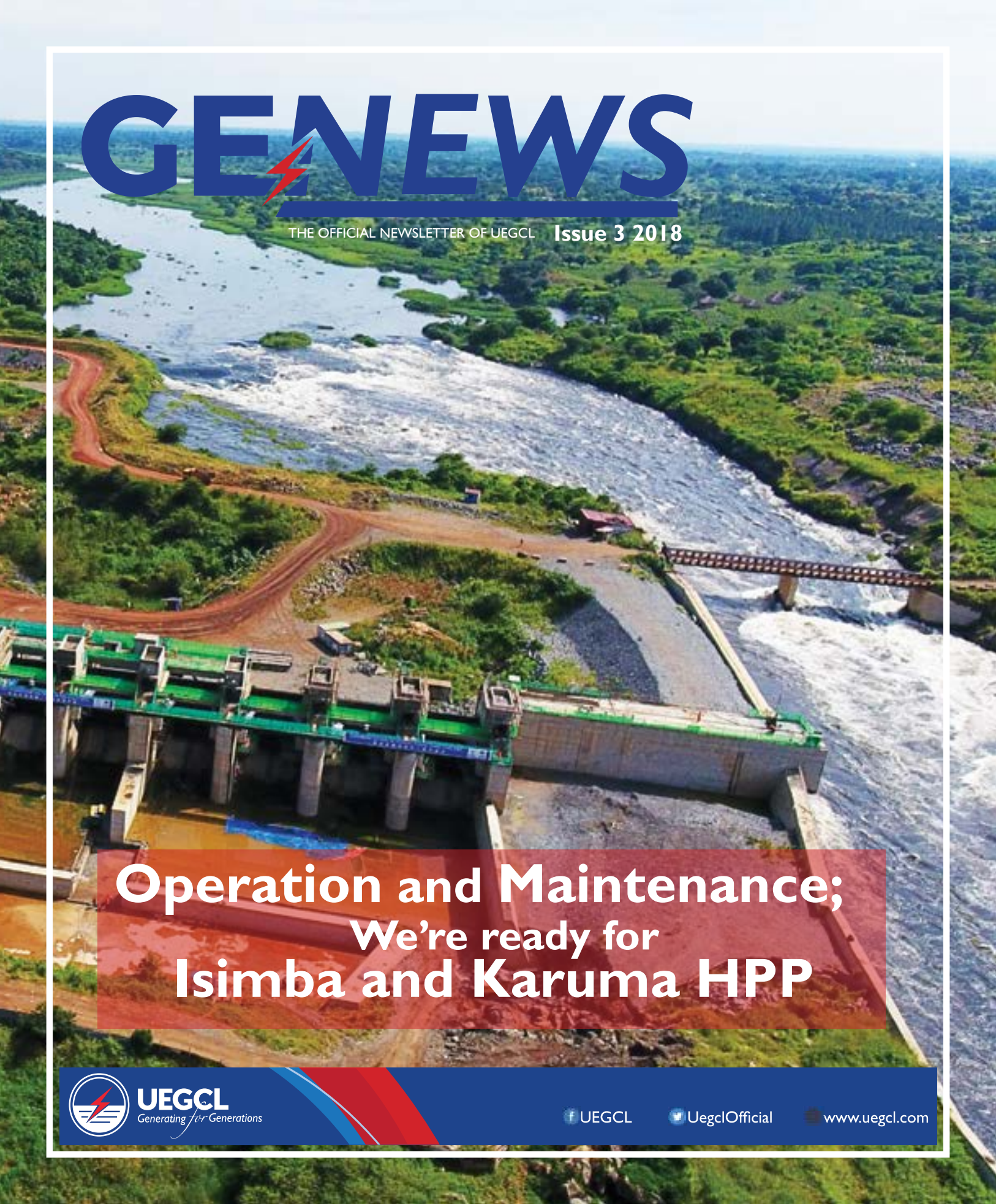

GENEWS

THE OFFICIAL NEWSLETTER OF UEGCL Issue 3 2018

Operation and Maintenance; We're ready for Isimba and Karuma HPP

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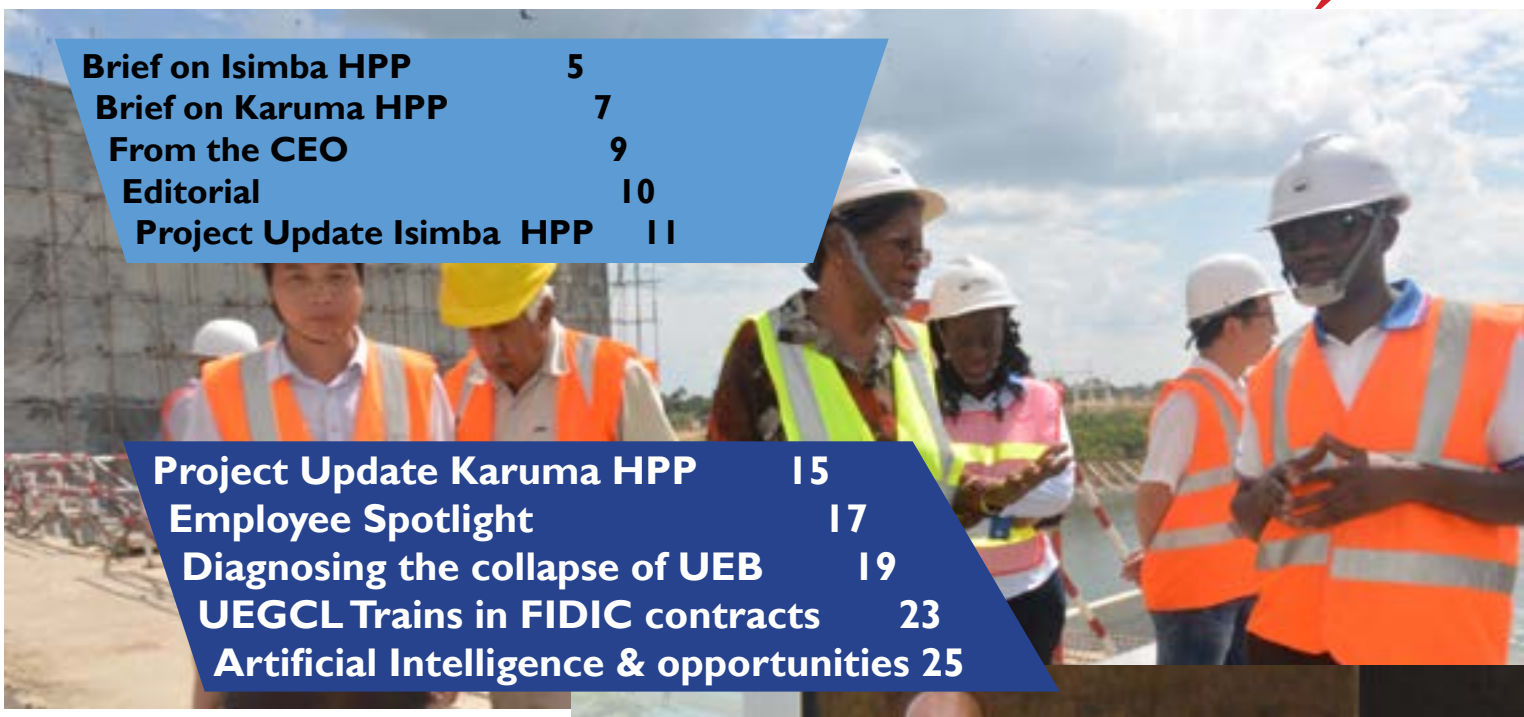
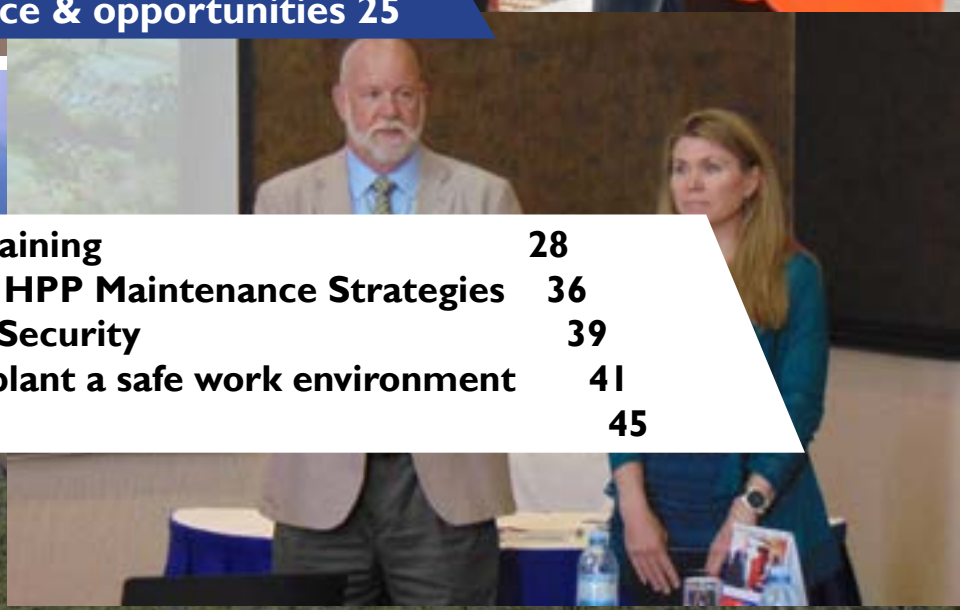
The dam section of the 600MW Karuma Hydropower Project (KHPP)

Contents.





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ISIMBA HYDRO POWER PROJECT(IHPP)

The 183 MW Isimba Hydro Power Project (HPP), is located 4km downstream of Simba Falls on the River Nile, approximately 50 km downstream of the source of Nile. The project site is about 21km from Kayunga Town as the nearest town and about 65km from Jinja Town.

Background and Key Dates

05th October 2013: Construction works launched by President Yoweri K. Museveni

30th April 2015: Project commencement Date

Type of Plant: Run of River Plant

Data : Installed Capacity The power station will be installed with four vertical Kaplan turbine-generator units with acapacity of 45.8MW per unit, thereby providing a combined installed capacity of 183.2MW.
Gross Head = 15.4m, Design Discharge = 1375 m3/s,
Mean Annual Energy Output: 1039 GWh
Concrete Dam: 14m high and 314m long.
Embankment Dam - Maximum Dam Height = 26.50m ,
Total Embankment Dam Length = 1424 metres.
Gravity Dam - Max Dam Height = 26.50m, Gravity Dam Length (Including Guide Walls) = 140m

Contract Price: USD 567.7 Million

Project Financing: 15% GoU (Upfront) and 85% Loan - China EXIM Bank

Contract Duration: 40 Months

Expected Completion Date: August 2018

Main Project Components : The Civil Works of the Hydropower Project Part mainly consist of Embankment Dam, Spillway, Powerhouse, and Switchyard. The Water Retaining Dams compose of Left-bank Earth Rock fill Dam (LED), Gravity Wing GDI, Gravity Wing
Wall GD2, and Right -bank Earth Rock fill Dam (RED)

KARUMA HYDRO POWER PROJECT (KHPP)

The 600 MW Karuma HPP is located on the Nile River in Kiryandongo District in mid-northern Uganda, 110km downstream of Lake Kyoga, and 270km from Kampala the Capital of Uganda.

Background and Key Dates
12th August 2013: Construction works launched by President Yoweri K. Museveni

Type of Plant: Run of River Plant

Data: Installed Capacity: 600MW, Gross head: 70m, Design discharge: 1128m3/s, Mean Annual Energy Output: 4.373 billion kWh, Concrete Dam: 14m high and 314m long, Water conductor system: 6 x 7.7m diameter Tunnels approximately 238m long, 6x Tailrace Branch Tunnels (TBT), Surge Chamber and 2x Trailrace 8,609m and 8,707m respectively. Tunnels (TRT) with finished diameter of 12.9m and length of 8,609m and 8,707m respectively.

Contract Price:
USD 1.7 Billion (Karuma HPP – USD 1,398,516,759 and Karuma Interconnection – USD 289,905,220)

Project Financing: 15% GoU and 85% Loan - EXIM Bank of ChinaContract

Duration: 60 Months

Expected Completion Date:
December 2018

Main Project Components:
Dam, Power Intake, Power House, Transformer Cavern, Surge Chamber, Pressure Shafts, Cable Shaft and Tailrace Tunnels

From the CEO

Dr. Eng. Harrison E. MUTIKANGA
UEGCL CEO

"Commencement of operations will be a major milestone for UEGCL"

It is with pleasure that we welcome our readers once again to the 3rd edition of the GENEWS publication which is aimed at informing our stakeholders about the various exploits and undertakings of the Company. This article is special as it comes at a time when significant progress has been made in the construction of the flagship projects of Karuma (600 MW) and Isimba (183 MW). This therefore marks the beginning of a transition phase from project implementation to Operations and Maintenance, a task that is cardinal to the future sustainability of UEGCL. My statement will therefore highlight our preparedness to efficiently and effectively operate the hydropower plants, and furthermore give a synopsis of our Quality Management System, efforts towards meeting the Government Generation Targets and finally provide an overview of this GENEWS publication.

O&M – we are ready

As already alluded to, the Karuma and Isimba hydro power stations will soon be up and running. Commencement of operations will be a major milestone for UEGCL and therefore all our efforts are geared towards ensuring a seamless and flawless transition into operations.

As will be recalled, the UEGCL O&M model is premised on the following tenets; efficient operations, affordable and competitive end user Tariffs, use of indigenous capacity (local content) profitability and sustainability.

It is with this in mind that UEGCL set out on a plan to develop its O&M capacity, hinged on two major pillars namely the recruitment of the core O&M Team, and the capacity building. Two years ago, we recruited young, talented, industrious and qualified folks to form our core O&M team. The timing was deliberate; so that they are present to appreciate the 'making of' the projects and to have a full understanding of what they will operate and maintain. Beyond this, we have over the years exposed them to trainings, apprenticeships, and internships in various locations both within and outside the country. For several weeks about a year ago, some 20 of these staff went to the Kafue Gorge Regional Training Centre (KGRTC) in Zambia; less than a month ago another batch of slightly over 20 returned from a 40-day training in China for a 'similar plant experience' in preparation for Isimba's commissioning. In between, we have conducted several trainings and collaborations with renowned international Utilities and Training institutions like Chelan of USA, CNR of France, and International Centre for Hydropower (ICH) of Norway etc. We have taken the team through Contract Management as well as Dam Safety training.

It's not wrong to deduce that perhaps it's because of the above experience and exposes that we have registered good and unfettered progress on both the Karuma and Isimba projects. Key to note is that in order to achieve economies of scale, we have had experts from outside coming to Uganda and Training our staff on home ground. This has benefited a wider group, and also given credence to our nascent Training Facility in Jinja. In summary, our team is therefore ready for the much fettered task of Operations and Maintenance.

Two years ago, we recruited young, talented, industrious and qualified folks to form our core O&M team.

Quality Management System

I am proud to inform you that a year ago, UEGCL was ISO 9001: 2015 certified! This is by no means a simple achievement in this sector. The ISO 9001:2015 Quality Management System, which we attained, is an international Quality Management Standard (QMS), applicable to all organizations irrespective of their sizes, sector or location. The purpose is to challenge them to demonstrate ability to provide goods & services that meet customer and applicable regulatory requirements. Our clamour for this certification was, and remains to illustrate our unwavering commitment to improving and streamlining our various processes and activities such as O&M, monitoring of operations at the Kiira/Nalubaale Complex, enhancing our procurement processes, Human Resource management, and our Information technology platform. The most recent surveillance audit, undertaken after a year of certification, scores us highly, a huge commendation for staying the ISO course.

Meeting the Generation Targets of Government

"To be One of the Leading Power Producers in the Great Lakes Region", is our Vision. We remain committed to delivering on the challenge set out in the National Development Plan NDP II and Vision 2040. According to these two policy documents, for Uganda to attain middle-income status by 2020, the target for electricity access is at 30 per cent and average consumption at 578 kWh per capita. Currently electricity connectivity is wallowing around 20-25% while average per capita consumption is at slightly under 100 kilowatt-hours per capita (kWh per capita). This is one-seventh of the consumption in Zambia (767 kWh per capita) and a paltry less than 3 per cent of the global average (3,026 kWh per capita) from the 2013 energy indicators provided by the International Energy Agency report of 2015 on key world energy statistics. Some pundits have challenged us thus, "why are you building more dams when we have more electricity than we can consume?" Like with classical economist Keynes, we believe that 'supply creates its own demand'. No investor with high power load requirements will risk to come invest in a country without adequate power, rather most investors of this nature are on the prowl looking for a location with reliable and adequate electricity-which we are striving to deliver. While at it, we are also having a discussion within the sector; should we bill on capacity or energy? The former denotes that we bill what's available at our generation plants and the latter denotes that we bill only that which is consumed. To enable us earn a good return to service the loans taken to build these facilities and to facilitate a good and adequate O&M regime, UEGCL is a proponent of billing on capacity or a model that supports the Company drive for financial sustainability. You will read some inferences to this discussion in more detail in this magazine.

Overview of the GENEWS

This edition is special in more ways than one. It's largely illustrative and picturesque, showing the outside aesthetics evolving with the development of these flagship projects. I mean, the view upstream from the Mbulamuti ferry crossing will never be the same again, and so will Karuma as viewed from the famous Karuma Bridge or in Nora along the Karuma-Gulu highway! We are striving to make the inside of these plants equally if not more captivating, creating a conducive environment for our operations and the visitors that shall occasionally come.

The depth and diversity in the content of this magazine has been made possible by some of our partners that have shared some insightful reads. These include UETCL, UMEME and ERA. I thank you and please keep it up. I also wish to convey thanks to the Ministry of Energy and Mineral Development for the guidance in policy and in other ways; The Ministry of Finance, Planning and Economic Development; the Regulator, ERA, the Parliament of Uganda especially the Committee on Natural resources; the Project Steering Committee; and in a special way our Development Partners. We of course do not forget our indefatigable staff who have steered the Company to its current position.

You will all find this magazine as reassuring as it is informative in reiterating –with greater detail- what I have shared above.

Enjoy.

UEGCL
Generating for Generations

Editorial

Simon P. KASYATE
Corporate Affairs Manager

"Welcome to Toronto, a city of two seasons; Winter and Construction," bellowed a tour guide's voice from the overhead speakers of a double-decker bus on which I was perched along with several tens of tourists taking a breather from a 2006 conference I was in town to attend. The sights and sounds of Toronto from the spectacular CN Tower to the shoreline boulevards notwithstanding; the idea of a city of two peculiar seasons just baffled me. I had to ask the guide when I got a moment for just the two of us. "Over here, we are either constructing a new or maintaining the old OR its winter. That's what these two seasons simply mean," he said. A dozen years and I have never forgotten those words. The philosophy behind this, he added, was that without maintenance, you allow for dilapidation and eventually destruction.

> *"Over here, we are either constructing a new or maintaining the old OR its winter. That's what these two seasons simply mean,"*

Never has this made more sense to me than when I got involved with, first working at an old hydropower plant and now with the construction of new hydropower plants. The buzzword in both places is Operation and Maintenance, popularly acronymed as O&M. Karuma (600MW) and Isimba (183MW) have been designed to last a century – only if well maintained and operated to international best standards. The failure to do so, experts assert, spells doom and gloom, not merely for the life of these installations but for the economic growth and development of this country/region, which they were built to propagate. According to a World Bank presentation to the HydroPower O&M workshop in Martigny Switzerland in October 2016, "Lifetime of the dams is virtually infinite provided they are designed, constructed, operated, maintained and monitored well." I agree. The World Bank also opined that where O&M is with the asset owner as shall be the case with Karuma and Isimba, the overriding advantage is that the owner has the highest interest in ensuring a sustainable flow of revenues and the long-term safety and performance of the facility. This is by far the best model only limited by the fact that more often than not, public institutions are usually constrained by the absence of resources, both human and financial. UEGCL, as you will read from this publication has and continues to do an incredible job with regard to capacity building in preparation for O&M.

> *"Lifetime of the dams is virtually infinite provided they are designed, constructed, operated, maintained and monitored well."*

Welcome to this, our 3rd edition of the biannual GeNews publication, an edition dedicated to UEGCL's O&M preparedness for the new flagship hydropower plants of Karuma and Isimba. This time next year, these two plants shall be 'firing away on all cylinders'. Our O&M preparedness will be put to its greatest test and the contents of this magazine speak to our preparedness and readiness to face up to this noble but uphill challenge.

This magazine is out just after the regulator Electricity Regulatory Authority (ERA) announced the 3rd quarter tariff adjustment for the end user tariff for both the domestic and industrial consumer. This announcement has generated quite some cry and hue; an increase of 52 shillings per unit for the domestic consumer and varied increases for the industrial consumer for peak, off-peak and shoulder periods. The life-line tariff, that's the first 15 kWh for domestic consumers, has increased from 150 shillings to 250 shillings per unit.

The reasons advanced for this upward trajectory in the tariff have been presented. From reading through this magazine, you will appreciate more the nexus between poor O&M of generation facilities and the tariff. Needless to state that poor O&M will sure lead to an increased tariff and the reverse holds true. So now you agree why to us at UEGCL, good O&M principals and practices remain a driving force. Enjoy the read.

This is the current aerial view of the Isimba(183MW HPP) powerhouse as seen from the view point

Status update on Isimba HPP

Meme KAGGA &
Kato KAAGA

Artelia Eau &- KKATT LTD; Isimba HPP's new owners' Engineer!

ARTELIA EAU & ENVIRONMENT, an international Engineering, and Environment Consultancy firm in consortium with KKATT CONSULT LIMITED, a local Ugandan firm is Isimba HPP's owner engineer. **KKATT CONSULT LIMITED** is one of the fastest local growing Engineering Company in Uganda.

In Mid-January 2018, Uganda Electricity Generation Company Limited (UEGCL) under the auspices of Government of Uganda (GoU) hired the new Owner's Engineer (OE) for the Isimba Hydro-Power Project taking over from Energy Infratech Pvt Limited (EIPL) whose contract expired in September 2017.

The two firms (ARTELIA/KKATT) won the opportunity of becoming the Consulting Engineer on behalf of the Client (UEGCL) for the then troubled Isimba Hydro Power dam project late last year in 2017.

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Current status

Currently, the consultant has embarked on design review, providing quality supervision and assurance, plus ensuring strict enforcement of contractual obligations by China International Water and Electric Corporation (CWE), the Engineering Procurement & Construction Contractor (EPCC), for the project in all aspects of the consortium's expertise.

"It was humbling and professionally rewarding for KKATT a (Local firm) to be part of such a huge hydro development infrastructure", Said, Eng. Kato Kagga, adding that working with Artelia & Eau a (Foreign-based Firm) would change the face of engineering in Uganda as government actualises the BUBU policy!

Uganda being conceptualized around strengthening the fundamentals of the economy to harness the abundant opportunities around the country such as abundant labor force and energy. To achieve the aforementioned, the government has laid strategies for local ambitious companies to participate in realising the country's Vision 20/40. Therein, envisages transforming society from peasant to middle-income economy by putting in place mega infrastructure developments such as the Isimba Dam.

KKATT CONSULT as a local Ugandan company is involved in building on the progress that has already been made plus addressing strategic bottlenecks that have constrained Uganda's socio-economic development. In Uganda's Vision 20/40 and as well as UEGCL's Mission, both have created and provided jobs for our economy plus employing the best engineers to supervise and work on the dam.

These, in turn, have gained more knowledge from the International expatriates from ARTELIA EAU & ENVIRONMENT Company of France-based at Isimba HPP.

Although KKATT has been in several sectors in Uganda and South Africa including Energy, Transportation, Oil & Gas, Water, Structures, Asset Management. The Isimba Hydro Power Project is the first multi-skilled project for KKATT. In that vein, we're striving hard to deliver the right services within time, cost and quality to ensure long lasting working relations with all the clients and key stakeholders. Additionally, UEGCL-KKATT has provided services to sectors within and outside Uganda including clients like UNRA, NW&SC, CNOOC, Total, to mention but a few. KKATT as a firm is committed to providing quality services in performing her duties in a professional manner clouded with integrity abiding by professional and legal requirements at all times. A Quality Management System conforming to Local and International Standards is implemented and maintained by the company with the aim of meeting the Expectations of her Clients, Communities, Shareholders, and Employees.

The local on-site staff has gained a variety of closures and knowledge in line with their duties. Hence, this adds value to their knowledge and experiences which will subsequently benefit the Ugandan economy in addition to ensuring sustainable, reliable and constant generation of power.

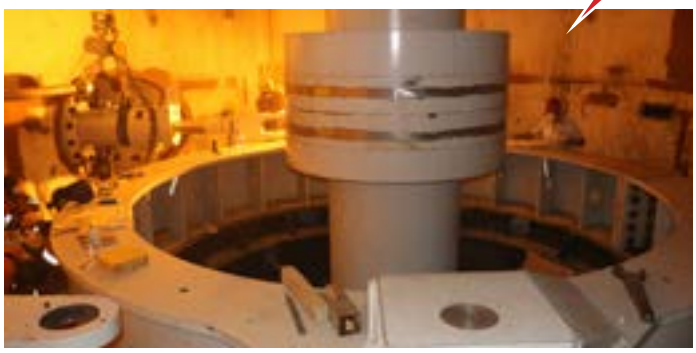
Through the Buy Uganda Build Uganda (BUBU) Policy, which allows for the participation of the locally established firms in the domestic market, KKATT has attained and will enhance the efficiency in the local market because of her additional participation in supervising the Isimba (183MW) Hydro Power Project. With such policy frameworks, no doubt Uganda is on the path to transforming into a middle-income status economy.

Finally, KKATT, as an indigenous company, appreciates the opportunity UEGCL has given to her by working hand in hand to deliver sustainable, reliable, quality and affordable electricity for socio-economic development for our country. As an entity, we pledge to provide "RIGHT FIRST TIME" services which consequently result in long-lasting working relations with Clients.

Progress at the Current:

Overall physical progress according to the OE: Artelia & KKATT consortium is 87% as of 30 June 2018 broken down as follows;

Civil Works: Concrete works approx. 99.8%, gravity dams 1 & 2 completed, spillways 1 & 2 completed, tailrace apron completed, wall cladding of powerhouse building using masonry blocks ongoing, roofing works (roof truss and roof covering) completed, By the end of August 2017, Concreting of Unit 1, 2, 3 and 4 were at elevations 1045.45, 1045.45, 1043.71 and 1043.71 respectively. RED material placement of clay, coarse filter, fine filter, and rock fill is ongoing, LED foundation treatment completed. Placement of materials has commenced. Decoration works & tiling in the powerhouse is underway.



Finalising instalations for unit two generating machine at Isimba HPP

Transmission: Design 99.5%, Concrete casting for tower foundations 149/149, Tower Erection 149/149, Tower Grounding 140/149, Cable & OPG Wire stringing (KM) out of 41.5; 28km is done. Works under this category to a tune of 83.41% have been certified as completed.

Electromechanical Works: EoT Crane installed and tested, upstream and downstream gantry cranes, cooling units are already delivered to the site. Approximately 80.35% of electromechanical works have been certified as completed.

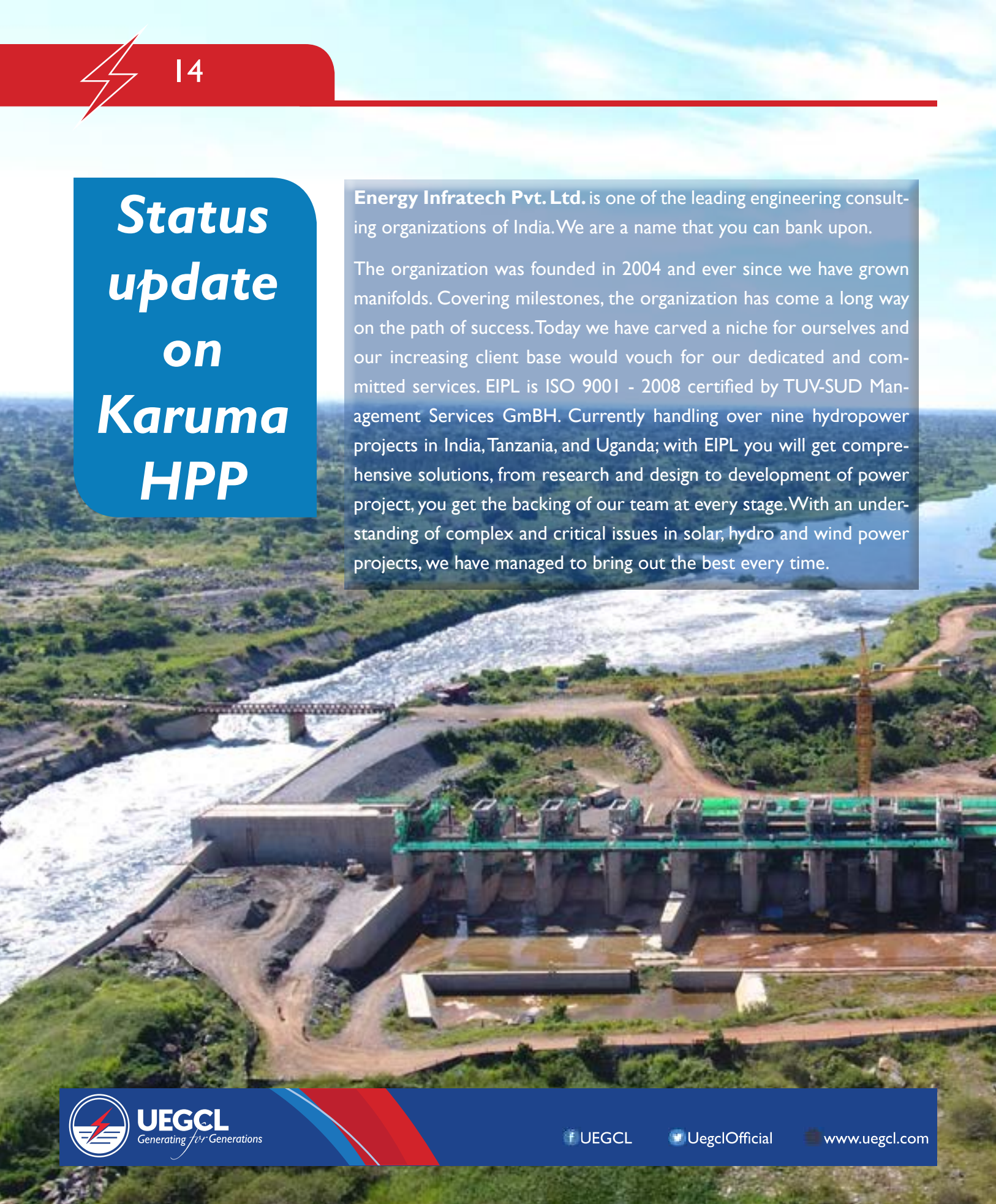
Hydro mechanical works: Embedment works on all units and spillways completed, draft tubes, draft tube cones, lower spillway radial gates, draft tube gates, trash racks and hydraulic gates and hydraulic hoists installation completed. Approximately 95.71 % of the hydro-mechanical works have been certified as completed. Unit 1 stands at 97%, Unit 2 90%, Unit 3 50%, unit 4 (preparation to install guide vanes).

Noteworthy, All EM & HM Equipment drawings were approved & manufacturing completed, 60% (3 out of 5) main transformers were delivered to the site and are currently being installed.

Status update on Karuma HPP

Energy Infratech Pvt. Ltd. is one of the leading engineering consulting organizations of India. We are a name that you can bank upon.

The organization was founded in 2004 and ever since we have grown manifolds. Covering milestones, the organization has come a long way on the path of success. Today we have carved a niche for ourselves and our increasing client base would vouch for our dedicated and committed services. EIPL is ISO 9001 - 2008 certified by TUV-SUD Management Services GmbH. Currently handling over nine hydropower projects in India, Tanzania, and Uganda; with EIPL you will get comprehensive solutions, from research and design to development of power project, you get the backing of our team at every stage. With an understanding of complex and critical issues in solar, hydro and wind power projects, we have managed to bring out the best every time.



EIPL & THE Karuma (600MW) HPP

Brief Scope of Works: Consultancy services for Detailed Feasibility studies, ESIA Studies, Designs and Preparation of Tender Documents and construction supervision for Karuma HE project.

Name of Client: Ministry of Energy & Mineral Development (Government of Uganda)

Location of Project: Uganda

Duration Of Contract: September 2009 – ongoing

Current Physical Progress

As of June 30, 2018, the Karuma HPP has attained 79% of physical progress broken down as follows;

Civil Works:

Dam: Concreting works in all the dam blocks are completed except few blocks in the stilling basin. Percent complete 100 %

Power Intake: Concrete works in the Intake towers are completed. At present concreting is going on in the Sand guide and floating trash anchorages. Percent complete 100 %

Head Race Tunnel: Concreting in HRT #6 is going on. Except the ADIT #1 junction rest lining of HRT and plugging between HRT #1 & 2 completed. Percent complete 94 %

Power House: Concreting of APH, Unit #1, 2, 3 (up to Machine hall) completed and block work in progress. Concreting above the spiral case (for turbine floor) is in progress for Unit #4, 5, 6. Percent complete 69.4 %

Main Transformer Cavern: Concreting for block #2, 3, 4 completed and block works is under progress. Preparations for block #1 final slab is in progress. Percent complete 96.1%

Tailrace branch tunnel: Invert for all the TBT's completed. Except TBT#6 overt lining for all the other units is completed. Plugging between TBT #1&2, 2&3 completed. Percent complete 86%

Surge Chamber: Concreting is going on Left and Right surge chambers. Percent completed 75 %.

TRT: Invert completed around 96 % and Overt 99%.

TRT Outfall: Concreting in outfall in progress at stop log gate, base plate, and slope protection. Percent complete 34 %

Hydro-Mechanical works:

Dam – Installation of radial gates completed in all the dam blocks. Installation of under sluice gate in dam block #4 completed.

Power Intake – Installation of Emergency gates for all the six units completed. Installation of gantry crane for maintenance gate in progress. Removal of bracings and painting for penstock in progress.

Tailrace surge chamber: Installation of gate slot in TSC #1, 2 in progress.

Electro-Mechanical works:

Power House: Lowering of Turbine shaft & Runner in Unit #2, 3 completed. Installation of the stator in Unit #2, 3 in progress. Assembly of Rotor #3 in Erection bay completed. Assembly of the lower bracket for Unit #2, 3 completed. Installation of the bottom ring for Unit #3 completed. Stay ring machining for Unit #1, 2, 3 completed and in progress in Unit #4.

BDT: Installation of IPBD in unit #1 & 3 in progress.

Employee Spotlight

Jonan Kiiza-
PRO Isimba HPP

One thing that defines Dan Beru aka (DB) is his attention to fashion. If you met him in the corridors of UEGCL, trust you me, you have 98% chances of mistaking him for any person occupying a top leadership position. DB is 24/7 Cheerful, a man with a character often identified with pastoral vocabulary.
This is DB for your information;

Name: **BERU DAN**
Age: 49

Education background/ profession: Bachelors in Business Administration; Diploma in Purchasing and Supplies/Stores Management.

Position: Ag. RECORDS AND STORES OFFICER
Experience: **10 YEARS**

When he joined UEGCL
05TH-APRIL-2013

How long have you been at UEGCL? **5-Years**

What was UEGCL like in the past 5 years?

The organization had a weak foundation then.

Where is UEGCL now in your opinion?
Break-even point

What have you achieved at UEGCL so far

I have since created the existing stores and archive at UEGCL.

What challenge do you recall that almost made you think of quitting your job?

I am not easily intimidated, for sure, it is the Almighty God I put first in all my dealings!

Have you ever lost your anger with any of your bosses?

NEVER BEFORE

What are some of the few areas you think the organisation can improve?

The Organisation should strive at being the best equal opportunity employer in this generation.

What are your hobbies?

I love academics, football and travelling.

Any word of advice for the young employees at UEGCL?

Young people should target at living by the mission, vision and the core values of the organization.
In doing such,they will definitely have a bright future in the world of employment.

UEGCL
Generating for Generations

Diagnosing the collapse of Uganda Electricity Board as UEGCL turns to Operations & Maintenance

Construction of the Owen falls dam

James OTTO
Strategy and Business Development Manager

In the next few months, UEGCL will join the ranks of KENGEN, ZESCO, and TANESCO as one of the several public electric utilities undertaking Operations & Maintenance (O&M). Noteworthy, UEGCL is not the first public utility to undertake O&M in Uganda; that award goes to the defunct Uganda Electricity Board (UEB). UEB was created on January 18, 1948, as a quasi-independent, vertically integrated monopoly to generate, transmit, distribute and supply electricity within Uganda, with a vision to eventually supply to the wider East African region. During her 51 years of operation, UEB has to be credited with the development of Uganda's electricity infrastructure from almost zero to (380MW) installed capacity and 180,234 customer connections.

Like many public utilities in Africa, UEB encounted amyriad of challenges which eventually led to her downfall in 1999. The challenges that UEB faced are the same challenges that many public utilities in Africa have been grappling with for decades and they are the same challenges that UEGCL might face years ahead. For any public utility to be successful in Africa, it must learn how to deal with three major issues; political interference, governance & management, and financial constraints. According to the World Bank report titled; Financial Viability of the Electricity Sector in Developing Countries: Recent Trends and Effectiveness of World Bank Interventions (2016), only 4 out of the 17 sampled leading electric utilities in Sub-Saharan Africa were profitable.

This represents a meager 20% as the well-run utilities and 80% as the poorly managed utilities. This World Bank findings are consistent with the 2015 PwC Africa Power & Utilities Sector Survey report titled a new

Africa energy world; a more positive power utilities outlook which found that 65% of utilities in Africa depended on government for financial support. Although the lack of funds limits the ability of utilities to expand supply, poor management is an even bigger issue, Eddy Njoroge, the former managing director of one of Kenya's power companies, KenGen, once said at a 2008 meeting in Nairobi of African power utilities, ***"African governments continue to award contracts and to appoint people to head utilities not on the basis of merit, but because of political and personal connections. "Leadership and good governance have come short of expectations."*** Adding that, they've ***"refused to let go the management of these firms and continue to appoint people they can control and manipulate to give contracts and reward cronies."***

UEB is a classic case of how political interference, poor governance & management coupled with financial constraints can lead to operational inefficiencies and eventually the demise of the utility.

A SNAPSHOT IN GOVERNANCE & MANAGEMENT ISSUES IN UEB

In the words of Robert Blake, the World Bank Country Programme Manager in an interview on 5 May 2002, "UEB was 'dysfunctional' and 'unreformable', its operational efficiency was almost the worst in the world". This blunt assessment summarizes the public perception on the performance of management and the Board of UEB. Public utilities that are 100% owned by government face the challenge of political influence in the appointment of Board and Senior Management which according to Eddy Njoroge pose a serious bearing on the performance of an entity.

The governance and management issues of UEB were first highlighted in an audit report by a team from the World Bank in 1988.

The World Bank pointed out that poor governance and management of UEB had resulted in the poor organizational design and severe low staff productivity (employee performance) which resulted in operational inefficiencies.

POOR ORGANIZATIONAL DESIGN

An Organizational design can be defined as the process of selecting and managing the culture, structure, processes, and positions in the organization so that the organization can control its activities.

Tanzanian troops guarding the important Owen falls dam after capturing it from pro-Amin forces in 1979

Essentially, UEB had a Board of Directors, appointed by the Minister of Energy consisting of not less than five members and no more than nine. The Chairman was also the Managing Director and Chief Executive of the organization. In lieu of the above, the World Bank Team pointed out that UEB's organizational structure had several major deficiencies which subdued efficient operation. First of all, management does not in practice exercise authority to make structural changes to improve operational efficiency. For example, tackling the problem of low staff Productivity would have involved reducing the size of UEB's staff, raising the salary of those who remain and setting up a system to monitor employee performance. Also, the span of control under the Deputy Managing Director was extremely wide as it had nine (9) positions in addition to the 26 district managers all reporting to him. The poor UEB structure resulted in low staff productivity, unequal distribution of workload between staff or departments, unclear lines of communication, lack of teamwork and slow decision making.

The other major issues raised by the World Bank team was that management had failed to develop enough local skills to undertake the prudent operation of the asset which had led to over-dependence on external expertize.

The team proposed that management revamps the training facility at the Nalubaale power plant and introduce a training program for the management team to address the management incompetency that existed in the management team.

LOW STAFF PRODUCTIVITY (EMPLOYEE PERFORMANCE)

At the time of the audit by the World Bank, UEB had approximately 2,800 staffs of which 300 were temporary. UEB's staff number was extremely large in relation to its installed capacity or number of customers or the size and complexity of its system. A large number of employees reflected the low average productivity in nearly all areas of operation. The staff productivity of UEB was computed in terms of the ratio of the number of employees to the number of customers connected to the grid. The result was mind-boggling as for every 34 customers, there is one employee at UEB. At the time, similar utilities that were being run more efficiently had a ratio of one employee to 160 customers meaning that UEB was about 5 times less efficient compared to similar utilities.

In other words, the work done by 5 UEB employees could have been done by one employee in a similar utility being run more efficiently.

The World Bank team revealed that although the official working hours were between 7:30 a.m. to 4:30 p.m., many employees seldom report to work at all and even those who report to work, some arrive past 9:30 a.m. and by 3:30 p.m., several employees are already leaving work. Furthermore, some employees would be engaged in an-UEB activities during working hours. The low staff productivity meant increased wage bill for UEB since the company had to pay salary to 5 employees to do work that could have been done by 1 employee if the utility had been running efficiently.

In his book ***'Good to Great: why some companies make the leap and others don't',*** Collins and his team undertook a 5-year research to determine the defining characteristics of great companies. He then explains why some companies are 'bad', others are 'mediocre', others are 'good' and others are 'great'. Great companies he says, ***'they got the right people on the bus, the wrong people off the bus, and the right people in the right seats and then they figured out where to drive it'.*** Collins argument here is that for an organization to perform, first and foremost it must have the right people in the right positions. Incentivizing the wrong people or the right people in the wrong positions will not drive staff productivity or performance. To improve staff productivity at UEB, the World Bank team advised the company to first restructure and then trim staff numbers, increase salary, introduce incentive award scheme based on performance and introduce training programs for the management team.

UEB's FINANCIAL CONSTRAINTS

The business of O&M can be capital intensive and utilities that don't have ready access to finance find themselves in severe financial constraints.

UEB like most public electric utilities had two main sources of finance essentially coming from tariff collections and government support.

UNREASONABLY LOW TARIFF?

The revenue coming from the tariff was inadequate primarily due to the unrealistically low tariff rate of US$.015 per kWh which was not cost reflective. The problem was further compounded by the high power losses of almost 40% (power lost is revenue lost) and the low ratio of electricity produced to revenue collected which stood at about 50%. Several government ministries and institutions were notorious for not paying their electricity bill, most notably Ministry of Defence and NWSC who believed that they were entitled to 'free' electricity. Consequently, the low tariff coupled with inefficiencies meant that the total revenue collected was not enough to meet the financial obligations of UEB.

HOW WERE INVESTMENTS IN ASSET REPLACEMENT FINANCED?

A major challenge for any plant operator is to be able to mobilize finance to undertake planned and unplanned asset replacement which are part and parcel of the O&M business. UMEME has so far front-loaded over USD 500Million while Eskom has surpassed the capital expenditure investment and modification minimum obligation of USD 6.8 million. These investments are amortized and recovered over time through the tariff. The World Bank team established that UEB depended on government to finance investments in asset replacement either through direct government budget or government borrows and on-lends to UEB. This O&M financing model of relying on the government to finance investments in asset replacement proved to be catastrophic as UEB's direct budget request to the government was heavily cut and also the process of government borrowing was long and protracted leading to asset deterioration.

WHY ARE THESE ISSUES STILL RELEVANT TO UEGCL?

The public sector reform programmes that led to the unbundling of UEB was part of the Structural Adjustment Programmes (SAPs) of the World Bank implemented in most developing countries in the 1980s and 1990s. The core reason that led to the reforms was that public sector service provision was inefficient and often ineffective. Whereas these reforms resulted into utilities that are more efficient, there is still need to further improve the efficiency of the state-owned utilities by addressing the issues of poor governance and management, political interference and financial constraints. As such, the World Bank and other donors in Africa through the program New Public Management (NPM) have been concerned with finding alternative ways of organizing and managing the public services with the focus on creating institutional and organizational contexts which are to the mirror of private sector modes of organizing and managing. Successful utilities in sub-Saharan Africa like KENGEN are organized and managed like the private sector with the ultimate aim to make a profit while at the same time leveraging the benefits of being a state-owned utility such as access to concessional loans which greatly buys down the tariff. This has been made possible because of the regulatory environment established by the Energy Regulatory Commission (ERC) of Kenya that is fair, transparent and predictable. UEGCL can become a publicly traded company by listing on the stock exchange.

This will not only provide pressure on management and Board to perform to meet the expectations of the thousands of the stockholders but it also focuses the company in the direction of profit-making besides providing services to the public. Listing is also a great way to raise funds for the company which can be used as investments for asset replacements or expansion into new generation facilities. The recommendations put forward by the World Bank to UEB on how to improve employee performance are still relevant and can be adopted by UEGCL.

Consider, for example, the need to *introduce incentive award scheme based on performance and also the need to have continuous tailor-made training programs for the management team.*

Also, recommendations such as 'right-sizing' which as Collins explained in his book Good to Great means an organization having the 'right people in the right places' are very important if UEGCL is to avoid the pitfalls of UEB.

The fundamental issue that must be streamlined and which led to the demise of UEB is; how will UEGCL finance investments in asset replacement during O&M especially the 600MW karuma? The UEB methods of financing asset replacements used by using savings from tariff collections or submitting to government budget or borrowing through government all proved to be ineffective and resulted in severe financial constraints and asset deterioration. But UEGCL can borrow a leaf from how UMEME finances its investments in asset replacements which is through direct borrowing. Direct borrowing is a fast way of raising funds without having to go through the long and protracted procedure of passing through parliament and cabinet. During UEB, assets would 'rot' as the utility waits for the government to undertake the borrowing and on-lending process. So, if UEGCL will undertake direct borrowing (which it must) then the process and especially the borrowing thresholds must be clarified by the shareholder and the repayment 'return on investment' clarified by the Regulator.

FIDIC CONTRACTS TRAINING COURSE PREPARES UEGCL FOR FUTURE HYDRO DEVELOPMENTS

Jonan KIIZA
PRO-Isimba HPP

Uganda Electricity Generation Company Limited (UEGCL) on 3 April 2018 hosted a FIDIC expert to train her staff in FIDIC contracts. The 3-day training was conducted at Hotel Protea in Kampala. The staff among others included the technical, legal, risk and audit.

"With the Isimba (183MW) & Karuma (600MW) HPP's nearing to completion, no doubt UEGCL's experience in handling Engineering, Procurement and Construction (EPC) Contracts has vastly increased over the years",
Said Dr. Eng. Harrison E. Mutikanga - UEGCL CEO.

UEGCL
Generating for Generations

FIDIC is (Federation Internationale des Ingenieurs-Conseils) and was founded in 1913 by three national associations of consulting engineers within Europe. Against this background, FIDIC is an international federation of national member associations of consulting engineers with a membership that covers 104 countries of the world.

Mr. Stephane M. Giraud-the trainer/ moderator is an accredited FIDIC trainer and an Adjudicator with many years of experience in contract designing, management, and dispute resolutions. Fusing his experience, made him an ideal candidate for the host to training her staff.

"This training has been very highly engaging and timely.

"This training is aimed at expanding knowledge in managing EPC contracts"

The course had a blend of theory and practical case studies derived from the different parts of the globe where EPC contracts have been executed with reference to FIDIC Yellow Book" Said Musa Mukulu- UEGCL

"This training is aimed at expanding knowledge in managing EPC contracts", said Dr. Eng. Harrison E. Mutikanga-UEGCL CEO In his opening remarks adding that, with the Isimba (183MW) and the Karuma (600MW) HPP's nearing completion, the company has got many more hydropower developments coming up like the Muzizi HPP hence making this training very timely.

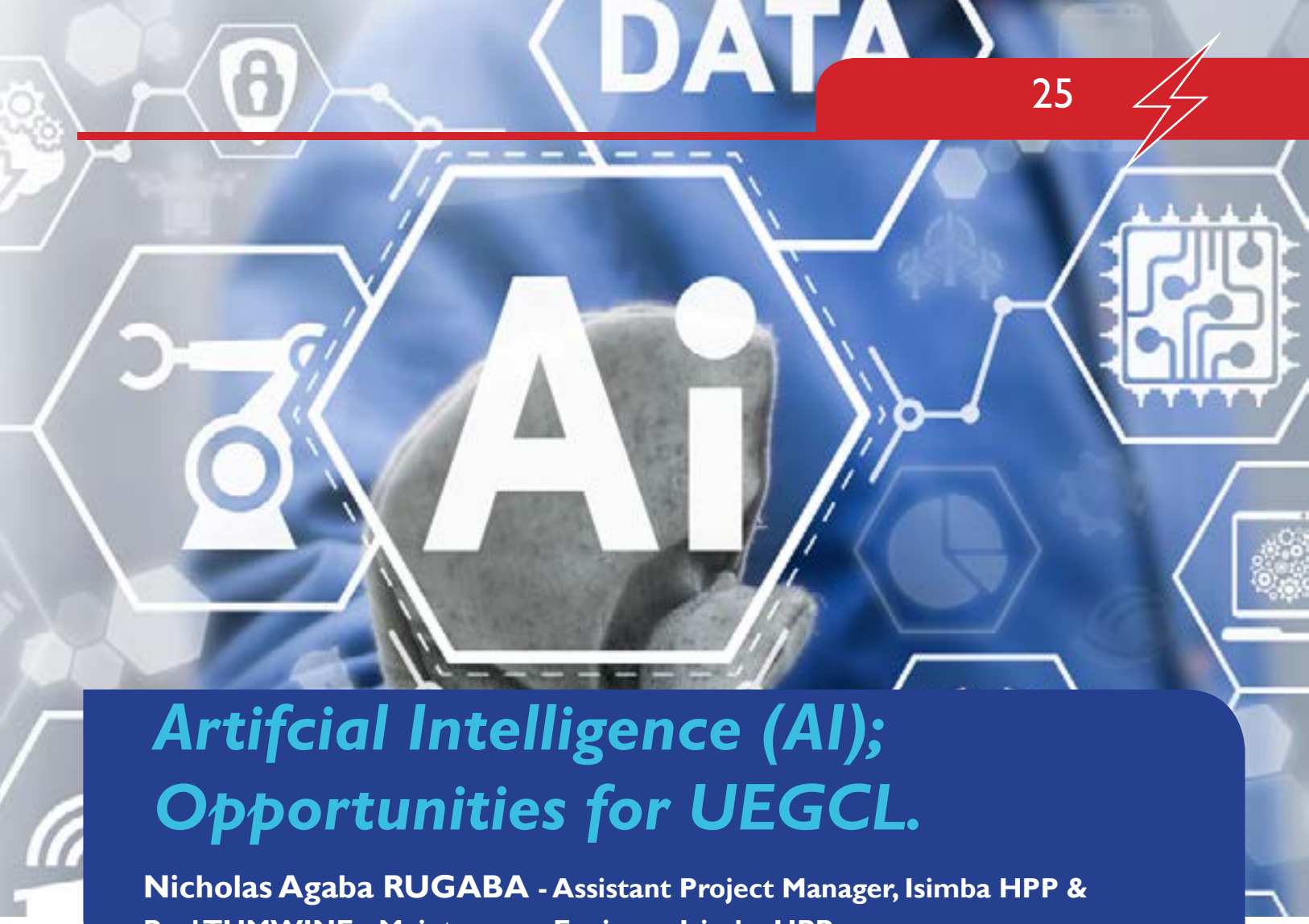
" We applaude Stephane M. Giraud for choosing appropriate cases noting that I have derived uncountable action points to include in the tender documents for the Muzizi HPP", Said, Ms. Mary Mwogeza the Project Manager (PM) Muzizi (45MW) and Nyagak III (55MW) HPP's.

In the same Disposition, Timothy Mubala-the Assistant PM Karuma HPP pledged to implement the knowledge from FIDIC in managing the EPC contract of Sino Hydro Limited.

From as many voices of the participants, the training seemed to have provided fundamental and timely insights especially in managing EPC contracts.

"I pass a vote of thanks to AFD for investing in capacity building at UEGCL," Said, Dr. Harrison E Mutikanga- UEGCL CEO. Alluding to a challenge to the participants not to seat on the knowledge attained but rather implement the same in their respective areas of operation.

The participants were awarded FIDIC course certificates and the training was wrapped up with a photo moment with the participants. With all that, UEGCL remains committed to her vision of being one of the leading power producers in the Great Lakes Region. This journey will include having enough preparations in contract knowledge and management.



Artifcial Intelligence (AI); Opportunities for UEGCL.

Nicholas Agaba RUGABA - **Assistant Project Manager, Isimba HPP &**
Paul TUMWINE - Maintenance Engineer, Isimba HPP

Globally, big organisations in different sectors including finance, engineering, energy, healthcare, banking etc. are embracing Data Analytics, Artificial Intelligence, Robotics and the IoT (Internet of Things). UEGCL, as an organisation hinged on Generating for Generations, is indeed keen on these concepts and ideas that are disrupting/ changing the way business is done or how strategies are being implemented. In this context, a few questions come to mind. What are these concepts and ideas all about? How are they relevant to the energy sector?

Can UEGCL leverage any benefits and opportunities accruing from Artificial Intelligence and Machine Learning?

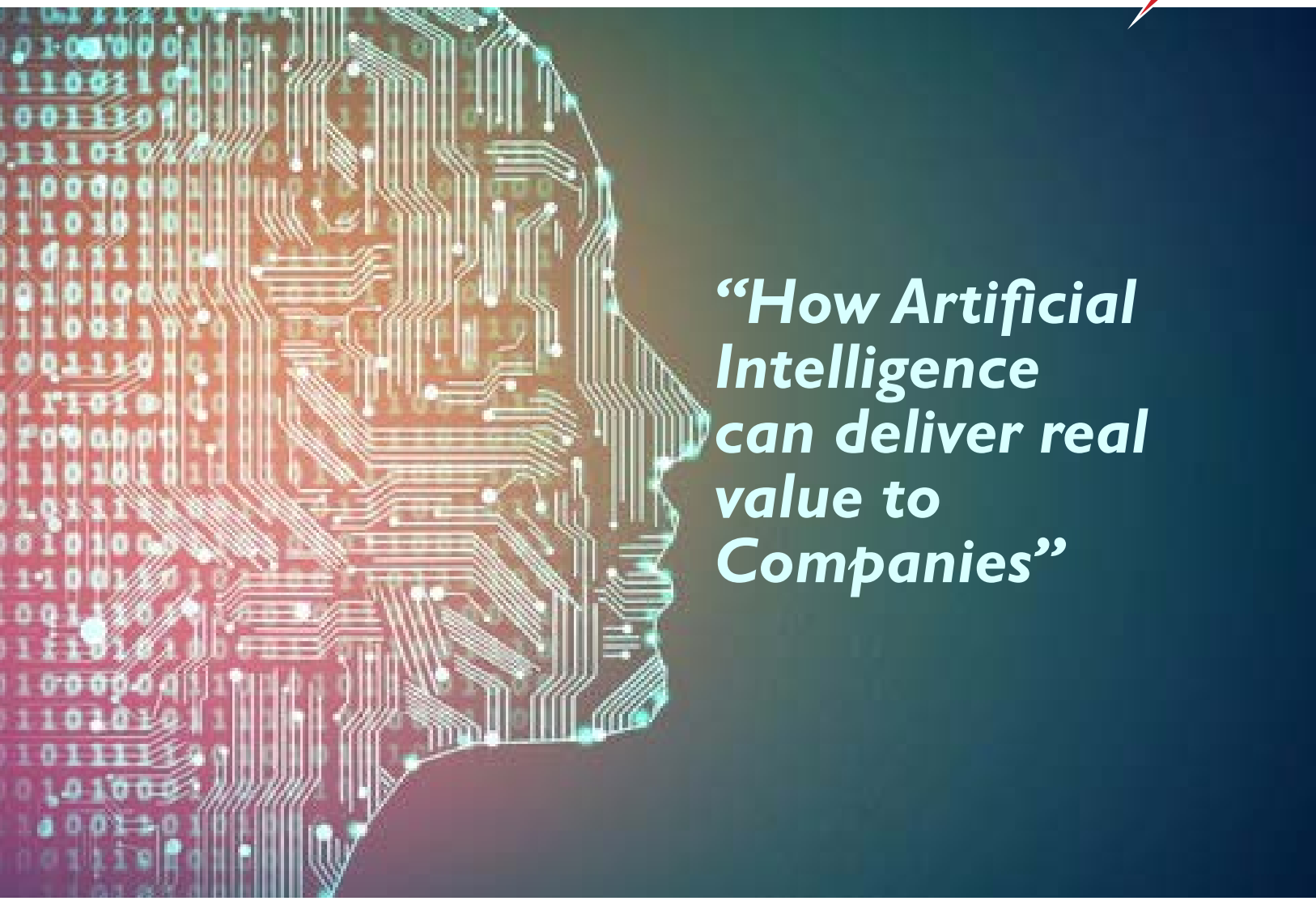
Wikipedia defines Artificial intelligence (AI, also machine intelligence, MI) as intelligence demonstrated by computers and machines, in contrast to the natural intelligence (NI) displayed by humans and other animals. In computer science, AI research is defined as the study of "intelligent agents": any device that perceives its environment and takes actions that maximize its chance of successfully achieving its goals.

For those of you with smartphones, smart-watches, and automobiles/ cars (if it is a newer model) have AI (Artificial Intelligence) inside serving you every day.

Do Artificial Intelligence, Machine Learning, Data Analytics etc. offer any opportunities to UEGCL? Yes.

UEGCL in its mandate of developing, operating and maintaining power generation facilities handles and deals with lots of data, all through the project phases of Operation and maintenance. Hydropower projects, for example, utilize a lot of data on hydrology, rainfall, catchment, earthquake, wind, geology etc. during the feasibility design/ assessment of the project. This data is massive and sometimes covers periods of up to 30 or 40 years. Additionally, during project design and construction, a lot of data is gathered namely material tests, geotechnical investigations, concrete tests, laboratory results etc. During Operation and Maintenance, a lot of data is still collected on major equipment and machines namely temperatures, vibrations, downtime, frequencies, dam monitoring data and other parameters. All this data can be big data, considering UEGCL is handling multiple projects across the country. UEGCL has an opportunity in Big Data and Analytics. Additionally, the projects employ over 10,000 employees at the peak of implementation. There is a lot of data associated with the personnel that is key in HSE management namely job title, work function, work hours, injury records, PPE stocks/ replacements etc. UEGCL can utilize data analytics to map trends and or establish correlations that may be useful in designing a suitable HSE management system that ensures SAFETY on project sites.

The McKinsey Institute in their research paper "How Artificial Intelligence can deliver real value to Companies" indicates that Utility Companies in the Energy sector are building smart grids and making smart grids smarter. For example, on transmission lines, smart wires combine with machine learning to enable real-time power dispatching and optimize it to current grid load and to buildings' asset portfolios. Additionally, drones and insect-size robots identify defects, predict failures, and inspect assets without interrupting production. On manpower/ O&M teams, with Artificial Intelligence and machine learning, the O&M teams are leaner with fewer technicians, but they spend more time on problem-solving; instead of logging inspection status by hand, documents are logged and routed automatically. The workforce is able to also receive real-time updates or notifications of machine failures on their smartphones or gadgets, and thus decrease the response times and reduce the impact of outages or machine shutdowns.



"How Artificial Intelligence can deliver real value to Companies"

Finally, Artificial Intelligence and Robotics offer opportunities for inventory management for both Project Implementation and Operations and Maintenance phases. Projects, for example, consume tonnes and tonnes of cement, fly ash, aggregates, steel, timber, pipe casings etc. These materials are stored in big warehouses or storage yards across the typical project site. Robots powered by Artificial Intelligence can run warehouses and storage rooms for construction materials or even machine spare parts. The AI-powered robots also have the capacity to order for stock when the inventory runs low.

It is evident; there are vast opportunities for UEGCL and other players in the energy sector to tap from Artificial Intelligence, Machine Learning, Data Analytics and Robotics. The time to tap into those opportunities is NOW.

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Hydro Generator Stator Assembly training in readiness for Karuma

Dr. Jemimah C. AKIROR Maintenance Manager
Ian SEDIRIMBA C&I Engineer

Uganda Electricity Generation Company Limited (UEGCL) is implementing Karuma hydropower project with a capacity of 600MW on behalf of the Government of Uganda (GoU).
The project is under an EPC contract with Sino-hydro Corporation Limited as the contractor and Energy Infratech Private Limited (EIPL) as the supervision consultant, the project began in December 2013 with a commissioning date of December 2018. The project completion stands at 70% as of November 2017. The project is 85% funded by China EXIM bank and 15% by
Government of Uganda Contribution at an estimated cost of $1.65Bn.

The Ugandan generation pool as of September 2017 had a total installed capacity of 938 MW (source: ERA website) with the three largest hydroelectric plants – Bujagali (250MW), Kiira (200MW), and Nalubale (180MW) contributing 630MW. Karuma coming online at the end of the year will increase the installed capacity by 64% bringing the total installed capacity to 1,538MW. This will boost Uganda's industrialization through the standard gauge railway and industrial park development. In addition, leverage Uganda's electricity export trade to neighboring countries as part of the government's effort to attain middle income status by 2020.

As part of the project contract, a training on hydro stator assembly was organized by the EPCC aimed at capacity building of the employer's operations and maintenance (O&M) team. A team of five engineers i.e. Dr. Jemimah C Akiror, Samy Ssekatawa, Augustine Mugisa, Oden Aryanyijuka and Ian Sedirimba were nominated by UEGCL to attend the training.

The team will be generator system experts during operation and maintenance having undergone a hands-on training on the stator assembly and manufacturing process. They will take the lead in maintenance, overhaul, testing and troubleshooting of the generator during its lifetime.
This article summaries what was learned during the training and how the training will be useful during operations and maintenance.

The Nity gritties of Stator Assembly

A hydropower generating unit is comprised of a turbine and generator set, the turbine converts the energy from the water into mechanical power which is then converted to electrical power in the generator. The turbine is coupled to the generator via a shaft which translates the mechanical power to the generator. In our case the turbine is a vertical-shaft, Francis type as that shown in the Figure above. Karuma has 6 turbine-generator sets each capable of generating 100MW at 11kV with a rotating speed of 142.86 rpm.
The generator is comprised of two components i.e. the stator and rotor. The stator is the stationary component while the rotor is the rotating component connected to the shaft. This article only focuses on one component of the generator - the stator, discussing how generator stator assembly was done at the manufacturer's factory premises.

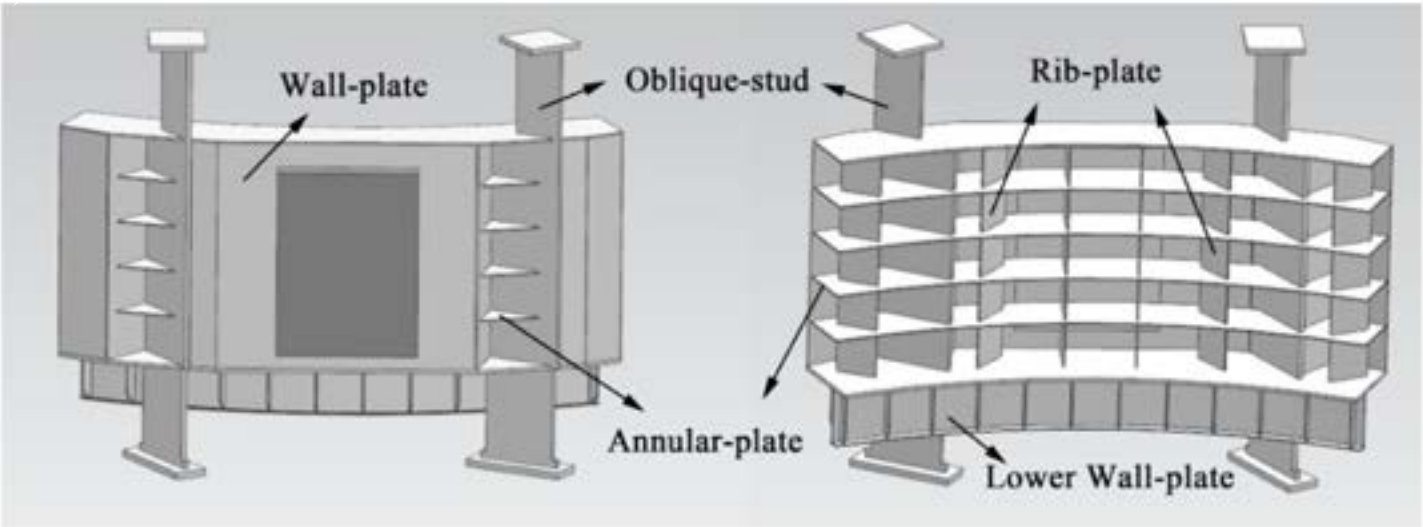


Figure 1: Stator Frame Sections

The stator is made up of three major components i.e. stator frame, stator core and stator windings. A brief description of each component and assembly process is as follows

a. Stator Frame

Figure 2: Assembled Stator Frame for Karuma

Karuma's stator frame is made of three sections, each bolted together to make a full frame. The stator frame is split into sections for ease of transportation from the factory to site. The frame has several functions;

- stator frame is to support a laminated stator core
- provide a medium for transmission of torque from the stator core to the stator frame soleplates which are firmly secured to the power station super structure.
- Fitting of generator coolers on the outside periphery of the stator frame Karuma's stator frame incorporates special keyed **(sole plates)** that allow the translation of radial forces of the stator core and stator frame to the stator foundation. The sole plates firmly fixed to the power station superstructure will prohibit this expansion, leading to the uneven thermal expansion of the stator core and frame at the top and the bottom of the machine, causing stator core relaxation problems.

sole plates have to do with translating any unbalanced radial forces to the foundation not necessarily thermal expansion. unless am mistaken, do you have a reference for this?

Prepare for Stator Assembly → Assemble the Stator Frame Sections in Erection Bay → Align and bolt stator frame sections together

b. Stator Core

The stator core accommodates the stator winding in its slots and conducts the required magnetic flux created by the poles with minimum losses and field current, serve as a part of machine cooling circuit

The stator core consists of silicon alloyed electrical steel laminations. The laminations are laid overlapping each other in a process called stacking. The stator core is vertically subdivided into partial packets by ventilation segments, the ventilation segments are arranged in such a way that they allow air to be guided and to flow smoothly for heat transfer and cooling air passages.
The stator core is interfaced with the stator frame via the vertical dovetail keybars, which are welded to the stator frame inner periphery.

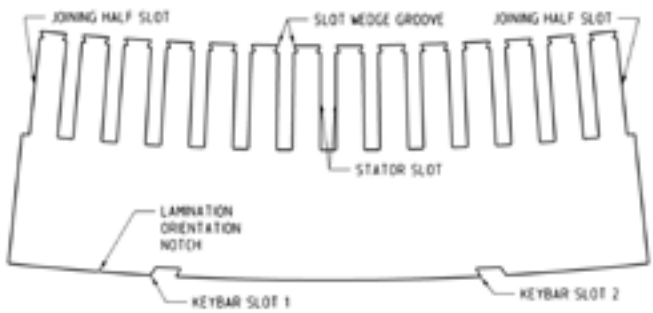
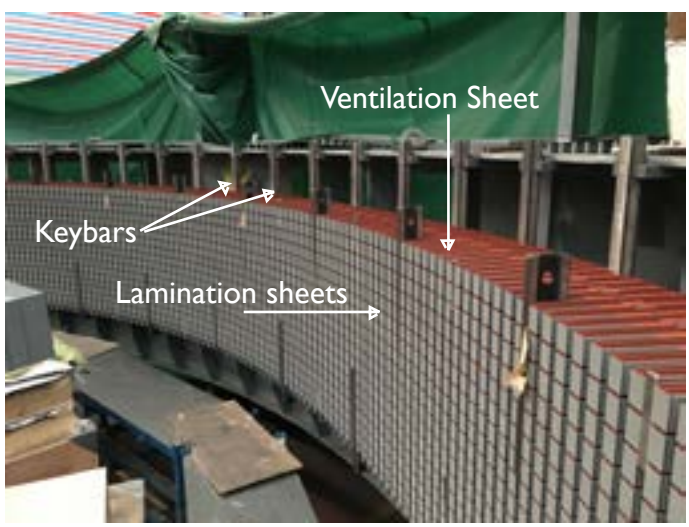


Figure 3: Laminated electrical sheet

Karuma has two keybars per each stator lamination segment.
The keybars serve the purpose of aligning the stator core stack and must be capable of transmitting full load and intermittent short circuit torques imposed on the machine during operation.

Assemble and Weld of Stator Keybars → Stacking and Pressing of Stator Core → Stator Core Loop Test → Pressing of Stator Core after Loop Test



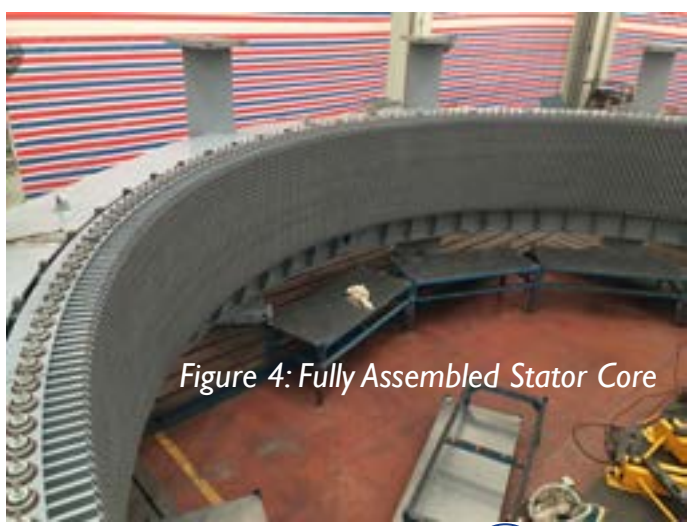


Figure 4: Fully Assembled Stator Core

c Stator Windings

The hydro generator stator winding essentially represents the three-phase electrical circuit in which the working EMF of correct magnitude is induced as a consequence of the rotating excitation magnetic field on the rotor.

A stator bar consists of suitably insulated copper wire coils fitted into the stator core slots, which are distributed and connected for the best electromagnetic advantage. All larger hydro generator windings are designed for high voltage operation, with line-to-line voltage levels varying between 9.5 to 11 kV.

Karuma's generator is made of pre-formed (form-wound) stator roebel bar type windings as it adopts lap winding shown below. Single turn bars are employed for the windings for Karuma, since the currents per circuit require large conductor cross sectional areas, and where closed loop coils become physically too heavy and mechanically too stiff to be inserted into the stator slots without risking mechanical damage. Two separate bars are normally manufactured to form a coil in a double layer winding, one for the bottom coil side, and the other for the top coil side. Given the large size and handling difficulties, they are inserted separately into the slots, and then joined at both ends by copper brazing.

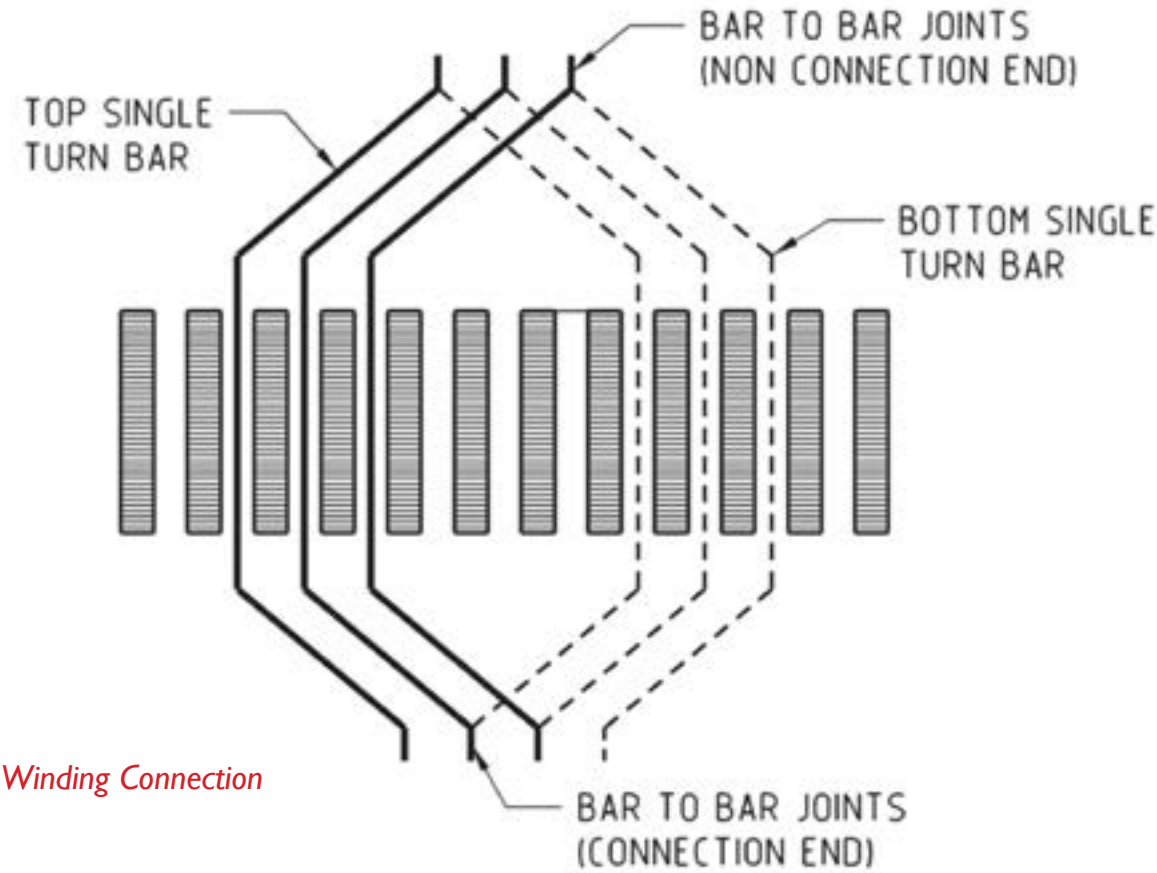
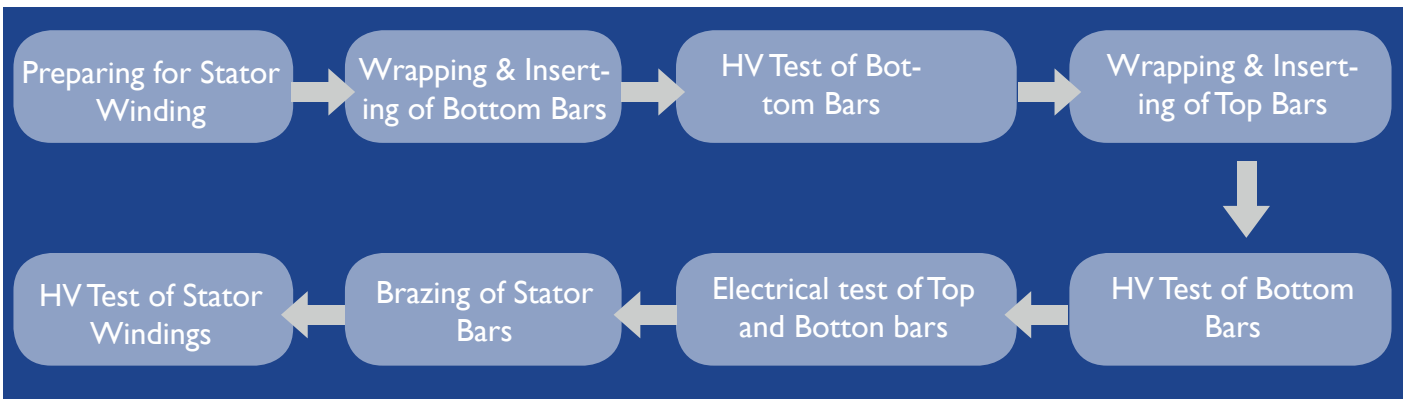


Figure 5: Lap Winding Connection

Figure 6: Karuma Generator Lap Winding

Sequence of Assembly



I. Challenges

During the assembly a lot of challenges were faced i.e. the assembly area was dusty and dirty, low quality assurance of the assembly and installation exhibited by cases of unexperienced work teams during stator bar wrapping, slot wedging, alignment of stator core along the core segments.

a.Segmented stator core

During the assembly of the core, alignment along the segment splits created problems during pressing. This can lead to a loose core during the operation of the generator. A loose core in a power plant in China led to an earth fault during its operation creating forced outages, unplanned and increased maintenance costs.

b.Dust and dirt assembly and installation area

The assembly of the stator was done in factory with some structural excavation. This created conditions as on the site, which the manufacturer previously had not considered to guard against. These dusty conditions can trap dirt and particles in the core that can compromise the lamination insulation.

c.Slot Wedging

During the installation of slot wedges, care was not taken to protect and prevent damage to the stator core during the hammering into position of the slot wedges.

d.Core misalignment during assembly.

Misalignments of the core packets at the segment joints especially after pressing occurred. Moreover, the gap created in a split stator core between the segment can cause the windings in those respective slots to be susceptible to insulation damage as the machine is operating.

While factory acceptance and quality control tests for example stator core loop test and HV stator bar tests performed on the stator may be successful. They may be inadequate to check the damaging of the stator core during insertion of slot wedges, tape sections during insertion of slot wedges and in some cases blocking the air ways around the stator core ventilation sheets, whose effects manifest after the machine has run for some hours.

The aforementioned challenges call for vigilant maintenance practices during operations including continual monitoring and thorough inspections during annual outage. These will typically focus on local heating of the core, signs of core fretting, core insulation failure and visible winding insulation failure.

II. Recommendations

a.Explicit owners' statement of require ments

For future power plant project development, the owner's statement of requirements should be clear and precise on the assembly and installation conditions for example a preference to site installation, specify some quality control and assurance of electromechanical equipment.

b.Development of an international stan dard on stator assembly

There needs to be a clear and concise international standard that specifies the conditions for stator assembly and installation. During the assembly process, the standard that took precedent was GB/T 8564 -2003 which was not very clear on the assembly conditions.

c.Re-assembly of the stator during over haul to eliminate split cores

Depending on the maintenance philosophy adopted, stator cores can only be overhauled from a period of 10 – 30 years. When that time comes, the assembly of the core will be done to form a continuous core without sections to eliminate the issues with split cores.

Going Forward!

The training provided a lot of insight on the hydro generator stator assembly process including all tests on different components to ascertain function and the challenges faced in stator assembly from day to day. Although not captured in the factory acceptance tests, implications of some of the challenges faced may include early aging of the insulation, core looseness, among others, which only manifest after several hours of generator run time.

A Sneak Peek into Isimba HPP Maintenance Strategies

Paul TUMWINE,
Mechanical Maintenance Engineer

UEGCL has started implementation of ISO 55001 Asset management system which is aimed at enabling an organization such as UEGCL to obtain value from her assets and also achieve her set objectives through effective and efficient management of assets. Isimba (183MW HPP) as an asset of UEGCL directly takes no exception in seeing this implementation through.

Maintenance of assets thereby plays a focal role when it comes to championing effective and efficient management of assets.
An operating power plant will at all times be required to generate electricity which is supplied to the national grid. From a commercial perspective, is the flow of water through the units translated into revenue? Also from a technical perspective, is the unit available for dispatch whenever required? Well, for one to comfortably answer these questions he/she has to have a fully functional maintenance strategy.
The Isimba Hydropower plant is expected to generate (183.2MW) from four the installed (4) axial flow Kaplan units with the help of another power plant auxiliary and ancillary systems. Just like any other power plant within and out of Uganda, the power plant owners face a key challenge of developing an optimized asset management strategy that targets safety and maximizes unit availability and most of all increase plant life.

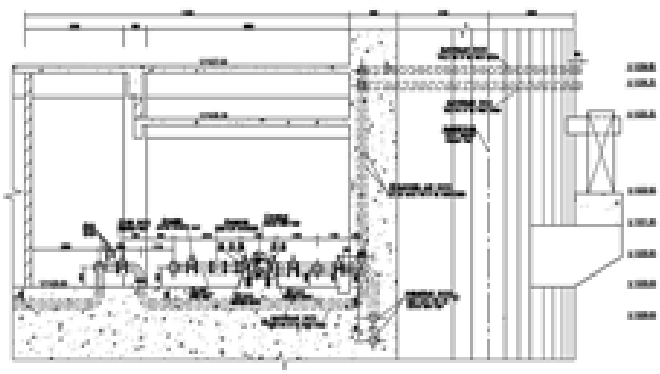
The key to the understanding of what maintenance approach to adopt is by understanding the system and also identifying subcomponents within the systems with help of equipment identification adopting the Kraftworks-Kennzeichen-System (KKS).

Additionally, various components also require different maintenance approaches. Most engineers are aware of the common maintenance strategies such as reactive maintenance (run to failure), preventive maintenance (Based on machine run schedule), and condition-based maintenance (measurable optimal performance parameters).

However, with the documentation regarding the various system at the Isimba HPP, the maintenance team appreciates that to run a good maintenance program for the power plant requires "merging" of the strategies at the component level of various plant systems. With that perspective echoed, the anticipated defects during operations are in three aspects i) mechanical components ii) hydraulic components and iii) electrical components.

The O&M team has already started developing system reports ranging from turbine and generator, governing, lubrication, cooling water, domestic water, HVAC, Scada, Protection, hydraulic steel gates e.t.c. why is this information important? The intention of merging the various strategies is to adopt high-reliability indices. A simple guide adopted during a typical maintenance analysis is shown in figure 1

To enable visualization to the analysis map above, let's focus on the Isimba HPP cooling water system whose primary heat exchanger is fully immersed at the tail race(see figure 2) at level 1032.92 masl and with an operating Tail Water Level (TWL) of 1038 masl (4 units running)



Based on the documentation at site and in several site discussions it is believed that the heat exchangers are "maintenance free", well it is believable to a lay person. Sadly some engineers "entertain" this famous catch phrase….."

Maintenance-free" let's all understand that an equipment which has a direct importance to a system has to be monitored and even in some cases redesigned to improve the overall system performance. With that in mind why do we still entertain this catch phrase… Discussion for another time.

Back to the Isimba HPP coolers, as much as the failure may not impact on the environment, it can impact on performance and thereby monitoring cooling parameters is important in that leading to a strategy of condition based maintenance even suggestions are currently being considered to have divers (trained in house or outsourced service) for regular inspections or underwater drones to have a visual insight of the coolers which leads to deploying another strategy to develop an interval based task as seen in figure 2. Similarly, a water filter in the cooling water system deploys another strategy which is mainly reactive in nature as you may be required to flush once clogged.

So as we can see understanding potential system failure modes and mechanisms then later component failure creates a form of reliability centered maintenance which encompasses the element risk management to the whole system.
The understanding of systems up to component/ parts level is a strength the Isimba maintenance team has as we approach to the operation and maintenance phase.

"The major difference between a thing that might go wrong and a thing that cannot possibly go wrong is that when a thing that cannot possibly go wrong goes wrong, it usually turns out to be impossible to get at and repair",

Isimba HPP after commissioning has a two years defects liability which provides for an opportune time for specialized skills enhancement driven by the operations department in the respective operations training plan. An efficient, reliable and effective maintenance plan increases the life of the power plant.

Many power plants have had catastrophic failures as a result of poor maintenance regimes the most noticeable being the major failure that occurred at Sayano-Shushenskaya hydroelectric dam in Russia where 75 people were killed, many were injured and 40 tons of oil were spilled in the Yenisei river as a result of poor maintenance on unit 2 and lack of maintenance on the mechanical over speed device which couldn't deploy on any of the other units. Maintenance on a component that costs less than US $9000 led to a massive destruction of up to US $ 1.3 Bn. Take a moment and let that sink in…..Yes, the business of maintaining a power plant is serious business and needs continuous assessments and improvement to customize what works for the Isimba Power plant.

In conclusion, there is light at the end of the tunnel as concerns maintenance of the Isimba power plant as UEGCL heads for operation and maintenance.

"The major difference between a thing that might go wrong and a thing that cannot possibly go wrong is that when a thing that cannot possibly go wrong goes wrong, it usually turns out to be impossible to get at and repair", says, Adams Douglas!

Strengthening UEGCL Security during O & M;

Alfred ODAMA - Security Officer

"Security is everyone's business"

Hydropower plants (HPP's) are the backbone of all critical infrastructures in Uganda. That being said, there's need to urgently develop a sound security management strategy due to the fact we 'live in an age where terrorism is the order of the day.

The Uganda Electricity Company Limited (UEGCL) boasts with 4 core values which include Safety, Accountability, Sustainability and innovation. At UEGCL, Security falls under the Department of Human resource management and Administration however overall implementation is by the 'Security officer. Managing security further calls for coordination with the UPDF Commander in charge of National Vital Assets & Strategic Installations Unit. This draws to an understanding that security is regarded as paramount at UEGCL-and her related assets.

Security at UEGCL, although not limited to the following, entails the identification of company information, assets, and developments, implementation of company policies, standards, procedures, and guidelines.

This also includes threat assessment and reporting, programming for security equipment & acquisition plus attending project security meetings. An amalgam of the above and much more entails a UEGCL security plan. The security plan is against the increasing threats of Terrorism, Thefts fire, trespassers Kidnap for ransoms and social strikes by the potential enemies of the organization.

Security at UEGCL is not in isolation of government security agencies.

In fact, the government being the initial stakeholder of security, UEGCL endeavors to work with RDC's, DISO, GISO's, RPC's, UPDF to ensure that our working environment is safe from any threats. The security officer has developed a strong partnership with Government security agencies.

At UEGCL, Security is everyone's business. For any objects / equipment that are not clear and are close to your vicinity, be responsible enough to report to our security office. Being security conscious and alert does not only save our lives as employees but also protects the assets of the government of Uganda.
At the current, UEGCL has put in place systems and measures to include the following:

- Guard posts with barriers located at the entry point to control access
- Metal detectors
- Placement of fencing, barricade, and signage
- Credentials/electronic access cards for employees and approved visitors and contractors.
- Padlock and key control
- Security cameras with 24 hours, live monitoring
- Contracted security guard services
- Security policies and procedures
- Suspicious activity incident reporting
- Coordinating with government security agencies

As an organization that is still growing, we've got numerous security plans to mitigate any gaps.

At the current, the EPC contractors at the Isimba (183MW) & Karuma (600MW) HPP's are manning their own security. As we head for O & M, UEGCL has already finalized concretizing on how to secure these precious assets. Digitalized security monitoring systems are in pipeline as well as improving the existing security mechanisms in place.

The following plans will improve security at all the branches;

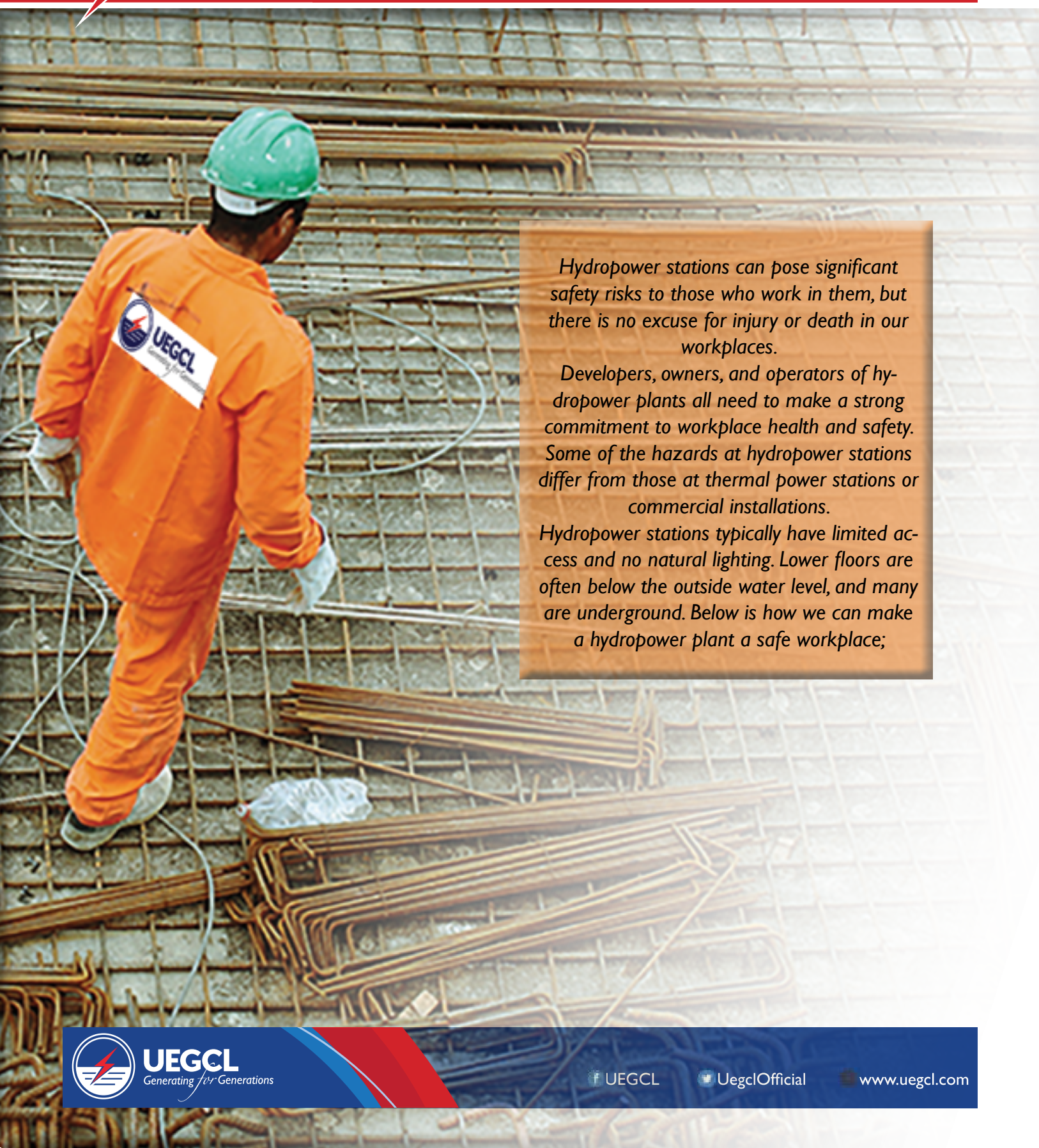
- Security Audits and Risk assessment
- Contracting a security company for the Isimba and Karuma which will directly be supervised by UEGCL.
- Installation of a digital security system which will be monitored centrally by the Security officer
- Finalizing the master security plan including protection action plan
- Routine security meetings and inspections jointly with the security committee

In conclusion, there's no blessing outside life; and coincidentally, two of the four UEGCL's core values allude to "Safety" and "Sustainability". Comrades, endeavor to be safe at your works station as the first principle and then sustain that safe environment!

How can we make a Hydro Power Plant a safe workplace?

Dennis BUREGYEYA
Shift Charge Engineer

Stator assembly works ongoing for Unit 1 generator at SanBanXi Hydropower plant, in Guizhou province, China. Works going on with safety in mind; appropriate Personal Protective Equipment (PPE), signage and barricade.



Hydropower stations can pose significant safety risks to those who work in them, but there is no excuse for injury or death in our workplaces.

Developers, owners, and operators of hydropower plants all need to make a strong commitment to workplace health and safety. Some of the hazards at hydropower stations differ from those at thermal power stations or commercial installations.

Hydropower stations typically have limited access and no natural lighting. Lower floors are often below the outside water level, and many are underground. Below is how we can make a hydropower plant a safe workplace;

Designing safety into hydropower stations.

When designing and implementing a new hydropower scheme, or when upgrading an existing station, we need to carefully consider the required standard of workplace health and safety, and the scope of work necessary to achieve that standard. This means understanding the relevant legislation, building codes and the requirements of the insurer. We also need to be clear about how responsibilities are shared between all the parties involved – the designer, developer, owner, contractors, and so on. But while standards, codes, and guides are a good starting point, the final solution needs to be tailored to the particular circumstances and level of risk at the station in question. Safety systems for hydropower plants can be complex and sophisticated, but simple systems can also be robust – it all depends on the specific requirements of the facility in question.

Planning ahead to control risks.

A general approach taken to minimize workplace risks involves planning ahead to prevent workplace accidents, injuries, and illnesses. We do this by ensuring that systems of work are safe and that equipment is properly maintained. Employees must receive health and safety information, training and appropriate supervision.

Safety upgrades for older hydropower stations.

Typically, new hydropower stations are well designed and comply with appropriate safety standards and local building codes. Larger hydropower stations can have safety systems as complex and thorough as those in modern multi-floor commercial buildings. However, older plants were often designed with little regard for safety, and now need urgent attention to comply with modern workplace health and safety standards. While safety facilities are readily incorporated into new hydropower schemes, they may be more difficult to retrofit into existing stations. The scope of work will need to take into account the interfaces with existing facilities and the tailoring required to suit the specific site and location.

Power Station evacuation.

Whatever the nature of the crisis, people must be able to get out of a hydropower station safely. All stations should have at least two independent ways to exit. If one route becomes inaccessible, an alternative emergency escape route should always be available. Adequate lighting is essential for emergency escapes. The primary consideration should be to provide safe facilities to get personnel out of a hydropower station safely before conditions inside become dangerous. The second consideration should be providing facilities to get people out safely after conditions become dangerous. Only then do we think about safety facilities to prevent damage to the plant itself.

Flood protection.

Hydropower stations can and do flood. Failure of drainage pumps can lead to a slow increase in the water level and eventual flooding of the station. Alternatively, a plant failure and leakage that drainage pumps cannot manage can cause rapid flooding of the station. This makes water-level, flood, and evacuation alarm an absolute necessity. Flood protection schemes can be implemented to automatically close intake gates, main inlet valves or ring gate.

Fire and smoke control.

We need to detect fires as early as possible, prevent them from spreading, alert all personnel, and provide safe and well-lit means of evacuation as soon as possible. Smoke control and ventilation are also extremely important. Fire will rapidly fill a hydro station with thick, black, acrid smoke, which is often a far greater hazard to personnel than the fire itself,

as it obscures vision (preventing occupants from finding safe escape routes, as well as hindering search and rescue operations). It can also poison people well before the temperature of the fire or smoke causes injury. A holistic fire protection system needs to attend to the full range of passive measures (e.g. Fire resistant doors, fire-rated construction materials, and methods), active measures (e.g. sprinklers, venting, fire-fighting equipment) and operational measures (e.g. plans, systems and training for fire prevention and response).

Emergency and crisis management

Safety at hydro stations involves more than simply having the correct equipment or hardware present at the site. It involves an ongoing commitment by the owner, management, operator, and employees to provide and maintain a safe and healthy work environment. This commitment should be documented in writing and form part of a workplace health and safety policy supported by safe work systems and documentation. These should include a written risk control program an

Dam Safety Management in Operation & Maintenance of Dams & its future in Uganda

Wilberforce MANIRAKIZA
Civil Engineer Dam Safety

Dams provide a wide range of significant functions like Hydropower, flood control, water supply, irrigation, navigation, recreation, fish breeding, tourism etc. For example the development of Karuma and Isimba dams will add (600MW) and (183.2 MW) respectively to the national grid, vital for the Uganda's socio-economic development. However construction of a dam poses a threat to the downstream communities and a high risk to the Owner.

South Fork Dam Disaster – United States (1889) Death Toll: 2,209

A **dam** is a barrier across flowing water that obstructs, directs or slows down the flow, often creating a reservoir, lake or impoundments (Wikipedia). When a Dam is built, the barrier structures affect the natural flow of water. The release of water is now controlled by man-made structures. When these structures fail, there is uncontrollable quick release of massive quantities of water to the downstream of the dam resulting in a disaster which may destroy lives and property if there is no appropriate emergency response. The worst failure occurred at Banquiao dam where over 145,000 died due to the impact of the flood.

Isimba Dam

Aerial View of Isimba HPP after Second stage River Diversion

For the case of Isimba, the dam was designed to comfortably release a maximum design flood of 4,500m3/s (4.5 million liters per second). When the Isimba reservoir is filled up for Operation, it will have a capacity of 170Mm3 (170 billion liters). This means that in the worst case scenario, if the whole dam breached, and all this quantity of water with a height of 15 meters (about a height of a 5-storeyed building) is released at the same time, it would violently sweep off most of the downstream communities thus leading to loss of lives, property (including the nearby Mbulamuti Ferry) and business of the Owner (UEGCL) would come to a standstill, a loss worth of millions of dollars to the government. This sounds scaring but dam failures that have happened elsewhere in the World have been an eye opener to these realities.

Case History of the Worst Dam Failure

While in the process of writing this article, Patel dam in our neighbourhood Kenya failed due to flooding after heavy rains. This dam breach claimed over 40 lives and left thousands of people homeless.
A similar case of heavy rainfall due to climate change combined with melting of snow mountain lead to the failure of the main & emergency spillways of Oroville Dam, USA on Feb. 12, 2017. Climate change might be the next potential threat to dam Safety.

Soon after the completion of the dam in 1952, cracks started appearing in the sluice gates. The issue was handled on a serious basis under the supervision of Soviet civil engineers and the gates were soon repaired. They used to call the dam as 'Iron Dam' as it was believed to never take any damage in the future.
In August 1975, after the collision of the Super Typhoon Nina and a cold front, more than a year's rain fell within 24 hours. The water level in the dam began to rise, and the sediment sluice gates were unable to handle all the water pressure which made the gates to collapse instantaneously. As a result, a total of 1.7 billion m^3 of water (exactly 10 times the size of proposed Isimba reservoir) was released in total at an average velocity of 31 mph which even devastated the land situated thousands of square kilometers away from it. (Chillopedia)
In developed countries, they learnt from their mistakes they have made that lead to dam breach catastrophes & that's when they appreciate the value of dam safety management.

Consequences of failure

It is of critical importance to know that the consequences of the dam failure is the liability of the Owner, in our case UEGCL.

This is why i believe a dam break is one of the most significant risks of uegcl as the owner and operator of the yet to be commissioned hydro power plants. When a dam is developed, it becomes a liability on the owner since it imposes a new threat to the lives & property of the communities living downstream of the dam.

In terms of cost to the owner;

Owner is liable to compensating lives & property lost obviously not forgetting the asset loss and business loss. In simple terms the owner loses daily revenue that he would earn from the business. Remedial cost is very high. A case study of wolf creek dam with an embankment dam 1.2Km long (same as the right embankment dam of isimba) recommended alternative costed about 2 times the original cost after observing severe hydraulic Distress after impoundment.
Therefore the magnitude of consequences must be analyzed while the owner is investing in dam safety management.

Measures to prevent or mitigate a dam failure

These disasters can be prevented or managed if it so happens by having and implementing an appropriate dam safety management system which includes;

- dam monitoring and maintenance,
- developing and implementation of the

emergency prepared plan (with dam break analysis & inundation maps) and o&m plan.

It is also important to point out that according to the world's dam failure statistics, the biggest percentage has occurred during the first filling of a reservoir. This is why uegcl management is planning to consider establishing a committee of experienced and trained personnel to monitor structures, supervise and guide the rate of filling of the isimba reservoir. This was one of the recommendations from the panel of experts.

Some of the emergency events may not give enough time to fly in an expert thus in house capacity must be built to the required international standards.

Current Status of Dam Safety in Uganda

In uganda, this dam safety value has not yet been highly appreciated because no dam break incident has ever Occurred. There are still many gaps like;

- Lack of nation legislation on dam safety,
- Lack of national dam safety office under ministry of water & environment to regulate dam safety practices in uganda
- Lack of state membership with icold (International committee on large dams) Africa has 24 icold member states including south africa, zambia, ethiopia and kenya as the only east african member state.

Considering the intensity of risk to uegcl as the owner and operator of the yet to be commissioned dams, the management of uegcl continues to support minimization of this risk through;

- Employing, training and capacity building of dam safety engineers,
- Involving a dam safety poe in the on-going projects and
- Procuring a dam safety consultant who Has since commenced on development of a comprehensive dam safety management system for both karuma & isimba hpp.

Key achievements in dam safety in uegcl

Young dam safety engineers were recruited and are being groomed through training & active involvement in construction of the dam.

A key milestone achieved is the mobilization of funds and the commencement of procurement process for the rehabilitation, of the kiira/nalubaale complex to ensure sustainable long term electricity generation, increased plant capacity, improved plant efficiency and to mitigate the effects of concrete expansion and cracks due to Alkali Aggregate Reaction (AAR) a dam safety consultant has already been procured to assess the dam safety conditions of both karuma & isimba. The consultant is expected to develop a comprehensive dam safety management system for both projects.

He expected to work closely with the young engineers who will implement the system during operation & maintenance. The future of dam safety in uegcl/uganda

Uegcl is planning to establish a dam safety unit headed by a dam manager who will be the custodian of the master emergency preparedness plan & coordinate the dam safety of the whole cascade of dams under UEGCL.

Ministry of water & environment is in the process of establishing a dam safety office which will enforce the dam safety regulations and regulate dam safety practices of dam owners.

There is currently a draft of national dam safety guidelines which need to be fine-tuned and enacted.

UEGCL is planning to spearhead pursuing of state membership of icold. The International Commission on Large Dams (ICOLD) is a non-governmental international organization which provides a forum for the exchange of knowledge and experience in dam engineering.

In conclusion, construction & operation of any dam puts lives, property & business at risk. Therefore proper monitoring & maintenance of the dam is rather of paramount importance to both the owner & the surrounding communities.

Disasters are always caused by a chain of mistakes and unfortunate events and same is true if we analyze the history of dam failures. With the advancement of technology and with the advent of new precautionary measures, dam failures will minimize with time and hopefully many possible worst dam disasters can be avoided.

Since safety is one of our core values, uegcl will continue to take precautionary measures to safe guard the lives of the people/communities downstream as we generate for generations.

The Independent Panel of Experts (IPoEs) at the Isimba (183MW HPP)

Jonan KIIZA
PRO-Isimba HPP

On Monday 2 to 5 April 2018, the Isimba (183 MW) Hydropower Project (HPP) hosted the Independent Panel of Experts (IPoEs). The IPoEs is composed of a seven -member team who include Charles C. Hutton-(Chairperson), Prof. Jackson A. Mwakali, Ljiljana Spasic-Grill, John Russell, John Gummer, Jean-Pierre Tournier and Kaare Høeg. This is a highly experienced team comprising of geotechnical, hydro-mechanical, electromechanical and civil engineering experts from the different European countries.

"I want to reassure the nation that the project will be completed in time"

The panel that visits the project every after six months and was in the country for a 5-day independent expert assessment of the project. The IPoEs last visited the project in November 2017 and made recommendations for respective action.

"The IPoE's is here to give a sovereign view on the design of the dam, quality of construction works and at the end of every mission, make recommendations on any of the identified gaps", Said, Dr. Eng. Harrison E. Mutikanga-UEGCL CEO.

The IPoEs was formed in 2016 by the Government of Uganda (GoU) in respect to the construction of the Isimba HPP & the corresponding Bujagaali 132kV interconnection.

While at the Isimba HPP on 2 April 2018, the IPoEs were guided by the Isimba HPP owners' engineer-Artelia & KKATT Consortium to inspect the different project installations in the powerhouse, switch-yard plus the 1625 km long left and right embankment dams. The inspection was conducted in consortium with the EPC contractor China International Water & Electric Corporation (CWE).

"The project has tremendously changed and that the EPC contractor has paid attention to the recommendations made in 2017", Said Chuck C. Hutton-Chairperson IPoE's

"I want to reassure the nation that the project will be completed in time",

Said, Dr. Harrison E. Mutikanga-CEO UEGCL. Adding that, the EPC contractor CWE has submitted a revised schedule of works to the owner's engineer who is still reviewing the same.

According to Mr. Horia Babau-Project Manager (PM)-OE, the Isimba (183 MW) HPP has attained a physical progress of 82%. Artelia & KKATT consortium took over the role of the owner's engineer of the Isimba HPP mid-January 2018. The contract was designed for 12 months ending this year 2018, although with a possibility of extension up to 8 months.

Upon completion, the Isimba HPP will complement 183 Megawatts on the national grid. The project was scheduled for 40 months which will be ending this August 2018. The full panel's visit to the Isimba HPP was considered very strategic by UEGCL management owing to the fact that the project is nearing completion. UEGCL and her consultant Artelia-KKATT awaits the next report of IPOEs.

The Role of the Governing system In Power Generation; An Analysis On Naluubale & Kiira complex.

Sandra Matty KAJUMBA
Control And Instrumentation Engineer

The turbine governing system at a hydropower plant is used to control the speed and power output of the turbine. This is done by regulating the amount of water passing through the turbine and adjusting the blade angle; meanwhile, the governor controls the power output
delivered to the grid. This is achieved by opening and closing the guide vanes and adjusting the turbine blades.

For synchronous generators which is the case for all generators connected to the national grid/infinite bus, a constant mechanical/rotational speed must be maintained at all times irrespective of the grid conditions. The generators at Nalubale HPP rotate at 150 rpm while those at Kiira HPP rotate at 115 rpm. Additionally, those at Isimba HPP rotate at a constant speed of 88 rpm while those at Karuma HPP rotate at 142.9 rpm irrespective of the grid conditions.

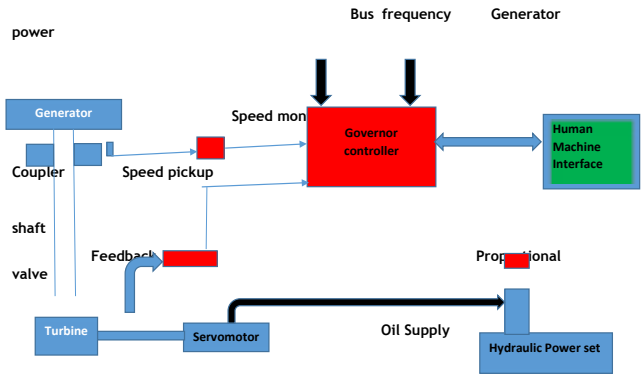
This mechanical speed is translated into electrical speed called frequency. As per the Ugandan grid code, the frequency of any generator connected to the grid must always be maintained at 50Hz. In the case of any slight deviation in this speed, it is the role of the governing system to automatically maintain the electrical speed to 50Hz and mechanical speed for the respective power plants.

frequency=(mechanical speed X number of poles on the rotor)÷120

Mechanical governors: these were the first governors invented. Like all governor systems, a speed signal is obtained from the turbine shaft and transmitted to a pendulum motor. This motor consist of two fly-weights/balls attached to arms that pivot near the axis of rotation. The arms are attached to a collar on a shaft. As the ball head rotational speed increases, the fly balls move out because of centrifugal force pushing a rod down. Over time, turbine governor systems have evolved from Mechanical governors to electronic governors.

The rod, usually termed the speeder rod, acts on the pilot valve to route oil to the main valve and the servomotors.

As the weights moved out, the plunger was pulled down. The ball head is usually turned by a three-phase motor (pendulum motor) that is powered by a permanent magnet generator (PMG) that is driven by the unit being governed. The speed of the pendulum motor is always directly proportional to the speed of the PMG and the unit.



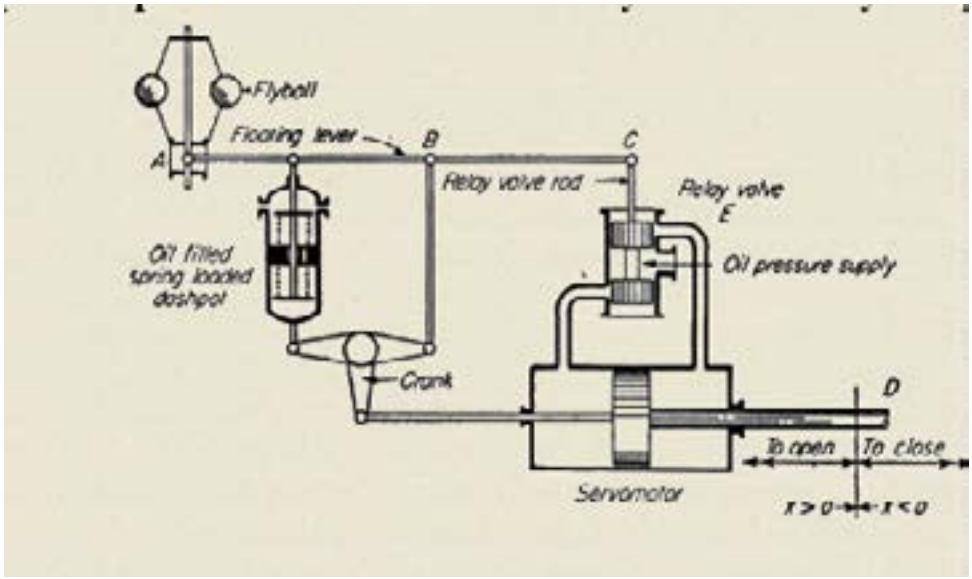


Figure 1: Conventional Mechanical governor [1]

The mechanical governor system was installed at Naluubale HPP. However, the mechanical systems had various drawbacks. These included: excessive wear and tear, pollution of oil, irregularly governing, inability to maintain uniform frequency/load, the danger of pendulum getting stuck, irregular regulation due to incorrect voltage to the pendulum motor among others. Over time, Units 2, 3, 7 and 9 were upgraded to use electronic governors.

Figure 2: Actuator for the mechanical governors at Nalubale HPP

Electromechanical governor:

Next came the generation electro-mechanical governors where speed sensing, speed/output setting and stabilizing parameters were controlled electrically and the use of mechanical components was reduced considerably.
A magnetic speed pickup sensor on the turbine shaft was used to monitor the mechanical speed of the turbine. In this type of governor, analog circuitry is used to develop setpoint signal that is used to position the control actuators of hydroelectric units. An electro-hydraulic interface is used to connect the electronic setpoint signal into a hydraulic oil flow from a hydraulic servo valve system which determines the position of the turbine control actuators. This is a Proportional Integral Derivative controller. These governors increased the reliability, stability, and life of the equipment and facilitated more 150 functional requirements.

Electronic governor:

Today all the mechanical parts are replaced by a digital computer called a Programmable Logic Controller (PLC). Sensors measure the rotor speed, guide vane position and power output and the computer output a signal to an electronically controlled hydraulic valve. [2]

Figure 3: Electronics equipment of the governor system at Isimba HPP and Simens S7-300 PLC

These analogue and digital input signals are transmitted to the Programmable Logic Controller. The PLC then processes all the information sent from these sensors, computes a deviation between the set value and the actual value and considering this deviation, sends a digital signal to the Analogue to digital converter. Eventually, this value translates into an adjustment of the guide vanes and turbine blades respectively.

Electronic governors use electronic circuits for control. They type of governor has been implemented at Kiira HPP (TC 1703), Isimba HPP and Karuma HPP. Units 2, 3, 7 and 9 at Naluubale HPP have been upgraded to the electronic governor. (TC 1703). Particularly, the governing system for Isimba HPP is MGC400. Additionally, some units in

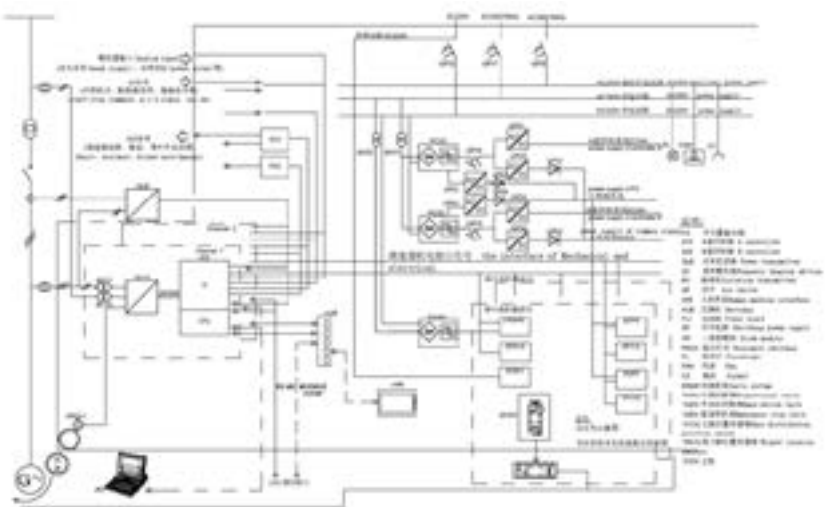


Figure 4: Isimba HPP electronic governor layout

Nalubale units have been upgraded to use electronic governors because of the numerous advantages of electronic governors. These include higher reliability, self-diagnostic feature, modular design, the flexibility of changing control functions via software, the stability of set parameters, reduced wiring and easy remote control through optical fiber cables among others.

Our preparedness for stakeholder and community engagement during Operations and Maintenance of Karuma and Isimba

Isaac Bernard MWESIGWA
Senior Sociologist Karuma HPP

The significance of effective stakeholder and community engagement in the planning and preparation of projects for operation and maintenance necessitates an understanding of dealing with host communities and key stakeholders, particularly those who represent a perceived threat to your project. This is often a dilemma during project implementation and failure to get it right can be costly in terms of public controversy, delayed or abandoned projects as well as running the risk of damaged careers, reputations, and relations.

Not involving the public in project development, implementation and operations can have serious long-term negative impacts on a community's economic, environmental and social outcomes. Instituting dialogue and establishing strong and genuine relationships with local communities and other stakeholders is now recognized as an extremely important part of any project. From large to small-scale infrastructure projects to the development of local community facilities i.e. such as those under CDAP and CSR investments, stakeholders matter!

Our current high-profile projects in hydroelectric power such as Karuma and Isimba have all encountered public controversy, outrage, and media attention due to perceived shortcomings in participatory design and the standard of public consultation – with some key stakeholders faulted for poor stakeholder management at the inception of projects. With the intervention of UEGCL, in managing the contract administration for Karuma and Isimba HPP, the face of these two flagship projects changed.

UEGCL will continuously integrate stakeholder engagement in the project cycle and commit to stakeholder involvement and satisfaction. Through CSR and planned CDAP initiatives during the operation and maintenance of the Karuma (600MW) and Isimba (183MW) HPPs, our host communities will benefit from a range of services including School infrastructure improvement, Health infrastructure improvement, Support to Agriculture, Rural Electrification, Water supply, Construction of boreholes and VIP Latrines among others.

Today, more informed and sophisticated communities demand transparent and effective processes that enable community involvement in decision-making.

Increasingly, public input and participation is expected and, in most cases, demanded at the earliest stages of a project's design, construction, operations up to decommissioning. Host communities need to understand the full implications of a project at the concept stage so that there is an opportunity for concerns to be raised and addressed. Gaining a social license to operate from the community can be an uncertain process and can easily get off track.

UEGCL will continue building awareness, through different forms as stipulated in our stakeholder engagement plan, maintaining effective partnerships for operations and maintenance is a critical element of the successful development, implementation and ongoing operations planning.

Planning and design processes are more likely to be aligned with community views if these views are directly reflected in concept development, and feedback is provided on how the input influenced the decision. Such early engagement will assist in establishing strong relationships that can continue throughout the implementation and operational stages of projects. Regular and continuous engagement at each stage of a project is more likely to reveal important issues and provide valuable feedback as the projects transit into operations and maintenance.

Today's projects are faced with complex socio-political challenges that require stakeholder-centered project management, which should be aligned to stakeholder value and satisfaction. Such challenges have unpredictable consequences and require agile collective collaboration with all stakeholders. During Operations for Karuma and Isimba, UEGCL will integrate stakeholder engagement into operations. The following key plans will be taken into account during the transition from projects to operations.

- Periodically review and update your stakeholder Information.
- Continuously assess stakeholder perceptions about the projects during O&M.
- Continue to disclose, consult, and report to stakeholders as needed.
- Ensure integration of ongoing stakeholder commitments into operations management systems.
- Communicate emergency preparedness and response plans on a regular basis.
- Maintain an operational grievance mechanism to respond to potential risks and Impacts.
- Establishing a participatory or third-party monitoring program.

Understanding the Kaplan Turbine for Isimba (183 MW) HPP

Eseri ATHOLERE
Mechanical Engineer
Namanve Thermal Plant

The Kaplan turbine is one of the most commonly used turbines in hydropower infrastructure around the globe. The Kaplan Turbine was originally developed by Viktor Kaplan, an Austrian engineer, towards the beginning of the 20 century. Viktor developed the Kaplan turbine by further improving the basic principles of the Francis Turbine. **A Francis turbine is a mixed flow (with both radial and axial flows)** turbine which bears fixed blades. To develop the Kaplan turbine, Viktor combined automatically adjustable propeller blades with automatically adjustable wicket gates. This gave birth to the Kaplan turbine with a more efficient production of power in considerably lower head application scenarios which were not possible with the Francis turbine. A Kaplan turbine is a reaction-type turbine in which the water pressure decreases as it passes from the inlet into the blade wheel through to the outlet.

Today, various configurations of the Kaplan turbine have been developed so as to make it more efficient and also give it a wider operational head range. Typical Kaplan turbine system configurations are:

- Fixed blade (fixed pitch) propeller in combination with wicket gates
- Moveable blade (variable pitch) propeller without wicket gates
- Moveable blade (variable pitch) propeller in combination with wicket gates

In the double-regulated turbine systems (movable blade propeller in combination with wicket gates), the runner blade position (pitch) is harmonized to wicket gate position to optimize the turbine operation to the actual water flow rate through wicket gates. This characteristic makes the double regulated turbine most suitable for large flow and low head situations. Its efficiency is between 80 and 95 percent

The head experienced from the Kaplan Turbine ranges anywhere from 1.5 meters to over 50 meters. The turbine however usually operates most efficiently between heads of 1.5 meters and 20 meters. Over 20 meters, it is most likely that the efficiency of the turbine will start to decrease.

Kaplan Turbines can be installed in vertical, horizontal or inclined position, depending on the input flow and drive mechanism orientation. UEGCL's Isimba HPP and the Nalubaale- Kiira complex are all installed with the vertical oriented Kaplan turbine. The vertical orientated Kaplan Turbines allow for runner diameters up to 10 meters. The efficiency of these Kaplan turbines can be increased by adjusting the inlet angle, the exit angles, the radius of the turbine, and the blade pitch angle. All of these factors are unique based on the flow rate of each specific location and flow scenario. Kaplan turbines are effective in nearly any region around the world because they do not require much head. As long as there is relatively high hydraulic flow, a Kaplan turbine may be put into place.

Operation Principle of the Kaplan Turbine.

Kaplan turbine is suitable for operation when water energy is available in the low head (1.5m – 25m) and high flow (70 – 800m3/s). This necessitates the need for water to be stored in a large reservoir in a relatively shallow altitude. In a Kaplan turbine, flow is entered through a spiral casing. The decreasing cross-sectional area of the spiral casing leads the flow to enter the central portion almost at uniform velocity throughout the perimeter. The water flows to the runner after passing by the open wicket gates and finally, it leaves through a draft tube.

Cross section of a runner blade has a curved shape. When water flows over it, it will induce a lift force due to airfoil effect (Newton's third law of motion: to every action, there is an equal and opposite reaction). The tangential component of the lift force will make the runner rotate. This rotation will be transferred to the generator rotor by means of a shaft which is a rigid link that connects the turbine hub to the rotor.

Kaplan turbine is axial flow machines where the absolute velocity of the flow is parallel to the axis of the turbine. Water is precisely directed to pass through turbine blades with help of a shroud.

Usually, power demand fluctuates over-times. Therefore, a governing mechanism which controls the positioning of guide vanes is used to control water flow rate.

This enables adequate response to a varying/fluctuating power demand. Adjustable blades of a Kaplan turbine are designed to operate under a wide range of operating conditions. An adjustable blade experiences relative velocity of flow. The fundamental principle in blade design is "the relative velocity of fluid flow should be at an optimum angle of attack at all cross-sections. Even though the absolute velocity is axial, relative velocity will be inclined to depend upon the blade velocity. The inclination of relative velocity increases from the top of the blade (close to the hub) to the middle portion of the blade due to increase in blade velocity. There should thus be a continuous twist in the blade from root to the middle part of the blade so that there is an optimum angle of attack at every cross-sectional area. With varying flow condition, relative velocity will change drastically. When the flow rate is high, the relative velocity of flow will be more axial so blades should pitch vertically.

If the flow rate is low, the relative velocity of flow is more tangential so blades are pitched in the tangential direction. Pitching action of the blade ensures that the blade is turning at an optimum angle of attack during varying flow. Apart from controlling flow rate, the guide vanes also control swirl flow.

The flow would be highly swirling in nature due to its tangential entry; if guide vanes were not present. A swirling flow would thus reduce the efficiency of the turbine drastically due to its poor angle of attack.

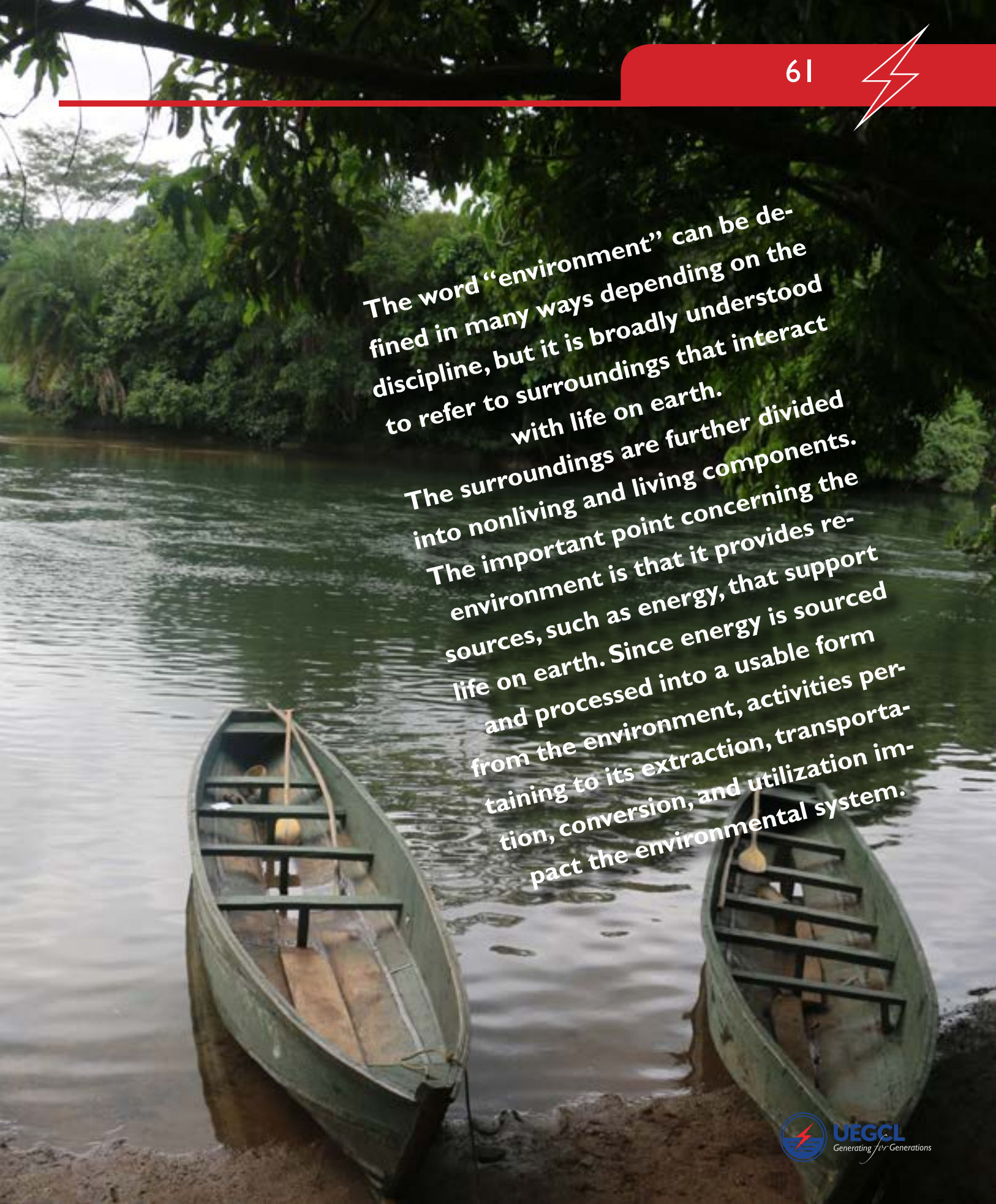
Cavitation is the greatest challenge in the design of Kaplan turbine. Cavitation causes material erosion and vibration thus causing turbine failure. Cavitation is unavoidable in Kaplan turbine since the pressure goes very low in most of the regions. Cavitation can be reduced by using suitable blade material (ASTM A487 stainless steel), and use of airtight film. The draft tube transforms dynamic pressure to static pressure due to its increasing area. This also helps to reduce cavitation. The principle of overcoming cavitation is designing a turbine such that the minimum pressure in the passage of a liquid flow, should always be more than the vapor pressure of the liquid at the working temperature.

Lowering one of the Kaplan turbine units at Isimba HPP

Why we must preserve the Environment!

Doreen ABAMURUNGI
Environmental Officer - Isimba HPP

UEGCL
Generating for Generations



The word "environment" can be defined in many ways depending on the discipline, but it is broadly understood to refer to surroundings that interact with life on earth.

The surroundings are further divided into nonliving and living components. The important point concerning the environment is that it provides resources, such as energy, that support life on earth. Since energy is sourced and processed into a usable form from the environment, activities pertaining to its extraction, transportation, conversion, and utilization impact the environmental system.

Reducing poverty and achieving sustained development must be done in conjunction with a healthy planet. The Millennium Development Goals (MDG's) recognize that environmental sustainability is part of global economic and social well-being. Unfortunately, exploitation of natural resources such as forests, land, water, and fisheries-often by the powerful few-have caused alarming changes in our natural world in recent decades, often harming the most vulnerable people in the world who depend on natural resources for their livelihood.

Uganda's vulnerable ecosystem has been placed under increasing stress by high population growth, rising incomes, and energy consumption. In Uganda, as elsewhere in the world, environmental problems such as water shortages, land degradation, lack of clean and affordable energy resources severely hinder efforts to achieve sustainable development. In addition to these problems, climate change poses a threat to the achievement of the MDGs and the related national poverty eradication and sustainable development objectives.

Hydropower plant and the environment

Hydropower is an important renewable energy resource worldwide. It is nonpolluting; however, its development is accompanied by environmental and social drawbacks. Issues of degradation of the environment and climate change can negatively impact hydropower generation.

Hydropower does not pollute the water or the air. However, hydropower facilities can have large environmental impacts by changing the environment and affecting land use, homes, and natural habitats in the dam area.

For Isimba HPP, most of the social and environmental impacts have occurred during the construction phase. This phase has involved putting up engineering structures such as roads, dam, tunnels, power plants structures, and electricity transmission lines. The land is being cleared and some human settlements were displaced to make room for such constructions.

Inundation of land by the reservoir will destroy the ecosystem, destroy infrastructure, and displace settlements. These activities result in localized air and water pollution, loss in biodiversity, destruction of infrastructure, change of landscape, destruction of settlements, and loss of livelihood and cultural identity in the direct project affected areas. However, all these impacts are being mitigated as follows;

- Restoration offsets, regeneration of vegetation and by planting trees in the project area especially along the river banks and reservoir boundaries.
- Conservation of a river ecosystem by maintaining flows capable of maintaining the river.
- Implementing measures to prevent invasion of foreign species throughout the duration of projects, including the construction period.
- Follow-up studies after the measures are taken and evaluation of their effectiveness; among others.

The reservoir may emit an amount of methane, a powerful greenhouse gas, when vegetation and algae decay with changing water levels. Solutions may include controlling erosion in upstream watersheds and managing water elevation more carefully, especially during warm seasons.

Therefore, it is important to ensure that energy is extracted, converted, and utilized sustainably. The term "sustainable energy" is most of the time applied when one wants to describe the energy that is not associated with significant environmental damage (and climate change) and whose current generation does not compromise on the potential of future generations to meet their energy needs. The transition to sustainable energy resources provides an opportunity to address multiple environmental, economic, and development needs of the country and the world at large.

A sustainable hydropower project is possible but needs proper planning and careful system design to manage the challenges. Well-planned hydropower projects can contribute to supply sustainable energy.

UEGCL in the media


Shs600b Isimba rock claim empty - Solicitor General


Study new power distribution models - expert


UEGCL
DENIS ONENARACH
Job: Driver
Period: From February 2016 to date.
Employer: Sinohydro Corporation Limited.
Home District: Nebbi
Status: Married
Post statist


UEGCL
#KarumaPeople
CHARLOTE TUMUHAIRWE
Job: Ass. camp manager and kitchen supervisor
Period: 2015 to date.
Employer: Sinohydro Corporation Limited.
Home District: Rubirizi
Status: Single
Working on this project is a great honor and privilege since it interact with many people from UEGCL, MEMD & Sinohydro. I have managed to pay tuition and upkeep for young sister who is soon graduating and also built a house for my parents.


UEGCL optimistic of Isimba commissioning soon


Experts make final checks on Isimba


Promise Tracker
Isimba months away from adding power to the national grid

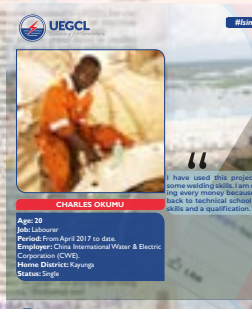

Karuma Dam opens in


Isimba dam: Q
claim of sh200


Low power demand a wo


Isimba dam gets new consultant


UEGCL optimistic of Isimba commissi


UEGCL
CHARLES OKUMU
Age: 20
Job: Labourer
Period: From April 2017 to date.
Employer: China International Water & Electric Corporation (CWE).
Home District: Kayunga
Status: Single

UEGCL
#IsimbaPeople
BATA SAMUEL
Age: 40
Status: Married with 10 children
Home District: Kayunga
Job: Mason
Period: From 2016 to date.
Employer: China International Water & Electric Corporation (CWE).
The project has helped me to support my big family. I have been able to take all my children to school arising from the income I get from working with CWE .I hope to buy my family a plot of land by the end of the year 2018
egclOfficial


UEGCL
#KarumaPeople
ODONGO PETER
Age: 27
Work station: Electro-Mechanical Workshop
Job: Welder
Period: From Jan, 2017 to date.
Employer: Sinohydro Corporation


UEGCL
UNITH NDAGIRE
Job: Assistant Surveyor
Period: 2015 to date.
Employer: Sinohydro Corporation Limited.
Status: Married
By employing Ugan Sinohydro has imp many including my to take care of my siblings with less project has greatly enhance my work e the last 3 years.

UEGCL
Generating for Gene

Post statistics: 6,190 people reached, 304 reactions and over 809 clicks

ics: 7,100 people reached, 283 reactions and over 1,000 post clicks

UEGCL ready to mitigate environmental impacts of hydro-power developments

Edgar KANSIME
GT Environmental Officer
Isimba HPP

The UEGCL mission statement resounds as one walks through the corridors of any of her offices countrywide. "Sustainably generate Reliable, quality and affordable Electricity for Socio-Economic Development". Sustainability is a keyword in this case. My colleagues and I usually hold debates during our lunch breaks at work. I remember vividly when the topic of sustainability of Hydropower generation came up.

Be it known that humankind has flourished, largely due to the ability to harness far more energy than we are physically able to generate. Most if not all of these efforts have had unintended consequences, however, studies have continuously proved otherwise. Pollutants know no geographical boundary and as a result, the pollution issue has become a nightmarish problem and strong national and international pressure groups have sprung up. They're having a definite impact on the development of energy resources.

With more and more emphasis being put on the Environment, numerous "Go-Green" campaigns and the evolution of cleaner and less bulky Power Generation technologies, Hydropower has come under a rather forfeiting microscope. The magnitude of its impact to the Environment has brought many nations to seek other means of power generation.

Hydropower has been unexcitingly compared to the new kids on the block, solar and wind. It's a centuries-old technology, associated with massive government projects of almost unimaginable scale. In Uganda for example, UEGCL is putting in place multi-billion dollar plants that are the largest in terms of output and value in the Country's history.

It's also controversial due to some of its adverse impacts caused by the flooding of large tracts of land in order to make large-scale hydropower possible. Consequently, this has generated pushback from the environmental community.

However, hydropower still remains a pivotal factor in the development of African countries given the fact that it's a result of us harnessing our own Natural resources. I am a strong believer that Uganda can still generate the power it needs to achieve her economic development goals and at the same time protect her natural environment. This can be achieved through the planning of proper Environment Impact Assessment studies and biodiversity assessment and monitoring activities prior to the onset of such huge hydropower projects. The essence of these studies is globally acclaimed as foresight into some of the impacts the project might have on the natural environment, and formulating standard mitigation activities to counter these impacts.

"Sustainably generate Reliable, quality and affordable Electricity for Socio-Economic Development".

The Chaglla project, on the Huallaga River in Peru, was and still remains an example of thorough environmental and social risk assessment in the modern times. A highly engaged stakeholder process resulted in assessments on "fish and ecology, water quality modeling, downstream flow modeling, a resettlement action plan, and analysis of the project's carbon footprint."

Additional outcomes included the establishment of a new social services and agricultural services extension center, 800 local people trained to work on the project, a recycling center set up, the discovery of several new species and the establishment of an "important bird area" in the region which will help protect the biodiverse forest.

These plans should not only counter the impacts at the Projects level but also should consider those impacts during operation and maintenance of hydropower stations. In fact, operating a hydroelectric power plant may also change the water temperature and the river's flow.

These changes may harm native plants and animals in the river and on land. Other programs like the Community Development Action plan and continuous community sensitization specifically target the surrounding communities and those directly impacted by the onset of the project in their area.

Community sensitization about the pros of having such huge projects in their area, for example, social and economic boost through jobs and improved infrastructure, can aid to pamper some of the backlashes from the local communities. "While all energy sources have some undesirable impacts, and hydropower is no exception, it does have the advantage of being both carbon-free and, in most cases, continuously available". However, it should be noted that hydropower facilities can have large environmental impacts by changing the environment and affecting land use, homes, and natural habitats in the dam area.

Most hydroelectric power plants have a dam and a reservoir. These structures may obstruct fish migration and affect their populations. Reservoirs may also cover people's homes, important natural areas, agricultural land, and archaeological sites. So building dams can require relocating people and this becomes simpler with Resettlement Action Plans in place.

Ideally, both Isimba HPP and Karuma HPP have done exhaustive Environment and Social Impact Assessment studies and the onsite Health, Safety and Environment teams together with the company Sociologists are always at hand to monitor, and handle any impacts at the Project sites. With this on board, UEGCL is ready to generate for generations hence more set for operations and maintenance!

The Isimba (183 MW) HPP joins the rest of the world to celebrate "world day for safety & health"

Herbert Daren MUSOKE-
HSE Officer - Owners Engineer Isimba HPP

"Health, Safety, and Environment (HSE) procedures and guidelines should not be interpreted or perceived as certain bureaucratic paperwork to be followed by the HSE team only"

The International Labour Organisation (ILO) marks the World Day for Safety and Health at Work on the 28 of April to promote the prevention of occupational accidents and illnesses globally. It is an awareness-raising campaign intended to focus international attention on emerging trends in the field of occupational safety and health and on the magnitude of work-related injuries, diseases, and fatalities worldwide.

On 25 April 2018, the Isimba HPP Implementation team joined the rest of the world to mark this significant day. The day was marked in style including a 5km safety procession around the project area, conducting safety awareness sessions, first aid, and firefighting training.

From that background, Safety is everyone's responsibility. "Health, Safety, and Environment (HSE) procedures and guidelines should not be interpreted or perceived as certain bureaucratic paperwork to be followed by the HSE team only". The HSE culture cannot grow in any institution unless it is supported by top management. It is on record that company's or sites where the top management does not lead by example, their HSE culture is very poor. Here at Isimba HPP, the Health, Safety and Environment department gets full support from UEGCL's Board and Top Management.

Occupational Safety and Health (OSH)

Occupational Safety: This is the protection of people from physical injury at workplaces.

Occupational Health: This is the protection of bodies and minds of people from illness resulting from the materials, processes or procedures used in the workplace.

Safety awareness session by CWE HSE Manager and UEGCL PM

Hazard: This is the potential of a substance, person, activity or process to cause harm.

Risk: This is the likelihood of a substance, activity or process to cause harm, damage or loss.

Many workers, supervisors, and managers think that personal protective equipment (PPE) is all that is required to be safe; this is a misconception. In the hierarchy of hazard control, PPE is only a last resort. At Isimba HPP, all levels of the hierarchy of control are followed. Throughout the implementation of Isimba HPP, hazards are identified by conducting risk assessments, job safety analysis, and application of the hazard hierarchy of controls

Hierarchy of Control

•Elimination e.g. where practicable, work involving the hazard of a fall from height is undertaken on the ground

•Substitution; use of less hazardous substances, substitute a type of machine with another which is better guarded to make the same product.

•Engineering controls; separate the operator from a known hazard by enclosing the process, use machinery that is automatically operated, isolation, insulation, ventilation etc.

•Administrative controls including training workers, reducing exposure time, providing sufficient supervision, signage etc

.•Personal Protective Equipment used as the last line of control.

Employer's Responsibility as Required by OSH Act 2006

•To take as far as is reasonably practicable all measures for the protection of his or her workers and the general public from dangerous aspects of the employer's undertaking at his or her own cost

•Provision of safe workplaces, machinery, and equipment;

•Provision of adequate and appropriate information, instructions, and training

•Provision of adequate supervision

•Provision without the cost of personal protective equipment

The employer would be responsible for all predictable and unpredictable eventualities related to his failure to satisfy the above requirements.

Failure to satisfy the above requirements, a worker may be charged for contributory negligence and /or may lose the assumed compensation in the event of an incident.

Below are some of the high-risk activities anticipated during Isimba HPP implementation

•Electrical works

•Confined space entry

Employee's Duty of Care as Required by OSH Act 2006

•Taking reasonable care of their own health and safety.

•Taking reasonable care that their conduct does not adversely affect others.

•Complying with instructions.

•Reporting any HSE anomalies observed.

•Ensuring that they have understood and undertaken a risk assessment/job safety analysis with their supervisor prior to the commencement of any work.

•Using appropriate PPE for all tasks executed

Supervision to Operation and Maintenance: effective change management at its best.

Cissy Nawatene SSEKAJIIJA
Public Relations Officer

The processes, tools and techniques of managing the people side of change to achieve the required business outcome which in essence is ***change management*** is becoming the next big discipline and we need to get on board with it. However, incorporating the organizational tools that can be utilized to help the organization make a holistic transition, adoption to the change and the ability to manage it is by far the utmost challenge companies are facing.

Change typically results as a reaction to specific problems or opportunities organizations face based on internal or external stimuli. However, benchmarking from UEGCL, we are faced with an opportunity of operating and maintaining the flagship projects of Karuma (600MW) and Isimba (183MW) a transition from the vigorous supervision of works from the inception stage of bush clearing to operation and maintenance with strict exceptions to comply to the O&M work plans, rules , regulations and adherence to the manuals.

The problem. however, is not the transition but how we're preparing to transit.

For a company transiting to achieve operational excellence, it has to address issues related to effective ***change management*** involving all concerned stakeholders. Currently, UEGCL on board with ***Change management*** and communication plus a planned and adopted strategy to encourage growth and improvement . In effect a clear roadmap is needed to identify the beginning, the route to be taken, and the destination. This strategy is purposely to ensure that plentiful preparation is done during the transition period from the current state of – supervision of the construction works of the flagship projects to the ***desired state*** of –Operation and Maintenance with emphasis that the lasting benefits of change are achieved.

The transition period however comes with a high level of **commitment** to the discipline and with the prerequisite strategies to address the most important issues of Cooperation and teamwork: communication and engagement, streaming roles and expectations, focusing on a plan that is implementable with appreciated long term values, goals and actions in place not forgetting validating and rewarding those responding to change because they drive the team looking ahead. However, Due to ever-changing stakeholder expectations, the science of organizational change is in itself constantly changing and progressing.The human component of change management may be one of the most difficult to traverse because people do not inherently like change or adjust to it well. Consequently, early involvement of all stakeholders, implementing process, and constantly adjusting for improvement is critical to a successful transition.

"Culture does not change because we desire to change it. Culture changes when the organization is transformed; the culture reflects the realities of people working together every day." ***- Frances Hesselbein***

If we must ask ourselves a question then it should be ***"how the early and readiness planning, testing and exercising will help deliver UEGCL to the desired state"? The answer for me is clear and it starts with planning out the things that need to be marked off in the ram-up to O&M as listed below***

a) The development of an all-embracing readiness strategy/plan with clear objectives is the first requirement to management of a transition. As good practice dictates, projects should be justified by a rock-solid business plan from start to end with a clear line of responsibilities across all stakeholders internal and external. This not only embeds the ***culture*** of teamwork but spreads the overhead because the roles, responsibilities and governance is clearly established.

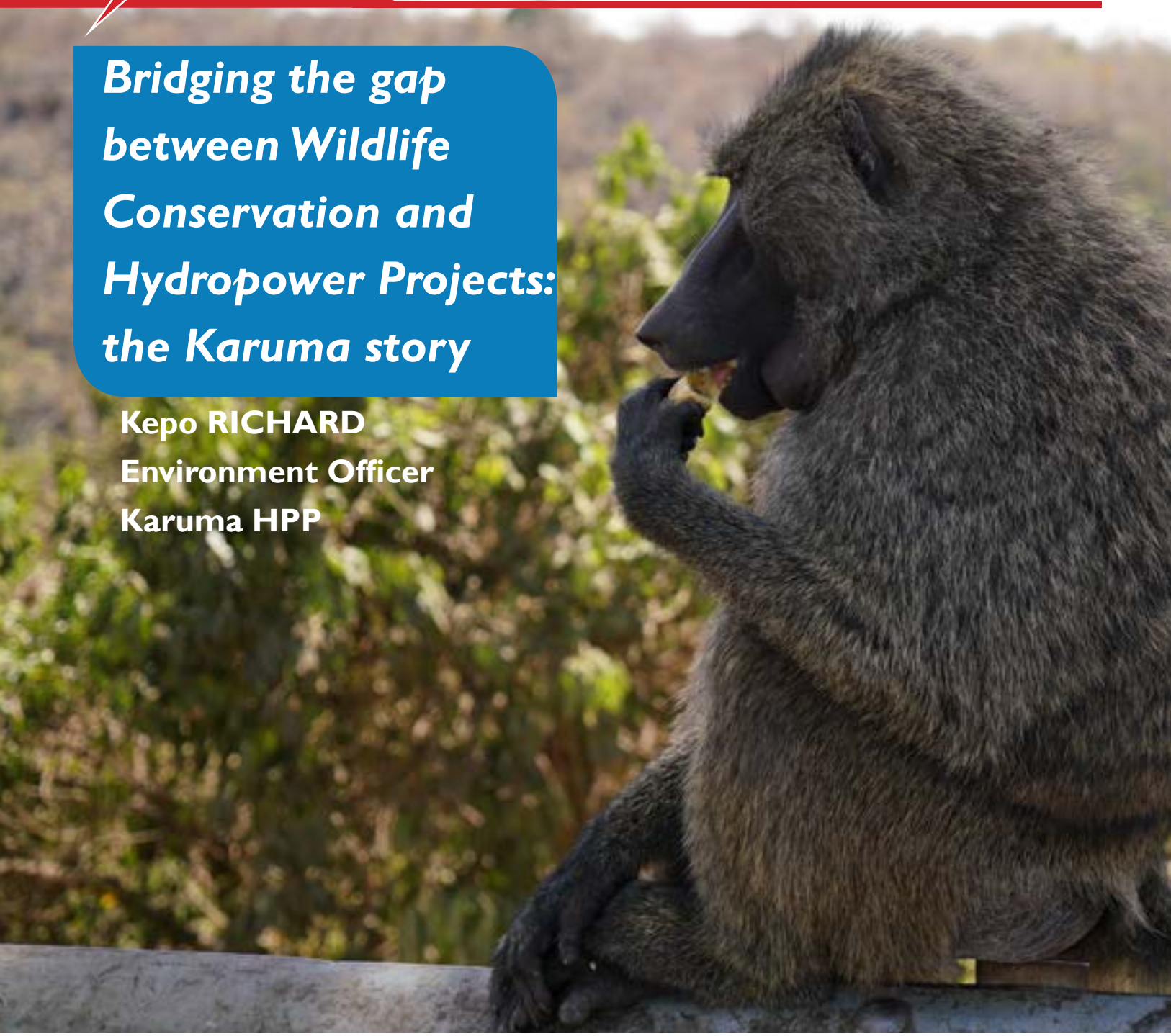
b) The immersion of all stakeholders (external and internal) in the transition creates an emotional connection and creates a level of loyalty , moving them away from the fixed and inflexible one-dimension planning and challenging them to think collectively by involving all of them in the planning for your next big project Operation and Maintenance. This can be done through a readiness package which also requires amalgamation between people, processes, infrastructure and technology which eventually fosters collaboration.

c) There is need to ascertain the risks involved and gaps to be addressed along before the operational inauguration and ensure stress is positioned on the most associated risks to the organization in preparation for the reality that it is time to manage the plants. As it's always known, focusing on building capabilities to deliver the readiness plan will help to mitigate the risk of some contingency and crisis situations occurring in the first place.

d) Investing in the change management discipline which UEGCL is already doing is in essence capitalizing on operational readiness at the earliest stage. Investment will definitely add costs to the capital expenditure **BUT** will drive benefits that far exceed this cost of both immediately upon operation launch and therefore show fruits of enriched efficiency and productivity, increased quality, better customer service and improved compliance.

e) Lastly and passionately, I will recommend **communication and measurement of progress towards readiness.** This is the golden thread that runs through the entire practice of change management. The communication team should be on board with every plan, activity, meeting, discussion, achievement or shortcoming. The process of Identifying, planning and executing a good change management strategy is dependent on good communication because it is the backbone a successful transition. The need to provide a qualitative and quantitative framework to track progress, evidence capability, highlight areas of risk and communicate with stakeholders is by far the MOST important of all.

Bridging the gap between Wildlife Conservation and Hydropower Projects: the Karuma story



Kepo RICHARD
Environment Officer
Karuma HPP

The alarms and fears by conservation experts and media cynics for the construction of hydropower plants inside or adjacent to protected areas is not a new phenomenon. We have all heard the talk about the negative impacts on eco-tourism, induced human-wildlife conflicts, poaching threats to ecological and marine life conservation among others.

The (600MW) Karuma Hydro Power project is one of such ventures, located within the vicinity of 2 conservation areas namely; the Karuma Wildlife Reserve (KWR) and Murchison Falls National Park.

This area is of high biological value with landforms such as Karuma falls, grasslands, wetlands and several water streams. The reserve also harbors wildlife species such as the olive baboons (a very common scene around Karuma bridge) ,Uganda kobs, , lions, Rothschild's giraffes, vervet monkeys, leopards, buffaloes and elephants, the black and white Columbus monkeys, L'Hoest's monkeys, Topis, Hippos and ribis that call the Reserve their home among others. *"These animals have no borders and they traverse within and across the protected area."*

The main tunnel that harbors the hydromechanical and electromechanical equipment's are constructed 6.4km within the Karuma Wildlife Reserve.
The systematic alteration and destruction caused over originally pristine habitats could lead to increased competition between the project and wild animals for space and resources. This reserve is also a home to major tourist activities such as game viewing, bird watching, water-based activities among others.

The project has had some impacts already, such as; habitat destruction i.e. clearing of vegetation on some parts of the park, visual intrusion by movement of large trucks and presence of a large number of workers, disturbance of terrestrial fauna as a result of bright lights and other activities which could interfere with social behavior of the animals.

On a positive, the project has brought social amenities closer, such as medical facilities, provision of employment among others.

"If not well managed, stray animals can cause serious damage to hydropower plants". They can damage the crucial piece of equipment as they move around to look for food. Such incidents have recently been witnessed in some parts of the world i.e. on 17 July 2017 in Livingston, Zambia, a baboon entered the switchyard and caused power blackout for over 4 hours affecting more than 5,000 people.
A similar incident happened in Kenya on Tuesday, July 7, 2016, when a monkey tripped a transformer at a KenGen operated power plant causing a national wide blackout. All these coupled with the tripping of the Zurich power plant when a lizard entered an electrical panel causing a blackout in the Swiss capital.

These incidents result in losses of megawatts of power and triggering a blackout on top of affecting wildlife through electrocution. This, in turn, leads to additional financial implications in form of repairs and to some extent replacement of the damaged hydroelectric equipment's. This, therefore, calls for proactive measures to avoid this happening at Karuma hydropower station in the present and near future. Another aspect to consider is that wild animal safeguard requires a particularly cautious approach. UEGCL is already undertaking some precautionary measures to safeguard against project clash with wildlife. These include;

Sensitization of workers at the site on co-existence and the importance of wildlife and nature conservation.
Routine biodiversity monitoring, done in collaboration with a team from the Uganda Wildlife Authority. This is conducted on a monthly basis to track the movements of the wild animals.
Aquatic ecosystem surveys have also been undertaken to assess values within and surrounding the project development area and an assessment of the potential for these values to be affected by direct and indirect impacts associated with the construction, operation and decommissioning phases

Construction of fish passageways/ fish ladders is expected to provide a detour route for migrating fish so that they can get over or around a dam that's blocking the way to and from their spawning grounds.
Staff training and benchmarking visits: UEGCL is committed to training its staff to expand their knowledge base, adopt new technologies and methods in addressing complex project issues. In the recent past, some select staff participated in a refresher training on dam safety, operations, and maintenance management held in Johannesburg – South Africa.

As UEGCL prepares for the commissioning of the Karuma hydropower station, the following additional strategies could be explored to protect equipment's and keep off wild animals from electrocution;

1. Installation of automatic Scarecrow sprinklers. These contain battery-operated motion detectors that spray a startling burst of water at animal equipment invaders.

2. Fencing

This is a popular wild animal protection practice that can last for many years and has the following types:
Wire Fences. These are effective, long-lasting, and require relatively little maintenance.
Beehive fences. African elephants are afraid of bees. These bees' stings can be extremely painful even for the thick-skinned elephants. Beekeeping has the additional advantage of producing honey, potentially diversifying and increasing the livelihoods.
Electric Fences. Constructed to inflict an electric shock to animals that come in contact with the fence. It's recommended that electric fences are marked with a warning sign to prevent any possible human contact.

3. Natural Repellents

We may also prefer using environmental friendly measures instead of mechanical protective practices to keep off wild animals;
Planting repellent plants. Such as tansy, Artemisia and yarrow and culinary herbs like mint, oregano, thyme, tarragon, and chives.

Sonic Electronic Repellent; These tools that emit sound in the attempt to repel, deter unwanted animals such as insects, rodents, birds and large mammals and they cover a wide range of the acoustic spectrum.

Bridging the gap between wildlife conservation and infrastructure development remains a challenge. It perhaps changes that may ultimately determine the sustainability of protected areas such as Karuma Wildlife Reserve. While the potential economic and ecological values of the reserve to the nation and indeed the rest of Ugandans cannot be ignored, UEGCL remains focused on ways to avoid, minimize and mitigate the potential impacts of hydropower development on wildlife and habitats.

Buffer zoning. Established around the edge of the hydropower station. This is planted with crops like garlic, chili paper that repels elephants, baboon, monkeys, Deer, etc.

4. Electronic Repellents;

Effective, long-lasting, and eco-friendly method for equipment protection that repels animals without harming them;

Ultrasonic Electronic Repellent. This is designed to confuse, disorient and intimidate monkeys to quickly scare them away from the effective area.

THE ISIMBA (183 MW) HPP UEGCL'S BEST PROJECT OF THE YEAR 2017 ; HOW THEY WON IT.

Jonan KIIZA,
PRO - Isimba HPP

UEGCL
Generating for Generations

As part of her culture, Uganda Electricity Generation Company Limited (UEGCL) every year celebrates the efforts of her workers. The date of this event varies conversely, the only constant, is the month of December.

"Having our O&M teams of the Isimba & Karuma HPP's to China & Kafue Gorge-Zambia respectively plus completing the second river diversion at the Isimba HPP; UEGCL acting as Isimba HPP's interim owners engineer for the remaining part of the year among many others qualify 2017 to be an incredible year for the organization", **Said Eng. George Mutetweka-Chief Operations Officer.**

"Having our O&M teams of the Isimba & Karuma HPP's to China & Kafue Gorge-Zambia respectively plus completing the second river diversion at the Isimba HPP; UEGCL acting as Isimba HPP's interim owners engineer for the remaining part of the year among many others qualify 2017 to be an incredible year for the organization",

Additionally, 2017 might have come with its unique challenges, but UEGCL surmounted them. Notably, In September 2017, the government of Uganda did not renew the contract for the Isimba HPP owners' engineer, EIPL, and that invariably sent UEGCL right into the deep end regarding project supervision. This effort by the Isimba team could not go without recognition and reward by the organization.

Thus at the end of the year 2017 party, 5 employees were recognized as "best" in respect to their duty stations. For the Isimba was Paul Tumwine - (Mechanical Engineer), Irene Eyatoru- Karuma HPP and Lucy Akwi & Raymond Akankwasa-Head office. Arising from the records from individual's appraisal scores, Paul Tumwine- Isimba HPP emerged as the overall best employee of the organization. It was with no doubt that the Isimba HPP emerged as the best project of the year 2017 and consequently rewarded with a stunning 3 Million Uganda Shillings.

Why & how Paul Tumwine emerged the best employee of 2017?

As the saying goes, "where there's smoke there's usually fire", it accurately feeds us into this brief analogy with respect to the above subject matter. I joined UEGCL in October 2017 and I was commissioned to the Isimba (183MW HPP) which is situated in Kayunga & Kamuli districts of Uganda.

This period was characterized by intense civil works and mechanical installations at the hydropower project. As I was grappling to fit in at the project; Paul Tumwine was always my first spot! As per mandate of communication to the organization's publics via social media platforms ideally calls for an accurate description of any equipment being installed at the HPP.

Paul was very exceptionally handy and outgoing, this characteristic is shared by all members of Isimba HPP. Being available on phone 24-hours is another odd virtue with him.

"For all the times I called Paul between 1 and 2 AM, he would be at the power-house", Said **Eseri, one of the graduate trainees at Isimba!**

On several countless times, I would get Paul off his desk to come to mine so that he looks at the accuracy of my social media posts, more especially the descriptions of mechanical equipment being installed at the Isimba HPP. All these perspectives of the team were sealed by the opportune arrival of the month of November 2017 in which the human resource seeks outstanding staff.

Well, it is very normal in Africa for individuals to present very long and beautifully packaged eulogies about people upon their death. More even so, to some who do not deserve a positive mention because of living a contrary lifestyle.

In few words, let me describe UEGCL's best employee of the year 2017; Paul is social, flexible, hardworking, encouraging, positive, a good listener, precisely he is a gentleman. Paul was indeed the deserved UEGCL's face in the year 2017.

The nomination exercise

"The employee nomination forms are delivered to administrators at the different projects preferably two months earlier than December to allow for concrete data analysis", **Said Doris- UEGCL HR assistant.**

"UEGCL considers and rewards her outstanding workforce from the different bureaus", **Said, Jackline Kambabazi- UEGCL HR Manager adding that this gesture motivates staff.**

" I commend last year's organizing committee for staging an excellent end of year party plus conducting a transparent employee of the year exercise", Said, Harriet Oyulu Ekude- UEGCL's -CHRO

She also alluded that so many surprises await UEGCL's staff come to this end of year party 2018. *"You will realize that UEGCL human resource personnel has greatly increased as we head to operations and maintenance of the two flagship projects of the Isimba & Karuma HPP's", Added Harriet- UEGCL CHRO!*

"For all the times I called Paul between 1 and 2 AM, he would be at the power-house",

" I commend last year's organizing committee for staging an excellent end of year party plus conducting a transparent employee of the year exercise",

Isimba HPP the Best UEGCL Project of the year ended 2017

The Isimba HPP is Located 4 Km downstream of Isimba falls on the Victoria Nile. The Isimba hydropower project is expected to be commissioned by end of 2018 with an installed capacity of (183MW). The HPP has got 42 employees headed by the Project Manager. Their roles range from engineering, administration and support services.

The Isimba Hydropower project emerged as the best performing project in the performance evaluation concluded on February 12, 2018. The performance of the departments is measured against how much they have achieved with respect to their objectives set out in the preamble of the year. These objectives are meant to be SMART and in covenant with the corporate scorecard of the organization.

"The process of evaluating the different departments of the organization is very transparent and available for public critique in case of any discontent by any party", Said Henry Lutwama of Business performance.

In the same disposition, the head of business performance Mrs. Beat Nabacwa highlighted the need for departments to have their evidence in order ahead of evaluation. *"It is the other thing to do what you've set out to do and the other thing to have evidence in respect to executing a given objective",* **Said Beat Nabacwa,** adding that, *"departments must always ensure that their respective objectives are SMART..."*

The Isimba HPP under Scrutiny!

The leadership Factor

The success of the team is dependent on the coach's tactics. The Isimba HPP's coach **Eng. Chad Silas AKITA** cannot be omitted as a factor for the outstanding performance of the project.

He is a calm, soft-spoken, and very meticulous a leader! His team captain Nicholas Rugaba aka the "Grit Master" indeed knows how to transmit the instructions from the coach to the team members. Anecdotal evidence shows that the different sector managers, like Michael Esimu - Generation manager and managers below him Like Patrick Angupale and David Lubega plus the Senior Civil Engineers Andrew Ambazimana, Angelo Semagulo and the project admin, Abise Hellen entirely exhibit leadership foundations.

"The quality of output of the team is correlational with the quality of its leaders", as put in Clemmer & McNeil (1989). This fairly is in covenant with the leadership analogy above!

Team Work

I will not want to go scholarly in defining teamwork. Amid gathering several scholarly angles to the same, teamwork is the ability of the workers to bear the same vision.

Like teamwork is propagated by the UEGCL with her culture. The Isimba HPP has amplified the organization's culture say team breakfast, traveling as a team, celebrating each other's success and sharing the pain.

The morning breakfast is also composite of toolbox talks where safety issues and precautions are reechoed to members accessing the site facility. At the Isimba HPP, the team takes every opportunity together for cohesion. I am talking about walking the talk of teamwork. Isimba is honestly the benchmark of a practical organization cohesion.

The Interim OE Factor

When the Contract for the owner's engineer, Energy Infratech PVT Limited expired in September 2017; Government of Uganda (GoU) decided not to renew the OE's contract based on that contractual premise. The process of Procuring the Isimba- OE was not to be a fortnight activity by UEGCL hence work on site could not be stopped.

The Isimba UEGCL team was throng right into the deep end, as the project supervisor for the interim until a new OE was procured.

It lasted for 4 months! This remains by far the true measure of the team's competence and determination. This period called for long working hours, postponement of contractual rights like leave days, persistent project supervision of the different key project installations, review of method statements/documents plus consistent archiving of the same.

"All In all, the Isimba HPP has proved to be one of the progressing projects this year 2017 and the committee based on evidence has qualified Isimba as best project", **Said, Eng. Jotham Ssempewo-Chairman evaluation committee.**

In a nutshell, as I mentioned from the onset, some of the characteristics that made the Isimba HPP the best project of the year 2017 were not necessarily among the benchmarks set out by the evaluation committee. In my opinion, the team at Isimba HPP was very solid, positive, enthusiastic with young men and women who present grit for making UEGCL one of the leading power producers in the great lakes region.

The Isimba (183MW) is almost ready for O&M, Says, and The Project Steering Committee (PSC)

Jonan KIIZA
PRO - Isimba HPP

The project steering committee (PSC) on 28 February 2018 visited the Isimba (183MW) HPP to assess the progress. The PSC is headed by Dr. Eng. Badru M. Kiggundu- as its Chairperson.

The PSC is a composition of the Permanent secretaries for the Ministries of Energy and Mineral Development, Ministry of Finance Planning and

"This, is commendable progress and provides the much-needed hope that the Isimba hydro power dam will be on the grid by the end of 2018…",

Economic Development as well as Ministry of Justice and Constitutional Affairs. The other members on the PSC include Chief Executive Officer of Uganda Electricity Generation Company Limited (UEGCL) and Chief Executive of Uganda Electricity Transmission Company limited (UETCL). The PSC conduct regular site visits to check on the progress of the two flagship projects.

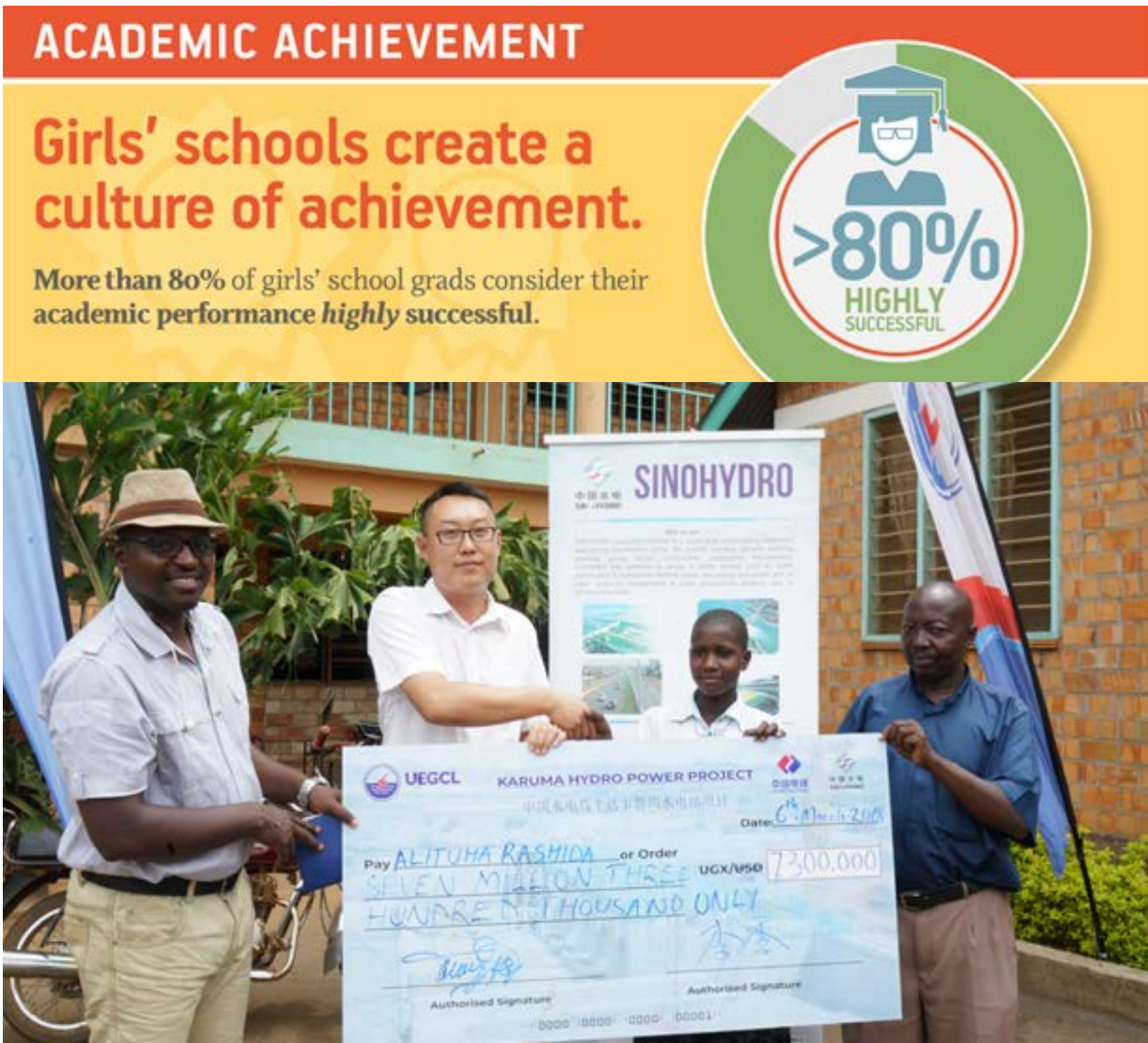
The PSC was impressed by the general physical project progress at the Isimba (183MW) hydro Power project which was at 80% noting that, *"this, is commendable progress and provides the much-needed hope that the Isimba hydro power dam will be on the grid by the end of 2018…",* **Said Dr. Eng Badru Kiggundu-Chairperson PSC**

The PSC met with all the implementing stakeholders of the project who included UEGCL, UETCL, Ministry of Energy, the new Owners' Engineer Artelia and KATT and the contractor the EPC Contractor-China Water and Electric Corporation (CWE).
The PSC was later guided for a site inspection by the owners engineer (OE) to the key project installations which included; the powerhouse, switchyard (132kV), the Left & Right Embankment dams respectively.
"I like the pace of the contractor and I think it makes up for the earlier lost time", said Dr. Eng. Badru M. Kiggundu adding a word of caution to the EPC contractor in respect to maintaining standards of occupational Health and Safety.
He further alluded that the safety of workers on site is as important as the timely completion of the project!

The Project Steering Committee was constituted by President of Uganda H.E Y.K Museveni to superintend over the country's flagship hydro power projects of Karuma (600MW) and Isimba (183MW).
Upon completion this year 2018, the power from the Isimba HPP shall be evacuated through a 42 KM transmission line rated at 132 kV that will adjoin the rest of the national grid at the Bujagali switchyard. The two flagship hydropower projects of the Isimba and Karuma are expected to significantly reduce on the end user tariff once commissioned. Both projects are being constructed using 85% concession loans from China's Exim Bank and 15 % funding from Government of Uganda (GoU).

Sinohydro Corporation launches "SEND A GIRL TO SCHOOL" campaign

Muhammad LUBOGO
PRO - Karuma HPP



"I actually thought it was a dream when my father came home to tell me that Uganda Electricity Generation Company Limited (UEGCL) & Sinohydro Corporation were going to take care of my school fees" – Ms. Alituha Rashida in her little-muffled voice narrated with tears of joy coupled with a wide smile on her face.

Ahead of Women's day celebration in Uganda, UEGCL & Sinohydro Corporation launched a campaign dubbed as 'Take a Girl to School' as part of the (600MW) Karuma Hydropower Project Corporate Social Responsibility (CSR). Sinohydro Corporation committed to sending two young girls to school who would otherwise have found it hard to be in school.

This year-2018 12 of January, the Uganda National Examinations Board released Primary Leaving Examinations (PLE) results for the past year 2017. Therein, Ms. Akello Angela 14-years from Agobadong Primary School in Oyam district had scored aggregate 8 while Ms. Alituha Rashida 14-years from Kigumba Intensive Primary School had also scored aggregate 8. The duo emerged as the best female PLE pupils in the two districts of Oyam and Kiryandongo respectively.

Ms. Rashida Alituha (14) currently a senior one student at St. Andrea Kahwa Secondary and Ms. Angella Akello a senior one student at St. Katherine Secondary School, Lira each received a stunning USD 2,000 (equivalent to approximately UGX 7.3 Million) to cater for their entire O' Level education.

The cheque handover ceremonies were held on 6 March 2018 in Hoima and 7 March 2018 in Lira districts of Uganda.

School fees are not the only item that can keep a girl child in school. The money (USD 2,000) for each girl was paid directly to the respective schools upfront to cater for the girls (Alituha and Akello) school dues and will also undertake to provide the student termly requirements such as sanitary towels, sanitary wear like personal wear and other scholastic materials.

"If you are planning for a year, sow rice; if you are planning for a decade, plant trees; if you are planning for a lifetime, educate people." Said Mr. Li, Administration Manager, Sinohydro Corporation during the cheque handover.

Sinohydro Corporation has been involved in several CSR initiatives that include the construction of a market at Karuma, putting up several boreholes, conducting annual medical camps and refurbishing schools within the areas adjoining to the hydropower project. As part of the major CSR initiatives, Sinohydro will, by the end of the Karuma project construction build two hospitals, a school and actuated a bursary school all of which are costly in millions of dollars.

"Going beyond your call of duty which is building the country's biggest electricity dam (Karuma Hydropower project) is not only commendable but goes a long way in showing your commitment to bettering Uganda," said Simon Kasyate, UEGCL Corporate Affairs Manager.

Adding that, "Such interventions like educating Uganda's children is at the core of our country's quest for middle-income status because it adds to the numerous efforts in educating and skilling our human resource,".

Akello is an orphan, raised by a peasant single mother and currently living with her grandfather, a retired police officer, and Rashida is first born in a family of 7 whose father is a market vendor at Karuma while the mother is a peasant farmer. Both Alituha & Akello have a career ambition to become doctors one day. From time to time, UEGCL was tasked to follow up on the performance and welfare of the girls throughout their scholarship period. Who knows, good grades might result in something bigger for the coming generations..!

"If you are planning for a year, sow rice; if you are planning for a decade, plant trees; if you are planning for a lifetime, educate people." ***Chinese proverb***

QUALITY MANAGEMENT SYSTEM (QMS) AND ISO 9001:2015, UEGCL'S GATEWAY TO OPERATIONAL EXCELLENCE.

Written By Carol BISHAGENDA - IT Officer &
Nicholas Rugaba AGABA - Assistant Project Manager

One year since Uganda Electricity Generation Company Limited (UEGCL) attained the ISO 9001: 2015 Certification, the Quality Management System (QMS) continues to take root in the organization's approach to delivering services in Uganda's energy sector. As indicated in the standard, the adoption of QMS is a strategic decision taken by top management for UEGCL to improve its overall performance in service delivery and also provide a sound basis for sustainable development initiatives.

This clearly indicates that implementing the QMS is a strong anchor for performance and sustainability. For clarity, ISO 9001:2015 is the International Standard that clearly spells out the requirements for running a Quality Management System (QMS). The international standard employs the process approach, which incorporates the Plan-Do-Check-Act (PDCA) cycle and Risk-based thinking. UEGCL's organizational processes should add value internally and externally all along the way, from capturing customer requirements to final delivery.

These Processes transform inputs (i.e., understanding requirements) into desired outputs (meeting requirements). Statutory and regulatory requirements can also be expressed as legal requirements in the EPC Contracts, Consultancy contracts, MoUs with development partners, legislation like the Electricity Act, the Companies Act, ERA Act etc.

Under Clause 4 of the ISO 9001:2015 Standard, the organization is tasked with determining both external and internal issues and the expectations of all interested parties that are relevant to the strategic direction and vision/mission.

This has been ably done through the SWOT Analysis that was conducted during the consultative meetings to develop the Strategic Plan for 2018 to 2023. These later define the customer requirements and feed into the "Plan" phase of the Quality Management System.

The Operations Department has developed Operational Readiness Plans and also conducted training (both on and off-site) thus building the knowledge and capacity necessary for operation and maintenance. The organizational knowledge also acquired during the project's phase (for Karuma and Isimba HPPs) is instrumental in achieving UEGCL's objectives to acquire and develop new energy projects across the country. Aspects on Organisational knowledge are highlighted under Clause 7 of the ISO 9001:2015.

The standard under clause 7.1.4 goes ahead to indicate the requirements for determining, providing and maintaining a conducive environment that is necessary for organizational activities and processes. The suitable environment is a combination of human and physical factors namely social, psychological and physical. In this regard, team building sessions, employee motivation, workplace design and ergonomics are key to implementation of QMS. Clause 7 and 8 guide the QMS on the "Do" phase of implementing what is planned using the resources available.

UEGCL is steadily growing in the adoption and utilization of the Balanced Score Card (BSC) as a tool for Performance Measurement and Strategy Implementation/ Execution.

This initiative falls under Clause 9.1 of the ISO 9001:2015 that requires UEGCL to evaluate the performance and the effectiveness of the Quality Management System. Under the BSC, UEGCL has established quality objectives across relevant functions, levels/ tiers and processes.

The quality objectives are measurable and take into account legal/ contractual requirements. There are Key Performance Indicators/ KPIs or Deliverables for all the quality objectives under the tier 1 and tier 2 scorecards, thus complying with ISO 9001:2015.

The standard (ISO 9001:2015) under Clause 9.2 indicates the requirements for conducting internal audits at planned intervals to provide information on whether the quality management system (QMS) conforms to UEGCL's requirements on quality and ISO standards. This exercise was done in March and April 2018 by a team of trained internal auditors across the organization.

The internal audit was planned within structured audit criteria, defined the scope to ensure objectivity and impartially and in addition to the BSC helps to "Check" whether the QMS conforms its own requirements and those of the international standard and is effectively implemented and maintained. Risk planning and mitigation requirements are indicated under Clause 6.1 of the ISO 9001:2015. The requirements particularly focus on determining risks and opportunities that need to be addressed across the organizations identified processes e.g. in projects, finance, administration, fleet management, communication, operation, and maintenance etc. Risk-based thinking is geared towards enhancing desirable effects, preventing/ reducing undesired effects so as to achieve improvement in our operations and taking action to prevent recurrence. The currents initiatives by the Risk Management function and various departments to develop the Corporate Risk Register and Department Risk Registers are in compliance with the ISO standard.

One should note that even when planned process outputs are being achieved and requirements fulfilled, UEGCL still seeks to improve process performance, customer satisfaction, and reputation. This is achieved, for example, by small□step continual improvement ("Act"), breakthrough improvements and/or by innovation, corrective actions and re-organizations to improve suitability, adequacy, and effectiveness of the Quality Management System.

Clause 5.1 of ISO 9001:2015 requires top management to demonstrate both leadership and commitment to the quality management system. UEGCL's top management ensures that the requirements of the Quality Management System, including the policies and objectives, are consistent with the strategic direction, and that policies and objectives are established whilst ensuring that the human and financial resources needed for implementing the Management System are available.

Understanding Operations and maintenance in the view of a non-engineer

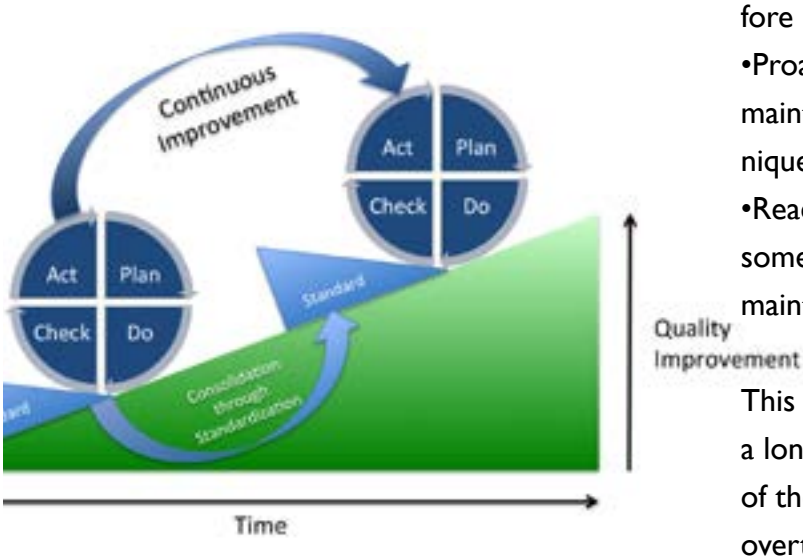
Noella NSABA
Public Relations Assistant-UEGCL

Every equipment and structure has its own life to serve the purpose for which it is meant. A well-maintained equipment not only serves its purpose efficiently, economically and reliably but also exceeds its expected lifetime. State-of-the-art approaches to the operations and maintenance (O&M) of hydropower facilities are needed to ensure the best performance. Poor operations and maintenance, through a lack of investment, inadequate training or outdated approaches, can cause high outage rates, performance losses, and increased operating costs. This can lead to loss in energy production, reduced revenues and in some cases result in dam safety and environmental concerns. Hydropower project's associated failure and mishaps are preventable if structures are properly and effectively maintained. When it comes to power blackouts; these too can equally be prevented if systems and structures are properly looked after.

Of course, this is a whole discourse on "asset management" prioritized by UEGCL in this period tendering us into deep operations and maintenance. As a company, we're the implementing agency of the construction of two flagship hydropower projects- of the (Isimba (183MW) & Karuma (600MW).

Subsequently, UEGCL after acquiring a license from ERA will champion the operation and maintenance of the two flagship hydropower plants (Karuma & Isimba). As at the current, Karuma HPP is one of the biggest hydropower plants in the East African region. It is worth noting that a lot of care and caution must be undertaken when handling such massive projects. This includes having strategies, policies and the right human resource in place at the time of O& M.

As new industry standards are introduced, hydropower developers and operators across the spectrum are seeking more efficient, cost-effective methods for maintaining their existing hydropower assets.



The ongoing revolution is the digitisation of control systems to enhance operations and reduce maintenance costs, coupled with the need to balance other variable renewable technologies such as wind and solar. This is helping to drive innovation in O&M for the hydropower sector as a whole! Operation and maintenance is understood from four distinct dimensions which include;

•Preventive Maintenance: Preventive Maintenance is planned/routine or scheduled maintenance.

•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".

•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.

•Proactive Maintenance: Most recent innovation in maintenance is called proactive. It utilizes a technique called "root cause failure analysis".

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

This has been a dominant form of maintenance for a long time and its costs are relatively high because of the unplanned downtime, damaged machinery, and overtime expenditure

There are advantages and drawbacks to each type of maintenance as listed above. UEGCL has taken steps in evaluating all of them, however, anecdotal evidence in literature and hydropower operations vindicate Preventive Maintenance (PM) has been proven generally reliable in the past and is still the core of the most maintenance programs. A proper O & M program requires cooperation, dedication, attentiveness, and participation at all levels and cannot succeed without everyone being involved while understanding the basic principles and supporting the cause. Construction of two major hydropower plants goes to demand for a community that will eventually help maintain and operate it for year and years.

UEGCL at Labor Day Celebrations- Sembabule!

Rita BECHO
Graduate Trainee- PR Assistant

The UEGCL team represented at the Labor Day Celebrations.

The International Labor Day is a public holiday celebrated globally every 1 of May annually at least by many countries. The history of Labor Day dates back in the 19 century where constant struggles were put up by the working class to attain an 8-hour work day. The strike of 20,000 US workmen recorded this celebrated milestone in 1886. Like many other strikes begin somewhat peaceful, the Haymarket demonstrations became anarchical. Arising from it, 67 policemen were wounded, of whom seven died. The police opened fire, killing several men and wounding 200, and the Haymarket Tragedy became a part of U. S. history.

From those events, in 1889, the International Socialist Conference declared that, in commemoration of the Haymarket affair, May 1 would be an international holiday for labor, now known in many places as International Workers' Day. Uganda has been a member of the International Labour Organisation since 1963. To that extent, the country has a very justifiable reason to join in celebrating workers globally. On this day, different districts that make-up Uganda comes together to celebrate the International Labor Day on 1 May. It is an annual holiday to celebrate the achievements of workers. For other countries, Labour Day is celebrated on different dates, often one with special significance for the labor movement in that country. Labour Day is, therefore, a public holiday in many countries

. For the case of Canada and the United States, Labour Day is celebrated on the first Monday of September and considered the unofficial end of summer, with summer vacations ending.

This year's theme in Uganda was "Uniting workers for social and economic Advancement." At UEGCL, in line with our mission statement that states "to sustainably generate reliable and affordable electricity for socio-economic development," Uganda Electricity Generation Company Limited was honored to celebrate Labor Day with the rest of the country in Sembabule District. A team of 20 staff from the different departments at UEGCL volunteered to participate in the march amid a heavy downpour.

The occasion was dignified with the presence of H.E the President of the Republic of Uganda, Yoweri Kaguta Museveni, State officials and different companies who were all excited to celebrate the occasion.

The UEGCL team left for Masaka the evening before 1 May 2018 and camped there ahead of the celebrations. In the Morning, while on our way, with the strong winds blowing, the heavy downpour grace us. Of course, this had dare consequences like getting stuck due to the slippery murram road to Sembabule district. After a little turmoil on the way, we arrived at the grounds where all the participants organized themselves in groups for the marching session. UEGCL officials paraded in smart overalls with helmets and a few in safety shoes.

The UEGCL team at the marching ground.

This was an element to put out to the audience that we're indeed generating for generations. Schools presented, comedians acted a few scenes and the President eventually arrived. He made a quick march through the different parades and later took his seat.

In the downpour, the marching began and the army and police force led the way as the amateurs followed.

It was our turn now when we raised our banner high and threw our legs at 45 degrees as a team to ensure that we did our best as we marched on.

Rita BECHO
Graduate Trainee - PR Assistant

We also sent out social media messages from the different platforms including Twitter, Facebook, and Whatsapp all hosted in the brand of UEGCL.

Uganda Electricity Generation Company Limited is in her final preparations for the Operation and Maintenance of the flagship hydropower projects of Karuma (600MW) and Isimba (183 MW). However, this year's theme on the Labor Day celebrations calls for unity amongst workers to ensure social and economic advancement. The hydropower projects are here to increase power to the national grid. Economists have regarded this as a factor in spurring economic development in Uganda.

Operation and Maintenance is basically the key to supervise the projects on how they are working and whether they are being kept to the standards to ensure the proper running of the power plants. The operations and maintenance teams from the project sites are under different pieces of training and are ready to implement their lessons. Plans are underway and strategies are being put in place to ensure the smooth running of the different projects.

As we continue Generating for Generations, we will still commemorate Labor Day to celebrate the achievement of workers at UEGCL.

The UEGCL Board of Directors visit the Isimba (183 MW) HPP and the Kiira-Nalubaale complex

Jonan KIIZA
PRO-Isimba HPP

The UEGCL board of directors (BOD's) on 15 & 16 March 2018 visited the Isimba (183 MW) HPP and the Nalubaale- Kiira complex. The UEGCL BoDs is comprised of 7 members. This first quarter, the Chairperson Eng. Proscovia Magaret Njuki with only three other directors who included Dr. Nickson Kamukama, Mr. Dravu Ronald, and Ms. Zigiti Zeridah visited the UEGCL assets.

" Our mandate is to inspect and assess progress of ongoing HPP's of the Isimba and Karuma plus the other assets of the organisations", Said, Eng. Proscovia Magaret Njuki.

This visit was special in a way that UEGCL will be commissioning the Isimba (183MW) HPP & Karuma (600MW) by the end of this year- 2018. The Isimba HPP project commenced on April 30, 2018, and the contract was awarded to the three Gorges- China International Water & Electric Corporation (CWE) at US$ 567.7 Million. At the time UEGCL board visited, the 40 months contract had only 4 months left on the schedule.

"The progress is promising and most certainly the HPP will be commissioned in August 2018 unless otherwise", said, Eng. Proscovia M. Njuki-UEGCL BoD Chairperson

UEGCL
Generating for Generations

Noteworthy, this was also a maiden encounter of the UEGCL BoDs with the Isimba HPP owner's engineer-Artelia & KKATT consortium who assumed her role in the middle of January 2018. The UEGCL BoDs further acknowledged the impact of the OE noting that, "there's a lot of improvement in the health, safety and environment standards at the HPP; approving the EPC contractor- CWE for ensuring that the powerhouse is lightened up plus other safety measures in place..."

The UEGCL BoDs further encouraged the OE not to compromise on quality in the remaining ongoing works. Speaking in the same forum, Mr. Horia Babau, Project Manager-Artelia & KKATT consortium put to the attention of UEGCL board issues slowing the remaining part of the project including the delayed payment of interim certificate number 12 for the EPC contractor CWE, plus the delayed finalization of land compensations.

"This is the reason why the transmission line (Isimba-Bujagaali 32kV) may not be completed in time", Said Mr. Horia Babau-OE project manager.

In a quick response from the UEGCL Board to the OE & the EPC contractor CWE, Ms. Zigiti Zeridah promised to follow up with the Ministry of Finance on the interim payment certificate number 12…"

As a matter of urgency, Eng. Proscovia Magaret Njuki assured the contractor that, "the UEGCL BoD would attend to the issue of land compensation and acquisition as a matter of urgency..."

Meanwhile, the trip to Kira-Nalubaale complex on 16 March 2018 was to monitor the functionality of the two hydropower stations managed by Eskom Uganda Limited (EUL). The UEGCL board while at the complex was led by EUL for a guided site tour of the complex's key installations like the powerhouse, switchyard and intake sections.

Therein, the UEGCL BoDs noted a myriad of issues unattended to by Eskom Uganda Limited (EUL) and warned that they should immediately be acted upon. Most of these were in line with how the complex was being maintained although notable, was the delay in completing unit 3 at the (180MW) Nalubaale hydropower station.

"Ensure to implement all the recommendations made in concluded studies on this power station", Said, Eng. Proscovia Magaret Njuki. The UEGCL board was also impressed by Eskom Uganda Limited gesture of giving back to the communities in form of CSR projects.

Thozoma Zangi- EUL CEO in her submission noted that the critical areas pointed out by the complex owner- UEGCL were to be attended to expeditiously.

As it were, Uganda Electricity Generation Company Limited board of directors maintained that the Isimba and Karuma HPP's will be concluded this year 2018. With no doubt, the increase in electricity is expected to reduce the unit cost, and among other factors, this will spur social economic development.

"The Isimba HPP has come a long way to depict the face it has at the current",

RUSUMO BOARD CONCLUDES THEIR TRIP TO UGANDA ON A BENCHMARKING MISSION

Jonan Kiiza
PRO - Isimba

Uganda Electricity Generation Company Limited hosted the Rusumo board members for a 5-day benchmarking mission to Uganda from Monday 28 May to 1 June 2018. A team of 7 members led by the Rusumo board Chairperson Mr. Ndahiyaye Nalasque arrived in the country on a benchmarking mission of UEGCL's hydropower developments. These primarily included the two flagship hydropower projects of the Isimba (183 MW) and Karuma (600MW). Also on this mission, the Rusumo board wanted to appreciate how UEGCL runs the existing government assets of the Nalubaale-Kiira complex.

The Regional Rusumo Falls hydroelectric (RRFP) is a hydropower project under Rusumo Power Company Limited (RPCL). The project is located along the River Kagera on Rusumo Falls. The company is a combined initiative by the three governments of Rwanda, Burundi and the united republic of Tanzania. These developments are as a result of a tripartite agreement by the three government signed on 16 February, 2018.

"Far from the hydropower plant, this consortium is aimed at bridging regional gaps and enhancing relations among the member countries", **Said Mr. Ndahiyaye-the Rusumo board chairperson.**

"This gesture by the Rusumo board is an indication that UEGCL has taken a center stage in realizing her vision adding that we will remain focused on our 5-year strategic plan that will see us increase power capacity to (1292.1MW) by 2023" Said **Dr. Eng. Harrison E. Mutikanga UEGCL - CEO** while welcoming the board.

Speaking in the same Forum, Eng. Proscovia Magaret Njuki noted that UEGCL is in the centre of government's development objectives as anchored in the national development plan (2015-2020), Vision 2020 and the National Resistance Movement (NRM) manifesto. Whereas the Rusumo HPP is (80MW), the total output as per the tripartite will be shared equally among the three member countries.

The power will be evacuated from the generation plant via 220 kilovolt transmission lines to transmission stations in: Gitega, Burundi, a distance of 158 kilometres (98 mi); Kigali, Rwanda, a distance of 115 kilometres (71 mi); and, Nyakanazi, Tanzania, a distance of 98 kilometres (61 mi).

The works at the Rusumo HPP commenced on 30 March 2017 and the facility is expected to be commissioned in 2020.

What is synonymous, the Rusumo HPP was contracted to a Chinese firm as it is true with the Karuma & Isimba HPP's. Far from the contractual engagement on the Karuma & Isimba HPP's, the Rusumo contract was a split tender with civil works contracted to a joint venture CGCOC Group and Jiangxi Water & Hydropower Construction Company Limited while electro mechanical works will be handled by ANDRITZ Hydro from Germany and India. Seeking an explanation into this arrangement Mr. Ndahiyaye-Board chairperson Rusumo argued that this was an attempt to ensure total quality in the implementation of the project other than handing over all the works to a single contractor.

Relatedly, the board interrogated the project managers and their respective technical teams on a myriad of issues like payments, handling the owners engineer, quality assurance issues with specific focus on dealing with cracks, plus finally how to deal with employment of the local human resource.

"In all try your best to have a resident design engineer from the owners engineer on site, otherwise, if his off shore, this is likely to delay the design approvals which in turn delays completion of works adding that cracks are a common phenomenon in tropical region and to remedy them, one needs experienced inspectors in the right place plus timely curing of the concrete", said Eng. Chad Silas Akita-Isimba HPP project manager

The Rusumo board unanimously agreed that their choice of organization to benchmark was spot on. As part of their mission plan, they also toured the Nalubaale- Kiira complex which ushered to them a whole new dimension of managing concessions. The team was treated with a dinner organised by Dr. Harrison E. Mutikanga-UEGCL CEO. The team left the country on 2 June 2018.

Understanding Regulation Systems: Critical Lessons from Sanbanxi HPP Training

Denis OTYEKA
Mechanical Maintenance Engineer-Isimba HPP

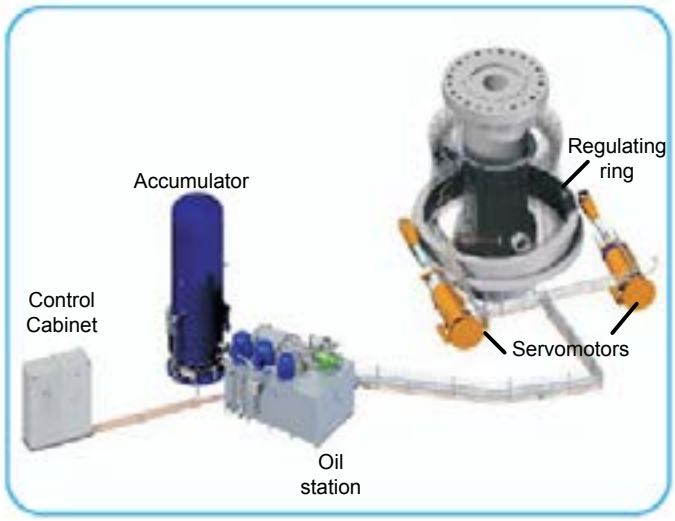
The governor or the governing system is the main controller of the hydraulic turbines. It is an equivalent of the brain which controls and initiates all the activities in the human body. It is noteworthy that the human brain is the central organ of the human nervous system and together with the spinal cord, they make up the central nervous system. The brain controls most of the activities in the body; processing, integrating and coordinating the information received from the sense organs plus making decisions. These are later sent as instructions to the rest of the body for actualisation.
In the same disposition, the governor is the central control system of the hydraulic turbine like the brain. It encompasses receiving of signals, interpretation, coordination, and conversion of the received signals into the required output.

The key functions of the governor are here listed as:
- To maintain and adjust system speed for synchronization with the grid.
- Maintain system frequency after synchronization by adjusting turbine output to load changes.
- Adjust Unit output in response to the operator or the supervisory commands.
- Perform normal shutdown or emergency over speed shut down for unit protection.

The governor performs the above tasks and automatically regulates the hydraulic turbine by opening or closing the guide vanes. The rate of change with which the guide vanes are opened or closed is dependent on how far the system is from given set points. For example, if the loading on the system increases, the frequency of the system tends to decrease, which causes the turbine to slow down from the rated speed. The response of the governor, in this case, is to open the guide vanes enough so that the rotating speed of the unit can recover and be kept at rated speed.

Governor operation and major components
The turbine automatic regulating system is made up of regulation cabinet (control cabinet), oil pressure unit (oil station and accumulator), and the servomotor as illustrated in the figure one.

Figure 1: Governor



Pic Reference: Overview of the power system by ABS Ennnin, G. Coleman, A. Ansah

The regulation cabinet is composed of the following parts:

Speed measuring unit: This measures the speed and speed deviation of the unit and transmits the signals into an integrated unit. The modern governor is generally provided with two methods of speed measurement: speed measurement of using a fluted disc and as a verification method, which involves frequency measurement of residual pressure.

Integrated unit: This comprehensively processes various input signals, generates the control signal and outputs this signal into the electric conversion device. The conversion device converts the electrical control signal sent into a displacement signal. The electric displacement conversion device is generally a combination of different types of valves; proportional servo valve, digital cartridge valve, and a step motor, etc.

Amplifying unit: Amplifiers are intermediate elements that increase the magnitude or amplitude of signals. They are divided into two links of electrical amplification and mechanical magnification.

The mechanical amplification includes the magnifying mechanism which is composed of the pilot valve, the auxiliary servomotor, and the main distribution valve.

Its function is to magnify the regulatory signals output by the integrated unit step by step, so as to control the guide vane opening or closing or the blade angle for the Kaplan turbine.

Electrical amplifiers increase the power of the signal with energy supplied from an external source. This is generally not the case with most devices described as mechanical amplifiers; all the energy is provided by the original signal and there is no power amplification

Feedback mechanism from guide vane opening:

When a command is sent for the guide vanes to open by some distance, this feedback mechanism monitors the actual opening of the guide vanes to ensure that the set opening is not exceeded. This closed loop signal stops the regulation when the given state is reached i.e. the actual guide vane opening is consistent with the desired/requested opening of the guide vane.

1. **Oil pressure unit:**

The oil pressure unit of the governor is composed of the turbine oil, oil tank, oil return tank, oil pump, oil delivery pipes, oil pressure tank, valves and other accessories.

The oil pressure device is used to continuously generate the pressure oil necessary to drive the governor system to control the distributor guide vane opening or closing for startup, shutdown and system stability.

The pressurized oil tank is composed of both oil and compressed air in the ratio of 1:2 Corresponding to the volume of oil and compressed air respectively.

The air due to its contractible nature to store energy like the spring is used in the pressurized oil tank in order to prevent the oil pressure from dropping sharply so that the system is reliable during operation due to system demand.

During operation, the system pressure is maintained by the oil pump and automatic air admission system to cater for the small changes in pressure. The normal operating oil pressure is 6.3MP,so when the oil pressure drops to 5.6MPa lower limit of the normal operating pressure, the oil pump will be automatically started to pump the oil in the oil tank to the pressure oil tank and when the oil pressure is built up to 6.3MPa, the oil pump will be stopped. Also during the pressure building process in the oil pressure tank, the automatic air admission device admits required amount of air into the system so as to keep the air-oil ratio of oil pressure device within the designed standard.

Actuating mechanism: This is the main servomotor, which controls the guide vane (blade) opening via a regulating ring to change the water flow into the unit.

Safety features on governors

Automatic Air Admission device: This device works to maintain the required air-oil ratio pressure in the accumulator

Safety valve: The safety valve is a relief valve which is designed to open when the pressure is above the set valve in the oil tank. This also works to prevent overload of the screw pump and the pressure tank and also for the safety of the hydraulic system.

Emergency shutdown valve: This valve is used to close the guide vanes in case of an emergency so as to ensure the safety of the unit.

There are a manual emergency shutdown valve and an electric emergency shutdown valve which override any guide vane set point.

Over speed limiter: This system which is a collection of valves operates to ensure the unit speed does not rise beyond its acceptable limits for any reason.

Step-Closure valve: This valve permits the closure of the guide vanes in two steps to prevent water hammer effect (especially in high head power plants), which can cause damage to the hydraulic system components.

Sanbanxi HPP step-closure control system was initially designed to operate on a mechanical hydraulic control mechanism. This was later changed to an electromagnetic control mechanism simply because the system became unreliable during operation due to leakage of hydraulic oil within the device assembly.

"The mechanical hydraulic system has many pipes within its assembly that make it susceptible to low oil pressure due to oil leakages".

Comparatively, Isimba HPP also has a step closure valve, unlike Karuma HPP. It is designed to operate on Mechanical hydraulic control mechanism hence there is high chance that it may experience the same problems Sanbanxi HPP experienced.

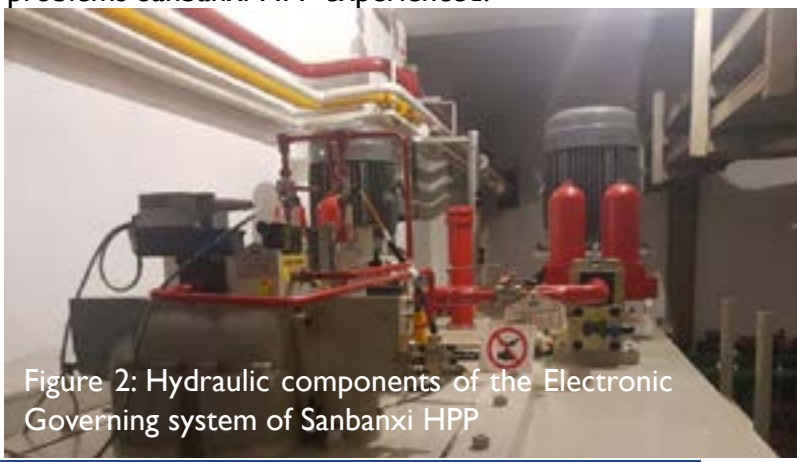


Figure 2: Hydraulic components of the Electronic Governing system of Sanbanxi HPP

Types of governors:

There are major common types of governors as highlighted in the Table below;

Type of governor	Mechanical Hydraulic	Electro-hydraulic (Analogue Electronics)	Electro-hydraulic (Digital)
Actuation mechanism	Guide vanes are opened or closed through a force from the pressurized oil		
Controlling mechanism	Mechanical components - Pendulums - Valves	Analog circuitry used to develop set point signals	Digital control via PLC
Description	Speed sensing - Flyball type pendulum - Permanent magnet generator and pendulum motor	Electrohydraulic interface connects the electronic set points into a hydraulic flow to control the guide vanes	All analogue inputs from different sensors are converted into digital signals processed in the PLC which outputs the signal for actuation via the analogue digital converter valve
Advantages	- Robust - Can be operated in manual mode via knobs and handles	- Increased reliability and sensitivity - No mechanical feedback mechanism - No distributing valve - No pilot valve	- higher reliability - self-diagnostic feature - modular design - flexibility of changing control functions via software - stability of set parameters - reduced wiring and easy remote control through optical fiber cables
Drawbacks	- Excessive wear and tear - Pollution of oil - Irregular regulation due to incorrect voltage to the pendulum - Danger of pendulum getting stuck		
Installation	Nalubale power station		Sanbanxi HPP, Nalubale PS, Kiira PS, Isimba HPP, Karuma HPP

Features of the governing systems in three hydropower plants.

Sanbanxi HPP	Karuma HPP	Isimba HPP
- Has step closure valve with the electrical control system	- Doesn't have a step closure valve	- Has a step closure valve with the mechanical control system
- Has no compressed air storage tank	- Has no compressed air storage tank	- Has compressed air storage tank
- Has no accident control valves	- Has accident control valves	- Has accident control valves

Conclusion

Speaking about the governor without mentioning some key maintenance activities and modes of conduct during operation would make this article incomplete. Proper operation and maintenance ensure long-term normal operation of the regulating system, increasing reliability and reducing forced hours, accidents and hidden dangers.

Key routine maintenance activities for the governor

- The oil level, oil temperature, and oil pressure should be monitored to ensure the normal operation of the governor and oil pressure device.
- After the first oil change, the oil quality treatment should be conducted after one month.
- The oil quality treatment should be conducted or the oil should be replaced every one year.
- The oil filters should be timely and regularly cleaned to ensure normal oil flow.
- In order to avoid water entering into oil, the air dryer must be checked regularly.
- The pipeline, valve, flange and other junctions should be checked regularly for any leakage and deformation so as to maintain the system pressure.
- The dust and sundries should be prevented from entering into the oil to avoid oil contaminations
- Check to ensure the electro-hydraulic transducer and check valve operate steadily without noise and vibration.
- The working oil pump and spare oil pump should be switched interchangeably with each other every one week, and attention shall be paid for any noise, over-high oil temperature and other abnormal phenomena during the oil pump operation process.

Daily Key Precautions to be taken during operation:

During daily operations and maintenance, we should pay attention to following points for maintenance and inspection of microcomputer governor:

- Maintenance of electro-hydraulic transducer. In microcomputer governor, the electro-hydraulic transducer is one of the elements which are most prone to fault. Since the requirements for operation environment and oil quality are high, even under the normal operation condition, we need to pay attention during our inspection so as to timely handle the problems if any.
- The cabinet door of the governor should be closed at any time to guarantee its leak proofness and prevent sundries from entering into the cabinet, so as to prevent damage to the electromechanical element and oil contamination.
- The periodical works of hydraulic oil and oil filtering equipment of governor should be strict.
- It is forbidden to conduct an unauthorized operation to screen keyboard.

• The Karuma similar plant training helped me to understand and appreciate the different types of governing systems with their modes of controls, advantages, disadvantages, maintenance routines and common problems associated with the governors, so much of which could not be covered in this article. I also learned how to select the best governing system in this era of advancing technology. Ingrained in me was that the hydraulic section of the governing system operates majorly on Pascal's principle of transmission of fluids governed by the equation F1/A1=F2/A2.

I thank management for this opportunity to train and expound on my knowledge in governors as we prepare to generate for generations at Isimba and Karuma HPPs.

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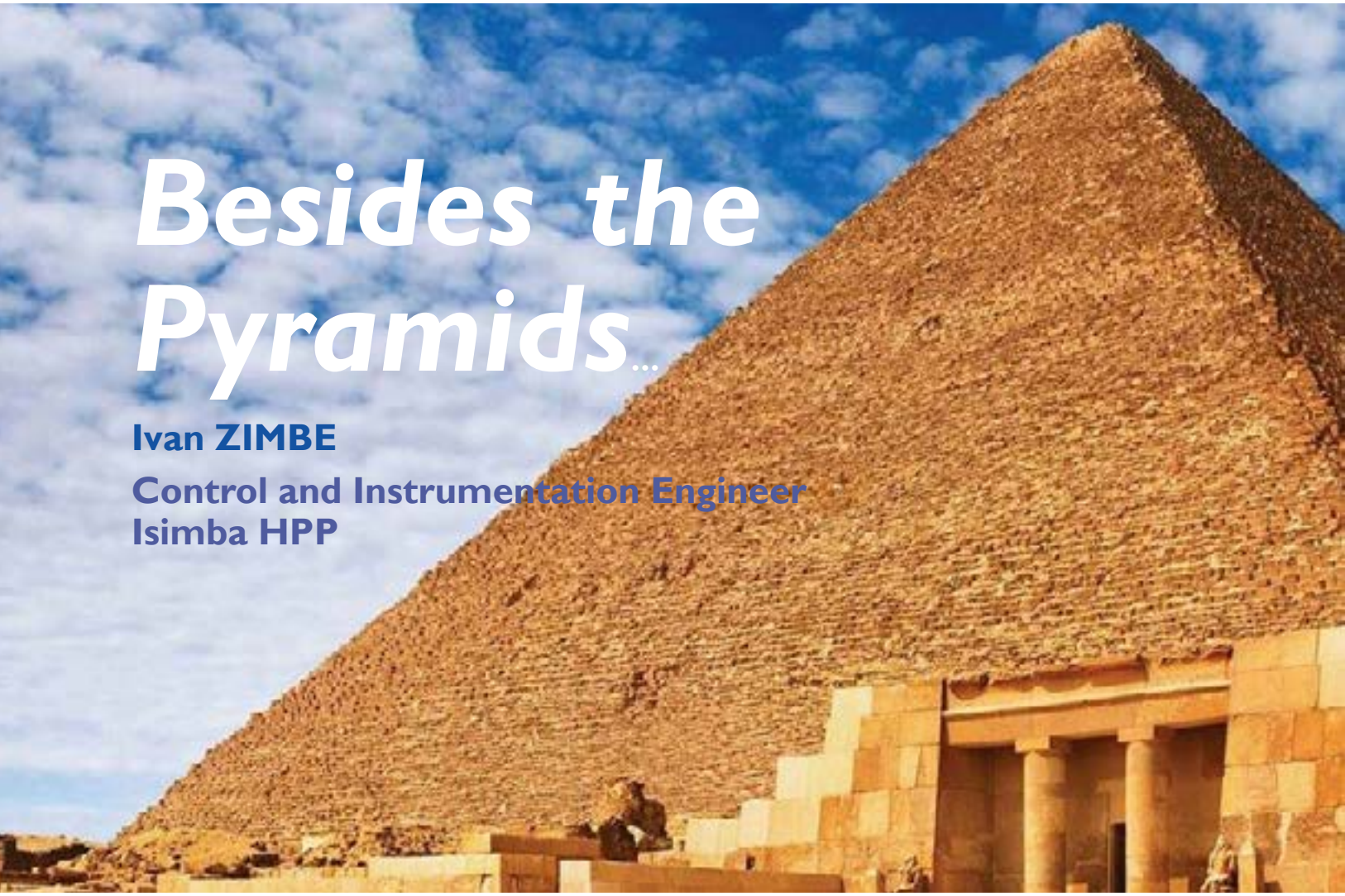

Besides the Pyramids...

Ivan ZIMBE
Control and Instrumentation Engineer
Isimba HPP

Have no doubt, one of the first thoughts that ring into any one's mind when you get into "Misr" also known as "Egypt", is the rich charming history of the "Pharaohs" plus their antiquities. The aforesaid in the modern times have gathered very many tourists from the different parts of the globe. Well, much as this ended up on my menu, allow me to first indulge you in what took me to Egypt under the auspices of JICA & UEGCL.

Back to school!

In a multicultural class with representatives from Kenya, Tanzania, Democratic Republic of Congo, South Sudan, Sudan and Ethiopia, the 2 representatives from Uganda Electricity Generation Company Limited (UEGCL) raised the Ugandan flag high as it were. Introductions from participants of various backgrounds spelled out the possibility of knowledge sharing and extensive exposure to new ideas in Hydropower developments.

This was made possible under the auspices of Japanese International Corporation Agency in conjunction with the Egyptian Electricity Holding Company.

The core aim of this capacity building encounter is to equip participants from Nile basin nations with knowledge and skills to create a workforce to operate and maintain a proposed electricity interconnection grid for the Nile basin.

The 4 weeks training in Advanced Power Systems Protection commenced with a test to evaluate the level of understanding of the basic power systems protection principles.

The course focused on protection fundamentals, primary protection schemes, power transformer protection, busbar protection, transmission line protection and tele-protection schemes to mention but a few.

The course was concluded with an exam plus a certificate awarding ceremony.

Ahead of commissioning of Isimba HPP, how vital was this training?

The protection system of Isimba HPP has been precisely designed with the goals of an efficient protection system from selectivity/discrimination to ensure isolation of only the faulty part of the system, stability to have Isimba HPP remain on-line if a fault occurs outside the protection zone, speed of operation to detect and clear a fault in the minimum possible time implemented with high speed relaying and fast circuit breaker operation, sensitivity to detect any magnitude of fault current flowing, reliability that has been implemented through redundancy in case of equipment failure and further back up protection schemes and the economics of course, prioritizing the cost of the assets.

Successful simulation of the network conditions and calculation of fault currents at different points from generation plant to the grid, at Bujagali switchyard, is the foundation for equipment ratings like current transformers, protection settings and the numerous protection schemes to be implemented. These settings and schemes are implemented in conjunction with Uganda Electricity Transmission Company Ltd (UETCL) since the generators are connected to the grid and UETCL has the mandate to operate and maintain the grid network of Uganda.

Linking to UEGCL objectives

With the initial commissioning procedures submitted and approved by the Owner's engineer, you can clearly see the operation and maintenance of Isimba HPP in sight. One of the key electrical systems during commissioning is the protection system. Prior to commissioning, protection equipment is installed and tested ensuring it meets the required standards. Protection schemes shall be implemented on the protection relays and the settings shall be adjusted to synchronize with the grid settings as recommended by UETCL.

In preparation of the commissioning and operation of Isimba HPP, the UEGCL management has entrusted their control and instrumentation engineers and equipped them through training in advanced power systems protection in a bid to build capacity to operate and maintain Isimba Hydropower plant efficiently and effectively.

Alternative Renewable Energy; a case of Zafarana (545MW) wind farm

Amidst luxurious hotels in the Gulf of Suez, are wind speeds of an average of 9.5m/s harvested by a farm of wind turbines. We traveled south-east of Cairo city to Zafarana wind farm. One of the major factors considered in the selection of this site were the wind speeds, flat land, low turbulence and the high capacity factor. The (545MW) wind farm was built in 8 phases and produces 1,124,650 MWh of energy per year. This is all renewable energy which is an important step towards sustainability and protection of the environment. The plc controlled wind turbines generate power at 690V which is stepped up to 22kV by a transformer, then supplied to the common busbar at the Zafarana substation.

The question here is, Can UEGCL venture into wind power generation someday? Some feasibility studies have been done by private developers that it is very possible to synchronize two renewable energies. However, wind power has drawbacks such as; minimum wind speeds required to start generating are usually around 5m/s without which no power can be generated.

Pyramid Extra High Voltage Research Centre
The Pyramid Extra High Voltage Research Centre (PEHVRC) has established and applies a quality management system for testing, servicing, technical research and studies for electrical network components according to DIN EN ISO 9001:2000.
PEHVRC has executed several research projects in the fields of engineering, energy saving, minimizing the electrical losses, limiting pollution effects on the electrical network, improving consumer services, minimizing electrical equipment outages and developing national electrical industries.
PEHVRC is equipped with facilities to carry out in-depth tests on electrical equipment including the impulse testing stations that can generate up to 2400kV, electromagnetic shield hall and instruments for partial discharge, mobile labs for transient and overvoltage measurement and GIS testing facility to mention but a few.
Could UEGCL spearhead the start of a standard high voltage testing and servicing station in the East African region? Could we set the pace in developing a centralized testing and approval (fit to be on the grid) for all high voltage equipment in the region? Well, it seems feasible if you ask me!

Last, not examinable paper; "the Egyptian Pyramids" We could not have flown over 2900 miles to Egypt only to miss the biggest marvel of Egypt, The Pyramids!!!!! Despite the fact that it was not the main objective of our visit, it was beckoning at the back of my mind to tour the famous pyramids which are symbolic of ancient civil engineering. Wonderful, the Egyptian pyramids graced my academic tour.

"Sanbanxi Hydropower Station in China", A Replica of Uganda's Karuma's HPP

Ronald LUTAAYA

Defining the Karuma Hydro power plant (HPP) by features, no doubt, it is the first of its kind in East Africa. Its uniqueness is attributed to the fact that its power house is over 70m below the earth's crust. Upon commissioning, the Karuma HPP will have the highest capacity generator in the East African region and against that premise, it will be mandated to control the region's grid frequency. Arising from the above background, management felt it prudent to subject the Operations and Maintenance team to an experiential training at a similar running plant. Twenty-two Karuma HPP and 3 Isimba HPP Operations and Maintenance staff travelled deep in the countryside of China to train for 6 weeks at a hydropower plant whose only notable difference with Karuma HPP is the installed capacity.

The training was conducted at Sanbanxi Hydro Power station (HPS) located in the upper reaches of Yuan River, Jinping County, in the western province of Guizhou. Sanbanxi HPS has 4 vertical Francis turbines with a total installed capacity of (1020MW). Sanbanxi HPP is operated by Wuling Power Corporation, a subsidiary of State Investment Corporation. Sanbanxi HPP is remotely operated over 800km away at Wuling Power Corporation's headquarter in Changsha.

The training encompassed various areas in operation, maintenance and notable were safety and risk management principles of an underground power station. The training comprised a 2 week-long general classroom sessions and 2 fortnight-long field learning sessions coupled with examinations at the end of each.

The team was divided into 3 cohorts; Operations, Electrical and Mechanical, and attached to qualified trainers and the plant's staff conducting the daily operation and maintenance chores. The team was fortunate that the training coincided a 10-year major overhaul of a generator at Sanbanxi HPS. A rare opportunity like this meant that the team was actively involved in generator stator building, replacement of unit control panels, gas insulated switchgear servicing, governor system servicing, turbine blade machining and generator commissioning tests.
Personally, I was most captivated by the switchgear training that included both gas insulated switchgear and medium voltage breakers. Stripping the breaker open to examine the motorised and manual mechanisms for charging the spring that allows fast contact open/closing was unparalleled in forever grasping the concept.

The training included a study tour of Guazhi HPS, also operated Wuling Power Corporation and is only 17km downstream of Sanbanxi HPS. Guazhi HPS has an installed capacity of 150MW with 3 fixed Kaplan of (50MW) each. Distinctively, its guide vane ring is actuated by 3 servo motors contrary to the conventional 2 servo motors one would find on most plants. The team then proceeded to tour the remote control centre in Changsha. The Wuling Corporation operates a total of 12 hydro, 5 wind, 7 solar and 2 thermal power plants.

UEGCL IN VIEW POINT;

As the future holds, remote operation will become an inevitability as more power plants are implemented by UEGCL in her bid to achieve the vision generating for generations. It was reassuring, upon comparison, to ascertain the similarities in architecture with Karuma and Isimba HPP's network and thus minor additions are required to implement remote operation of these plants.

The successful completion of the training was commemorated with a graduation ceremony by the Wuling Power Corporation at their headquarters. Shortly after, the team was treated to a meal of the best local delicacies of Changsha including "stinky tofu". Yes, it is actually called stinky tofu and yes, it is a quite a stench… smelly feet if you asked me. The consensus amongst the locals is that the smellier the tofu, the tastier it is. A souvenir would only come second to this experience in stamping the memory of the training in our minds forever.

The team was grateful for the further enlightenment gained in the operation and maintenance practices of a hydro power plant, especially one similar in design to Karuma HPP. The team is ever more equipped, confident and psyched up to efficiently and reliably put 600MW on the grid.

UMEME Readies for New Generation Capacity

With the improvements in the performance of the economy, Umeme, the power utility, projects an increase in electricity demand over the period.
In a bid to improve power distribution network in Uganda and in readiness for extra generation capacities in the Karuma (600MW) and Isimba (183MW), Umeme has so far invested over US$565 million in upgrading its system.

Over the past 12 years, Umeme's investments in the distribution infrastructure have led to the doubling of the physical infrastructure, improved efficiencies, tripling of customer connections, supply reliability, and improved customer service.
Mr Selestino Babungi, the managing director, says since the company took over from Uganda Electricity Board in 2005, the power distribution company has been focusing on restoration and expansion of the grid, reduction in energy losses, improvements in efficiencies, rollout of prepaid metering, connections of new customers to the grid, improving public safety, improved service delivery and reliability of supply.

The impact of the investments is evident in the performance of the distribution sector and general electricity sector in Uganda.
"The electricity supply industry is somewhat financially stable with minimal government subsidies.

Increased grid expansion and access to electricity contributes to Uganda's economic development and improves social services like education, health, and household incomes," Mr. Babungi says.
He says during 2017, a total of US$65m was invested in the network. Some of the key projects that were executed include the construction of a 40 MVA Moniko substation in Lugazi and Mbalala, completion of Namugongo integration lines, GetFit mini hydro project integration lines, upgrade of Lugogo to Kibuli lines, refurbishment of lines in Kabale,

Mukono and Pallisa, rollout of prepaid metering and upgrading of Namanve Industrial Park, conversion of the government accounts to prepaid metering and the upgrade of power transformers.
"The focus will continue to be on growth and efficiency related projects in readiness for the upcoming generation capacity," he says.
Umeme's investment in infrastructure as private sector capital is complimenting government fiscal

resources in building national infrastructure.
"What this means is that the government does not now need to look and allocate cash for the distribution network infrastructure development as this is being done by Umeme, allow the government to relocate its scarce resources to other key sectors in health, education and the transport infrastructure development network," Mr. Babungi adds.

The benefits of these investments are evidenced by improved system reliability, network reliability, improved safety, reduction in energy losses, increased customer connections and the deployment of technological innovations such as Yaka, Automated Meter Reading technology, the UmemeApp, all of which have offered a new customer experience to all the utility's stakeholders.

Before the advent of Umeme, the government did everything from generation, transformation, and distribution on a heavily subsidized sector. Today, thanks to Umeme, the sector is financially self-sustaining. Because of Umeme's operational efficiency, the energy sector can comfortably cover its generation costs, thus attracting private generation capacity into the country. As a result, over 27 small, medium and large private generators countrywide are engaging in various generation projects.

The sector today is somewhat financially sustainable with minimal subsidies from the government, effective generation capacity has increased to 680MW from 150MV, grid connections more than quadrupled, distribution efficiencies improved from 50 per cent to 82 per cent, Umeme has invested more than $565 million of private capital and considerable value has been created for customers and stakeholders. Uganda's electricity sector model is being replicated across other countries. There is optimism in relation to what was delivered in the past. It is worth noting that Umeme has the capabilities and platform to deliver the future.

The current state of the electricity sector in Uganda requires significant investments in tandem with projected growth in the generation.
"Our next investment cycle of 2018 -2021 prioritizes network growth-related capital investments on the back of the expected increase in the power supply and the country's industrialization drive. The additional capital requires a new financing structure and strategy, which are a priority for 2018," Mr. Babungi says.

This is coupled with the delivery of the 2017 regulatory targets on energy losses, which closed at 17.2% from 19% in 2016, collections, which stood at an average of 102% and operating efficiency, which stood at 83% while executing the network investment plan. With the improvements in the performance of the economy, the power utility company projects an increase in electricity demand over the period. This is one of the key reason that the generators and funders at the Bujagali, Karuma and Isimba dams insisted that Umeme become co-signatories to the loan agreements because of its excellent ability in

Revenue collections up 102% from 80%

- Distribution efficiencies up 83% from 50%
- 10 new substation built and added onto the network
- 21 refurbished substations
- Over 11,000 new transformers injected from 5,731
- Over 45,000kms the of network from 22,000kms
- Innovation; Yaka the largely successful prepayment billing system, SCADA, AMR (Automated Meter Reading technology,

UmemeApp

- Supply reliability up bill collections and timely payments to the Uganda Electricity Transmission Company Limited (UETCL), which it terms remits it to the generators. Up to 75% of Umeme's revenue collections go to UETCL for the payment of the various generating companies.

The company is also looking at the pricing of the power that is coming upstream in the next few years, stimulating demand for excess generated power, new generation, grid build up, access and investment needs to be able to utilize the over 2,000MW of electricity is set to be added onto the grid in the next few years.

"We recognize that the upcoming period requires further significant investments in grid expansion. The government ambition of increasing electricity penetration from current 23 per cent (of which 16 per cent is on the grid) to 40 per cent of households by 2025, coupled with the projected increase in effective generation capacity from the current 650MW to over 1,600 MW by 2020, underlines the urgency for investments in the distribution network," he says.

Mr. Babungi says they estimate an investment of $1.5b (Shs5.4 trillion) over a 10-year period to achieve the government objective. Mobilisation and deployment of this capital shall be an important work stream for the company over the coming period. Continuous investment in the grid ensures its efficiency, reliability, safety, and ability to evacuate and distribute increased generation capacity.

Key Highlights

- Over US$500m investments to date
- Over 1.2m customers from 296,000
- Losses down 17.2% from 38%

DOES PRIVATISATION LEAD TO A REDUCTION IN ELECTRICITY TARIFFS?

One of the most widely talked about issues as concerns electricity today is the tariff or price of a unit of electricity and its affordability.

A number of developing countries including East African countries launched reforms in their electricity markets way back in the 1990s. Whereas the sequencing of these reforms has differed from country to country, the objectives appear to be similar. In particular, these countries were concerned with the high levels of system losses, the low collection rates, poor quality of supply and service, and inadequate investments in the network and generation capacity.

Reforming the sector to encourage private sector investment and participation was seen as a solution to the above challenges. The model adopted by most countries involved the enactment of an electricity or energy law that provided for the creation of an independent regulator.

An independent regulator was deemed necessary in order to ensure a fair balance of the interests of all stakeholders particularly consumers, Government, and investors in the sector. The objectives of the reforms could be summarized as enhancement of the overall efficiency and promotion of private investment in the electricity sector.

Much as there was no specific mention of reduction in electricity tariffs as one of the objectives, by inference; the public expected this to happen as a result of improvements in efficiency. To the displeasure of electricity consumers, the reduction in tariffs has not occurred in any of the Sub-Saharan African countries that have embraced these reforms or privatized their electricity markets. Therefore, where is the problem? Was the public misled to expect a reduction in electricity tariffs?

The fundamental challenge facing Sub-Saharan African countries is the fact that they implemented these reforms at the time when electricity networks were dilapidated and required significant investments to revamp them.

"Electricity tariffs were heavily subsidized and not reflective of the true costs of providing the service" and the generation capacity was heavily constrained and insufficient to meet the demand. Much as the objective of the electricity sector reforms was the enhancement of the overall efficiency and promotion of private investment in the electricity sector, new investments by the private sector come at a cost.

The private sector will price the unit of electricity in a manner that recovers or meets their debt service obligations which are usually denominated in foreign currency (usually United States Dollars or Euros), recovers the shareholders' equity which is also denominated in foreign currency, return on investment which is also denominated in foreign currency and the operation and maintenance costs of which more than 50% is often denominated in foreign currency.

As a result of this structure, the costs of the sector in Uganda Shillings or local currency are highly sensitive to movements in the exchange rate of the Shilling against the United States Dollar or Euro. Private investors and lenders usually cushion themselves against any future changes in policy or pricing by executing long-term Power Purchase Agreements (usually 20 years) with the buyer of their electricity, the "Uganda Electricity Transmission Company Limited". Since the Uganda Electricity Transmission Company Limited is a Government entity, investors always ensure that they secure Government support by executing an Implementation Agreement with the Government of Uganda.

To the extent that the private investor has to recover the full costs related to debt service obligations (Principal and Interest), return on investment, operation and maintenance costs, among others, it logically follows that the costs recoverable in the tariff during the initial years of debt service will increase as new investments are made.

On the contrary, when investments are financed by Government, the effect is always different. After financing an infrastructure project, Government may opt not to recover investment costs from consumers but rather spread the burden/cost to all eligible taxpayers today or to future generations. Government is not a profit maximizer and does not necessarily have to earn a return on equity or investment. In the cases where investments are financed by Government, the consumer may enjoy the infrastructure service at a lower cost than if it were provided by the private sector.

Using the above realities, one can conclude that the way forward for the development of our electricity industry is for the joint provision of this service by both Government and the private sector. The decision by Government to change the subsidy allocation strategy to the

electricity sector from end-user consumption in 2012 to subsiding capital investments such as Karuma is a sustainable way of developing the electricity sector.

In the meantime, it is inevitable for tariffs to be at cost-reflective levels in line with changes in inflation, foreign exchange rate, and fuel prices as set out in a clear Tariff Adjustment Methodology. If such an adjustment does not happen for one reason or another, then private investment in new generation capacity will dwindle and demand will outstrip supply leading to Load shedding with the attendant costs of un-served energy to the economy and the consumers. Considering the current wave of attention blowing on the Electricity Supply Industry,

"the joint efforts of all concerned stakeholders right now should be geared at raising strategies to grow the current demand so that sector revenue requirement can be spread over a wider continuum of units which will subsequently reduce the unit cost of power.

To be able to grow demand, there should be a joint effort of Government, Development Partners, and the Private Sector to strengthen and expand the transmission and distribution network infrastructure to reach the industrial zones and load centers, in addition, to increase in population growth.

Some people have argued across several media platforms that ERA should unilaterally reduce electricity tariffs across all customer categories and that this action will lead to increased demand and consumption of electricity to the extent that the required revenue requirement will still be billed and recovered.

However, there is a risk in this approach that needs to be considered. It is very possible that electricity consumers may not respond immediately or may not respond in the medium to long term causing under-recovery in the sector revenue requirement and thus affecting the financial sustainability of the Electricity Industry.

The Electricity Regulatory Authority's careful observation and studies of electricity consumption reveal that if the entire households and institutions in the country were to use electricity as the alternative source of energy for cooking, we would require a total of 17,000 MW to meet this energy requirement for one day, way above our current installed capacity. In the case of Kampala, you would require an additional 400 MW. What a beautiful challenge!

UETCL ACQUIRES A MOBILE 132/33-11KV SUBSTATION

Mobile Substation

In a bid to improve and expedite service delivery in her operations, Uganda Electricity Transmission Company Limited (UETCL) this year 2018 launched a movable substation. UETCL is a government parastatal incorporated in 2001 to make bulk electricity purchases and transmit the electricity along high voltage wires to local and foreign distribution points. UETCL is, therefore, a sole authorized national bulk energy purchaser and the sole authorized electricity importer and exporter in Uganda.

A mobile substation is a substation that is movable. Substations are typically built to step down high voltages used for power transmission to low voltages required for distribution to final consumers

This is made possible by the installation of transformers and their associated switchgear, for example, circuit breakers and isolators.

Whereas typical substations are fixed at the location of construction, a mobile substation can be moved from one location to another. It is mounted on a trailer for mobility as can be seen in above picture and comes in form of a ready-to-connect complete substation assembly. Mobile substations are a perfect solution, whenever utilities need to provide interim grid connections and temporary power supplies.

The Mobile substation is intended for several applications such as the facilitation of projects by providing an alternative temporary supply
and to boost supply in the current un-firm Substations, where maintenance or upgrading must be conducted. The Mobile substation together with Emergency Restoration Towers was included in the utility strategies to provide improved security of supply, where the mobile units would be rapidly deployed in the event of catastrophic failures to restore supply within hours.

Furthermore, this unit shall also be used to provide supply to major customers within significantly shorter periods that would be required to provide a permanent supply.

The typical mobile substation may be used as follows:
During refurbishment/upgrading of the existing un-firm substations
During routine maintenance in the case of the same un-firm substations
For urgent key customer supply (i.e. supply cannot be met by the construction schedule)
As an emergency spare in the case of catastrophic failure

UETCL mobile substation under inspection in Tororo on its arrival.

Kamuli Districts await CDAP Implementation as Isimba HPP nears commissioning!

Thomas KATEGERE
Chairman LCV - Kamuli District

Community Development Action Plan (CDAP) is an initiative of the government of Uganda to remedy the consequences that accumulated from the construction of the Isimba (183 MW HPP) in the districts of Kayunga and Kamuli.

Kamuli district is located in south-eastern Uganda, it lies at an average altitude of 1,083 m above sea level and extends from 00 - 56' North / 330 - 05' East up to 010 - 20' North / 330 - 15' East. Kamuli District is bordered by River Nile and Kayunga District in the west, Jinja district in the South, Iganga district in the Southeast, Kaliro District in the East, and Lake Kyoga in the north. It has a total land area of 3,443.62 km2 and 835.12 km2 (23%) of water.

Kamuli district formerly known as Bugabula district is part of the Busoga Kingdom. Administratively, it is divided into 3 Counties namely Budiope, Bugabula, and Buzaya. These constitute 17 sub-counties and 1 Town Council, which is Kamuli Town Council.

The district is comprised of 104 parishes and 1,293 villages. The total population is 486,319 of which the 51.4% are female. Kamuli district which borders the Victoria Nile was equally affected by the construction of the Isimba HPP and most certainly these effects may continue even after when the dam is commissioned late this year 2018. This made CDAP most inevitable for the communities that are close to the vicinity of the hydropower station.

The CDAP encompasses affected communities and their catchment areas. It builds on the initiatives and activities highlighted in the Resettlement Action Plan (RAP) and will be implemented, managed and funded on an ongoing basis for the next many years.

The overall objective of the project is to improve the local social infrastructure as part of quick-impact activities to enhance community support especially in the areas of improving water supply, education and health facilities etc. Thus against that background as Kamuli district, we have participated in a myriad of processes to make this a reality. In conjunction with UEGCL, we have faith that not only will Kamuli residents partake of the fruit of their **"Kiira"** but also get ahold of the following;

Refurbishment of St. Andrews Kiyunga PS, Nankanduro P.S, and Wanyama Technical Institute & health facilities including the Mbulamuti HC3, Kiyunga HC 2, Buluya HC 2 and Nankanduro HC4 are budgeted in CDAP 2018. Furthermore, the CDAP initiative extends to include construction of water and sanitation infrastructure at Kisozi and Mbulamuti.

Making several follow-ups with the Uganda Electricity Generation Company Limitedn (UEGCL) revealed that the evaluation of contractors is in advanced stages. Much as there is a slight delay in having CDAP rolled out, we appreciate and anticipate that the scheme will impact the lives of the communities that live near the dam and beyond.

As district leaders, we continue to pledge our support to the government of Uganda in relation to establishing such mega infrastructure as the Isimba HPP. Noteworthy, we have at every opportunity and on several media advised our people who were compensated to kindly vacate government land before river impoundment. This is part of our unrelenting effort to support government plans in our community.

Now that the Nile river is under intense pressure arising from the many hydro infrastructures it serves, we as Kamuli district are finalising in having a variety of tree species planted along the Victoria Nile under the auspices of UEGCL. Although the focus, for now, is the catchment areas.

I call upon our local leaders, elites from Busoga region to get hold of this development and use it for economic benefit. Let us build small industries, hotels, beaches, invest in modern agriculture and other economic ventures.

Together, we will see Uganda move to a middle-income status which is a grand vision of the National Resistance Movement under the wise leadership of **H.E Y. K Museveni.**

For God and my country!

Efficient Energy Use

Simon Peter KASYATE
Corperate Affairs Manager - UEGCL

If you own a car, there is an over 90 per cent chance you know its fuel capacity. The reason is simple, to appreciate its fuel consumption. Appreciating your car's fuel consumption helps in planning your journeys. Let's also agree that fuel consumption is tops on the criteria when buying a jalopy. If you own a flat iron, there is a less than 10% chance you know its wattage. Did I hear someone ask, 'what is wattage?" Oh yes; it starts from knowing what wattage is indeed. In the simplest of ways wattage is the amount of electric power consumed by a given appliance e.g Radio, Television, microwave cooker, refrigerator, and heaters etcetera. For the most part, we buy the above electric appliances on all considerations but their wattage. We do not even for the most part know where the wattage is written yet we all look at the back part of every car to read its 'CCs'. Often, the choice for a flatiron is more about its design and colour as to its wattage capacity. So is the motivation for buying a fridge or microwave – never about their capacity vis-à-vis our needs. So you will find a young bachelor owning a double-door fridge as a status symbol, keeps it running 24/7 with no more than a 5-litre jerry can of boiled water for drinking! We load 2 kgs of clothes in a 15 kilogramme washing machine, press 'wash' and after use a 3000 watts flat iron to press clothes that would have done pretty well under a 1800 watts model. Most households had 100 watts bulbs until recently when the energy savers revolution introduced us to single digits watts bulbs with the same or even more light intensity.

And so, while a household of ten light bulbs consumed a collective 1000-Watts from sunset to midnight, today, the same consumes 5% (50 watts) if each bulb is 5 Watts. This means, previously, this household 'wasted' 950 watts every time their ten bulbs were on.
Same happens when you use appliances wantonly without a care what their consumption capacity is.

It is not far fetched to guess that for most of us, over 60% of our power bill is electricity we 'wasted' and not consumed! In real terms, if your bill were UGX 100,000; what you actually used would be 40,000/- and the 60,000/- went to 'waste'. Yet, the cry and hue over expensive power is reaching deafening proportions!

Sustainable Development Goal 7 (SDG7) denotes 'affordable and clean energy'. 'Ensuring universal access to affordable electricity by 2030 means investing in clean energy sources such as solar, wind and thermal. Adopting cost-effective standards for a wider range of technologies could also reduce the global electricity consumption by buildings and industry by 14 percent. This means avoiding roughly 1,300 mid-size power plants. Expanding infrastructure and upgrading technology to provide clean energy in all developing countries is a crucial goal that can both encourage growth and help the environment.'
This is at global level and the sound of it is a directive to governments. But as individuals there is a something we can do in attaining this goal.

That something has a name; its name is efficient energy use. Efficient energy use is, according to Internet search resource Wikipedia, the goal to reduce the amount of energy (read, electricity) required to power appliances. 'Improvements in energy efficiency are generally achieved by adopting a more efficient technology or production process or by application of commonly accepted methods to reduce energy losses.' Efficient energy use is a lifestyle, it's a consciousness that there is better and cheaper ways of enjoying electricity. And that speaks directly to affordability by folks paying for exactly what they have used and not 'wasted'. To illustrate it better using the car example, if your need is purely mobility from home to town, over a distance of 20 kilometres, all you will require is a vehicle of say 800-1500 CCs as opposed to a guzzler of 2000-5000CCs. Even if your desire is more than just mobility and includes class and comfort, newer varieties of cars come with fuel efficient technologies compared to the older versions offering you low cost in fuel yet providing the comfort and class you crave. It's exactly the same with electric appliances.

It will be a fete of miraculous proportions if the world will achieve SDG 7 – which aims at 'access to affordable, reliable, sustainable and modern energy for all' by 2030 if as individuals we shun efficient electricity use.

Career Growth & Development at UEGCL

UEGCL O&M team at the Gezhouba Hydro power plant in China. The team underwent a 40- day simillar plant training in preparation for operation & maintenance of Isimba HPP.

Jonan KIIZA- PRO Isimba HPP Graduated with a Masters of Journalism & Media Studies of Uganda Christina University Mukono

Dr. Eng. Harrison E. MUTIKANGA UEGCL CEO receiving a certificate in Asset Management of Chelan PUD at Sheraton Hotel Kampala

Joseph OKECHO Chief Internal Auditor, Risk & Compliance Officer Graduated with a Ph.D - Doctorate in Leadership and Management of Common Wealth University

New Recruitments

Caroline TUSINGWIRE - Graduate trainee procurement, Head office
Maria BAZIRAKE-Internal Auditor, Head office
Beatrice KULUME-Legal officer, Head office
Racheal INGABIRE-Graduate trainee electrical engineer, Karuma HPP
Immaculate MUKANDORI - Finance, Head office
Ronald SEKITENE - Electrical engineer, Namanve Thermal plant
Mathew OTIM ARIKOSI- Graduate trainee civil engineer, Karuma HPP
Donart NAYEBARE- Graduate trainee electrical engineer, Karuma HPP
Elaine Sandra MWEBESA KABAJUNGU- Graduate trainee business performace officer, Head office
James MUSAPITI-Graduate trainee procurement, Head office
Brian KIGOZI MICHAEL-Graduate trainee mechanical engineer, Isimba HPP
Herbert MUKASA -Graduate trainee civil engineer, Karuma HPP
Beatrice NYAMAIZI- Graduate trainee strategy & business development, Head office
Raymond Christopher ODOI-Graduate trainee internal auditor, Head office
Emmanuel NDEGYEYA SERWEGA- Graduate trainee ICT officer, Head office
Cynthia BABIRYE-Graduate trainee ICT officer, Head office

Promotions:

Flavia ANYIKO - Promoted to Risk Manager

Rogers Leondro NSAMBA- Confirmed as Generation Manager Karuma HPP

Peter OTTO- Promoted to Senior Civil Engineer Isimba HPP

Oden ARYANYIJUKA- Promoted to Electrical Engineer Karuma HPP

Gasper AKUHE - Promoted to Civil Engineer Karuma HPP

Eseri ATHOLERE- Promoted to Mechanical Engineer Namanve Thermal Plant

UEGCL Generating for Generations

...through our lens

The Independent Panel of Experts (IPOE's) at the Isimba HPP on 2 April 2018. The panel is composed of 7-members namely Charles C. HUTTON (Chairperson), Prof. Jackson A. MWAKALI, Ljiljana Spasic- GRILL, John RUSSELL, Jean-Pierre TOURNIER, John GUMMER & Kaare HOEG.

Minister of Energy and Mineral Development Hon. Irene MULONI (centre) meets the new O.E for Isimba HPP Artelia-KKATT at her office. Extreme right is Dr. Eng. Harrison E. MUTIKANGA- CEO UEGCL

The Speaker of Parliament Rt. Hon. Rebbeca A. KADAGA at the commissioning of rehabilitation works for Mbulamuti P/S in May.
CWE- the Isimba HPP contractor - is rehabilitating the school as part of CSR

UEGCL INTERNAL COMMS

GENEWSwire
THE OFFICIAL UEGCL EVENTS NEWSLETTER

16th J

UEGCL SEALS 2-YEAR DEAL WITH ESG

In December 2017, the UEGCL board launched the Strategic Plan for the years 2018-2023.There-in, among the four themes included Sustainable Growth aimed at growing the business portfolio and delivering consistent sound financial results.

Dr. Eng. Harrison MUTIKANGA, C.E.O & E. Brooke WHITAKER, Chief of Party Power Africa Uganda after signing the MoU.

It is with this background and in fi achieving its strategic objectives th 2018 UEGCL signed a 2-year Memo Understanding with Energy & Se (ESG) who are implementing the P Africa Uganda Accelerator progra by USAID. In attendance from both Dr. Harrison E. Mutikanga- UEGCL Brooke Whitaker - Chief of Party Uganda plus their technical staff.

"We extend our sincere thanks to E partnering with UEGCL in the que our vision of being "One of the Le Producers in the Great Lakes Regi

Dr. Eng. Harrison E. MUTIKANGA
Chief Executive Officer

UEGCL SMALL HPP PLAN

- Nyagak (6.6 MW)
- Okulachere (6.5 MW)
- Maziba (1 MW)

2,216 MW

The government of Uganda envisages increasing electricity generation by 2023 once Karuma HPP, Isimba HPP & plus other mini hydros are completed

Within the Framework of this MoU, facilitate financial closure of small-sc generation projects, support UEGCL and diversification efforts, integrat planning and support the relations UEGCL and US, generation compar Chelan County PUD.

"ESG support to UEGCL is a key m opens a new chapter for the Uganda Sector/USAID relationship with a fo accelerating supply of electricity to populace, said, E. Brooke Whitaker-C Power Africa Uganda.

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Issue 6
18th July, 2018

UEGCL AT THE 79TH AFRICAN WATER ASSOCIATION SCIENTIFIC FAIR

79th AfWA

The Africa Water Association Scientific Technical Council (STC) and Exhibition is underway in Kampala. Hosted at the National Water & Sewerage Cooperation (NWSC) Resource Center at Bugolobi, the exhibition has attracted several industry players in the water and other support sectors; **Uganda Electricity Generation Company Limited (UEGCL)** is one of them. UEGCL is showcasing the progress on the two flagship hydropower projects of Karuma (600MW) and Isimba (183MW)

Theme: *Harnessing ICT to accelerate sustainable water and sanitation for all in Africa*

Dr. Silver MUGISHA, NWSC MD and Dr. Christopher EBAL, NWSC Board of Directors at the UEGCL Stall

"This is undoubtedly a huge project (Karuma HPP)"

Dr. Christopher EBAL,
Board Chairperson NWSC

The showstopper attraction at the UEGCL booth is the Karuma project model showing the 'spaghetti connection' of tunnels and ADITs in the underground structure that the power project is. Other exhibitors at this event include Huawei, Umeme, Roofing Group, UTL, Davis & Shirtilif and the host NWSC.

UEGCL has a mandate to deliver reliable, quality and affordable electricity for socio-economic development.

100 Utility AfWA Members

The 5-day conference and exhibition was officially launched by the State Minister for Water, Hon. Ronald KIBUULE. Present at the launch were the AfWA President Usher SYLVAIN and delegates from a host of African countries as well as local partners like KCCA Executive Director Mrs Jennifer MUSISI and NWSC Managing Director, Dr. Silver MUGISHA.

The African Water Association (AfWA) is a professional association of establishments, enterprises, and utilities operating in the areas of drinking water, sanitation and environment in Africa. AfWA is mandated to enhance the exchange of ideas and recent developments in the water and sanitation industry, which it does through the quarterly Scientific Technical Council (STC) meetings among others.

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Corporate Affairs Production
Issue 3
13th July, 2018

THE LAND COMMISSION VISIT TO THE 183MW ISIMBA HPP

Shs 600 Bn
claim over land with rock

Isimba (183MW) Hydro Power project, on Monday 9 July played host to the commission of inquiry into land matters in Uganda. Led by Justice Catherine BAMUGEMEREIRE, the 7 member commission visited the Isimba project site on invitation of the Project steering committee,'to look into the matters of exaggerated claim on the rock and delayed land compensations of the Project Affected Persons PAPs'. Prominent among the compensation claims is the case of a 600 billion claim over land with rock, whose owner(s) allege was not sufficiently compensated for. The matter is before court. The other claims include Raft the Nile, a company demanding compensation of 125 billion and Hairy Lemony claiming 3 billion from Government of Uganda in respect to loss of business arising from the establishment of the Isimba HPP.

In light of the above, the commission sought first-hand information from the PAP's, Ministry of Energy and Mineral Development (MEMD) and Kagga & Partners, the Resettlement Action Plan (RAP) implementer and consultant respectively.

"Out of the **3787** claimants at Isimba dam, **56** claimants cannot be traced for compensation"

Justice Catherine BAMUGEMEREIRE
Chairperson Land Commission.

The commission later appraised themselves with the project progress touring the key installation including the powerhouse, Switchyard (132kV), the right and left embankment dams, plus the stone quarry which is about 5kms

The Isimba HPP is scheduled to be completed this coming August 2018. However, issues of compensation for PAPs are among the reasons the project timelines are feared to be extended.

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Issue 2
11th July, 2018

CORPORATE AFFAIRS TEAM TAKES ON BUGUNGU FOREST

DAY 1

Revitalizing the morale, improving productivity plus helping the team to get to know each other better was among the many factors that informed the corporate affairs department 2-day retreat on 3-4 July 2018 to Bugungu forest at Buikwe district and a tour to the new Nile Bridge at Jinja.

Bugungu tree project seats on 200 acres of land with myriad of tree species which include;

- Pine
- Eucalyptus and
- Other breeds

"*This is one of the successful Corporate Social Responsibility campaigns held by UEGCL, Said,*"

Simon KASYATE- Corporate Affairs Manager

DAY 2

The team underwent an intense but rather detailed (text, graphical and animated) presentation on the progress of the project before heading to the safety arena for a toolbox talk ahead of the site visit.

In Pictures

FACT FILE ON NEW NILE BRIDGE:
Location: Victoria Nile
Cost: UGX 343 Bn
Length: 525m
Pylon: 69m inverted Y
Physical Progress: 94%

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WE ARE UEGCL

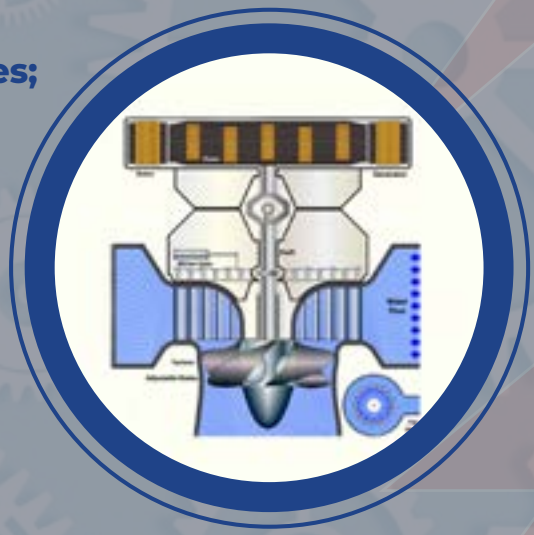
Generating for Generations

"To be one of the leading power producers in the Great Lake Region"
That's our **Vision**

Our **Mission** is
"To sustainably ***generate*** reliable, quality and affordable electricity for socio-economic development"

These are our **Core Values;**

1. Integrity
2. Innovation
3. Accountability
4. Safety &
5. Sustainability



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