centered maintenance helps prioritize the most critical assets, focusing on components essential for power generation while minimizing unnecessary maintenance efforts. Predictive maintenance uses advanced monitoring tools such as vibration analysis, oil testing, temperature tracking, and leak detection to foresee potential failures and address them before they happen. Proactive maintenance goes a step further by identifying and eliminating the root causes of failures rather than just fixing immediate problems. While reactive maintenance, or run-to-failure, is sometimes inevitable, it is the least preferred approach due to the high costs and disruptions associated with emergency repairs.

Technology plays a crucial role in ensuring smooth operations at Karuma HPP. The plant is equipped with an online condition monitoring system that tracks the performance of generators, turbines, and transformers in real time. Standard operating procedures and well-documented maintenance records help guide decision-making and emergency response strategies. By maintaining detailed logs of plant conditions, operators can anticipate potential failures, schedule necessary shutdowns, and ensure that critical spare parts are readily available when needed.



Beyond the machinery, the human factor is essential in keeping Karuma HPP operating at its best.

Beyond the machinery, the human factor is essential in keeping Karuma HPP operating at its best. Engineers and operators undergo continuous training to stay updated with the latest technological advancements and best practices. Knowledge transfer between staff members ensures a collaborative environment where experiences are shared, and performance is constantly improved. As a Shift Charge Engineer, responsibilities extend

beyond overseeing personnel; the job includes ensuring stable power generation, managing voltage and frequency, supervising safety protocols, addressing faults in real-time, and reporting incidents that could impact operations.

In conclusion, Karuma HPP is more than just a power plant; it is a pillar of Uganda's energy future. The combination of routine maintenance and condition-based monitoring has allowed the plant to operate efficiently while reducing downtime and prolonging the lifespan of its equipment. With a commitment to innovation, efficiency, and continuous improvement, Karuma HPP remains a reliable and sustainable source of energy for the country. More than just generating electricity, it is generating progress, fueling industries, homes, and economic growth.

Finding UEGCL's Purpose

in the Commissioning of the 600 MW Karuma HPP

Muzafalu KAYONDO (Ph.D)
Head Research & Business Development

It is not uncommon for a man to wonder what their purpose is on this small blue dot (called Earth) floating through the vast universe. Most of us have appreciated the life we live, and have attached a spiritual purpose to it. Others have crafted themselves a plan and cause for their living. Now, whatever that is, there is a nexus of activities that propagate life on Earth, that every one of us must contribute to. For the teams, individuals, companies, etc, that work with or are associated (through activities) with UEGCL, their purpose must at some point align with UEGCL's purpose.

UEGCL has meticulously

> *Making Electricity Safely Available for Supply at All Times from all its Power Plants*

crafted its purpose statement as "Making Electricity Safely Available for Supply at All Times from all its Power Plants". This statement underscores UEGCL's commitment to ensuring a stable, safe, and continuous supply of electricity to Uganda's growing economy. This Purpose Statement is UEGCL's reason to exist! This statement is the lifeline of every activity that takes place at UEGCL. To put it in perspective, this purpose statement calls on every individual who works with or interacts with activities of UEGCL to do so with that purpose statement in mind. Everyone interacting with UEGCL in any capacity should understand that their role is to contribute to the safe availability of electricity supply at all times. This article explores how the Karuma HPP commissioning aligns with UEGCL's purpose, and unpacks how each UEGCL employee's contribution is essential to realizing this purpose. From engineers and technical staff to administrative personnel and support teams, every individual at UEGCL plays an integral role in making sure electricity is safely available for supply at all times. UEGCL's purpose statement means that it is not only the shift operators ensuring power is available for supply but everyone at UEGCL—including the cleaner at the Head Office! The shift operator's role may be to turn on a switch or click a button here and there, but someone at Head Office needs to make sure they are facilitated. It's therefore a 'chain reaction' of activities that must align together to make sure that the lines stay energised! In other words, a Procurement officer procuring safety boots for plant personnel must sit in a comfortable and clean office (by a cleaner), feel safe (security team), and utilise ICT equipment (ICT team), to timely make the necessary procurement to support the Shift Attendant or plant maintenance teams! Everyone is involved at some stage, and everyone must understand their role in the realisation of UEGCL's purpose

Now, the commissioning of the largest hydropower plant in the country (the 600 MW Karuma HPP), greatly expands

the

600 MW

Karuma HPP

greatly expands the portfolio that has to be kept safely available for supply at all times.

the portfolio that has to be kept safely available for supply at all times. With Karuma now on board, UEGCL's purpose remains the same. However, UEGCL now feels a greater responsibility, not only to Ugandans but to the region where the electricity we generate is exported. Usually, this electricity is required to support lifelines in hospitals, industries, homes, and even the power plant itself! In reality, when you come to think of it, UEGCL's purpose is to support the various segments

of our economy (including those where we export energy). A patient on life-support in a hospital Intensive Care Unit is relying on you to make sure that electricity is always safely available! A single lapse in judgement by anyone at UEGCL could, in reality, be a matter of life and death, whether it is the front desk person arriving late, or the technician forgetting to tighten a bolt. It is therefore important that every one of us thinks of our role here at UEGCL as a contributory role on which the life of many is anchored. No wonder, Sustainable Development Goal 7 recognises the need for affordable and clean energy, as this is seen as a life need.

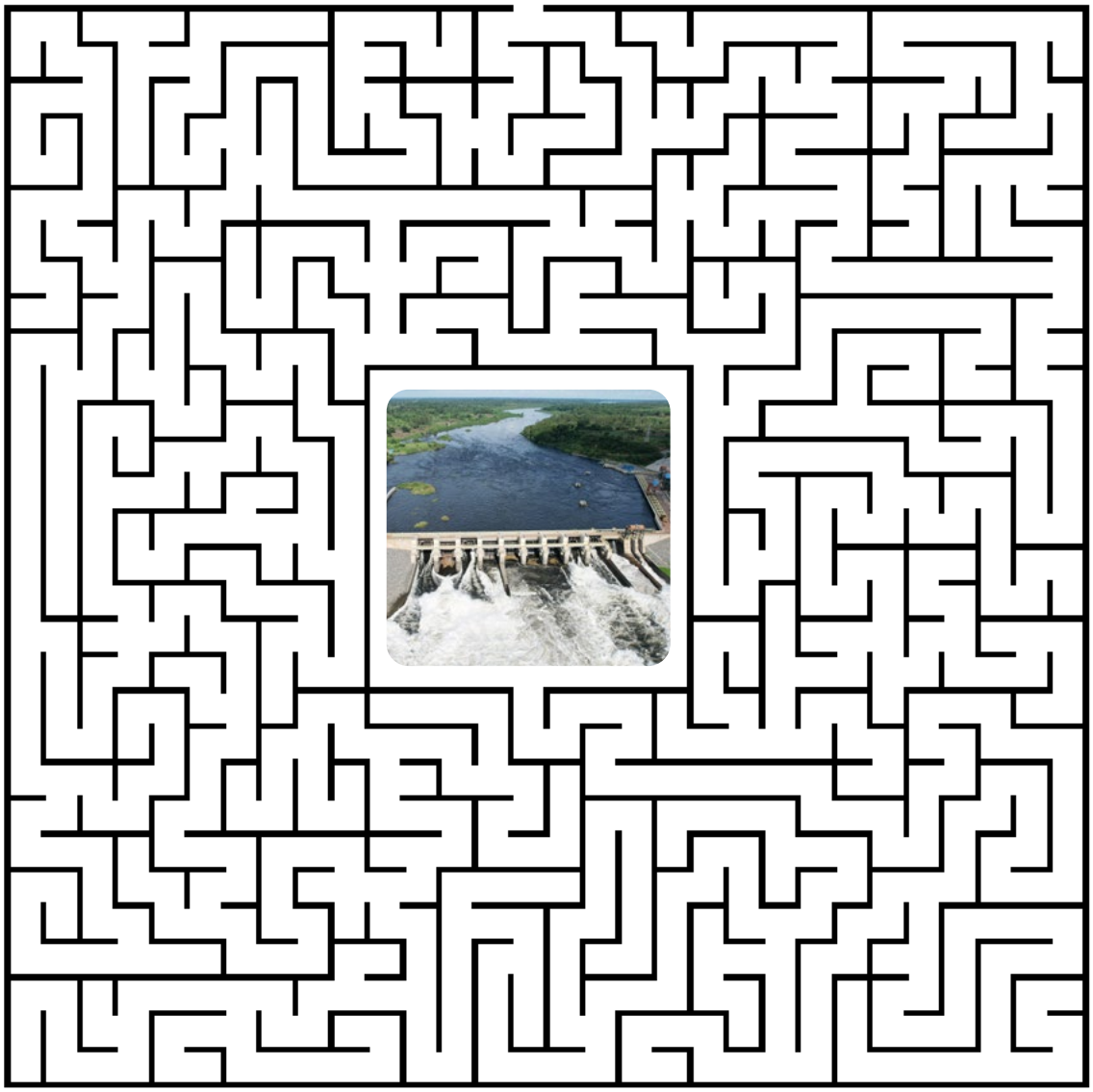
With 600 MW now on the grid, its continuous availability at all times will be in fulfilment of the purpose of UEGCL. As such, all activities and individuals aligned to the operation and maintenance of Karuma HPP, whether direct O&M staff or support staff in the different departments must work with the sole purpose of making sure that Karuma HPP does not cause lights to go off. The security team at Karuma must continuously make sure that the site/plant is secure; the persons serving food at the Karuma canteen must make sure that the food is served timely;

the CCA team too must make sure that they timely make this GeNews publication available for all UEGCL staff to enable them to read and reflect on the contents of this article! Of course, not to mention the daily dedication of the HR, Performance, Research, Risk, Projects, and all departments and units of UEGCL in the execution of their activities. Perhaps, their reason for existence (at least from 8 – 5 pm) is to align with UEGCL's purpose, and I hope this is the reason they wake up every day to go to work!

To make sure that the units at Karuma (and all our other plants) remain safely available at all times for electricity supply requires making individual sacrifices. At every time of day/night, there must always be a UEGCL staff on duty somewhere, and for Karuma, this is no exception. Someone must take a watch of what's going on at all times at the different plants of UEGCL. This is the inherent nature of O&M of power plants. We at all times need someone to be monitoring the performance of the different systems of the plant. Therefore, as we reflect on the addition of a large hydropower plant to the grid, we must also be cognizant of its implications. A power plant the size of Karuma being on the grid equally means that we must be ready and prepared for what could happen if it goes off the grid - suddenly! We know that with great power comes a great responsibility, and this responsibility is critically summed up in UEGCL's purpose. This is even more critical for Karuma, as we must triple the average expectation compared to other large power plants in Uganda. No wonder several UEGCL teams refer to Karuma as the elephant, and I hope by that, they know that the elephant must keep standing and walking at all times! Otherwise, should it stumble and fall, the sound will be heard all the way up to Nairobi! This is what we have on our shoulders as UEGCL, a great feat to behold and to maintain.

In closing, it's indeed true that the task ahead of us is immense, and lies not only with the O&M team at Karuma but also cascades down to the security attendant at Head Office and all our other plants. Everyone has a role to play in the fulfilment of UEGCL's Purpose. Everyone must believe that the reason they wake up each day and head to their respective sites is to ensure that electricity is safely available for supply at all times and from all our power plants. Once each and everyone understands this and associates with it, and the responsibility that comes along, then the execution of it will become easier. I therefore call upon everyone in our respective capacities and service roles at UEGCL, to be cognisant of the reason why UEGCL exists, and to always have it at the back of our minds as we execute our daily tasks. I hope that at a personal level, we all equally find purpose in UEGCL's reason for existence.

MIND GAME: FIND YOUR WAY TO THE POWER PLANT



UECGL's Birth to Karuma

Hydropower Plant: Sustainable Electricity to Power Improved Livelihood

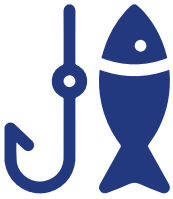
Alan Denis OROMA
Sociologist KHPP

Uganda Electricity Generation Company Limited's (UEGCL) Mission is to Sustainably Generate Reliable, Quality, and reasonably priced Electricity for Socio-Economic Development. With birth pangs, UEGCL has delivered the magnificent Karuma Hydropower plant to the nation. The addition of Karuma's megawatts to Uganda's electricity grid will help transform the human condition in Uganda. Sustainability in the context of power generation denotes meeting the electricity needs of the current generation without compromising that of future generations and where current and future electricity consumers will continually use generated power for generations to come, unstopped.

In UEGCL's mandate, the social fabric is a crucial component in ensuring the sustainability of UEGCL investments so that current efforts last for generations to come. Strategically, UEGCL through the Ministry of Energy and Mineral Development engaged host communities to provide land which is now home to the hydropower station. This was done with

care ensuring that the landowners/people were resettled through direct cash payments at district land values and in-kind compensations for extremely vulnerable affected persons which prompted healthy co-existence. This created thousands of employment opportunities for youth and other members of the project host communities, in effect creating income for families and households ensuring basic needs are met, standards of living improved and long-term spillover effects into youth gaining practical technical skills and experience in different engineering fields and construction work which are tools for sustainable livelihoods in communities.

The main ingredient for generating power is river water, used by communities for fishing and cultural crafts mainly in the form of papyrus reeds and mats. These were sources of community livelihoods and thus UEGCL ensured that even when electricity is being generated, existing water-based livelihoods are not compromised. UEGCL created an ecological flow system design where power generation continues but also enables designated access to water for fishing and crafts. UEGCL continuously equipped fishing communities with knowledge on improved fishing technologies, held constructive engagement of host community through sensitization during the river diversion and reservoir filling periods. As a way of giving back to the community, in effect consolidating sustainability in power generation, UEGCL through the contractor SINOHYDRO provided education sponsorship to the needy vulnerable girl child in secondary schools' education, Health, and infrastructure development such as at Masindi Military Hospital (Masindi District), Dicuinyi Health Facility, and Amaji Primary School (Oyam). Consequently, the social welfare of beneficiaries improved due to enhanced access to education that enabled the acquisition of requisite societal values necessary for successful lives and thus a contribution in anchoring the project into the community, above all, providing the positive association with the electricity project generation and its benefits to communities.



UEGCL continuously equipped fishing communities with knowledge on improved fishing technologies

UECGL was cognizant of the fact that power generation projects attract a high influx of populations into project areas which cause public seismic disturbances on the existing social services. To ensure sustainability in hydropower

generation, UEGCL in partnership with health providers delivers HIV/AIDS epidemiological prevention and treatment programs targeting migrant labor. Relatedly to this cause, is the comprehensive Community Development Action Plan (CDAP) that is strengthening community systems to withstand such project aftershocks, for instance with services in schools' infrastructure that is creating stability in the social services used by host communities and more to come in health, water and sanitation, tourism, rural electrification, and environmental conservation.

In conclusion, sustainability, a core value of UEGCL ensured that electricity generation at Karuma meets the needs of the present without compromising that of future generations; these have been accomplished in the course of electricity project generation delivery through resettling and compensating project-affected persons, providing sustainable employment opportunities to people from project host districts, striking a balance with other water resource users, corporate social responsibility, environment conservation and mitigating interventions such as CDAP, other follow up social interventions and benefits sharing throughout plant operations, maintenance and ensuring that the Karuma power generation station becomes a contributing fore gleam of sustainably generated electricity that will power Uganda's industrialization.

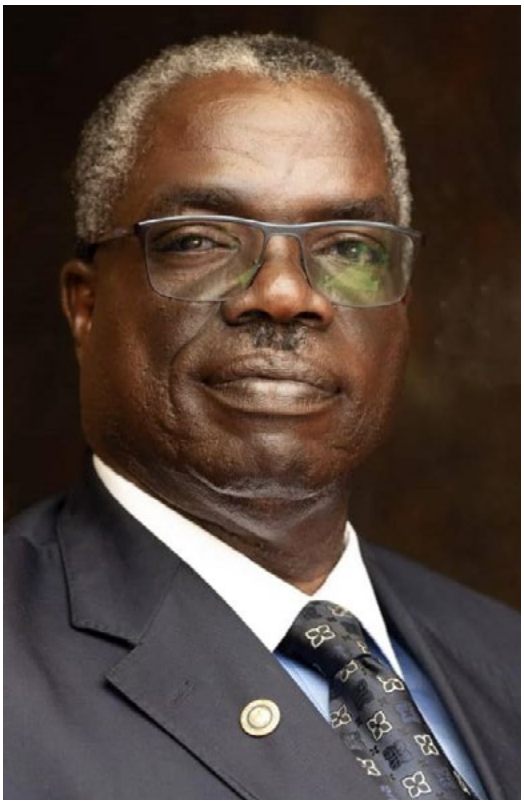
KARUMA | HYDROPOWER STATION

DID YOU KNOW?

During its construction, the 600 MW Karuma Hydropower Project significantly impacted local communities through its Community Development Action Programs (CDAP). Prioritizing Health and Education, over 4 schools and 3 health centres were built. Additionally, an Orphan Fund of $200,000 was set aside to support vulnerable children.

#KarumaCommissioning
#CommunityDevelopmentActionPlan

uegcl



Interview with Former CAO

Kiryandongo District

Mr. Martin Jacan GWOKTO
Former Chief Administrative Officer

Good afternoon, sir.

Good afternoon.

Briefly introduce yourself and tell us about your good office here in Kiryandongo.

My name is Martin Jacan Gwokto, and I serve as the Chief Administrative Officer of Kiryandongo District. Kiryandongo, one of the largest districts in Uganda, was established in 2010 and has a population of approximately 330,000 people. The district comprises two major constituencies, 13 lower local governments, 43 parishes, and a significant number of villages. As a decentralized government entity, we are responsible for delivering essential services to our communities while operating under the supervision of the central government. However, we take the lead in planning and implementing various government programs within the district, ensuring efficient service delivery and community development.

That means your office plays a big role in this district. We would like to understand the impact of the

Karuma Hydropower Project on the community, especially as we approach its commissioning after nearly eight years of development.

The Karuma Hydropower Project has had a significant impact on the communities in Kiryandongo District. One of the key benefits has been employment. Many people from the district have secured jobs through the project, which has improved their livelihoods by increasing their earnings. With a stable income, they can now meet their basic needs, support their families, and fulfil their obligations, ultimately leading to economic empowerment.

On the ground, the project-affected persons have greatly benefited from compensation. Those who were compensated have reinvested their money in various ways and this has created a very big economic boom in the district. The presence of the project has also led to significant socioeconomic growth, as business activities have expanded, and local production has increased, enabling people to generate income from their goods and services.

Tourism has also seen a rise, particularly through school tours to the project site. Furthermore, as a district, we have experienced substantial benefits, especially in the education sector, thanks to UEGCL's contributions. A good example is Diima Primary School, where infrastructure has been significantly improved.

Tourism has also seen a rise, particularly through school tours to the project site. Furthermore, as a district, we have experienced substantial benefits, especially in the education sector, thanks to UEGCL's contributions.

The construction of staff quarters, additional classrooms, and enhanced sanitation facilities has created a conducive learning environment. The school now stands as one of our model institutions, as teachers are living comfortably, and the overall learning conditions have improved.

That is very good. Now that we are going to commission and generate electricity, do you believe the district can fully utilize this power? Additionally, with the presence of some industries already emerging along the way, do you think this development will further drive industrialization within Kiryandongo? Considering the district's diverse population and cultural dynamics, how do you see this impacting economic growth and industrial expansion?

Kiryandongo's population is rapidly growing, and we now have four town

councils—Karuma, Bweyale, Kiryandongo, and Kigumba—experiencing significant expansion. However, inadequate and inconsistent power supply remains a major challenge. Some areas, like Kisungwa, completely lack electricity, while others face frequent outages. With the commissioning of Karuma, we expect these issues to be resolved, ensuring stable power across the district. This will greatly boost industrial growth, especially for small-scale industries struggling with high fuel costs. Many maize milling plants have been operating below capacity or shutting down due to unsustainable diesel prices. The high cost of fuel has forced many mills to shut down or operate below their full potential. Despite government programs providing maize milling plants, many are struggling to function due to the expensive fuel required to run them. At one time, diesel was almost at UGX 7,000. What profit can you make with that?

That gives us purpose also to keep going. Looking ahead, what do you think UEGCL is doing well, and where do you see areas for improvement? As the contractor completes the project and UEGCL takes over operations and maintenance, what final advice would you give to UEGCL to ensure the plant's successful management and long-term impact?

Thank you for the intervention. UEGCL has made commendable efforts, especially in education, which is the foundation for socio-economic transformation and development. Before these interventions, our schools were in a poor state—dilapidated infrastructure, demotivated students, and teachers lacking proper accommodation, often living in grass-thatched houses, which posed significant risks. Improving education in the project area should remain a priority. Better facilities will increase school enrollment, improve performance, and enable students to progress from primary to secondary and eventually to university. A strong education system ensures a full cycle of development, creating a brighter future for our children. Particular attention should be given to girl child education. If supported with school fees, more girls will have the opportunity to complete their studies, contributing to national development. Ignoring girls in education is like playing a football match with only half the team—you cannot win. When both boys and girls are given equal opportunities, the entire nation benefits.

Thank you very much, sir, for your time and valuable insights

A strong education system ensures a full cycle of development, creating a brighter future for our children.

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600MW Karuma

Commissioning: An ICT Perspective

Emmanuel NDEGYEYA
ICT Technician

The commissioning of the 600MW Karuma Hydropower Plant is a milestone not only for Uganda but also for Africa as a whole. As an ICT technician who has had the privilege of contributing to this groundbreaking project, it is a moment of pride and reflection. The Karuma Hydropower Plant, located along the River Nile in Uganda, is one of Africa's largest underground power stations and a testament to the power of innovation and collaboration.

My role in Karuma's commissioning process was both challenging and rewarding, with ICT playing a critical role in ensuring the seamless integration of advanced technologies required for the operation and monitoring of the plant, as broken down here below;

Communication Infrastructure: An underground power plant requires a robust communication

system to ensure efficient coordination among various teams. This involves the deployment of fiber optic networks and secure data transmission channels and also working towards establishing radio communication systems. Setting up these systems ensures uninterrupted connectivity in a challenging underground environment.

Automation and Control: Karuma is equipped with state-of-the-art Supervisory Control and Data Acquisition (SCADA) systems. These systems enable real-time monitoring and control of power generation processes. I was privileged to take part in configuring, testing, and maintaining the network infrastructure to support these systems.

Cybersecurity: As a critical/strategic infrastructure, the Karuma plant is a potential target for cyber threats. Ensuring the cybersecurity of the plant's ICT systems was paramount and involved implementing firewalls, intrusion detection systems, and regular vulnerability assessments.

Training and Support: Part of my responsibilities was to train staff on using ICT systems and provide ongoing support to address technical issues. This contributed to ensuring that the plant's personnel are well-equipped to manage its advanced technologies.

The journey to commissioning Karuma was not without its challenges, including the underground nature of the plant, which posed logistical and technical difficulties such as limited accessibility and the need for specialized equipment. Also, the integration of diverse technologies from multiple suppliers required meticulous planning and testing to ensure compatibility and reliability. Additionally, as with many large-scale projects, delays in procurement and resource allocation sometimes slowed progress. However, the dedication and teamwork of everyone involved made it possible to overcome these hurdles.

With the commissioning of Karuma, Uganda is set to experience a significant boost in its power supply. This will support industrialization, create jobs, and improve the quality of life for millions of people. The plant's design and technology set a

precedent for future projects, showcasing how innovation can address Africa's energy needs sustainably. As an ICT technician, being part of this transformative journey has been an honor. The lessons learned and experiences gained from Karuma will undoubtedly shape my professional journey and contribute to future projects of similar magnitude.

In conclusion, the 600MW Karuma Hydropower Plant stands as a symbol of what is possible when vision, technology, and dedication come together. It is a beacon of hope for Africa's energy sector and a step forward in the continent's journey toward sustainable development. As Uganda flips the switch on Karuma, the light it generates will illuminate not just homes and industries but also the path to a brighter, more innovative future.

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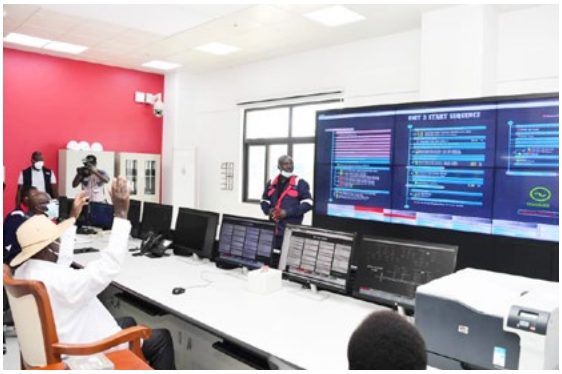
Karuma HPP Commissioning in pictures


COMMISSIONING



The 600 MW Karuma HPP

as an Anchor for Innovation, Research and Development at UEGCL

Muzafalu KAYONDO (Ph.D)
Head Research & Business Development

The commissioning of the 600 MW Karuma Hydropower Plant (HPP) marks a significant milestone in Uganda's energy sector and represents a crucial achievement for UEGCL. As one of the largest hydropower projects in East Africa, the Karuma HPP is expected to play a pivotal role in transforming Uganda's energy landscape by increasing electricity supply, stabilizing energy prices, and supporting industrialization. Beyond its immediate impact on power generation, however, the Karuma HPP opens a new frontier for UEGCL in terms of research, innovation, and the development of sustainable energy solutions.
This article explores the broader implications of the Karuma HPP

> *This article explores the broader implications of the Karuma HPP commissioning for UEGCL's research and innovation agenda.*

commissioning for UEGCL's research and innovation agenda. It highlights how UEGCL can leverage this monumental project to foster knowledge development, enhance operational efficiency, and position itself as a regional hub for energy sector innovation and commercialization. The following are some of the areas that UEGCL could capitalize on:

Enhanced Research Opportunities in Hydropower Technology

The Karuma commissioning presents UEGCL with a live, large-scale platform for applied research in hydropower technology. Hydropower plants like Karuma are complex systems with numerous components requiring continuous optimization, from turbines and generators to control and instrumentation systems. UEGCL can develop research initiatives to address operational challenges, increase plant efficiency, and improve maintenance protocols. Suggested research opportunities include:

Performance Monitoring and Analytics: UEGCL can track the performance of turbines, generators, and other components using advanced data analytics and sensor technologies. By collecting real-time performance data, UEGCL can predict component failures, reduce downtime, and improve operational efficiency. Karuma will certainly benefit from the ongoing digitalization project (DIGUEM) that is being piloted at Isimba HPP with potential for commercialization elsewhere.

Hydrology and Water Management Studies: The Karuma HPP is directly linked to the hydrology of the Nile River. Research on water flow patterns, water hyacinth and sedimentation, and climate change impacts can inform operational strategies for water use, flood control, and plant capacity optimization.

Automation and Smart Systems: Karuma HPP's reliance on modern control systems offers UEGCL the chance to study and test advanced automation solutions. Integrating artificial intelligence (AI) and machine learning (ML) into plant control systems could improve decision-making and reduce the need for human intervention.

Knowledge Transfer and Capacity Building

One of the most critical outcomes of commissioning a large-scale hydropower project is the transfer of technical knowledge to and capacity building for local professionals. UEGCL could certainly

leverage the lessons learned from Karuma to strengthen its human resource capacity, promote local expertise, and reduce reliance on foreign consultants. This would also directly feed into the Professional Services Unit (PSU) that is being rolled out and championed by the Strategy and Business Development team. Capacity-building initiatives could include:

Skills Development Programs: UEGCL can establish training programs for engineers, hydrologists, and technical personnel, allowing them to acquire hands-on experience in managing large-scale hydropower plants. Moreover, the Ministry of Energy has already identified Karuma as the potential site for the sector-wide Energy Training Facility (ETF). At this facility, UEGCL, with the advantage of the plant at Karuma, could spearhead modules in hydropower development as well as the O&M segment.

Internships and Research Collaborations: Collaborations with local universities and technical institutions can provide students and researchers with exposure to Karuma HPP's advanced technologies and operational practices.

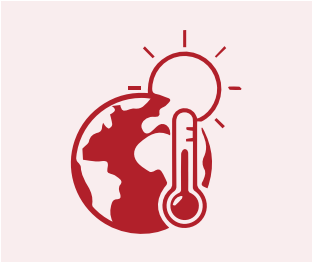
Research in Environmental and Social Sustainability

Hydropower projects have significant environmental and social impacts, and addressing these impacts is crucial for sustainable development. The Karuma HPP's commissioning provides UEGCL with an opportunity to explore sustainable energy research and contribute to global best practices in social and environmental management. Proposed areas under this are:

Environmental Impact Mitigation: UEGCL can research strategies to mitigate the environmental effects of hydropower, such as aquatic ecosystem preservation, fish migration support (especially with the fish ladder at Karuma), and sediment control (especially from water hyacinth and floating debris).

Community Development and Livelihood Restoration: Research on the social impact of displacement, community resettlement, and livelihoods for affected communities

can inform future hydropower development strategies. Karuma has undergone all these and is, therefore, ripe for related research.



Climate Change Resilience: UEGCL can assess the resilience of the Karuma HPP to climate change, including changes in river flow patterns, rainfall variability, and flood risks. This research would enable UEGCL to create long-term adaptation strategies for hydropower infrastructure.

Advancement of Local Content Development: The Karuma HPP commissioning highlights the need for a strong local supply chain to support large energy infrastructure projects, not only in Uganda but the region at large. UEGCL can use its research and innovation agenda, as well as its business development team, to foster local content development by encouraging local production of materials, equipment, and services. This can be achieved through the following:

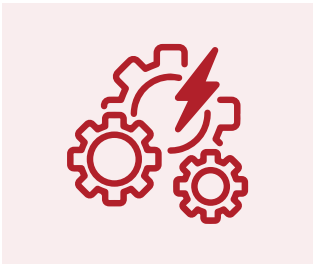
Development of Local Supply Chains: UEGCL can analyze the feasibility of producing hydropower-related equipment, such as turbines, transformers, and control system components, within Uganda. Perhaps UEGCL could create and finance a subsidiary whose purpose is to champion these initiatives to develop, test, and customize technologies to support the growing hydropower fleet in the country and the region at large. The commissioning of Karuma provides an opportunity to initiate this and to build on the opportunities it brings on board. To achieve this, UEGCL can work with Ugandan manufacturers to develop capacity for the production of spare parts and maintenance tools, reducing reliance on imports.

Innovation Hubs and Technology Parks: Creating a research and innovation hub near the Karuma HPP could support the development of local businesses and start-ups that offer specialized services and products for the energy sector. This is one of the initiatives that could benefit from collaboration across the entire value chain.

Energy Sector Innovation and Diversification

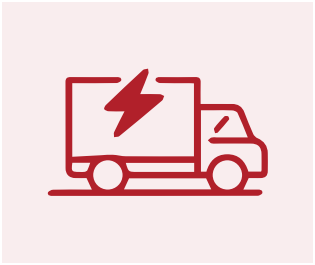
The commissioning of Karuma HPP provides UEGCL with the platform to diversify its research and development (R&D) portfolio beyond hydropower. As renewable energy becomes a global

priority, UEGCL's research efforts can be channelled into areas such as solar, wind, and hybrid energy solutions. Potential innovation pathways include:



Hybrid Power Systems: Research into hybrid energy systems that combine hydropower, solar, and battery storage could increase Uganda's energy security and provide a more flexible grid.

Green Hydrogen Production: The excess energy produced by Karuma HPP could be used to produce green hydrogen, a clean energy source with vast potential for Uganda's future energy needs.



Electrification of Transport: UEGCL's innovation agenda can include R&D into electric mobility (e-mobility) solutions, using the reliable energy supply from Karuma HPP to power electric buses, motorcycles, and other forms of transport. Moreover, some of these could be piloted at Karuma to support large operational areas of the plant.

Partnerships, Collaboration and Funding Opportunities

Karuma HPP's commissioning can attract partnerships with development

agencies, research institutions, and private investors. UEGCL's enhanced research capabilities make it a strategic partner for international research organizations interested in sustainable energy.

In conclusion, the commissioning of UEGCL's 600 MW Karuma Hydropower Plant is more than a milestone in Uganda's energy generation agenda. It is a game-changer for UEGCL's research and innovation agenda and could be a basis for a revolutionary approach to sustaining Uganda's energy industry.

The lessons learned, skills developed, and opportunities presented by this mega-project create a platform for UEGCL to become a leading research institution for sustainable energy in East Africa. With opportunities in technology development, capacity building, environmental sustainability, local content enhancement, and renewable energy diversification, UEGCL can position itself as a leader in energy sector innovation. Strategic partnerships, collaborations, and research grants further provide pathways for UEGCL to expand its influence and drive socio-economic transformation in Uganda and beyond. As the energy sector continues to evolve, UEGCL's investment in research and innovation will be key to maintaining a competitive edge and driving the future of sustainable energy in Uganda and Africa at large.

> *The lessons learned, skills developed, and opportunities presented by this mega-project create a platform for UEGCL to become a leading research institution for sustainable energy in East Africa.*

Interview with LCV

Nwoya District

Emmanuel ORACH
Chairperson LC5 Nwoya District

Mr. Emmanuel ORACH is the LCV of Nwoya District. A staff from CCA had an interview regarding the impact of the Karuma Hydropower Project on the district.

Please introduce yourself and tell us how the Karuma Hydro Power Plant has changed the lives of people in Nwoya district.
First of all, we want to thank you so much the team from Uganda Electricity Generation Company Limited. I am called Emmanuel Orach the chairman LC V Nwoya District Local Government, but also the chairperson of all chairpersons of Acholi sub-region joint leaders.

Well, to me, I want to thank the Government of Uganda for investing heavily in power generation. You may be aware in the last so many years most of our places were dark and what we used to call load shedding used to

The coming up of the Karuma generation station has given us a lot of hope that industrialization will spur and help the economy

be the order of the day. Life was not so easy and the amount of power that was available in the country was quite minimal. But as we talk, under the current leadership we want to thank the President and the able leadership of this country that has invested heavily in power generation. The coming up of the Karuma generation station has given us a lot of hope that industrialization will spur and help the economy of this country and more so the northern part of the region where we have been having a lot of challenges of power.

In fact, as we talk, people are too eager for this government intervention to have electricity, to power their small-scale projects, those who are in welding, others want some small industries to begin operating on this power, there are those who are dealing in agro processing and they have been using lots of fuel for generators to operate their businesses and they are making huge losses.

We have been having lots of problems with the hospital, especially our general hospital of Anaka as power was not enough. It used to be on and off.

But with the coming of this new power line that has been brought in being generated from Karuma, it is going to give us sufficient power to make sure lives are saved here and our farmers who are looking into doing commercial agriculture now are waiting. Some industries are spending too much money on fuel so they are waiting with serious anticipation, the day it will be fully commissioned, we will be very happy. To me, it is going to change our lives a lot. I also thank the government for the initiative to have power connected to every rural setting.

People are waiting to have fridges in their homes, some are making odi and they have been spending on some of these machines that don't even work properly. When there is power, it is going to make it easier for them to run their businesses. I am sure we are going to be very happy, and we thank the government for this intervention.

As I say this, Nwoya soon will have an industrial park land allocated, and where we have an industrial park means there will be many industries that will come up. And no industry can come without stable power without power that can be enough for them so when we get the site, we will alert the company to draw power there.

You can imagine what is going to be a real joy to us that industrial park will be there and power that will be sufficient. With the industrial park coming up and with the power that will be sufficient, there will be employment opportunities for our young people who are actually the majority in our community. So basically, that is it. We thank the government; we thank Uganda

People are waiting to have fridges in their homes, some are making odi and they have been spending on some of these machines that don't even work properly.

Electricity Generation Company for the good job well done. Yes.

What is your request to the government when they are implementing such projects such that they can also impact the communities around it? Like some of the CSR projects and things like that.

I think it is always so bad that we have communities that do not appreciate what someone has done. Usually, we take a lot of pride in going to funerals and appreciating a human being who has died. It's as if we are going to say thank you for dying. But I am different. I want to thank the government, I want to thank the President, I want to thank the Ministry of Energy for the intervention they made under the Corporate Social Responsibility.

You remember you came up and renovated and built some classroom blocks at a school in Purongo, that is an intervention the government has brought, classrooms and then teachers' accommodation was handled. We previously had a huge demand for classrooms and teacher's accommodation. There is also a need in the health sector, and we need health facilities built but there is no money.

I think you mostly impacted on education. I request the government therefore to impact on the health side. But still, if there are some more resources, let us do that. Let us have the health sector also developed and we build some facilities for them. To me that is what I am requesting to the government to do as part of their Corporate Social Responsibility. Thank you so much.

KARUMA | HYDROPOWER STATION

DID YOU KNOW?

During the construction of the Karuma Hydropower Project, approximately 3.9 million cubic meters of rock were excavated-, enough to fill 1,560 Olympic-sized swimming pools!! That's a massive amount of rock moved to make this engineering marvel a reality.

#KarumaCommissioning
#CommunityDevelopmentActionPlan

uegcl

MIND GAME: SHAKE UP YOUR BRAIN

K G H B P K E D A T B D R X C
T E Y E S P Q D N N G P E N B
W U D A Z T A C Y I O N S A F
D W R R W I T T W W U F E L O
A E O I C L E A E N I B R U T
M Z V N Z F L R W G G C V B R
G A K G A A C I F A V J O A E
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L A P C D D U C I N T A K E G
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K O V N R E M R O F S N A R T
K V E F C Q R O T A R E N E G

bearings
Francis
hydro
Kaplan
Nalubaale
PPA
safety
transformer
dam
generator
Intake
Karuma
power
reservoir
spillway
turbine
engineer
grid
Isimba
megawatts
power
rotor
thermal

Energizing Uganda

A Graduate Trainee's Perspective On Transforming Lives And Diversifying Revenue At Karuma.

Vanessa AIJUKA
Graduate Trainee, Strategy and Business Development

Through the lens of a graduate trainee, the Karuma hydropower plant represents more than an engineering feat, it symbolizes a transformative journey towards empowering communities and fostering economic growth. The commissioning of the Karuma Hydropower Plant is poised to transform lives by providing reliable energy, enhancing livelihoods, and driving development. Additionally, it stands as a beacon of opportunity for diversifying revenue streams, contributing to a more resilient and sustainable energy sector.

The commissioning of the 600 MW Karuma Hydropower Plant (KHPP) on September 26th, 2024, marked a pivotal moment in Uganda's energy sector and its broader commitment to universal electricity access. As a graduate trainee in the Strategy and Business Development Department at Uganda Electricity Generation Company Limited (UEGCL) for over a year now, I had the unique opportunity to witness Karuma's transition from the project phase in September

2023 through to its operational phase. This essay explores the journey of the Karuma KHPP, highlighting its socio-economic impact on Uganda and the innovative business ventures UEGCL is pursuing to enhance revenue generation.

Located on the Nile River in Kiryandongo District, 110km downstream of Lake Kyoga and 270km from Kampala, Uganda's capital, the Karuma HPP is the country's largest power-generating facility. The project, launched by President Yoweri K. Museveni in 2013, is a run-of-river plant, completed at a cost of approximately USD 1.7 Billion. This cost included USD 1.3 Billion for the plant under UEGCL and USD 289million for the Karuma Interconnection under the Uganda Electricity Transmission Company Limited (UETCL), financed mainly through a loan from the China Export-Import Bank (EXIM Bank), which covered 85% of the costs, with the remaining 15% funded by the Government of Uganda (GoU). The plant comprises six turbines, each with a capacity of 100MW.

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USD
289 Million
for the Karuma Interconnection

The transition from construction to operations involved meticulous testing and synchronization of the ready units with the national grid. By June 2024, all six turbines were operational, significantly bolstering Uganda's energy supply. This shift not only marked the completion of a major infrastructure project but also set the stage for enhanced energy production to meet the growing demands across various sectors, including industry and households.

The commissioning of the Karuma HPP is expected to deliver substantial socio-economic benefits, increasing Uganda's installed capacity to over 2000MW. This will facilitate broader energy access, aligning with Uganda's Vision 2040 objectives for sustainable economic growth. During the construction phase, UEGCL implemented several community development initiatives, such as school renovations and health center expansions. Notably, the construction of two classroom blocks, four staff houses, and four VIP latrines at Diima Primary School, as well as the development of

UEGCL implemented several community development initiatives, such as school renovations and health center expansions.

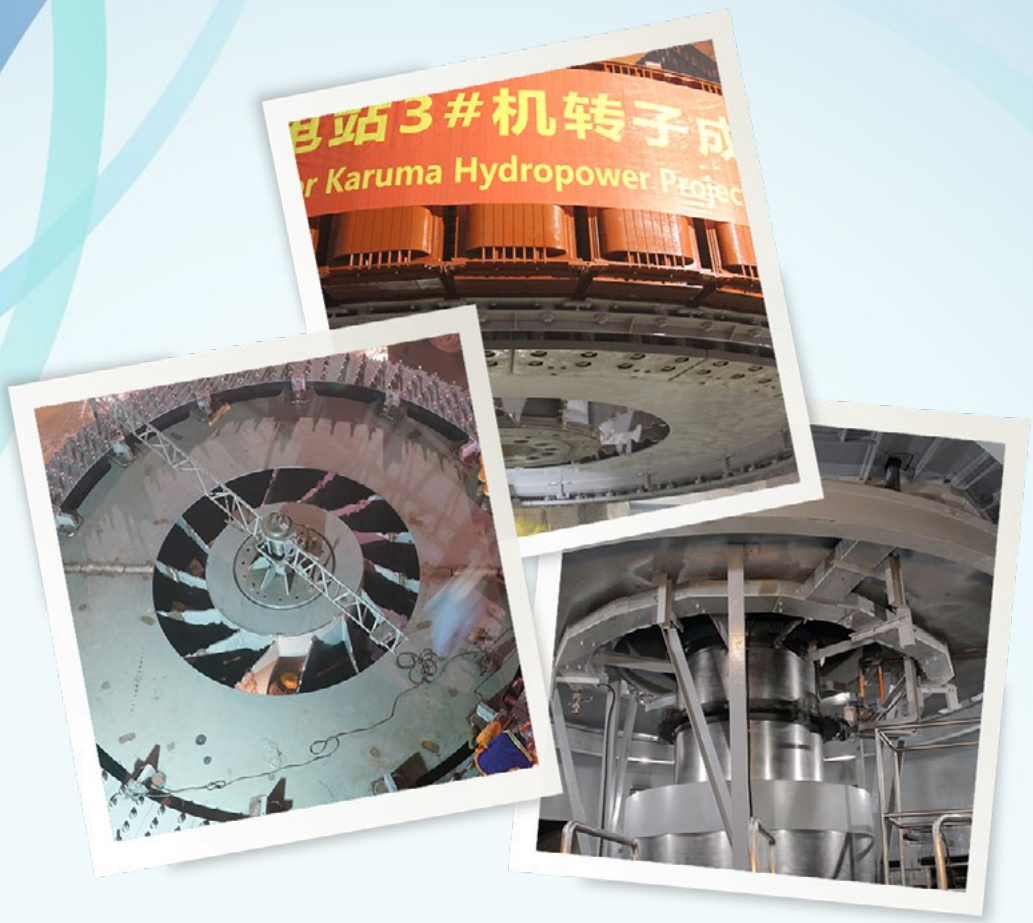
the Dii-Cuinyi Health Facility in Oyam District and the Masindi UPDF Health Centre IV, reflect UEGCL's commitment to improving local livelihoods through its Community Development Action Plan (CDAP) and Corporate Social Responsibility (CSR) efforts.

Beyond its core mandate of power generation, UEGCL envisions leveraging the Karuma Hydropower Plant (KHPP) to spearhead non-core business ventures aimed at diversifying its revenue streams. Recognizing the plant's significant potential for tourism, UEGCL plans to capitalize on existing facilities, including the Club House, Hostel and Canteen, to enhance visitors' experiences. Additionally, the Professional Services Unit will be bolstered by the Hydro Power Resource Centre, a dedicated space where UEGCL's experienced staff can conduct specialized training sessions. This facility will also be available for rental to other stakeholders in the energy sector for similar purposes. These strategic initiatives are designed not only to meet Uganda's growing energy demands but also to foster local economic development by promoting tourism and creating new business opportunities, thereby contributing to the broader socio-economic landscape.

In conclusion, the commissioning of the 600 MW Karuma Hydropower Plant is a testament to Uganda's dedication to enhancing its energy landscape and fostering socio-economic development. This plant stands as a symbol of progress, providing reliable energy and opening doors for innovative business ventures that uplift local communities and boost tourism across the country. As a graduate trainee, witnessing this transition through the final stages has been an invaluable experience, highlighting how energy infrastructure can play a key role in the country's development.

KARUMA | HYDROPOWER STATION

DID YOU KNOW?



At the Karuma Hydropower Project, the Rotor - the rotary part of the Hydro-generator, weighs a whopping 350,000 Kgs. To install it, two Powerhouse Cranes, each with a 200,000 Kg capacity, were combined to handle the great load. Additionally, the turbine shaft connects the Rotor to the Turbine, converting the water flowenergy into mechanical power to generate Electricity.

#KarumaCommissioning
#CommunityDevelopmentActionPlan

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Interview with LCV

Oyam District

Benson Walter DILLA
District Chairperson, Oyam District

Good evening, my names are Benson Walter Dilla Oyuku. I am the District Chairperson of Oyam Local Government, and I am grateful to be with you. Thank you.

Thank you. Please tell us how you feel the Karuma Hydro Power Project has impacted the people you represent of Oyam and Kamdini as we want to get your voice on how you feel the project has been of great help to the community that you represent.

Thank you, I want to thank the Government of Uganda under the leadership of General Yoweri Kaguta Museveni, and of course Parliament of Uganda and the cabinet for having given us this project.

The Karuma hydropower project has so many components under the same project. We used to have what we call load shedding in the country and because of load

shedding, electricity had to be rationed for the industries and the general population. And therefore, the generation company in Jinja would not supply the whole country. With the vision of General Museveni as the president, he looked at Karuma as the best option to help generate more electricity power and also support the neighboring country and of course the communities of this country like the ones in Oyam and Kamdini.

So basically, having the electricity generation company here, the impact will be felt subsequently because we have not started benefitting from the electricity generation directly. It is still under process however, along the way as I have said before, there are components under the same. We have been made aware there are programs under the same project called Corporate Social Responsibility. Under Corporate Social Responsibility, the district benefited by constructing and remodeling a primary school, Amaji. If you can see the level of Amaji now, you would believe that you expect Grade 1 in PLE because of the beauty that can make pupils pass the exams. I believe when handed over, no child should fail in Amaji and no teacher should cry because the school is well-modelled, well-rehabilitated, and well-fenced in terms of security.

Under Corporate Social Responsibility, the district benefited by constructing and remodeling a primary school, Amaji.

So, this is a benefit to the community and the parents who used to collect money to rehabilitate and construct staff houses, even as a district we would be tasked to build houses for teachers. We have 109 schools in Oyam, but very few of them have teachers' houses, if you go to Amaji under this program, it has been well remodeled and the community is benefiting. This is under education, but also, we have another program called the Community Development Action Program, which also constructed two classrooms with staff houses that will accommodate about four teachers in Nora Primary School. Even if it is a stand-alone and the wind comes, we are very strong whatever level. That classroom is well-roofed and well built, it can't be blown out by the wind. So, the community around Nora and in Juma Parish in the Kamdini subcounty has a lot of benefits from this.

As a district, we also equally have a lot of benefits because they have helped us to complete the gaps that the district should have used to look for some money to build maybe one staff house or two. But now they have made us four staff houses with four classrooms in two blocks. That is

very unique and very fundamental. So, the community are very much interested.

This would also mean the government should increase the wages for us to recruit enough teachers so that at the end of the day, there must be results and good performance. You cannot have a school of about 2,000 enrollments with about 12 or 13 teachers. There is still a big gap when you look at it in terms of ratio per child. So, we urge the government as well to increase for us the wages so that we recruit more teachers to give services in terms of educating pupils. Of course, at the end of the day, we expect results.

Under Corporate Social Responsibility, the same project donated to us what should have been a general hospital from the design and the master plan. There have been a lot of political fights here and there, but as a district leader, as long as the facility is in Oyam to deliver services to the people of Oyam, I do not quarrel about where it was constructed.

I also want to applaud the Parliamentary Committee of Health, when they came to visit the Health Center III construction in town council. And I want to appreciate UEGCL for their generosity because it was not part of their contract but this was a win under the Corporate Social Responsibility.

The facility has been taken over by the government under Ministry of Health. They have now done the fencing and provided water. The facility is well fenced. The facility has been connected to the national grid so that the issue of power is sorted. These are already good actions which have already been done there including the fencing.

The land is enough whether for a general hospital, whether the Health Center IV, whichever.

So, I want to thank you for this question you have given me and you have given me time to speak my mind. The health facilities shouldn't be politicized. The health facility is like a hotel, is like police, it is a public good that everyone needs. This facility has transformed the life of our community here. It has also helped us to reduce the maternal mortality rate which is very common in society. And above all, it is on the highway where incidences of accidents happen daily. But if the facility is well operationalized, it will serve the nation, not only the people of Oyam, not only the people of Kamdini.

Thank you so much. You have exhaustively answered the questions.

The land is enough whether for a general hospital, whether the Health Center IV, whichever.

"WE ARE GENERATING"

Operation And Maintenance

Of The 600mw Karuma Hydropower Plant

Andrew GENA
Shift Charge Engineer, Karuma HPP

The first unit at Karuma HPP was commissioned on 22nd March 2023, and since then we have been generating electricity safely while ensuring minimum downtime of individual components of the generating Unit and Plant. The operational reliability of the generating units of Karuma hydropower station is such that whenever the grid demands, it is available for generation. Some of the aspects, which we have taken into consideration, in the Operation of hydropower stations, are given below: Each failure/ tripping occurrence is questioned with a basic minimum of

> *Each failure/tripping occurrence is questioned with a basic minimum of three questions: (a) why this occurred? (b) How this occurred? (c) What is to be done to avoid its re-occurrence?*

three questions: (a) why this occurred? (b) How this occurred? (c) What is to be done to avoid its re-occurrence? This has reduced the failure rate to a greater extent. We have also adopted timely preventive maintenance schedules covering all vital areas and plants, in the detailed Daily, Weekly, Monthly, and Quarterly maintenance schedule. During the replacement of any part or equipment after its full utilization or breakdown, we ensure that the replaced part or equipment is of improved version and of the latest technology having longer durability to meet all desired requirements to increase plant efficiency and reliability. Operating condition is continuously monitored and recorded. Records are very important to diagnose the cause of fault/ failure/ replacement and to determine residual life. Early action is taken before any type of failure occurs. Even though original equipment manufacturers recommend maximum /minimum permissible parameters for their equipment, the records/ experience/ history play an important role in setting limiting values of parameters of this equipment, as characteristics of identical equipment vary from unit to unit and it's required to monitor its set values. Based on the history/records and recommendations of manufacturers maintenance schedules are framed. Breakdowns/forced outages are minimized by proper follow-up

of the maintenance schedules based on recommendations of manufacturers. The life of the equipment, thus, is enhanced. Starting/stopping of the units is planned to be minimal to increase and maximize the equipment life. We have also adopted optimum utilization of the manpower and material in operation. I have benefited from the arranged training for O & M staff to refresh their knowledge to get advanced technical information to improve work quality and quantity. The training of O & M staff has been mandatory for the transfer of O & M knowledge from original equipment manufacturers. Interactions amongst working staff at Karuma power stations have been an ongoing process to improve the performance of plant and equipment in totality to implement good Operation & Maintenance Practices. The provision of an "Online Condition Monitoring System" on the generator, turbine and main transformers was also considered at Karuma HPP.

At Karuma HPP, standard operating procedures (SOPs), work packages, simple maintenance instructions (SMIs) and isolation instructions have been formulated in an easily understandable manner to enhance the operation and maintenance. This is based on the collection and compilation of related information about O&M manuals and technologies, which have been formulated by the manufacturer.

At Karuma HPP, plant operators (Shift Assistants and Shift Attendants) under the stewardship of Shift Charge Engineers, have adopted the following measures: Preventive Maintenance: Preventive Maintenance is planned/routine or scheduled maintenance. Preventive maintenance intends to "prevent" problems or failures before they take place by following routine and comprehensive maintenance procedures. It is designed to improve equipment life and avoid any unplanned maintenance activities. Preventive maintenance covers inspection, replacement, and repair of any equipment or component based on time and set parameters. It includes lubrication, cleaning, adjusting and minor component replacement to extend the life of equipment and facility. Its main purpose is to minimize breakdown and excessive deterioration and to achieve fewer, shorter, and more predictable outages.

The provision of an "Online Condition Monitoring System" on the generator, turbine and main transformers was also considered at Karuma HPP.

Reliability-Centered Maintenance: this sort

of maintenance is defined as “a process used to determine the maintenance requirements of any physical asset in its operating context”. It is an ongoing process which determines the mix of reactive, preventive and proactive maintenance practices to provide reliability at the minimum cost. It recognizes that not all equipment in a facility is of equal importance for generation as well as plant safety. It recognizes that the design and operation of each piece of equipment differs; and, therefore, the possibility of failure differs from equipment to equipment.
In this program, diagnostic tools and measurements are used to assess when a component is near failure and should be replaced.
In this program, the basic thrust is to eliminate more costly unscheduled maintenance and to minimize preventive maintenance. In this type of maintenance, unimportant maintenance activities are left to the reactive maintenance approach. The goal, thus, of this program is to provide the appropriate amount of maintenance at the right time to prevent forced outages while at the same time eliminating unnecessary maintenance.

Predictive Maintenance: this sort of maintenance ensures the ability to judge when a part of the equipment is going to fail and replace the same before it does. Usually, it requires some form of testing and analysis which helps predict an imminent failure. Predictive maintenance can be used in conjunction with preventive maintenance practices. At Karuma hydropower station, there are many monitoring systems, which can be used to predict problems and possible failures. These include vibration monitoring, online oil analysis, temperature, system loading, IR values of generation, efficiency in power generator output, and leakages of oil and water. All of these data can be captured, tracked and analyzed. The results of the analysis of data can predict the future. Proactive Maintenance: The most recent innovation in maintenance is called proactive. It utilizes a technique called “root cause failure analysis”. In this type of maintenance primary cause of failure is diagnosed and corrected.

Reactive (Run to Failure) Maintenance: this is sometimes called crisis maintenance or hysterical maintenance. At Karuma HPP, this has been a discouraged form of maintenance and its costs are relatively high because of the unplanned downtime, damaged

Reactive (Run to Failure) Maintenance: this is sometimes called crisis maintenance or hysterical maintenance.

machinery and overtime expenditure. Run to failure should be a very small part of a modern maintenance program. Planned maintenance is preferred over this type to reduce downtime of the machine and avoid uncalled-for outages.

At Karuma HPP, we are currently undertaking planned or routine/preventive maintenance to reduce not only losses

in revenue, but also save from disastrous happening due to failure to structure(s), and breakdown of equipment at the time when their uses are most needed. This is because the inspection and performance tests during the routine maintenance make it possible to detect or predict deficiencies in the equipment/ structure(s) involved in the hydropower generation for timely planning of rectification, repairs and/or replacement. As such the operator(s) and maintenance staff are striving to be conversant with the physical features and functions of all the components of Karuma hydropower plants such as civil structural facilities, electro-mechanical equipment and the associated auxiliaries, control and safety devices installed.

The facilities, equipment and components selected for the Karuma hydropower plant require regular servicing. The plant operators and maintenance personnel are familiar with the regular servicing required to operate the plant reliably. An accurate and detailed record of O & M duties performed and observations made are necessary for the safe and reliable operation. The plant operation log book/log sheets provide a means of recording plant conditions and changes that affect these conditions, for future reference. The system records of the plant conditions and the records kept by the operator and maintenance personnel are also necessary. From these records, potential problems can often be anticipated and prevented. Shutdowns can be scheduled by observing the trends in the operation of the plant. This will also help determine which spare parts and consumable materials should be kept on hand at the plant.

At the Karuma hydropower plant, aspects worth consideration in the operation of stations are timely preventive and condition-based monitoring aimed at reducing failure rate by ensuring smooth operational levels of the power utility. This has been achieved by adopting a timely preventive maintenance schedule regarding all vital areas of the power project and condition-based monitoring.
As a Shift Charge Engineer, I have been ensuring the quality of Power generation through Voltage, Frequency and reactive power Control/Regulations (Active and Reactive Power management), Supervising personnel safety, Reporting all hazardous events and accidents, Attending to Faults that have occurred to rectify them, Reporting of all Faults/events, stating nature and gravity of faults/events to Operations Manager and Generation manager and I am also the first point of contact during Emergencies.

Karuma's Financing Journey

and how Uganda could finance the next large hydropower project.

Anthony M. WANENDEYA
Graduate Trainee Civil Engineer

On June 13, 2024, Hon. Matia Kasaija, the Minister of Finance, Planning, and Economic Development, presented the Financial Year 2024/2025 Budget speech in a live broadcast televised nationwide. Notably, the Public Investment Plan (PIP) for the financial year did not include any new Large Hydropower project. Instead, the minister allocated UGX 982.56 billion to Energy development, primarily for transmission and distribution networks. A portion of this allocation was designated for preparatory activities related to the 8,400MW Nuclear Power Plant in Buyende district.

Historically, Uganda's significant energy challenges have been addressed through "big solutions," primarily large hydropower projects. These projects have flourished in Uganda since the power sector reforms in 1999. However, with the advent of nuclear power plants, one might wonder if this signifies the end of an era for large hydropower projects. The answer to this crucial national question partly depends on understanding the distinction between viability and bankability.

Viability can take on many forms of definition but it is best defined in terms of economic viability. Economic viability refers to the assessment of whether a proposed project generates sufficient economic benefits to justify its economic costs, considering the impacts on society as a whole. This analysis goes beyond financial costs to include externalities and environmental impacts, which affect individuals outside the project scope. For example, a new Hydropower plant may yield benefits like enhancing regional economic activity and quality of life. Economic viability analysis often incorporates cost-effectiveness evaluations to ensure the project is the most efficient means to achieve the desired benefits.

Bankability according to the World Bank Group, refers to a project's ability to secure financing by evaluating its viability and associated risks. Normally, it is the responsibility of investors, such as international commercial banks, to assess the value and risks of an infrastructure project, determine its bankability, and then provide the necessary capital. This assessment considers factors such as overall costs, timelines, parties involved, return on investment, and other elements that comprise the risk profile. In developing countries like Uganda, bankability involves not only de-risking specific projects but also de-risking the country and its Public-Private Partnership (PPP) programs to attract investment.

A significant challenge associated with hydropower development is

transforming viable large-scale projects into bankable ventures. This challenge has been further exacerbated by economic pressures on the treasury, due to demands from other equally critical sectors. To gain insights into how the government has previously financed large hydropower projects, let's delve into the history, beginning with the Owen Falls Dam, now known as Nalubaale.

Uganda constructed its first substantial hydropower plant in the early 1950s at Nalubaale on the White Nile. A couple of decades later, the World Bank funded the rehabilitation and upgrade projects, increasing Nalubaale's generation capacity to 180 MW by 1996. Collaboratively, the World Bank, the Norwegian Agency for Development Assistance (NORAD), and the Swedish International Development Agency (SIDA) also financed the construction of the 200 MW Kiira hydropower plant.

Uganda's reliance on hydropower, however, exposed the power sector to vulnerable hydrological conditions. From 1998 to 2008, Lake Victoria, the primary reservoir for Nalubaale and Kiira, experienced a 1.5-meter drop in

average water level and in 2005, it reached its lowest point since 1951. Consequently, Uganda's total installed generation capacity plummeted by 60% creating an electricity supply deficit of up to 210 MW, resulting in widespread load-shedding.

In response, the Ministry of Energy and Minerals Development (MEMD) outlined short-, medium-, and long-term objectives to address the power supply shortfall. Immediate crisis mitigation measures included thermal generation and enhanced demand-side efficiency. The medium-term plan encompassed the construction of the 250 MW Bujagali hydropower project and smaller plants nationwide. Long-term solutions involved the construction of large-scale hydropower plants, namely, the Karuma (600 MW) and Isimba (183 MW) projects.

The 1999 power sector reform envisioned that new generation capacity would be mainly financed as Independent Power Producers (IPPs) through competitive bidding by private investors and developers. Karuma began in the late 1990s as an IPP led by Norway's Norpak Ltd., but Norpak withdrew from the project in 2008 when it failed to find sufficient funds to move beyond the feasibility stage (Viability stage). The GoU resumed the project in 2010 and hired an Indian firm, Energy Infratech, to conduct new feasibility studies. Infratech redesigned the power plant, increasing capacity from 250MW to 750MW although the project was scaled back to 600MW.

The 250 MW Bujagali dam, the most significant IPP project in Uganda, was prioritized by the World Bank for construction over the Karuma project. With an estimated total investment volume of US$ 860 million, the Bujagali HPP still ranks among the largest privately financed hydroelectric power projects in Sub-Saharan Africa. Bujagali began operation in 2012, however, construction delays and inflation caused the dam's cost to soar from US$ 460 million to US$ 862 million. Instead of the estimated tariff of US$6 per kilowatt hour, power from Bujagali sells for up to US$11 per kilowatt hour. This painful experience has caused GoU officials to question whether IPPs should

> *For this, let us do a hypothetical linear estimation of Financing for the 840 MW Ayago and 400 MW Kiba Hydropower projects using the two cases: the IPP model and the EPC - China Finance.*

be the vehicle for large hydropower projects, with concerns that this model is too expensive and time-consuming.

In 2002, a significant reform transformed China's power system, resulting in the establishment of separate State-Owned Enterprises (SOEs) for different functions: Grid, Generation, and Construction/ Consultancy. The Construction & Consultancy SOEs are exclusively tasked with developing new hydropower projects, with Power China being a prime example of such enterprises.

Building on the experience gained since the 2002 reforms, China's state-owned companies have expanded their hydropower projects globally. Notable examples include the 600 MW Karuma Hydropower Project in Uganda, the 2,400 MW Bakun Hydropower Plant in Malaysia, and the 1,250 MW Merowe Hydropower Project in Sudan. These projects are executed under the Engineering Procurement and Construction (EPC) model with Chinese financing.

When comparing working with the Chinese to IPPs, several advantages immediately become apparent. The Chinese offer more attractive financial assistance, making financing and construction quicker and more efficient. Their most significant advantage is their substantial financial resources. Chinese loans often exceed the maximum amounts offered by international financial institutions and carry lower interest rates. For instance, in the Karuma and Isimba projects, China Exim Bank provided a loan covering 85% of the total project cost, saving the government valuable time and effort coordinating multiple financiers. Crucially, these projects have maintained a tariff below US$ 5 cents per Kilowatt hour, significantly lower than the Bujagali HPP.

On the downside, the EPC – China Finance model presents a potential risk to the project's quality. Chinese contractors would only be involved in the construction phase as turnkey builders, without assuming any ongoing responsibility as owners or operators of the dams. This arrangement could incentivize substandard work, as contractors would be motivated to minimize costs. However, the IPP model alleviates some of these risks since

> *The IPP model, with its higher upfront costs, promises quicker returns and revenue generation due to shorter construction times.*

the IPPs are expected to be compliant with international regulatory, quality and environmental standards.

For this, let us do a hypothetical linear estimation of Financing for the 840 MW Ayago and 400 MW Kiba Hydropower projects using the two cases: the IPP model and the EPC - China Finance.

First, consider the cost implications. The IPP model projects a significant financial burden upfront. For Ayago, the cost is projected at US$ 2,984 million, while Kiba stands at US$ 1,402 million. These figures starkly contrast with the EPC - China Finance model, which presents a more economical US$ 1,876 million for Ayago and US$ 1,000 million for Kiba. The evident reduction in initial expenditure under the EPC model can be particularly appealing for a government constrained by immediate budget limitations.

However, cost alone does not paint the entire picture. The construction timeline is another critical factor. Under the IPP model, Ayago would be completed in eight years and Kiba in six, allowing for quicker integration into the national grid and earlier revenue generation. This is vital for meeting urgent energy demands and leveraging the projects' economic benefits sooner. Conversely, the EPC model extends these timelines significantly, with Ayago taking 14 years and Kiba taking 9 years. The prolonged construction period delays the operational phase, postponing the much-needed energy supply and potential economic benefits.

One might question the emphasis on hydropower. The explanation lies in the cost per megawatt of installed capacity. Data from the 2023 energy policy published by the Ministry of Energy and Mineral Development indicates that hydropower has the lowest costs at US$ 1.97 million per MW. In contrast, nuclear power costs US$ 6.77 million per MW, while waste-to-energy represents the most expensive option at US$ 8.8 million per MW. Additionally, Uganda possesses established expertise in hydropower development. It is therefore logical to fully exploit this potential before pursuing more costly alternatives.

In conclusion, striking the right balance between the IPP model and the EPC - China Finance model for hydropower financing presents a distinct set of trade-offs. The IPP model, with its higher upfront costs, promises quicker returns and revenue generation due to shorter construction times. In contrast, the EPC - China Finance model offers lower initial capital expenditure, which eases immediate financial burdens but extends the project timelines, delaying operational benefits. Ultimately, the best strategy for Uganda would harmonize short-term liquidity needs with long-term economic stability, ensuring sustainable energy development.


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Interview with RDC

Kiryandongo District

Mr. Dan MUGANGA
Resident District Commissioner

My name is Dan Muganga, the Resident District Commissioner, Kiryandongo District, which is part of Bunyoro sub-region, and one of the districts hosting Karuma Hydro Power Dam in this area.

The role of the RDC's office in the supporting the Karuma Hydropower Station is to oversee the security of the area and also to mobilize the population to support the activities ongoing at the dam. This is a very, very big infrastructure that will take Uganda to another level through the supply of power that will boost production, industrialization, and job creation.

And the community has been eagerly waiting. As a district, we are eager to see that the increased power supply will help us to reduce and address the power gaps.

Thank you. Now that the Karuma Hydropower Station has been officially commissioned, how do you feel the project has impacted the area of Kiryandongo in terms of social and economic development?

Economically, some

of our youth got some casual jobs with the contractor, earned some money and some livelihood improvement. Secondly, through the community resettlement plan, the affected persons have been able to put up new structures. New businesses have come up around Karuma Town Council and along the power line, all the way throughout Kiryandongo.

Regarding the construction of the project, it came with some community development projects, and that is under the Community Development Action Plan (CDAP), which is a whole master plan. And so far, we have implemented Diima Primary School, where we gave classroom blocks. What would be your take on such developmental projects that came with the construction of this hydropower project?

The projects of that nature have been helpful. Of course, some of those primary schools had old structures. And when you look at even sanitation, in those areas, they had increased school dropout. But right now, there's more school enrollment, and this one is now supporting us in the education sector.

Two, harmonization, it has harmonized communities that would be aggrieved. That would, in the long run, lead to improved quality of life. We look forward to more of these projects.

When you say impacted, there are some gaps, of course, like the health sector. The whole of that area does not have a hospital. It's a long stretch from Karuma up to Kiryandongo Hospital. And this is a highway area with high rates of accidents. The project has led to migrations, people have migrated from other areas and settled around. Population has increased and now, there's a challenge in the health sector to address health issues.

Getting back to your question, in the future regarding such community development programs, because the dam is here to stay, and more programs will come up. We'd request to have a district hospital constructed, either by supporting the existing hospital to be upgraded to a referral, because the numbers are high. And this is a refugee hosting district. We have a big, big population under the Kiryandongo Refugee Settlement, which is located in Bweyale. The numbers are surging because of the migrants who came due to the project. Some people are here to stay. They came as workers. Some have finished their work, but they can't go back to their home districts or home countries. They are here to stay.

Therefore, there is need to increase services to health, water, and roads. When you look at the Karuma Town Council, the road infrastructure is not that good. The streets need more roads opened up within the town council, and even the lighting I don't

think the town council also has power they are only tapping through rudimentary ongoing projects, but they need their own power, which will boost production and productivity.

How do you encourage the locals around here to take advantage of such opportunities to get connected to the national grid as well as government efforts in connecting more people and access to clean energy and doing away with using rudimentary methods of energy like firewood?

First of all, this community is neighboring the park. Our conservation efforts have been affected by the communities going in to cut trees for firewood and charcoal, and at the moment we have no alternative where we need to divert them. Therefore, we welcome the project, but also have a local connection under the rural electrification program to see to it that these small towns, communities, and schools, are connected. Therefore, we can base on that to convince them to abandon the rudimentary methods. There are other smaller interventions like the refugee programs under disaster response under Office of the Prime Minister, but those are not enough, where we teach them alternative energy sources, specifically on electricity, let's have the connections which will increase access and enable us to convince the population to get away from the park where they are cutting trees.

So, we are waiting for electricity from the National Grid, as we know that all electricity generated from Karuma is put on the same grid and we do not see a local connection network started. Therefore, it is high time that UEGCL and other government agencies look at connecting rural areas resulting from the construction of the dam so that we see also these lines lit so that they provide power.

In other sub-counties, we have few connections under rural electrification, people have embraced paying for electricity. Farmers in Kiryandongo have engaged in mass production. When you look at Mutunda Subcounty and the area of Kimogola where there is high production of maize, people have maize mills, they want to put up milk cooling plants others want to engage in welding, but they don't have power. So, it is high time that our people are connected to the grid. When you look at Bweyale, Chopelwo and Katulikire, all those areas, Bweyale itself, have over 500 maize mills, but they get serious power interruptions. Therefore, we are looking at added power.

For the settlements, the power is not enough, and that's why the refugees move out in mass numbers and attack the vegetation. So we need more power connections. And with the commissioning done, then we are headed for the best.

And what are your last

remarks and request to the Government as the host district of Uganda's flagship project?

Yes. One, we are looking at; there are a few affected persons under the community access program who still have some issues and we urge your mother ministry, MEMD to address the compensation issues, resettlement issues, so that our people are not annoyed with the project.

Two, Kiryandongo, and this is the feeling, that other districts got a lion share. There are key projects that have been implemented in other areas that lead to our people not being happy, so we urge UEGCL to do an analysis of the CSR and other action resettlement programs that you have implemented in districts like Oyam, and you replicate the same this side so that we can feel for better.

Thirdly, we'll look at reduced unit cost of electricity. Our people are expectant that when oil comes, then price of fuel is going to go down, likewise once you power Karuma, our people are looking at reduced power of electricity.

Then local content, getting our people jobs in the dam. We have some of our young people who are graduating and some have relevant skills. So our youth can be absorbed and therefore this would address the issue of unemployment.

Thank you very much for giving us your time, and we appreciate your message to the people.

You are welcome

Efficient Records Management: Driving

Karuma HPP's success story

Andrew Asasiira, Odetta Natuhwera, Proscovia Nuwagaba
Records management team

Records management is crucial for individuals and organizations and must be handled with utmost attention if results are to be achieved. For any individual or organization that overlooks this responsibility, the repercussions are disastrous. This reminds us of a Lady, who lost her ticket once on a bus transit. For some of us who have never travelled in Ugandan buses, this shouldn't happen to you if you are a good records keeper. When you board a bus, you are given a ticket as proof of payment, and in the middle of a journey, another person, "Bus Inspector," comes in requesting every individual seated on a bus to present his/her receipt, without which is a proof you never paid. This happened to Joan (not her real name) on the bus who never cared for her ticket well upon receiving it and was made to pay again. Her remaining journey was ruined due to her poor records management abilities. She was disappointed and kept blaming nobody but herself. Just like this lady's experience, poor

records management at a major project like Karuma Hydropower Plant (HPP) could lead to serious problems, such as losing important documents, delayed operations, and causing unnecessary costs to an organization. One scholar Sanderson wrote that "good records management improves the efficiency and effectiveness of public service delivery by reducing litigation risks, promoting accountability and transparency, ensuring compliance with regulatory requirements, and promoting informed decision–making" which has been very key at the helm of Karuma HPP's success.

Records in an organization are key and are like blood in the human body. Without it, the body cannot operate and this leads to death if a person doesn't get immediate care. For any organization to function excellently well, records must be given much attention too. As employees of UEGCL, we must guard and care for the company's records well because they provide a rich history of the company, evidence, and accountability, leading to better decision-making by its governing body, and reducing litigation costs. At Karuma HPP, the importance of records cannot be overstated. From construction blueprints to operational guidelines, every document plays a vital role in ensuring that the plant runs efficiently and meets regulatory and safety requirements. Poor record-keeping in such a high-stakes environment could delay maintenance schedules, disrupt power generation, and compromise safety compliance.

One of the key issues in records management is reading—not simply reading, but reading with understanding. There's a saying that "If you want to hide anything from an African, put it in writing." This indicates a general weakness in reading, especially with lengthy texts or records. Perhaps, it's due to the absence of a reading culture, where investing time in reading seems like a waste. Traditionally, reading is often confined to academic pursuits, aimed at passing exams. We begin reading in school, focusing solely on achieving high marks. Reading helps in understanding the purpose of a particular record, its value, and impact on an organization, and how long it should be

good records management improves the efficiency and effectiveness of public service delivery by reducing litigation risks, promoting accountability and transparency, ensuring compliance with regulatory requirements, and promoting informed decision–making

kept or stored. Failure to pay attention to reading a record will make you throw it in the dustbin, and you may be shocked to find it on the streets being used as packaging for chapati and tomatoes. At Karuma HPP, where thousands of drawings, architectural designs, and technical and financial records are generated, understanding what each document represents is crucial. Properly documented water-flow reports, plant safety regulations, energy generation log sheets, turbine maintenance records, and compliance certificates ensure smooth plant operations and accountability.

Implementation of a Records Management Program in an organization is critical to maintaining efficient business practices and procedures. Any organization should have a records management program to have its records managed professionally throughout their entire lifetime. In this way, records must be managed and cared for well when they are in registries and offices. When they are moved to records offices, they must be managed and be retrievable as fast as they are. During our first days at UEGCL in early 2024, a fellow staff from a different department visited us in the records office requesting stationery from the store, and the response was, “We don’t have access to the store.” Then he posed a question, “What are you here for?” We would like to address this question partly in this way: a records management program like that of UEGCL optimizes the use of records while limiting the costs and risks that can come with poorly managed records. Organized records should meet the following tests over time: improving access to information (a record can be located, retrieved, presented, and interpreted in context), meeting legal requirements (complete and unaltered), safeguarding vital information (a record can be proved to be what it purports to be, created or sent by the person purported to have created or sent it), reducing operating costs, minimizing litigation risks (contents of records can be trusted as complete and accurate), supporting better management decision-making, and preserving the rich history of the organization.

Today, we deal with a lot of electronic records since most business transactions are conducted electronically. UEGCL creates, receives, and maintains a variety of electronic records. Electronic records are fragile, yet they are key to the success of the organization. It is therefore prudent

We don’t have access to the store.” Then he posed a question, “What are you here for?

that, as a Records and Archives Professional, I effectively manage electronic records throughout their lifetime. In addition, we are in a position to guide our organization in making strategic decisions regarding electronic records management and information management. The scale and complexity of Karuma HPP make electronic records management even more critical. From real-time monitoring systems to digital maintenance logs, electronic records must be carefully stored, retrieved, and protected to ensure uninterrupted plant operation. BIP (Business Information Portal) a UEGCL platform has enabled our electronic records storage, sharing and retrieval with authorized access.

Management of electronic records involves addressing various issues, including creation, identification, storage, retrieval and access, retention, and disposal. These will be examined while relating to different organizational contexts. The creation of an electronic record marks the beginning of e-records management. Records are either born-digital, like emails, or created through conversion/digitization. Electronic document management helps organizations exploit information more effectively and support the immediate operational requirement for business information. Electronic records management supports the medium- to long-term information needs of the business, building and maintaining the corporate memory. To achieve this, UEGCL requires that all its Documents/Records be managed systematically and logically in compliance with legal and regulatory obligations. UEGCL's mandate is to establish, acquire, maintain, and operate electricity generation facilities and to promote research and development in the electricity generation sector while running the Company on sound business principles.

Its vision is to be one of the leading power producers in the Great Lakes Region, and its mission is to sustainably generate reliable, quality, and affordable electricity for socio-economic development. Having this in mind, Uganda Electricity Generation Company, through its information management team, installed an ERKS called the Business Information Portal (BIP), which handles all its Electronic Records and enables collaboration among its employees. If you want to stay at the top of the technologies here at UEGCL, kindly make our UEGCL BIP a home. For a project as large as Karuma HPP, an efficient records system like BIP is indispensable, ensuring that all critical plant records are secure, accessible, and well-organized and can be shared for the operations of the plant.

The records management team guarantees the security of the company's records. Security is very key in any record-keeping system—be

it physical records or electronic, all fall under the same category when it comes to security. Electronic records typically include features such as encryption to protect data both at rest and during transmission. Regular backups are performed to prevent data loss, ensuring that records are safe even in the event of a system failure or disaster, and strong passwords protect records from unauthorized access, retrieval, or alterations. These security measures are essential for maintaining the integrity and availability of records, protecting them from unauthorized access, corruption, or loss.

As earlier mentioned, records management is important, and it's everyone's responsibility because, if poorly managed, its impact affects everyone in an organization. I, therefore, call upon us, in our homes, daily operations, and at work, to handle records and documents well, ensuring their security, maintaining confidentiality, and preserving their intended purpose. With this, we shall exercise a high level of service delivery at our duty stations and raise UEGCL's flag high. With Karuma HPP now fully operational and available on the national grid, its success depends not only on technical expertise but also on efficient records management, ensuring smooth operations and long-term sustainability. Together with this in mind, we shall raise the UEGCL flag high.

Generating for Generations!

Records As A Bedrock

For Good Corporate Governance Amongst MDAs

Paulo HYUHA
Senior Records and Archives Officer

For any Government of Uganda (GoU) MDA (Ministry, Department & Agency) to be praised for good governance or rebuked for bad governance, there are many contributing factors, of which availability of records and the effective management thereof is one of the critical factors. But what exactly is a 'record'? and what does 'records management entail'? According to ISO standard 15489, a 'record is any recorded information created, received and maintained as evidence and as an asset by an organization or person, in pursuit of legal obligations or the transaction of business. Whilst 'Records management' is a field of management

> *At UEGCL, transparency, accountability, and safety are key physiognomies of good governance, which are essential for the company`s success.*

responsible for the efficient and systematic control of the creation, receipt, maintenance, use and disposition of records.

As per the Chartered Governance Institute UK & Ireland (2024), 'Corporate Governance' refers to the system of rules, practices, and processes that oversee the direction and control of a company. Corporate governance ensures that businesses have suitable decision-making processes and controls in place to balance the interests of all stakeholders, including shareholders, employees, suppliers, customers, and the community.

One of the key ways in which MDAs are held accountable for their actions is through evidence of business transactions in the form of records. Maintaining accurate records of business transactions is crucial for making the right decisions and ensuring good governance. In Uganda, all MDAs, including UEGCL, undergo scrutiny and evaluation, and they need to provide evidence of their activities. These records serve as proof of their actions and decisions and are vital for being accountable to stakeholders.

At UEGCL, transparency, accountability, and safety are key physiognomies of good governance, which are essential for the company`s success. Transparency builds trust through open communication and access to information; accountability encourages responsible decision-making; and safety protects stakeholder interests. To demonstrate accountability and compliance, UEGCL maintains various documentation including fiscal and procurement records, agreements and contracts, management papers, board minutes, personnel files, property and maintenance records, project and technical documents, etc. These records can be used to validate past decisions and provide insight for future planning.

To improve systems and service delivery and to make the management of public affairs more transparent and less prone to abuse, GoU has established several institutions and committees like the Office of Auditor General (OAG), Anti-Corruption Units, the Committee on Commissions, Statutory Authorities, and State Enterprises (COSASE), Public Accounts Committee (PAC), etc. These entities provide checks and balances for the management of MDA affairs. While performing their audit role, all these institutions heavily rely on records and documentation as the main source of proof and evidence.
Often in the media, public figures or government officials come under scrutiny for violating systems, processes, regulations, or even engaging in corruption. In such cases, the evidence usually comes from records. Whenever MDA Accounting Officers are summoned by committees like COSASE, OAG, or PAC,

they are required to provide specific documentation and records. Auditors use this documentation to identify and verify instances of abuse, misuse, and non-compliance with laws and regulations. Some accounting officers fail to provide the requested information for various reasons, such as loss or lack of documentation. Even when information is provided, there have been instances where the records are inaccurate, incomplete, unreliable, or not authentic.

In most audit findings, the auditing authorities have highlighted the lack of proper documentation and poor record-keeping as key areas that MDAs need to improve. Records and the evidence they contain are essential for MDAs to establish trust and demonstrate a commitment to good governance. The 2023 Auditor General's report cited poor record-keeping practices in most audited entities during the period. This poor record-keeping has a significant impact on the entire accounting function, making reporting and auditing virtually impossible.

Failure of an MDA to keep a record of its important files poses costly non-compliance issues and legal repercussions. This means that decisions are made on an ad hoc basis without the benefit of records. Fraud cannot be proven, and meaningful reporting and audits cannot be carried out. During the February 27, 2019, parliamentary debate on the closure of seven banks (Greenland Bank, Teefe Trust Bank, International Credit Bank, Crane Bank, National Bank of Commerce, Gold Trust Bank, and Cooperative Bank)), former Prime Minister Hon. Ruhakana Rugunda stressed the need for documentation and maintaining clear records for all dealings conducted by civil servants to ensure transparency and good governance. He is quoted to have said, "There should be a clear record of anything we do as civil servants for the sake of transparency and good governance.".

Many records and historical documents are at risk from various threats like poor environmental conditions, inadequate storage, unsafe handling, theft, vandalism, and natural disasters. For instance, a fire destroyed valuable records at Makerere University in 2020. It's crucial for organizations to proactively address and mitigate these risks to protect these valuable collections.

It should be noted that records management is not a choice, but rather a statutory obligation. International standards like ISO 15489 and national Acts and regulations exist, providing principles or requirements for managing records. Nationally, laws like the National Records and Archives Act (2001); the Access to Information Act (2005); the Companies Act (2012, Section 154); the

Anti-Money Laundering Regulations (2015, Section 42); PPDA Act (2003, Section 41); the Electricity (Reporting and Record Keeping) Regulations, 2019; the Electronic Signatures Act, 2011; the Treasury Instruction, 2017; the Public Finance Management Act, 2015; the Uganda Public Service Standing Orders, 2021; among others, require that MDAs keep, maintain and manage records relating to their operations. Hence all organizations need to identify the regulatory environment (laws, regulations, codes of best practices) that affects their records management.

Good corporate governance necessitates easily accessible and usable records to ensure integrity, transparency, and accountability. Effective records management practices are crucial for government organizations to safeguard themselves from legal issues and inefficiencies, and to comply with legislative requirements. However, many organizations neglect recordkeeping and only prioritize it when disasters, legal issues, or scandals arise. UEGCL currently stores over 90% of its records and documents in analogue paper form without any backup in case of disasters such as fire or flood. This situation makes it challenging and time-consuming to access analogue information. Furthermore, the process of handling correspondences is typically manual-involving physically moving paper documents between the Head Office and the Plants (Karuma, Isimba, Namanve, and Nalubaale-Kiira). Relying on a paper-based process can lead to unnecessary delays, longer turnaround times (TAT), and limited traceability. Therefore, UEGCL should embrace digital enablement through workflow automation and digitization. The transition to digital processes will enable secure information access, promote collaboration, facilitate remote working, boost team efficiency, and shorten workflow processing times, while also promoting a paper-light office environment.

Quotes:

1. “Providing access to reliable records is a necessary prerequisite for accountability, transparency, and good governance” Elizabeth Shepherd, an English archival scholar.

Providing access to reliable records is a necessary prerequisite for accountability, transparency, and good governance

Elizabeth Shepherd, an English archival scholar

AXE REGISTER

Membro degli Accordi di Mutuo Riconoscimento EA, IAF Signatory of EA, IAF Mutual Recognition Agreements

CS 007 25.02.22

CERTIFICATE

N. UG24-15805C

This is to certify that the Occupational Health and Safety Management System of

Uganda Electricity Generation Company Limited

P.O. Box 75831, Plot 6-9, Okot Close Bukoto, Kampala – UGANDA

HAS BEEN INDEPENDENTLY ASSESSED AND IS COMPLIANT WITH THE REQUIREMENTS OF

ISO 45001:2018

for the following scope of activities:

The establishment, acquisition, operation and maintenance of electricity generation facilities to the satisfaction of stakeholders.

IAF 25

For timely and up to date information on any changes in the status of the certification referred to in this certificate, please contact the number +39 0296368458 or the e-mail address info@axe-register.com

The validity of this certificate is subject to annual periodic surveillances and the complete review of the organization's management system every three years.

Date of initial registration	11/11/2024
Date of this certificate	11/11/2024
Date of expiry	10/11/2027

On behalf of the Certification Body
AXE REGISTER
Authorized Signatory
Amministratore

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UEGCL Achieving Integrated Management

System Certification for ISO 9001:2015, 14001:2015, and 45001:2018: A success story to Generating safely for Generations.

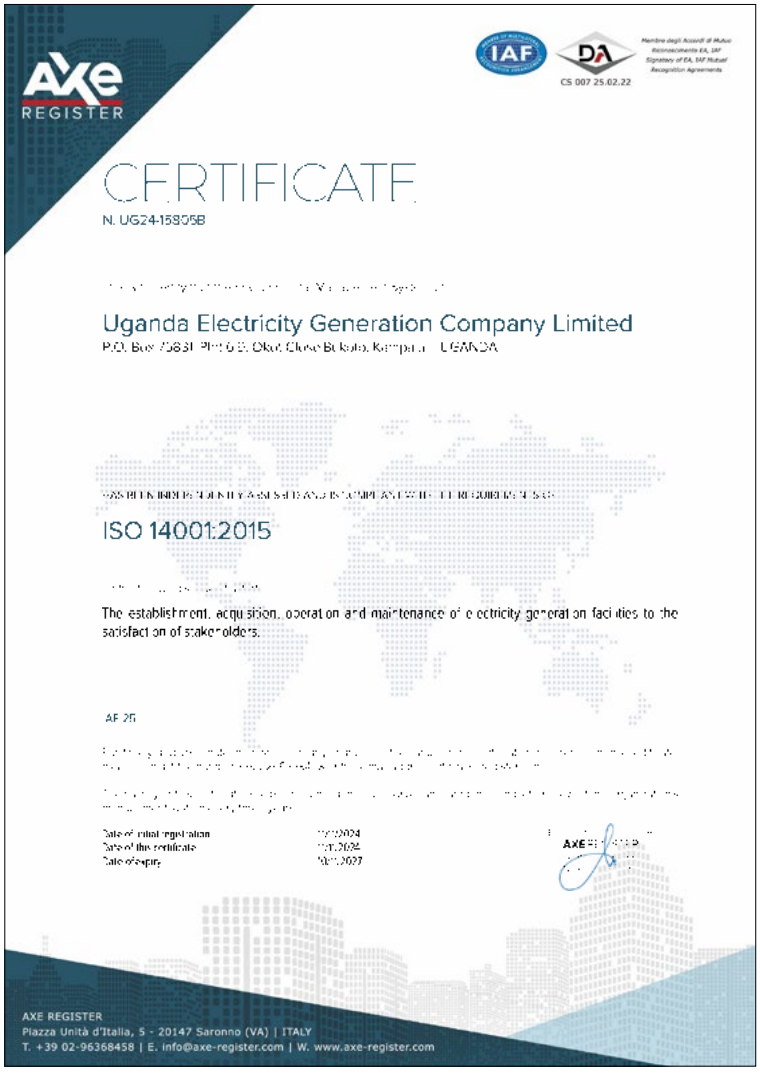
Nicholas WALYENDO
Manager Quality Assurance

On the 11th of October 2024, Uganda Electricity Generation Company Limited (UEGCL) achieved ISO Certification for Integrated Management Systems based on ISO 9001:2015, 14001:2015 and 4001:2018. The success is a result of nine days of rigorous certification audits at all UEGCL sites/plants conducted by ACM Limited/Axe-Register Germany-based Company. ACM Limited is a globally accredited body that assesses and provides certification services against International Organization for Standardization (ISO) Management System Standards. This is the first of its kind in the Government Ministries, Agencies, and Companies, including the Energy sector. Congratulations to the UEGCL Board, Top Management and Staff on this milestone.

This IMS Certification means a global recognition of UEGCL's well-implemented and maintained Management System that grants operational excellence in observing and adhering to good health and safety practices while mindful of sustainable use and interaction with

the Environment. What then brings the difference is the way we have done things from day one putting our clients' long-term success at the heart of everything we do.

The journey: Having acquired and sustained ISO 9001:2015 Certification in the year 2017, UEGCL, in July 2022, embarked on the journey to establish a Safety, Health, Environment and Quality Management System. This was a deliberate decision by the Board and Top Management to have the functions of Safety, Health, Environment, and Quality into a single process to streamline operations and help the Company synergize these closely related activities to improve efficiency and productivity.



In order for UEGCL to effectively realize this strategic decision, the Company needed to execute this process and its activities in an Integrated Management System. Based on the decision, UEGCL developed and implemented an IMS roadmap in such a way that the output conforms to customer satisfaction without violating any environmental, safety, and health rules and regulations. It's upon this trajectory that UEGCL underwent several process redesigns and modifications, self-assessments, awareness, and external assessments to achieve IMS Certification success.

A question on many minds now is, what exactly is UEGCL reaping from implementing IMS and getting the Certification? There are three core achievements registered so far.

First and foremost, efficiency and productivity: The IMS has led to more efficient operations within the UEGCL business by eliminating duplicate tasks and ensuring that processes are aligned with the entire organization. Developed and implemented Standardized procedures across all the different Departments to ensure uniformity in operations and outputs.

Secondly enhancing UEGCL's Compliance regime: UEGCL has developed a unified compliance system to multiple regulatory requirements to reduce the risk of non-compliance and associated penalties. UEGCL is more able to effectively track and manage compliance requirements across different standards and regulations.

Thirdly; increased customer satisfaction, improved risk management, and Sustainability and Social Responsibility. These are key strategic objectives outlined in the UEGCL's Strategic Plan 2023-2028 with IMS as one of the earmarked initiatives to realize these objectives. The Company has set up a comprehensive approach to risk management; identifying, assessing, and mitigating risks across various levels. The company has defined its stakeholders, developed engagement and monitoring plans to ensure stakeholders needs and expectations are met. The holistic approach has helped the organization reduce its environmental impacts, improve resource efficiency, and meet its sustainability goal.

Eventually, with IMS Certification, UEGCL's commitment to provide a healthy and safe work environment to meet the needs and expectations of its stakeholders and ensure the protection of Company equipment and assets is a priority. The Company's approach to recognising the need to meet the requirements of the Occupational Safety and Health Act 2006 and International Standards, including ISO 9001:2015, 14001:2015, and 45001:2018, is a day-to-day assignment to every staff. Key practices onboard, such as staff/contractors/ suppliers at all plants, recognize staff management of their own safety and safety for others. Adherence to safe systems of work such as the Lock Out Tag Out (LOTO) and Permit to Work (PTW) system is mandatory in all activities at each power plant. Regular inspections, risk assessment, toolbox talks, incident reporting and investigation, stakeholder engagement, compliance monitoring and enforcement, review and implementation of SOPs, among others,

> *Make electricity safely available for supply at all times from all our power plants*

are part and parcel of UEGCL's Culture.

UEGCL's Purpose is to "Make electricity safely available for supply at all times from all our power plants".

Therefore, continued commitment to IMS Certification for safety, health, environment and quality is a trajectory towards socio-economic transformation.

Generating Safely for Generations!

Manager Quality Assurance

Generating Safely for Generations.

AXE REGISTER

IAF DA

CS 007 25.02.22

CERTIFICATE

N. UG24 15805A

Uganda Electricity Generation Company Limited

P.O. Box 75831 Plot 6 9, Okol Close Bukoto, Kampala UGANDA

ISO 9001:2015

The establishment, acquisition, operation and maintenance of electricity generation facilities to the satisfaction of stakeholders.

IAF 25

Date of initial registration 11/11/2024
Date of this certificate 11/11/2024
Date of expiry 10/11/2027

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What it Means to

be a Female Engineer

Proscovia NANKYA
Shift Charge Engineer

My journey in this field started as a Graduate Engineer with Bujagali Energy Limited at Bujagali Dam. I worked there for almost 2 years before moving up to Assistant Electrical Engineer with WENRECo, coordinating with funders like KFW in implementing their funded programs in West Nile. I am currently a Shift Charge Engineer with Uganda Electricity Generation Company Limited (UEGCL) at Karuma Dam, where I have been stationed since September 2016.

Working at UEGCL has presented both challenges and opportunities. On a good note, I have been exposed to several

> *On a good note, I have been exposed to several opportunities, like international training, that have significantly improved my skills and knowledge as someone passionate about renewable energy.*

opportunities, like international training, that have significantly improved my skills and knowledge as someone passionate about renewable energy. These trainings have exposed me to current issues, which helps me to adapt easily to reforms and innovations in the field of UEGCL. For instance, the training that I attended at Kafue Gorge in Zambia for 3 months prepared me for the upcountry work experience as a lady engineer. I was encouraged by other lady engineers, and the resilience developed from this training has kept me at Karuma for over 7 years now.

While working on a large-scale underground power generation project has been technically demanding, the organizational culture, colleague support, and access to resources have made my job significantly easier and more comfortable. Working with the operations department has provided a hands-on understanding of how things work in practice. My UEGCL experience has given me a broader perspective on the socio-economic impact of projects, as well as an understanding of the regulatory environment. I have learnt about EPC contracts, public-private partnerships, compliance requirements, stakeholder engagement, and the importance of sustainable development. I have gained experience working on a multi-disciplinary project with multi-cultural project teams.

On the other hand, working as the only female engineer has presented gender dynamics in my role as I, at times, feel the emptiness of not having a fellow female engineering manager on site to consult on some issues. The least exciting experience on this job has been working the night shift and being on duty on weekends, thereby missing my child's big moments. The lockdown at the site during the COVID-19 pandemic was also tough. Having to stay away from my family for extended periods has been challenging as I have missed important family events and milestones, especially for the toddler. It is also difficult to manage household responsibilities while working upcountry. Additionally, working in a distant place has posed safety risks like weekly bus travels while trying to be present at work during the week and being a mother and wife during the weekends. Despite these challenges, I have found ways to adapt, such as better planning, seeking support from my supervisor, and using technology like video calls to stay connected to family.

From my experience, there is a need for policies to ensure flexible working hours, better parental leave options, and supportive childcare facilities in the workplace. It is also important to promote gender diversity and inclusion by establishing mentorship programs, addressing gender bias, and creating

a more supportive environment for women in engineering fields. I, therefore, urge UEGCL to keep up the spirit of dedicating funds to internal improvements like new technology and training human resources because investing in capacity building is investing in growth.

The survival of any project is highly dependent on the skills, knowledge and experience held by the employees and the management team. Highlighting FATs (Factory Acceptance Tests for Equipment), for example, these trainings have had the advantage of helping us to save time and costs that would be associated with fixing problems that would possibly arise with the equipment at the dam. I am excited to note that as a female electrical engineer, I have made commendable achievements in the field, including the following:

- The successful completion of the Wet Commissioning of Karuma HPP units Project to achieve the Commercial Operations Date (CoD).
- Rising through the ranks from a Graduate Engineer to an Assistant Electrical Engineer in Wenreco, to currently as a Shift Charge Engineer. I have also been seconded to various committees like safety, risk, and grievance management.
- The opportunity to mentor young future engineers, particularly young girls from schools like Gayaza High School, where I have championed creating a WhatsApp group for female engineers in Uganda to encourage and support each other.
- Contributing to my community development of Kiwanga in Mukono as a member of the security and development community committee. Here, I have focused on encouraging the installation of security lights in our village roads and helping the Chairman solicit funds to maintain our village roads.

If I had the chance to advise my younger self, I would be keen to insist on embracing challenges. Do not be afraid to take on difficult projects and responsibilities. Each challenge is an opportunity for growth. It is also good to have mentors in the field because their guidance and support are invaluable in navigating the engineering field. As a female engineer,

The survival of any project is highly dependent on the skills, knowledge and experience held by the employees and the management team.

it is important to balance your career and personal life.

Furthermore, networking is very important: Connect with colleagues, join professional organizations, and attend industry events. Engaging and networking with other engineers in these capacity-building trainings exposes us to experts in the field; we build connections and eventually share knowledge and skills over the years. Also, one has to keep updated with the latest advancements in electrical engineering, so it is good practice to invest in continuous education and training, seek opportunities for advancement, and negotiate for fair compensation.

After a career that spans almost 10 years in this field, I am confident to say that reflecting on the positive impacts I have made, the skills acquired, and the professional satisfaction that comes with my role, electrical engineering was the right choice. I aim to be a role model and mentor for other women in the profession.

Karuma's Deepwater Horizon & So Much More

Charles KYALISIIMA, Enos KALYESUBULA, and Gasper AKUHE
Civil Engineers

The year is 2017 and the construction at Karuma Hydropower Project is at its peak. The rest of the country is held up in Uganda Cranes' heart-breaking performance at the AFCON games, and Hon. Mbidde's kowtowing in someone's poohoo [sic]. But for a select team of graduate engineers, 2017 offers an entry ticket into the world of mega-engineering – the kind you only encounter in documentaries.

Concrete works at the dam site have recently resumed, following an 08-month stoppage during which improvements to the concrete production processes were proposed & adopted. These ranged from precooling of aggregates, replacing part of the water in concrete production by ice to keep its temperature at the placement point below 20°C, use of moisture probes, development of new mix designs with increased fly ash content and new water-reducing

& air entraining admixtures.

A Panel of Experts has been brought on board, and investigations to resolve the TRT fault zone uplift are at a close. The critical path has been negatively impacted and the December 2018 completion deadline seems "so far, and yet so close!" The 90th minute is upon us!

7000 workers, doing 02 shifts – day & night – are deployed at the multiple construction sites and every involved stakeholder is pushing full throttle; the Contractor delivering the work packages, the Owner's Engineer, project management consultants and Client (UEGCL and MEMD) undertaking several project management activities. Project management has ten knowledge functions all of which were performed by the three stakeholders (OE, PMC and Client). Despite the known challenges common to most mega-infrastructure projects around the world, the highest level of teamwork is exhibited and all parties are working collaboratively to realise progress.

Project quality management as one of the core functions of project management involves planning, managing and controlling quality. Most of the processes related to planning quality management were done during the pre-construction phases of the project which saw the development of an Employer's Statement of Requirements, which formed the basis for quality management and control. Being a flagship megaproject, quality management was a priority and was carefully handled.

As the waters of the River Nile navigate their way through the serene Karuma village, a 14m-high barrier (dam) brings its flow to a halt – and a reservoir is thus created. In the event that the reservoir is not given an outlet, the dam will overflow and possibly slide or topple. As per the Karuma design, 06 inlets (intakes) divert flow 70m below ground through six 7.7m diameter (2-storeys high) tunnels, channelling it to the powerhouse where it drives 06 hydroelectric turbines that in turn generate 100MW each.

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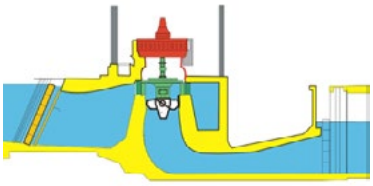

Courtesy: CNR Training Handbook

Just as a present-day audit of a road project would reveal an overdesign for the existing traffic conditions, similarly hydropower construction is intended to meet the energy needs of future generations. With electricity access at 11% (2010 baseline), the Uganda Vision 2040 Master Plan foresees ameliorating this figure to 80% - with improved livelihoods and an 8.4 percent point (average) GDP growth per annum by the year 2025.

"Energy and in particular electricity is a driver of socio-economic transformation of a nation. This necessitates generation and development of sufficient sources of energy to drive an economy. For Uganda to shift from peasantry to an industrialized and large urban society, it must be propelled by electricity as a form of modern energy." [1]

"There is a strong positive correlation between industrialization and rapid development, ... with the need to have a strong industrial base to cushion the economy from external shocks. A strong and competitive industrial base is therefore, important to create employment, advance technology and a resilient economy." [2]

Back to Karuma! With up to 4 million cubic meters of excavated rock, it sits in the world's top 10 and as Africa's number one, in terms of underground rock excavation for an infrastructure project. The project consists 04 underground caverns, 26km worth of tunnelling works, and necessitated 45,000 tons of steel & 690,000m3 of concrete. In comparison, The Burj Khalifa, utilized a

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record-breaking (up until 2009) 39,000 tons of steel and 330,000 cubic metres of concrete. And that's just the tip of the iceberg!

The Karuma engineers changed the course of the world's longest river, thrice! Yes, you read that right! (Going) once, twice, thrice! Speaking of walking on water, or more figuratively, on a river bed. Feel free to be amazed!

This was possible through the use of a rather ingenious engineering concept known as a cofferdam. A cofferdam is a watertight enclosure, temporary in nature, that is used to expose the bed of a water body to permit construction in dry conditions. Particularly, the cofferdam downstream of TRT Outfall was removed by excavation and the aid of controlled blasting.

On a "normal" day, there are over 20 work fronts – all buzzing with construction activity. Concrete is produced from the batching plant at controlled conditions; each concrete batch having a mix design suitable for site-specific conditions. After production of each batch, the fresh concrete properties would be determined before transportation and prior to placement. Placement was prohibited in ambient temperatures exceeding 35°C, with water jets on Hessian geotextile fabric and provision of shades, all employed as measures to alleviate thermal cracking.

Hydraulically powered slip-formwork platforms elevated construction teams, materials and equipment up to 45m above the Surge Chamber floor; gantry formwork sections were erected for tunnel concrete lining works up to 12.9m (4-storeys) high, and cherry pickers deployed for hoisting investigation teams undertaking anchor bar (reinforcement) pull-out tests & final inspection before final acceptance for water filling.

Every inch of both tailrace tunnels was surveyed & inspected – and findings recorded with utmost precision vis-à-vis location. With a combined length of 17km, and spanning 12.9m in diameter, these structures harboured us for some time. The authors recall a time when the clock system of recording locations was invented. Eavesdropping on one of our exhaustive discussions would leave audiences more confused than educated. "At 12 o'clock on Block 601 in TRT #1, there is honey combing." Creativity

and innovation were two wheels of a bicycle for the human brain.

Water filling of TRT #1 and TRT #2 was completed on August 28th 2019 and October 1st 2020, respectively.

It is said "scars have the ability to remind us that the past was real," and yet some wounds run deeper and heal longer than others. The year 2020 is forever etched in our memories – personally and institutionally. From the scores of fatalities that dominated international media, to the domestic violence that was a defining characteristic of broken families, the after-effects of the COVID-19 pandemic remain with us to date.

A typical evening at the Camp 2 cafeteria brings to memory scenes from the acclaimed TV series Prison Break. Grown men, fathers, husbands – lining up for an evening meal, or perhaps in a seemingly endless queue to wire Mobile Money to their loved ones – for those who were fortunate enough to still have loved ones waiting on them.

For the first time in centuries, the Chinese New Year, one of the most grandiose annual celebrations will find the world's second-largest economy under lockdown. For the Karuma Project, the repercussions were crushing. Three months into the second project completion time extension, the imposed COVID-19 lockdown meant that Chinese specialists, team leaders, and system owners could not travel; disrupting the procurement & delivery of electro-mechanical equipment – bringing the works to a threatening standstill pace.

"What you have experienced, no power on earth can take from you! Not only our experiences, but all we have done,

> *What you have experienced, no power on earth can take from you! Not only our experiences, but all we have done, whatever great thoughts we may have had, and all we have suffered, all this is not lost, though it is past; we have brought it into being. Having been is also a kind of being, and perhaps the surest kind." – Viktor E. Frankl (Man's Search for Meaning)*

whatever great thoughts we may have had, and all we have suffered, all this is not lost, though it is past; we have brought it into being. Having been is also a kind of being, and perhaps the surest kind." – Viktor E. Frankl (Man's Search for Meaning)

Lessons were everywhere, for the vigilant, to be learnt. First, negotiation and conflict resolution! After a while, the human condition became unbearable. The EPC Contractor's workers were "No longer at ease!" In several of such scenarios, Gasper & Herbert rose to the occasion, addressing fears, clarifying expectations, & harmonizing the interests of all Project parties. The ceaseless interventions by the site safety teams were a sight to behold. And UEGCL Management stuck faithfully to its mandate, to the welfare of its essential workers.

Success at last! After the heart-breaking attempt at wet commissioning of Unit #2, coupled with the sedimentation challenges encountered during the TRT Outfall gate lifting operations, the first Unit was ready for trial operation with grid connection. The date is April 1st 2023.

A bonanza of culture and languages, the Karuma hydropower project brought together Ugandans from all walks of life, and multidisciplinary professionals from all over the world. With the knowledge shared and experience gained from our constant interface with the Chinese (EPCC), Indians (EIPL), Europeans (OE, PMC & POE), and multi-sectoral engagements with local stakeholders, our appreciation of the world as a global village is eternally realized.

We, all three, are forever indebted for the once-in-a-lifetime opportunity granted to us that September day. We shall for all time hold fond memories of this little village, its kind people, the sunset walks, and acknowledgment of a job well done!

"As a young engineer, you do not really learn anything on a project where everything goes as planned. There's very little problem-solving on your part" – Stuart, PMC

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