

The FISSION

A Publication of the Kenya Nuclear Electricity Board



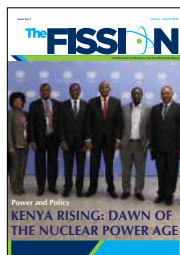
GLOBAL ACCLAIM

KNEB STAFF AWARDED IN RUSSIA

WINNER



KNEB's Director, Publicity and Advocacy, Mr. Basett Buyukah receives the award for Corporate Publication of the Year 2015 from Grace Munjuri, who is the immediate past Vice Chair of the Public Relations Society of Kenya.



Corporate Publication of the Year 2015

APPOINTMENT

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ENG. COLLINS JUMA AS
THE CHIEF EXECUTIVE
OFFICER OF KNEB**



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Editorial Director Basett Buyukah **Sub Editor** Emmanuel Wandera **Contributors** Basett Buyukah, Brian Nyawinda, Dennis Nkonge, Carl Madara, Jonathan Njoroge, Emmanuel Wandera, Faith Kosgei, Esther Musyoka, Monica Mwangi, Mary Wairimu, Irene Njoroge, **Design & Layout** Carl Madara, **Photography** Carl Madara, **Circulation** Dennis Nkonge

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CEO STATEMENT

Welcome to the 11th edition of the Fission magazine, which covers the period that runs from July to December 2017. Stakeholder engagement and education is one of the key aspects for a successful nuclear power programme. The Kenya Nuclear Electricity Board (KNEB) has invested on public sensitization through various activities and programs. KNEB has a robust stakeholder engagement plan. This issue highlights some of the activities undertaken during this period.

It is noteworthy that KNEB exhibited during the 2017 Agricultural Society of Kenya Nairobi International Trade Fair. The display was highly visible and prominent so much so that the organization was feted for innovation, creativity and flair in its display at the showground. This included deployment of a model of a nuclear power plant. For this, the Agricultural Society of Kenya adjudged KNEB as the second best stand in the Energy and Conservation Services sector category.

Also key during this period was the Kenya Nuclear Electricity Board engagement with stakeholders on why Kenya is working towards adding nuclear electricity in the energy mix. This was in partnership with the Consumers Federation of Kenya (COFEK). The Consumers Dialogue brought together professionals from diverse fields, students, civil society organizations, among others. The purpose was to share and exchange ideas and network on issues related to nuclear science and technology and its development in Kenya.

Further afield in Russia, one of KNEB's technical staff members was rewarded for an outstanding project during the World Youth and Students Festival 2017. Brian Nyawinda's achievement is another feather in the KNEB cap and testament to the versatility and industriousness of the highly motivated staff.

As we head into the second part of the financial year 2017-18, we look forward to good tidings and even greater achievements, individually and collectively.



Eng. Collins Juma
CEO

ENG. COLLINS JUMA

CEO

EDITORIAL

Welcome to the eleventh edition of the Fission Magazine. In this issue, as is custom we take a broad look at the news and events that have occurred as Kenya continues on the odyssey toward nuclear electricity generation.

In our cover story, we head true north to Russia and the idyllic Black sea city of Sochi where a Kenyan has been making waves as he comes out top in a competition during the World Festival of Youth and Students. We also get the back story of the international festival attended by five Kenyans, including three staff from the Kenya Nuclear Electricity Board, courtesy of the Memorandum of Understanding with the Russian State Nuclear Energy Corporation (ROSATOM). Then taking the flight back across the seas, we detour to the shores of West

Africa and take a peek into Africa's nuclear power development based on experiences and observations in Ghana.

Back in Kenya, we focus on the Nairobi International Trade Fair and the dynamic exhibition display, which earned KNEB accolades. Then shifting gears to the gender agenda in energy, we stop by the Women in Energy conference and the interactions, plenary discussions, ideas, opinions and experiences.

Then we turn the spotlight on the Strategic Environment and Social Assessment of the nuclear power programme. We take you through the process, what it entails, as well as its importance in the nuclear field. We also touch base with the learned friends as they converge in Kwale County for their Annual Conference 2017.

Plus, there's an intern's testimony of her experiences on the job. Plus, we step up on the right royal greens for more than just a round of golf. In addition, we go up close and personal in the Interview section and give you some travel tips. Not forgetting the health and lifestyle segment.

Welcome. Enjoy the read.

BASETT BUYUKAH

EDITORIAL DIRECTOR



Basett Buyukah
Director Publicity & Advocacy

KNEB STAFF AWARDED AT THE 19TH WORLD FESTIVAL OF YOUTH AND STUDENTS IN RUSSIA



Delegates from around the world at the Opening Ceremony of the 19th world festival of youths and students in Russia.

By KNEB Team

Kenya Nuclear Electricity Board staff member, Mr. Brian Nyawinda, was feted for an outstanding concept for a sustainable future project in the just concluded 19th World Festival of youth and students held in October 2017 in Sochi, Russia.

Pitted against 25,000 participants from 185 countries, Mr. Nyawinda's team emerged the best with their project titled "Aqua-cities" – a self-sustainable floating cities, aimed at solving the overpopulation problem in the future with the use of water purification system and alternative sources of energy.

History of the Event

The first world youth festival was organized in 1947 in the capital of Czechoslovakia and had a socialist and communist orientation. It was attended by 17,000 people from 71 countries. Since then, the festival has been held 18 times in different parts of the world – from Budapest (1949), Berlin (1951, 1973) to Cuba (1999), Ecuador (2013). Russia hosted the festival several times – in Moscow (1968, 1985) and in Sochi (2017).



Mr. Nyawinda's team that emerged the best with their project

The winning project was among the five best of over 300 presented and the participants were drawn from different countries. The team included Engr Caso Ojinnaka(Nigerian) Bence Kajtar(Hungary) Navindu Sachintha Devaraja(Sri Lanka) as well as Sergey Urvancev, Iveya Vlasova and Lidiya Volkova, all from Russia.

The team was privileged to present the project to Russian President Vladimir Putin who officially opened the ceremony.

In his remarks, President Putin said, "I am confident, you, the youth from various countries, of various nationalities and religions, are united by a common feeling of values and goals, striving for freedom, happiness, peace and accord on the planet, and aspiration for bigger achievements."

During the opening ceremony, youth leaders from various parts of the globe presented

the key themes of the festival - science, environment, energy, education, overcoming poverty and information technologies - with their stories of successful projects intended to improve people's lives and lay the basis for a brighter and safer future.

Under the theme: "For peace, solidarity and social justice, we struggle against imperialism. Honoring our past, we build the future". the festival brought together leaders of youth organizations, political parties, scientists, teachers, programmers, journalists, scholars, engineers, athletes, artists and many more.

The festival was designed to enable participants get training, discussions, roundtable, and workshops and spends time and exchange experiences and thoughts. For a week the participants attended lectures, seminars, participated in foresight sessions from leading experts in various fields, attended concerts

of famous musicians, skated, watched the air show "Falcons of Russia" and got acquainted with the cultural diversity of Russia.

The World Festival of Youth and Students aims to consolidate international youth community, strengthen international ties, as well as promote international and intercultural cooperation. One of the main goals of the 19th Festival was to shape a common vision of the future by the young leaders from different countries, trying to articulate responses to the most pressing challenges of the generation.



TAPPING GLOBAL YOUTHFUL EXUBERANCE IN RUSSIA'S NUCLEAR POWER INDUSTRY



Russia President Vladimir Putin Officially opens the event graced by youths from around the world

By Jonathan Njoroge

The engines roar into life and the aeroplane taxis further from the airport terminal and then eases itself onto the runway. As the plane accelerates for takeoff, I could feel the sudden change in speed on how my body slightly leans backwards. As we ascend, the buildings recede into the distance. We are off, Russia here we come.

It all began when the Russian State Atomic Energy Corporation, ROSATOM, extended an invitation to four Kenya Nuclear Electricity Board employees to attend the 19th Festival for Youth and Students in Sochi, Russia.

We got our travel documents in order, packed our luggage and we were set for our travel. We left Nairobi around 5pm on a Friday afternoon, and after 19 hours, including a transit through Doha, Qatar to catch the connecting flight, we were finally in Sochi, Russia - the host city of the festival.

I marvelled and fell in love with Sochi; its air so fresh and the breeze refreshingly cold, the streets were spotlessly clean, its people so friendly and warmly welcoming. Being a tourist town, Sochi has good scenery to offer with its beautiful mountainous terrain and you can see the snow covering the peaks of the mountains from a distance.

YouTube is nothing without “ we love Russia”, videos always keeping me smiling and laughing. This is the only way I had experienced Russia before I went to the festival.

The festival ran from 14th -22nd October 2017 and in attendance were 20,000 youths from 150 countries. The theme of the festival was “Peace, Solidarity and Social Justice, We Struggle against Imperialism. Honouring Our Past, We Build the Future!”

During the seven-day event, we took part in discussions regarding pressing political issues in various regions of the globe, from fighting xenophobia, to student movements, to universal access to health and education.

The festival was colourful, never in my life have I ever seen such diversity in culture, religion, race, language and ideas. The festival was rich in diversity, brought together by interest in the common good of our communities. The festival aims at ending hostilities among countries, individuals, religions and race through collaboration and empowerment.

Throughout the Festival I attended leadership presentations, motivational speeches and artificial intelligence. It is amazing to witness the advances made in developing artificial intelligence. For a moment, it felt like a scene from a futuristic science-fiction movie.

I had the privilege to attend an exhibition showcasing engineering departments from various universities. It was very impressive, to say the least. The creations made by the Russian students are amazing. Indeed, Kenyan engineering students, would do well to emulate them. Among the exhibits were drones, robots, and motorcycles which were all assembled by the students.

I was part of a group of five people, three South Africans and one Kenyan in the world of the future project. Ours was to picture and create our world of the future and show how it would look like. Our target was to make it to the top five.

However, the winning concept was a floating city, by a team which included my colleague from the Kenya Nuclear Electricity Board, Brian Nyawinda. Their concept of world of the future was a floating city. Sounds crazy right? Imagine if you told people in the 1940s that a man would set foot on the moon, I bet you would sound crazy too. This shows nothing is impossible and we can achieve if we put our mind into it.



I was impressed by how friendly and loving Russians are. I hold Russia close to my heart because I had a wonderful stay in the city of Sochi.

‘Mi Bente’, a song by J Balvin and Willy William had a lot of air play while I was in Russia and every time I hear it play, it reminds me about the sweet memories in Russia.

Rosatom President addresses the youths attending the festival

KNEB ENGAGES ELECTRICITY CONSUMERS ON THE NUCLEAR POWER PROGRAMME



Kenya Nuclear Electricity Board CEO, Eng. Collins Juma (left) during the public dialogue forum on nuclear energy, alongside Cofek secretary-general, Mr. Stephen Mutoro (Centre) and KNEB Ag. Chairperson, Teresia Mbaika.

By Faith Kosgei

On 4th December 2017, the Kenya Nuclear Electricity Board (KNEB) hosted a public dialogue on nuclear power development in Kenya. The stakeholder engagement was organized in collaboration with the Consumer Federation of Kenya (COFEK) at Laico Regency Hotel in Nairobi.

The function attracted various stakeholders who were eager to know more about Kenya's nuclear power programme. Participants were drawn from various walks of life including industry, civil society, academia, media, as well as women and youth groups.

"We have already done a prefeasibility study and siting work is underway. We anticipate to have actual sites by 2020," said Kenya Nuclear Electricity Board Chief Executive Officer Eng. Collins Juma

Eng. Juma noted that the programme is capital intensive. Construction of a nuclear power plant capable of producing 1,000MW would cost between Ksh 500 - 600 billion Kenya shillings (equivalent to 5 - 6 billion US dollars).

KNEB has signed Memoranda of Understanding (MoUs) with four countries to help Kenya in capacity building as the process is capital intensive and requires highly skilled personnel.

South Africa has two operational nuclear plants while Egypt is at an advanced stage toward construction of its first nuclear power plant. Ghana, Nigeria, Tunisia, Morocco, Zambia and Uganda are among the other countries on the continent at various phases of planning for nuclear power generation.

“Kenya will require an estimated 16,000 megawatts of electricity by 2030, yet the country is currently generating 2,300 megawatts from various energy sources,” Eng. Juma said.

Based on this, nuclear energy has been identified as a stable, efficient and reliable source of electricity to spur industrial development and stimulate economic growth.

During the Dialogue Forum, nuclear safety was explained as set of institutional, organizational and technical elements and conditions established to provide a sound foundation for ensuring a sustainable and high level of safety to the public and environment.

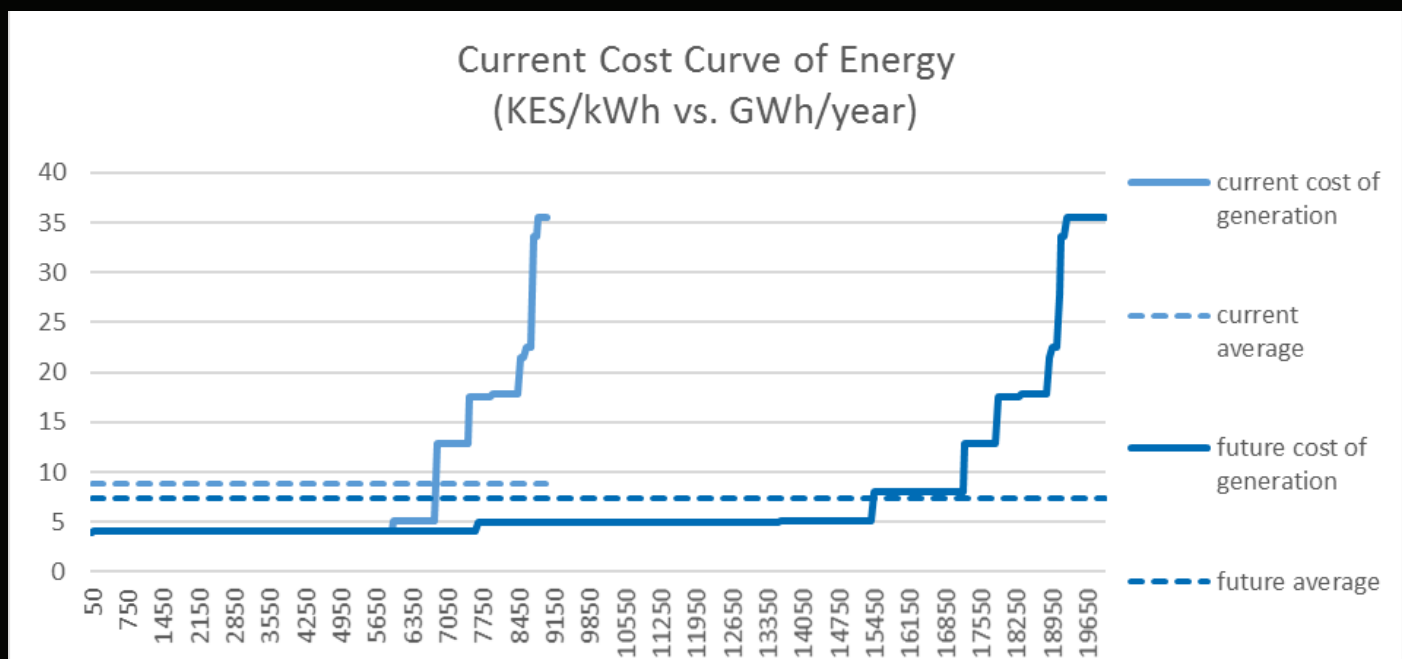
Participants were assured that Kenya fully recognizes and is committed to establishing a robust national nuclear safety infrastructure and commitment to the Global Nuclear Safety Regime.

Mr. Joseph Maina, Radiation Protection Board’s Acting CEO, put to rest fears concerning the safety, security and disposal of waste from nuclear energy

“Kenya has made great strides in enhancing the legal framework and approach through necessary regulatory structures to ensure nuclear systems, security and safeguards including the management of radioactive wastes and spent fuel is adhered to,” said Mr Maina.

While lauding the project as a major step forward for Kenya, COFEK Secretary General Mr. Stephen Mutoro urged KNEB to engage with consumers continuously and involve the counties in its outreach programmes.

KNEB has a robust public information, awareness and education program. This serves to demystify the technology and misconceptions about nuclear electricity generation. Kenya aims to have its first nuclear power plant operational in 2027.



PITCHING FOR NUCLEAR ELECTRICITY AT THE LAW SOCIETY OF KENYA ANNUAL CONFERENCE



KNEB Board Member, Ms. Belinda Kiilu flanked by KNEB staff interacts with delegates at the KNEB exhibition booth during the annual LSK Conference at Leisure Lodge Beach & Golf Resort, Diani, Kwale County.

By Emmanuel Wandera

The critical role of a legal and regulatory framework in a nuclear power programme was the key message by the Kenya Nuclear Electricity Board during the 2017 annual Law Society of Kenya (LSK) Conference. The annual lawyers meeting took place between 23rd to 27th August 2017 at the Leisure Lodge Beach & Golf Resort in Kwale County.

Under the theme: Safeguarding the rule of law and democratic gains, the conference converged lawyers from various parts of the country.

The Kenya Nuclear Electricity Board was a sponsor in the silver category. This was in recognition of the key role played by a good legal framework in developing a nuclear power programme.

“The legal profession has the onerous task of formulating the legal and regulatory framework for Kenya’s nuclear power programme as per the International Atomic Energy Agency’s guidelines,” said KNEB Board Member Belinda Kiilu.

She challenged the lawyers at the conference to spearhead public discourse on nuclear law.

“To undertake this role effectively, lawyers will require specialization and a good understanding of nuclear law,” added Ms. Kiilu.

The conference comes at a critical time when KNEB, in conjunction with the Radiation Protection Board, is at an advanced stage in preparing the Draft Nuclear Regulatory Bill. Once enacted by Parliament, the legislation will be beneficial to Kenya’s nuclear power programme as it seeks to establish a nuclear regulatory body to provide oversight and enforce stipulated standards as per international best practices in the nuclear industry.

At the KNEB exhibition stand, the lawyers attending the conference were enthusiastic in learning more about Kenya’s nuclear power programme, the progress made so far and the future outlook.



Delegates hold a joint session during the conference

KNEB WINS TOP AWARD AT THE NAIROBI INTERNATIONAL TRADE FAIR



KNEB board member Ernest Orito (L) and Stephen Karanja (R) with P&A Director Basett Buyukah are elated when KNEB was awarded for second best Energy Service And Conservation Sector stand.

By Esther Musyoka

October is an important month in the Kenya Nuclear Electricity Board diary, anchored on showcasing nuclear technology during the weeklong Nairobi International Trade Fair.

The 2017 edition was held at the Jamhuri Park Agricultural Society of Kenya showground between 2nd - 8th October 2017. The KNEB stand was a hive of activity with lots of showgoers keen to learn more about Kenya's plans for nuclear electricity generation.

A nuclear power plant model was the crown jewel of the display at the KNEB stand. It brought into clear focus the process through which electricity is produced from uranium fuel pellets. The elaborate demonstration model was a popular stopping point for persons from all walks of life. In addition, the virtual reality goggles that provided a tour of a nuclear power plant for eager visitors to the KNEB stand thrilled, excited and educated in equal measure.

The icing on the proverbial cake was KNEB being recognized by being awarded as the second best stand in the Energy Services and Conservation Sector. The top performance was virtually an energy sector affair with the Kenya Electricity Transmission Company (KETRACO) topping the accolades in the same category.

KNEB was also rated in the Best stand in Research and technology and Best Innovation and Invention. This boosted the morale of the KNEB team that is looking forward to winning more awards in the future.

AFRICA'S NUCLEAR FACTS AND FIGURES

South Africa is the only African country with fully functioning nuclear reactors, it is also the only independent state in the world to voluntarily end its own nuclear weapons programme, disassembling its weapons in the early 1990's.

South Africa plans to build eight new nuclear power plants totaling up to 9,600 megawatts by 2030 as part of their estimated \$37 billion nuclear expansion program.

According to the World Nuclear Association, countries actively considering nuclear power programs include Nigeria, Ghana, Senegal, Namibia, Sudan, Uganda and Namibia, while countries already developing plans include Nigeria and Kenya.

The Africa Energy Outlook notes that sub-Saharan Africa "includes three of the ten-largest uranium resource-holders in the world," which include Namibia and Niger.

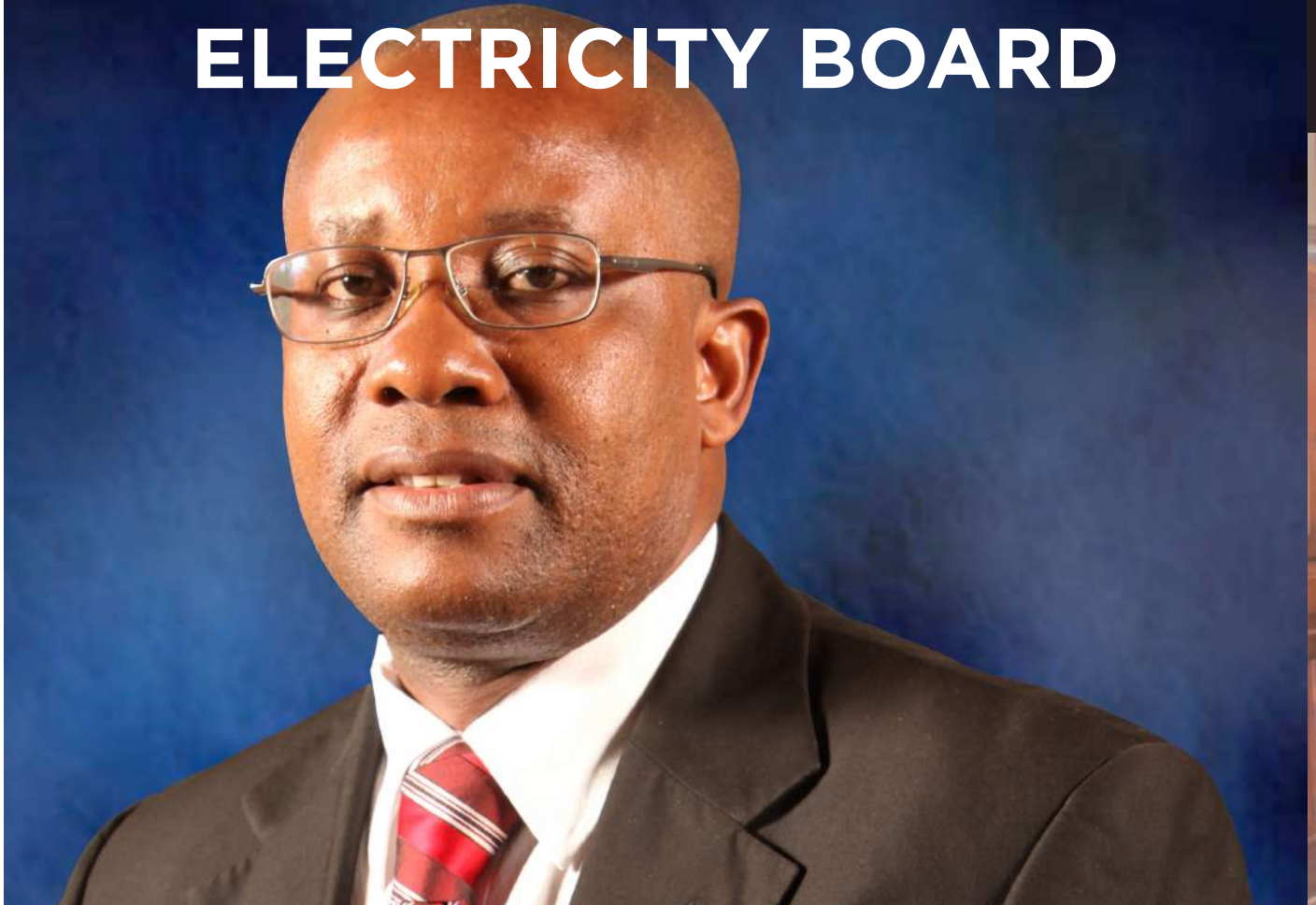
Namibia holds about 8.2 percent of the world's uranium reserves mined from two sites to fuel nuclear power stations around the world.

Niger also has two uranium mines which supplies about 7.7 percent of the world's uranium.

Koeberg Nuclear Power Station, Capetown, South Africa



APPOINTMENT OF ENG. COLLINS JUMA AS THE CHIEF EXECUTIVE OFFICER OF KENYA NUCLEAR ELECTRICITY BOARD



Eng. Collins Juma has been appointed the Chief Executive Officer of Kenya Nuclear Electricity Board with effect from 1st August 2017. Prior to that, Eng. Juma, has been the Acting Chief Executive officer since 22nd December, 2015. He previously served as Director, Technical Affairs at KNEB since November 2011.

He holds a Bachelor of Engineering Degree (Mechanical) from the Indian Institute of Technology and a Masters degree in Operations Management from the University of Nairobi. Eng. Juma has served as a Council Member and is a Fellow of the Institution of Engineers of Kenya. He is also a registered Consulting Engineer with Engineers Board of Kenya and has worked in the energy sector for over 20 years, including stints at Kenya Power and KENGEN. He is currently pursuing a PhD in Operations Management from the University of Nairobi.

His in- depth and extensive experience working in the energy sector and being part of the team that pioneered the introduction of nuclear electricity generation in Kenya since 2010 will be critical as Kenya plans to set up its first nuclear power plant with a capacity of 1000MW by 2027. This is expected to rise to a total of 4000MW by 2033 making nuclear electricity a key component of the country's energy mix and an enabler to realization of vision 2030 through provision of affordable, reliable and clean electricity to all.

THE A TO Z OF THE STRATEGIC ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR KENYA 'S NUCLEAR POWER PROGRAMME



KNEB's SESA team after meeting with Nyeri county Governor H.E. Mutahi Kahiga (5th from Left)

By Dennis Nkonge

One of the most lingering questions in many people's mind during the stakeholder interaction process is: why is Kenya going nuclear? To answer this we need to explore the benefits of nuclear electricity through a socio-political, environmental context and evaluate Kenya's situation.

Nuclear energy is considered cost competitive compared to fossil fuel based generation. This is true in spite of relatively high costs related to upfront investment and to stringent standards for safety and security, emergency management, decommissioning and nuclear waste management. From a comparative basis, taking into account socio-political, health and environmental costs, the economics of nuclear power is considered attractive by some, in comparison to fossil fuel.

Nuclear power plants are operated as base load on the premise that it provides stable and continuous

availability of electricity at any given time.

Uranium availability is not a limiting factor and the cost of uranium fuel is lower and less volatile as compared to fossil fuel. The complete nuclear energy cycle produces limited greenhouse gases as compared to fossil fuel based energy production.

Future electricity generation in the coming decades will require energy mix sources, which emits low levels of greenhouse gasses or none at all. This therefore makes nuclear energy one of the energy options for climate change mitigation. This should be adopted as one of the Nationally Appropriate Mitigation Actions (NAMAs) for climate change in Kenya.

It is from this background that Kenya Nuclear Electricity Board is conducting Strategic Environmental and Social Assessment (SESA) to ascertain the socio-economic and environmental impact of introducing nuclear electricity generation in Kenya.

SESA is a tool to improve the environmental and social performance of public plans and programmes. It aims to inform and involve interested and affected public and government bodies and explicitly addresses their inputs and concerns throughout the decision-making process.

The purpose of conducting SESA is to enable social and environmental considerations to be identified and fully integrated into the development of the proposed Nuclear Power Programme (NPP) by the Kenya Nuclear Energy Board (KNEB) where stakeholder involvement is also considered a key component.

SESA is an interactive process of gathering data and evidence, assessing social and environmental effects, developing mitigation measures and making recommendations to refine plans or programmes in view of the predicted social and environmental effects and the monitoring of significant effects of implementing the plan or programme.

SESA will provide information on the likely significant effects on society and the environment including biodiversity, population and human health, national and community well-being, fauna and flora, soil, water, air, climatic factors, material assets, cultural heritage including architectural and archaeological heritage and landscape. The current study by KNEB will include a range of socio-economic factors such as employment, demographics, life expectancy, vulnerability to illness, locations of settlements and infrastructure, property values, and access to services. Based on the special, often contested status of nuclear, there will also be a ratification process that uses stakeholder involvement to define the national position.

The main objective for the Strategic Environmental and Social Assessment (SESA) is to assess whether the envisioned Nuclear Power Programme, has properly integrated the existing national social and environmental policies and legal frameworks as well as assessing the level of integration of the envisioned Nuclear Power Programme with other relevant plans and strategies. It also aims to identify, describe and assess the likely significant social and environmental effects of implementing the proposed Nuclear Power Programme and to integrate stakeholders in the socio-economic and environmental perspectives.

EAST OR WEST: STEPS TOWARD NUCLEAR ENERGY DEVELOPMENT STRADDLES THE AFRICAN CONTINENT



By Esther Musyoka

In August 2017, KNEB's Esther Musyoka was privileged to attend a conference on Media & Nuclear Security Workshop in Africa, which was held in Kumasi, Ghana. Here below are her reflections and perspectives drawn from the interactions and deliberations.

Energy just like water is a scarce and expensive commodity in Africa. On average, just about 25% of the population in sub-Saharan region has access to electricity. South Africa whose energy mix includes nuclear power is the shining light, literally and figuratively.

Most African countries meet their electricity needs from conventional sources especially, but not limited to, geothermal, hydropower, solar, wind, natural gas, diesel, wood and biogas. The electricity demand in the continent is projected to grow with anticipated population growth, urbanization and economic productivity.

In recent times, the issue of climate change and efforts to reduce carbon emissions has immensely contributed to countries rethinking their energy strategies. A good number of African countries have since turned their focus toward considering nuclear power development to alleviate heavy levies for carbon emissions and build more resilient energy sectors in terms of long-term reliability and sustainability.

The World Bank has declared 32 out of 48 nations on the continent to be in an energy crisis. Even in those nations with electricity coverage, power is often unreliable due to power outages equivalent to almost a month or more per year, on average. Frequent irregular power supplies negatively impact manufacturing

as well as domestic and foreign investment. Low access to electricity translates to low Gross Domestic Product and stunted economic development.

The Paris Agreement on Climate Change and 2030 Agenda for Sustainable Development are developing global discussions in response to addressing the threatening impacts of climate change; the global challenge that does not respect national borders. GOAL 7 in the 17 Sustainable Development Goals is Affordable and Clean Energy esteemed high for its essential contribution in any economy be it security, jobs, education, healthcare, manufacturing or food production.

In terms of energy, countries are moving towards embracing or expanding renewable energy and nuclear power to curb greenhouse gas emissions and power outages. Ghana is among other African countries such as Kenya, Nigeria, Zambia, Uganda, Morocco and Egypt, considering the inclusion of nuclear power.

Like in any other country on the continent, everyday conversations in Ghana are dominated by the hardships caused by fluctuations and shortages in supply of electricity and water. The electricity crisis in the West African country has become a household phenomenon and led to the adoption of the word 'dumsor' by the locals translated to mean 'on and off'. The term also describes persistent, irregular and unpredictable electric power outages. This situation is replicated in various parts of the African continent.

As at 2016, Ghana's electricity installed capacity was 3,795MW from thermal, hydropower and renewable sources. Access to electricity does not only entail installation and connection of households or business premises to the national grid but also ensuring reliable and affordable power for the citizens of a nation. In 1960s, Ghana under Nkrumah's regime embarked on the journey of considering nuclear power to address persistent crisis in electricity and reduce the heavy reliance on thermal and hydro sources. The inauguration of an Atomic Energy Project, which acquired a research reactor has since transformed to the current Ghana Atomic Energy Commission (GAEC). This is the state organization charged with surveillance of the use of nuclear power in in the country.

The International Atomic Energy Agency (IAEA) recently conducted an Integrated Nuclear Infrastructure Review (INIR) mission to Ghana to assess the status of its infrastructure for the introduction of nuclear power. The IAEA's recommendation was that Ghana has made significant progress in the development of its nuclear power infrastructure and completion of all studies will inform the government to make a knowledgeable commitment to a nuclear power programme.

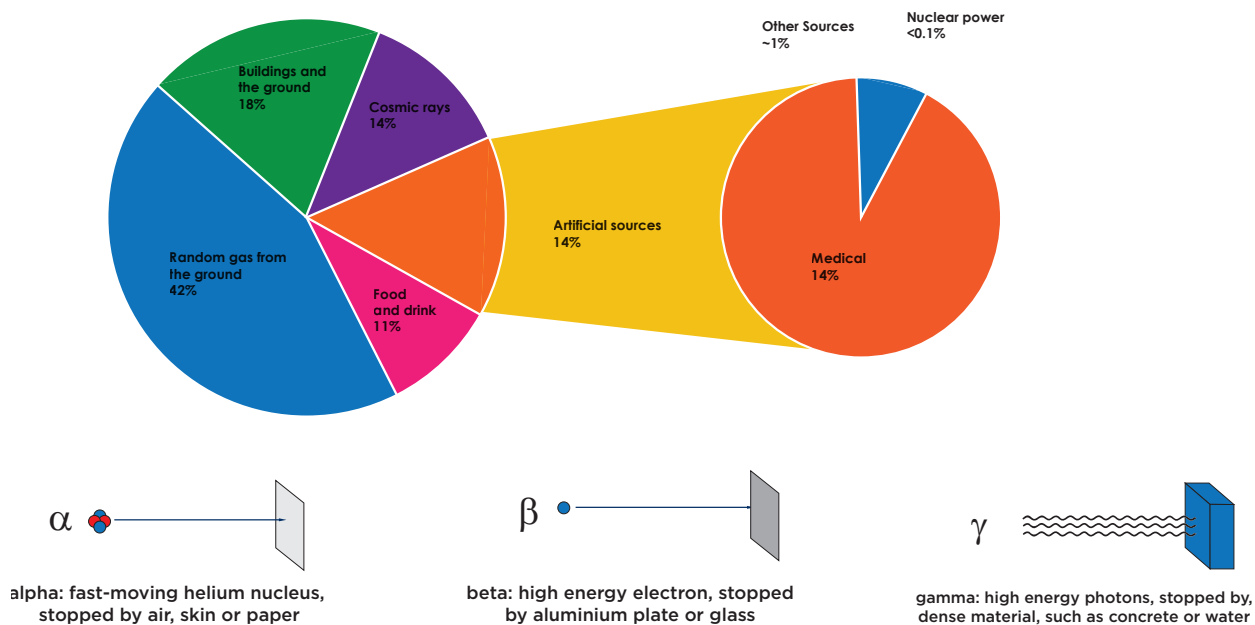
Like Ghana, Kenya is on the path toward nuclear power development, with a target date of 2027 to commission its first nuclear power plant. South Africa is expanding its nuclear power programme to add an extra 9,000MW by 2030. Africa is pursuing diverse energy sources to not only address electricity shortfalls but also to play their role towards reducing the impacts of climate change.

Cognizant of the fact that no energy sources need to be tapped in a complementary way, nuclear power programmes are becoming a major consideration to achieve energy independence.

Nuclear power is often misconstrued and the negative perceptions about it are mainly triggered by fallacies. Despite three international incidents: Three Mile Island in the late 1970s, Chernobyl in 1986 and Fukushima-Daichi in 2011, the nuclear industry is thriving with several new projects in various parts of the world. Indeed, nuclear power industry is ranked second after aircraft industry as the most regulated safety-wise. Despite the challenges that come with advancement in any technology, many countries have enormously benefitted from nuclear power generation.

To sum it up, some food for thought is captured in the words of African Development Bank President, Dr. Akinwumi Adesina: “Africa is simply tired of being in the dark. It is time to take decisive action and turn around this narrative: to light up and power Africa and accelerate the pace of economic transformation, unlock the potential of businesses, and drive much needed industrialization to create jobs”.

Sources of background radiation



Protection from radiation

- Time:** Dose is reducing by limiting exposure time.
 - Distance:** The intensity of radiation decreases with distance from its source.
 - Shielding:** Barriers of lead, concrete or water give good protection from penetrating radiation such as gamma rays.
 - Containment:** Radioactive materials are confined to keep them isolated from the environment.
- The international commission for radiological protection (ICRP) has developed a system for protection with three basic principles:
- Justification:** No practice involving exposure to radiation should be adopted unless it produces a net benefit to those exposed or to society generally.
 - Optimization:** Radiation doses and risks should be kept “as low as reasonably achievable” (ALARA), economic and social factors being taken into account.
 - Limitation:** The exposure of individual should be subject to dose or risk limits, above which the radiation risk would be deemed unacceptable.

What is radiation?

Radiation is energy being transmitted through space. Visible light, ultra-violet light transmission signals from TV and radio communications are all forms of radiation that are common in our daily lives. These are all referred to as 'non-ionizing' radiation. Radiation particularly associated with nuclear medicine and the use of nuclear energy, along with X-rays, is 'ionizing' radiation.

Key points

- Radiation is **easy to detect**, even at extremely low levels.
- Radiation **exists naturally** everywhere at widely varying levels. Places exist where people live with 100 times higher than average background from the ground. A few areas even have levels 1000 times the average.
- Mankind has evolved in a world with strongly differing background radiation without developing a sense to detect it.
- Radiation has always been around and is now **well understood**. It has been used and studied for more than 100 years.

WOMEN, ENERGY, AND ECONOMIC EMPOWERMENT: THE TRILEMMA AND OPPORTUNITY



KNEB CEO Eng. Collins Juma contributes as a panelist at the workshop flanked by CEO's in the energy Sector.

By KNEB TEAM

Energy Access and Women Empowerment was the focus of the second edition of the Women in Energy Conference and Awards held on 13-14 December 2017 at Strathmore University, Nairobi. The conference laid emphasis on promoting and enhancing women's participation and leadership in this field, which is pivotal in national development.

The conference was organized by the Ministry of Energy and Petroleum in collaboration with Brands & Beyond, Kenya Private Sector Alliance (KEPSA) and the Strathmore University.

In making strides to ensure gender equality and empowerment of women, the law provides for gender equality in employment both in public and private sector. Therefore, the Government through the Ministry of Energy has been in the forefront in promoting the involvement of women in energy through this movement.

During the inaugural women in energy awards in 2016, it was noted that the government is fully committed to ensuring that gender is no hurdle toward women's empowerment in Kenya. To buttress this fact, it was showcased that gender-friendly initiatives like the Access to Government Procurement Opportunities (AGPO) and the two-thirds gender have aided this cause.

"Women's involvement in the energy sector is both at the technical level where women are employed as engineers or as managers and secondly where they are empowered to be producers and distributors in the small scale renewable energy sector," said Mr. Paul Mbuti, Senior Assistant Director- Renewable Energy in the Ministry of Energy and Petroleum.

During the deliberations, it was noted that Women were often perceived as consumers, rather than as part of the production chain or entrepreneurs in the energy sector.

Delegates observed that in a sector dominated by men, social inclusion is needed to achieve equitable economic development and improved service delivery.

"If we have more women in our operations, you will find that the industry will succeed and for us to develop economic freedom we have to empower women," said Mrs Nazi Kivutha, wife of the Makueni Governor.

"We need to give the women a chance. We can only talk of women empowerment if we identify them, support and encourage them," added the Makeuni County First Lady.

Women led enterprises in the energy sector such as Skylon Global Company (solar), Green Leaf Renewable Energy (Biogas), The Mekatilili Program, Village Industrial Power (steam), Kasigau Tree Farm (briquettes) and Takamoto (biogas), have women championing for the benefits of adopting renewable energy.

It was noted that there are opportunities in the energy sector especially with the key government projects including the oil exploration oil in Turkana. What is required now is the creation of a road map to take full advantage of the opportunities and enable full participation of women in every facet.

One of the key discussants at the conference was Kenya Nuclear Electricity Board member, Dr. Josephine Sinyo. She gave insights on Kenya's nuclear power development and its role in the larger energy mix.

Dr. Sinyo further noted that nuclear energy is critical in solving climate change and that it offers various economic, environmental, strategic and operational advantages, while lauding the Women in Energy conference for fostering dialogue among stakeholders dialogue and nurturing shared confidence, as well as informed consent of various issues, including nuclear energy.

Some of the key topics discussed and illuminated upon included the nature of the changing energy landscape and its implications, the nexus between the global outlook for energy and Kenya's own grand plan, as well as the importance of a strategic plan for energy security, sustainability and smart technology.

Also in focus was how to enhance understanding of business opportunities available in the energy sector and a discussion on how women could constructively address barriers to success such as unconscious bias.

The Women in Energy Conference and Awards saw active participation from the Ministry of Energy and

its Utilities (Kenya Nuclear Electricity Board, KenGen, Kenya Power, Geothermal Development Company, KETRACO & Rural Electrification Authority), as well as The Energy Regulatory Commission.

Others entities/organizations represented included the Kenya Revenue Authority (KRA), Kenya Private Sector Alliance (KEPSA), Tullow Oil, County First Ladies and Students drawn from various Universities.

The annual conference brings together men and women who are active participants in the energy sector to address the existing gender gap in the sector as well as inspire, recognize and reward women’s participation.

It further seeks to facilitate the development of an authentic community of women who are putting “the best foot forward and going above their call of duty” to influence the landscape of the energy sector in Africa.

The overall objective: “Seizing the Opportunities,” is geared to strengthening women’s capacity and encouraging them to effectively participate in, and benefit from, energy marketplace.



Top: Board member Josephine Sinyo with contributes at the open session.

Left: A participant airs her views at the live interaction session

INTERESTING FACTS ABOUT NUCLEAR REACTORS



Just one uranium fuel pellet - roughly the size of the tip of an adult's little finger – contains the same amount of energy as **17,000 cubic feet** of natural gas, **1,780 pounds** of coal or **149 gallons** of oil



Nuclear energy is being used in more than **30 countries** around the world, and even powers Mars rovers



A typical nuclear plant can generate enough electricity to **power 690,000 houses** without creating air emissions



13 percent of the world's electricity comes from nuclear power plants that emit little to no **greenhouse gases**



A typical nuclear reactor works **24/7** at a **90%** average capacity factor



A typical nuclear reactor on an average refuels **1/3rd** of fuel every **18th** month

THE LARGEST PRODUCERS OF NUCLEAR POWER ARE THE US, FRANCE AND JAPAN.



AN INTERN'S EXPERIENCE IN THE NUCLEAR WORLD



By Mary Wairimu

It is a privilege to have gotten an internship opportunity in the Procurement Department of the Kenya Nuclear Electricity Board (KNEB). Although courses taken in campus can help one to prepare for a future career in a specific field, it is an experiential component that provides the skills necessary to enter a field and be successful.

Thus, internship is very important. Any major experience in life causes excitement and nervousness. The first day of my internship was not different from this norm. I must say that the initial feeling was intimidating, but that dissipated once I met my new colleagues at work and settled down.

The working environment has been a steep learning curve, not only in the procurement field - but also about nuclear technology. I am fortunate to work in an engaging and also a challenging working environment. The internship has introduced me to a lot of useful resources and given me an opportunity to meet, interact and learn from a large group of professionals and experts from different fields.

At KNEB I not only worked in the office, but I had a great opportunity to be part of the staff that attended the 2017 Nairobi International Trade Fair, where we educated, informed and sensitized the public on nuclear electricity. The show is anchored on affording stakeholders and the general public an opportunity to understand and continually create awareness on the developments in and about Kenya Nuclear Power program. The experience equipped me with strong teamwork and communication skills as well as upskilling me with greater insight of the energy sector.

I have learnt that teamwork is key in making nuclear energy generation a reality. I also am honored to have attended training on HIV/AIDS awareness, drugs and substance abuse, gender mainstreaming, security and environmental protection. This was a great and interesting experience as a young person.

I got a great opportunity to learn about the basic tasks in the Procurement department. By virtue of its structure in the supply chain, the Procurement department has a link with all other functions in the organization and greatly impacts the success of other departments.

The department puts emphasis on lean organization which means no wastage (money, time or anything). Planning is the most important task that serves as the operational success at KNEB's Procurement department. The overall planning accuracy especially in terms of demand and supply planning is very good and gives the department a robust platform to work.

As my internship draws to a close, I reflect back on all that I have learnt and realize what an excellent experience this has been. I have learnt more than I could have anticipated. The experience has helped reinforce my knowledge of how Kenya intends to achieve safe and secure nuclear energy generation.

My experience at KNEB has been overwhelming, I look around and feel that it was the best I could get. I feel indebted to everyone who has walked with me in this journey. To all the staff who have continually dedicated their valuable time and enormous effort in guiding, directing and supporting me throughout the internship, I truly am grateful. Thank you KNEB for making me more prepared to achieve my goals and have the career I have always wanted.

As I pen off, I believe KNEB is moving steadily towards the reality of nuclear electricity generation in Kenya.



Nuclear power & reactors worldwide

Location	Nuclear electricity generation, 2016 (billion kWh)	Share of total electricity production, 2016 (%)	Number of operable reactors*	Nuclear generating capacity* (MWe)
Argentina	7.7	5.6	3	1627
Armenia	2.2	31.4	1	376
Belgium	41.3	51.7	7	5943
Brazil	15.9	2.9	2	1896
Bulgaria	15.8	35.0	2	1926
Canada	97.4	15.6	19	13,553
China	210.5	3.6	36	32,637
Czech Rep	22.7	29.4	6	3904
Finland	22.3	33.7	4	2764
France	384.0	72.3	58	63,130
Germany	80.1	13.1	8	10,728
Hungary	15.2	51.3	4	1889
India	35.0	3.4	22	6219
Iran	5.9	2.1	1	915
Japan	17.5	2.2	42	39,952
Mexico	10.3	6.2	2	1600
Netherlands	3.8	3.4	1	485
Pakistan	5.1	4.4	4	1040
Romania	10.4	17.1	2	1310
Russia	179.7	17.1	35	26,865
Slovakia	13.7	54.1	4	1816
Slovenia	5.4	35.2	1	696
South Africa	15.2	6.6	2	1830
South Korea	154.2	30.3	25	23,081
Spain	56.1	21.4	7	7121
Sweden	60.6	40.0	9	8849
Switzerland	20.3	34.4	5	3333
Ukraine	81.0	52.3	15	13,107
UK	65.1	20.4	15	8883
USA	805.3	19.7	99	99,678
Total**	2490	11.5	447	392,080

*as of 01.05.2017

Sources:KNEB, WNA, IAEA

**The world total includes six reactors on Taiwan with a combined capacity of 4927 MWe, which generated a total of 35.1 billion kWh in 2016, accounting for 16.3% of its electricity generation.

THE INTERVIEW



Brian Nyawinda is a Technical Officer at the Kenya Nuclear Electricity Board. The burly, bubbly and outgoing personality oozes the passion to harness the potential which nuclear energy possesses to spur Kenya's economic development. He spoke with The Fission magazine's Dennis Nkonge on his philosophy of life, affection for nuclear technology and a lot more.

Let's start with your early life. Tell us something interesting you remember about your early school days?

I took part in inter school football and basketball games; I enjoyed being part of the school football and basketball team.

You currently work at KNEB. What are your other passions?

I take part in mentorship programs for young people with

a view to empowering them to be men of substance in the society.

Who is your role model?

Kofi Annan. He was willing to come to Kenya at a very critical time and assist in the mediation that led to signing of agreement that ended the 2007 Post- election violence after the contested polls.

What is the most memorable moment in your life?

When I won an international youth competition entitled "Industries of the future" in Sochi, Russia.

Which character trait defines you the most?

Conscientious: I plan ahead rather than being spontaneous.

What is your all-time favorite movie or novel?

Suits.

There are two lessons I learnt from the series.

- i. "Anyone Can Do My Job, But No One Can Be Me." This shows that everyone is unique and special in their own right. There is no comparison between any position, status or designation.
- ii. "Never Destroy Anyone in Public When You Can Accomplish The Same Result In Private."

Everyone cares about their reputation. Today, it's your enemy. Tomorrow, it might be you. Never sabotage anyone in public because it will put you in the jeopardy. This depicts the brevity of human life.

If you were a character in a movie, which one would you be?

In the Series suits, I would be Mr. Harvey Specter. Making each moment count.

So, what's your driving force in life?

The fact that God is faithful gives me the drive to venture for I know He is with me.

Now tell us, who is your favorite musician?

Don Williams. In particular the number: "I've been loved by the best." I love this song.

What are your hobbies?

Going out for nature walk, adventure and reading.

Tell us about your family?

We enjoy each other's company.

If you could start all over again, would you change your career path in any way? Why?

No. Because I have grown with my career and I love what I do.

In your view, how would nuclear electricity help Kenya?

It will bring many benefits to the

country, such as:

a) Job creation – Nuclear plants create between 1,400 and 1,800 construction jobs and up to 700 long-term, permanent jobs to operate and maintain the plant hence working towards a developed future for the next generation.

b) Growth in the economy and manufacturing industry – Nuclear plants contribute substantially to national and local economies, both in direct spending and in economic activities generated by the presence of the plant and its employees and the surrounding community.

c) Upgrade of industrial quality level – The nuclear industry is a high quality and high standard field that requires upgrading of local industries to meet the set standards.

d) Affordable, clean and safe electricity – Nuclear electricity is affordable and can help in stabilizing electricity prices by eliminating the unstable increases/decreases from imported fuels.

e) Nuclear power plants provide stability in supply – Safety requirements of nuclear power plants require operation on 24-hour basis. This provides an advantage for economies that have constant substantive power supply for operation of 24-hour economies. As Kenya moves towards a 24-hour economy, nuclear plants provide a great option for supply of energy required.

If someone asked you to justify why nuclear electricity is a good option for Kenya, what would your response be?

a) For the Vision 2030 projects and programmes to be realized, the energy requirement will rise to over 16,000 MW. This demand will need to be met by a variety of energy sources including nuclear power.

b) Nuclear energy is a critical technology for addressing climate change.

c) Nuclear energy is competitive relative to other electricity sources and offers protection from the volatility of fossil fuel and CO2 prices.

d) Nuclear energy offers supply security: uranium resources are well distributed around the world and nuclear fuel is easily stored.

e) Nuclear energy offers remarkable operational performance and safety, largely due to a new generation of reactors (referred to as Generation three plus).

Given your illustrious career, what do you consider to be your major achievement?

Coming up with award winning project for the future on the international stage in Sochi, Russia.

What are you grappling with at your age?

Career and family choices

Assume you were the President of Kenya for a day, what is the one issue that you would put your focus on?

Provision of universal health coverage.

THE END



Mr. Brian Nyawinda and his team when they were feted for an outstanding concept for a sustainable future project in the just concluded 19th World Festival of youth and students held in October 2017 in Sochi, Russia

Crossword Puzzle Answers

19. Dose

Down
 1. Radiation
 3. Kinetic
 5. Energy
 6. Gamma
 7. Thorium
 9. Fission
 11. Electrons
 12. Austria
 14. Uranium
 16. Beta

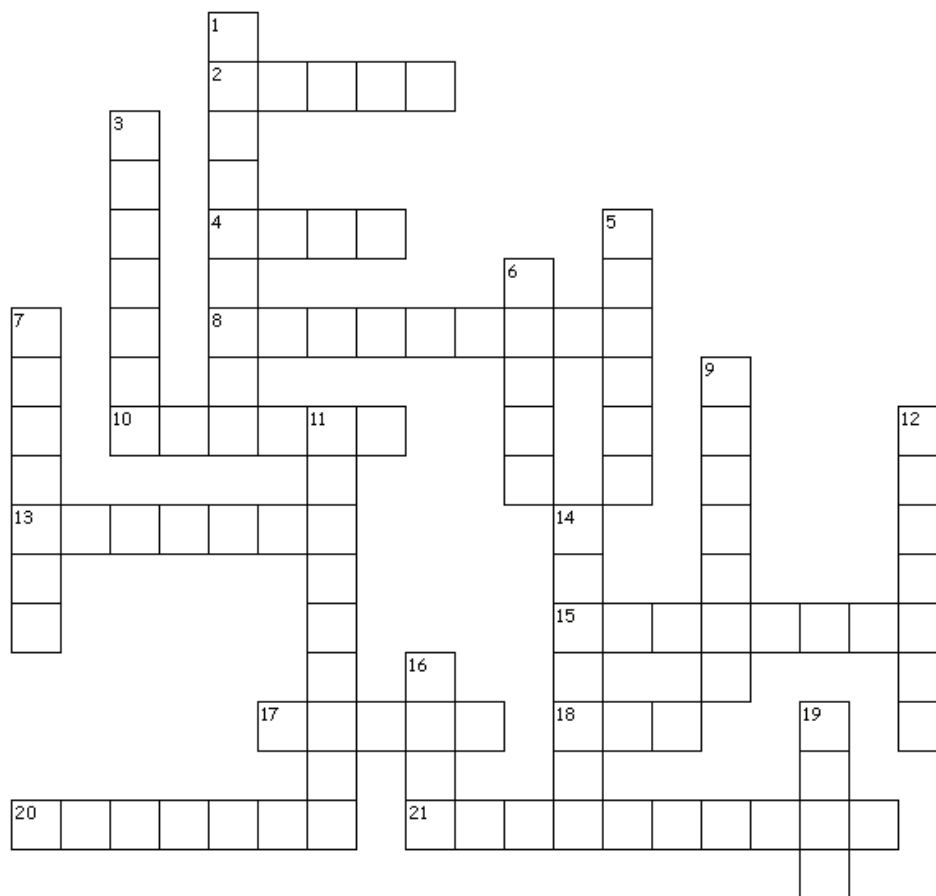
Across
 2. Alpha
 4. Atom
 8. Irradiate
 10. Cancer
 13. Isotope
 15. Absorber
 17. Power
 18. Ion
 20. Nucleus
 21. Atomic mass

Country Nuclear Profile in Africa

	Country	Status
1.	Egypt	Site preparation for first four NPP with a total of 4800 MWe is underway.
2.	South Africa	Two reactors currently in operation at Koeberg with total installed capacity of 1,800MWe
3.	Nigeria	30kW research reactor in operation. Nigeria Nuclear Regulatory Authority (NNRA) was set up for regulatory oversight on all uses of ionizing radiation. Nigeria Atomic Energy Commission (NAEC) announced selection of four sites for further evaluation. Signed a cooperation agreement with Russia including provision for uranium exploration and mining in the country.
4.	Ghana	30kW research reactor in operation. Nuclear Regulatory Power Act to establish an independent regulator – Ghana Nuclear Regulatory Authority (NRA) - was passed by Parliament in 2015.
5.	Kenya	Plans to realize NPP by 2027. Agreements of assistance in Nuclear Power Development with Russia, China and Korea have been signed. Nuclear energy policy to set up the national nuclear regulator is pending presidential ascent. Site selection is underway.
6.	Uganda	Government signed an agreement with IAEA to initiate the provision of a framework to develop nuclear power generation.
7.	Tanzania	Government has expressed an intention to investigate the use of nuclear power
8.	Zambia	Agreement between Rosatom and Ministry of Education for the construction of the center for Nuclear Science and technology in Zambia, with a 10 MWe research reactor.
9.	Namibia	The government has committed to a policy position of supplying its own electricity from nuclear power given that the country holds about 7% of the world's uranium reserves.
10.	Tunisia	Evaluation of possible construction of a 600 - 1000 MWe NPP by the government is underway.
11.	Libya	10MW research reactor present. Development of Institutional infrastructure for setting up a NPP currently underway. A site for both power generation and desalination has been selected.
12.	Algeria	Two research reactors currently operating. Signed agreements with Rosatom and China for design, construction and operation of NPPs and nuclear research respectively.
13.	Morocco	2MW Triga research reactor under construction. Pre-project study for desalination is complete. Government has approved setting up of a Nuclear Safety Agency
14.	Sudan	Government set up the Nuclear Energy Generation Department. Plans to have an NPP with four 300-600 MWe or 4400 MWe operating by 2030

Nuclear Science & Technology

CROSSWORD PUZZLE

**Across**

- 2.** is the least penetrating radiation and can be stopped (or absorbed) by a sheet of paper.
4. Basic unit of a chemical element
8. To expose to some form of radiation
10. Too much ionization of body tissues may cause
13. Element that contain equal numbers of protons but different numbers of neutrons in their nuclei
15. A material that stops ionizing radiation
17. Rate at which energy is transformed?
18. An atomic particle that is electrically charged, either negative or positive
20. Core of an atom
21. Total no of protons and neutrons

Down

- 1.** Transfer of heat through space
3. Energy at motion
5. Ability to do work
6. Electromagnetic radiation of the shortest wavelength and highest energy
7. Chemical element with symbol Th
9. Splitting of a heavy nucleus into two roughly equal parts
11. Negatively charged particles of atom
12. Headquarters of International Atomic Energy Agency
14. Fuel most widely used to produce nuclear energy
16. Radiation that can be stopped by a thin sheet of aluminum.
19. Term denoting the quantity of radiation or energy absorbed in a specific mass

[Answers on Page 25](#)

TIPS ON GOOD SKIN CARE

By Monica Mwangi

How to get a glowing skin? How to have flawless skin? These are the questions that most people ask skin specialists and dermatologists and they need satisfying answers.

Clear glowing skin is a dream for every person. No one likes pimples, zits, dark spots, baggy eyes or dark circles. There are different skin types and different problems associated with them.

Dry skin can get itchy sometimes and needs to be hydrated often to keep it glowing. Oily skin is prone to pimples and has a greasy texture. Some people have normal skin, which is God's gift, and then there are people with combination skin who have to face the problems of both dry skin and oily skin.

Perfect skin is not too oily or dry but needs to be taken care with regular toning and cleansing. Here are some of the tips to a glowing skin:

Clear Glowing Skin Naturally

Most people have two different facial skin, the area near the cheeks and eyes is dry while the forehead and area around the mouth look greasy and has a darker shade.

They need to treat these areas differently with different kinds of creams. Every skin type has a problem. But, where there is a will there is a way. The change needs to come from within.

Nutritious, Fiber Rich Diet

Everything healthy starts from your diet. Digestive problems result in skin impurities; hence diet is really

essential for healthy skin. Taking in the right amount of micro-nutrients and vitamins is great for a clear skin. Food for glowing skin should be carefully selected, natural protein foods like fish, nuts and white meat, grains like buckwheat, brown rice and quinoa, vegetables like broccoli, tomato and beets are very healthy and good for the skin

Drink Water

As we know there are many health benefits of drinking water and juices, one of the best is to help your skin to purify the impurities, and glowing skin tips are incomplete without the inclusion of this essential point. Water cleanses the body and eliminates the toxins and waste. It hydrates the body and removes excess oils and dirt. 15% of our skin is made up of water

Avoid the Sun

The sun is a great source for vitamin D. The morning sun from 7am to 9am is good for the skin. However avoiding the sun after this time is very essential. The UV rays are quite strong and they not only damage the texture of the skin but overexposure to these rays can result in skin cancer. Avoid prolonged exposure to the sun especially between 10 am to 2 pm as the sun rays can get really harsh.

Exfoliate

When it comes to topical skin care, most of us concentrate on cleansing, toning and moisturizing and completely ignore exfoliation. But natural tips for glowing skin by experts emphasize the importance of exfoliating the skin because it is the best solution to the question of how to get rid of dead skin cells. Periodic exfoliation using natural ingredients like Bengal gram flour, oats, orange peel or lentil powder can remove dead cells, dust, impurities and blackheads from the skin and make it smooth and flawless.

Use a Toner

The three basic tips to get clear skin are cleansing, toning and moisturizing. But what exactly is toning? Toners are supposed to be used right after cleansing the skin with a foam based face wash in order to restore the skin's pH balance.

Healthy toners provide skin repairing substances such as antioxidants, fatty acids, ceramides and glycerine and provide it with a fresher, smoother and younger appearance. Toners are an important part of skin care because it provides deep pore cleansing to the skin and reduces the size of the open pores and makes the skin smooth and flawless while drying out oily T-zone of the face.

Leave Stress Behind:

How to have beautiful skin? If this is your question, the answer is rest! Sleep is the number one secret to maintaining a healthy lifestyle and get flawless and glowing skin naturally. Stress hormones lead to excessive oil production which will result in white heads. Running, a warm bath and a short sleep help reduce stress and get rid of acne. At least 7 to 8 hours of sleep is needed for an active mind and glowing skin. Occasional visits to the spa and swimming pool will relax your muscles.

Top High Fiber Foods

Fruits

- Raspberries
- Pear, with Skin
- Apple, with Skin
- Banana
- Orange
- Strawberries
- Dried Figs
- Raisins

Grains, Cereal and Pasta

- Spaghetti Whole-Wheat
- Barley
- Bran flakes
- Oat Bran Muffin
- Oatmeal Instant
- Popcorn Air-Popped
- Brown Rice
- Rye Bread
- Whole-Wheat Bread

Legumes, Nuts and Seeds

- Split Peas
- Lentils
- Black Beans
- Lima Beans
- Baked Beans
- Almonds
- Pistachio Nuts
- Pecans

Vegetables

- Artichoke
- Green Peas
- Broccoli
- Turnip Greens
- Brussels Sprouts
- Sweet Corn
- Potato, with Skin
- Tomato Paste
- Carrots

SWANSON Health Products
www.swansonherbs.com

KNEB TAKES THE NUCLEAR CONVERSATION TO THE GOLFING GREENS



By Irene Njoroge

For the third year running, the Kenya Nuclear Electricity Board was the main sponsor of the Lady Captain's Prize Golf Tournament. This year's edition was held on 18th November 2017 at the Royal Nairobi Golf Club. The event attracted over 200 golfers from around the country on the lush greens of the club located off Nairobi's Ngong road.

The KNEB team pitched tent at the grounds ready to engage the participants and broaden their understanding of nuclear technology. The annual event which brought together top tier business executives from both government and private sector provided a great opportunity to get their perception on nuclear energy and how its introduction will fit in the country's energy mix.

During the award ceremony, KNEB CEO Eng Collins Juma gave an insightful history of the Kenya Nuclear Electricity Board and the strides made so far. Winners in all the categories were awarded with KNEB branded items.

The engagement with the golfers forms part of KNEB's schedule of activities to reach critical stakeholders in different arenas to inform, educate and sensitize them on Kenya's nuclear power development programme.

CLEARED FOR TRAVEL, VISA INS AND OUTS



By Irene Njoroge

For those of us who have travelled outside Kenya, one of the most involving stages of it is obtaining a visa. The visa process varies depending on the country to be visited. Indeed, passport holders of some countries get visas on arrival, while others do not need a visa to travel. Kenyan Passport holders can travel to about sixty countries either visa free and/or obtain their visa on arrival.

According to the Henley & Partners Visa Restrictions Index - a global ranking of countries according to the travel freedom that their citizens enjoy, and in 2017-, ranked the Kenyan passport 68th in the world according to the Index.

The Index is produced in cooperation with the International Air Transport Association (IATA), which maintains the world's largest database of travel information, and is published annually. Countries are ranked according to the total number of other countries which they can access visa-free.

Kenyan citizens can travel visa-free and obtain a visa on arrival to 68 countries and territories. E-visas are treated in the same way as visas on arrival where the conditions for obtaining an e-visa are straightforward (e.g. fee, return ticket, hotel reservation).

So your next annual leave is fast approaching, and you have been toying with the idea of taking a vacation abroad. You have already ticked the boxes locally - been to the Kenyan coast, Rift Valley, The Masai Mara and you have been thinking it is now time to explore outside the Kenyan borders. You have your passport but problem is you don't want the tedious visa application process, well, there is good news for you.

Here are the 68 countries and territories you can travel to easily:

VISA NOT REQUIRED

- | | | |
|------------------------|-------------|--------------|
| 1) Antigua and Barbuda | 3) Barbados | 6) Hong Kong |
| 2) Bahamas | 4) Botswana | 7) Dominica |
| | 5) Burundi | 8) Eritrea |

- 9) Ethiopia
 - 10) Fiji
 - 11) Gambia
 - 12) Ghana
 - 13) Grenada
 - 14) Haiti
 - 15) Indonesia
 - 16) Jamaica
 - 17) Kiribati
 - 18) Lesotho
 - 19) Malawi
 - 20) Malaysia
 - 21) Mauritius
 - 22) Micronesia
 - 23) Namibia
 - 24) Panama
 - 25) Philippines
 - 26) Saint Kitts and Nevis
 - 27) Saint Vincent & the Grenadines
 - 28) Senegal
 - 29) Singapore
 - 30) Swaziland
 - 31) Tanzania
 - 32) Trinidad and Tobago
 - 33) Uganda
 - 34) Vanuatu
 - 35) Zambia
 - 36) Zimbabwe
- 4) Cape Verde
 - 5) Comoros
 - 6) Democratic Republic of the Congo
 - 7) Djibouti
 - 8) Guinea-Bissau
 - 9) Iran
 - 10) Laos
 - 11) Madagascar
 - 12) Maldives
 - 13) Mali
 - 14) Mauritania
 - 15) Nepal
 - 16) Nigeria
 - 17) Palau
 - 18) Rwanda
 - 19) Saint Lucia
 - 20) Samoa
 - 21) Seychelles
 - 22) Sierra Leone
 - 23) South Sudan
 - 24) Sudan
 - 25) Timor-Leste
 - 26) Togo
 - 27) Tuvalu

VISA ON ARRIVAL

- 1) Bolivia
 - 2) Burkina Faso
 - 3) Cambodia
- 1) Bahrain
 - 2) Gabon
 - 3) Georgia
 - 4) India
 - 5) Sri Lanka



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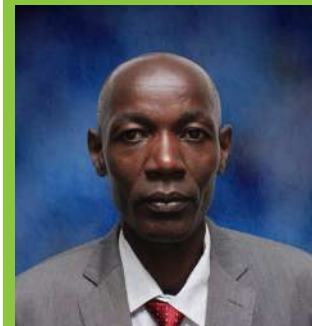
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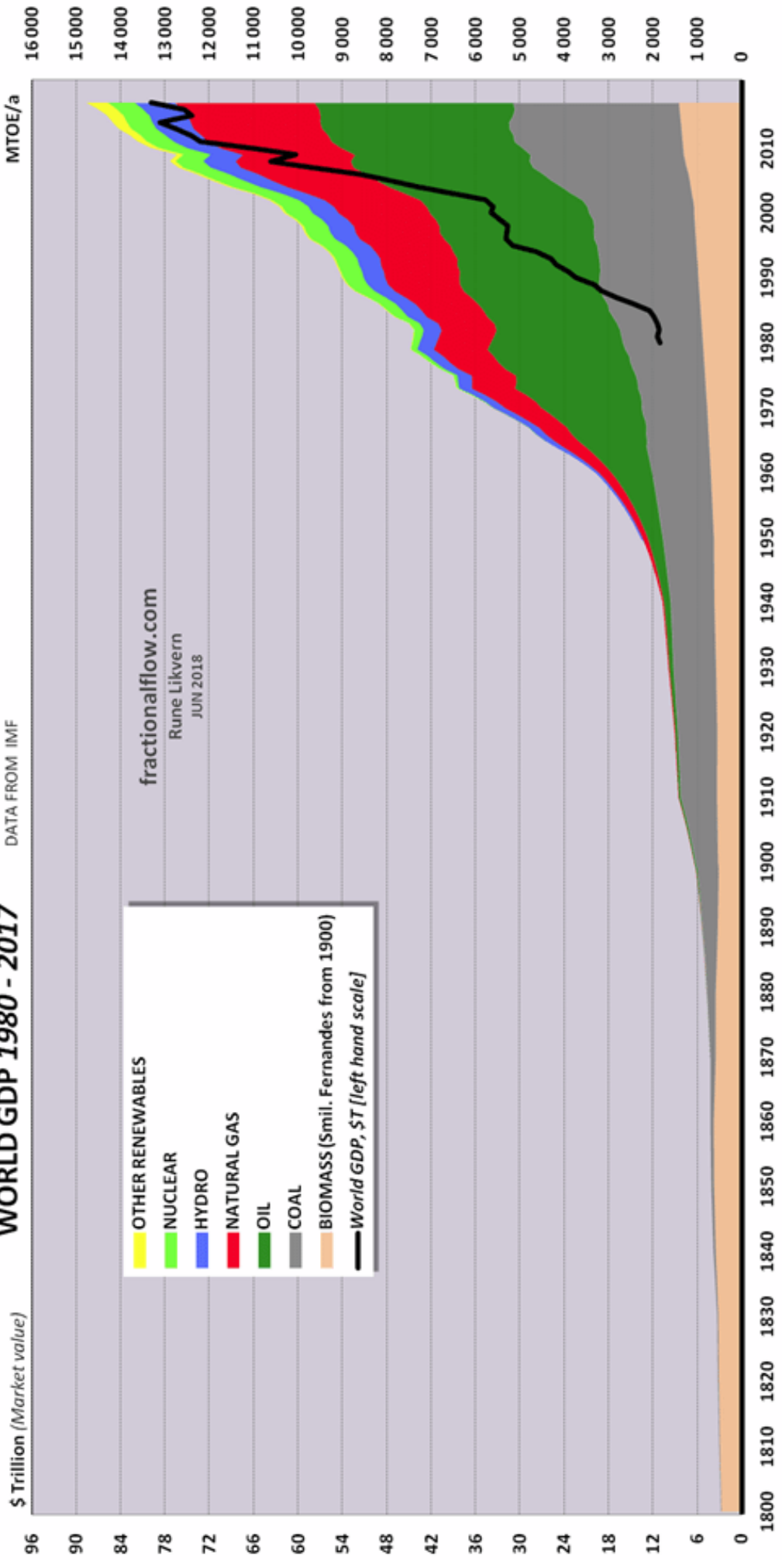
Mr George Muthemba
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National Treasury

WORLD ENERGY CONSUMPTION AND MIX 1800 - 2017

BASED UPON DATA FROM BP STATISTICAL REVIEW 2018 (1965 - 2017), PRE 1965 FROM SMIL, BIOMASS SINCE 1900 FROM FERNANDES

WORLD GDP 1980 - 2017

DATA FROM IMF





Kenya Nuclear Electricity Board
Kawi House, South C
P.O. Box 26374 00100
Nairobi, Kenya
Tel: + 254 (20) 2219410
Email: info@nuclear.co.ke



@nuclearkenya



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