

Energy Digest

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A Publication of the Kenya Renewable Energy Association

Issue 1: June-July 2013

**KENYA LEADS EA
REGION IN SOLAR
PANEL ASSEMBLY**

**M-PESA
SOLAR
ENERGY
DEAL**

**BIOGAS
'WAVE' GAINS
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an impact



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To advertise in the Energy Digest contact us at:

Tel.: +254 715 116 738
E-mail: administrator@kerea.org
PO Box 42040 - 00100
Nairobi, Kenya



Integral Media

www.integral-media.co.ke

Publishing and Production

Integral Media
Bandari Plaza, 2nd Floor
Woodvale Grove, Westlands
PO Box 11463 - 00100
Nairobi, Kenya

Tel.: +254 (722) 624174

Editor

A Ngigi

Design and Layout
P Kalinge

Correspondents

A Odhiambo
S Mbogo

Marketing

Nancy Mwirikia

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Renewable energy key to Kenya's future



*Mr. Charles Muchunku, Chairman,
Kenya Renewable Energy Association*

Pragmatic targets, supportive budgets and definitive timelines should back the new energy policy, says Kenya Renewable Energy Association Chairman, Charles Muchunku.

Petroleum and electricity supply a big percentage of the country's industrial and commercial energy needs. However, the cost of energy from these sources has been increasing rapidly over the last decade; putting an increasingly large burden on business and households. Hence, Renewable Energy and Energy Efficiency (RE&EE) have a key role to play in Kenya's economic growth.

Often overlooked is the fact that wood fuel and other biomass account for an estimated 68 per cent of Kenya's energy supply; providing more than 85 per cent the energy needs of rural and urban households. In addition to households, wood fuel and charcoal are used extensively by institutions such as prisons, schools, clinics and hospitals, as well as Small and Medium Enterprises (SMEs), which include hotels, food vendors and small-scale processing facilities. Industries requiring thermal energy for their processes for instance the tea industry, food processors — and cement manufacturers are also switching to biomass due to the increasing cost of petroleum.

Regrettably, biomass in Kenya is characterised by unsustainable supply, inefficient production and consumption and a growing supply deficit.

Although a situational analysis of the energy sector immediately highlights the challenges, it is important to note that these challenges are also indicative of the potential opportunities for renewable energy and energy efficiency solutions and business.

“Challenges are also indicative of the potential opportunities”

From a legal and regulatory perspective, the recently-gazetted solar PV and solar water heating regulations promise to improve product and service delivery in RE&EE sectors and increase business opportunities.

Furthermore, we await in earnest the new energy policy which seeks to address the implications of a devolved form of Government and back the ambitions of the Vision 2030. We hope that the policy statements therein will be boldly backed by pragmatic targets, supportive budgets and definitive timelines.

The Kenya Renewable Energy Association (KERA) welcomes you to the first edition of Energy Digest. It is the only publication in Kenya that is focused on providing accurate and insightful news and information on the climate sector in Kenya, especially in renewable energy, energy efficiency and related issues. We hope that you will find it informative and useful.

KERA would like to express its thanks to the German Federal Ministry for Economic Cooperation and Development (BMZ) and its implementing agents Bfz and Sequa for providing the kick-start financing for this inaugural edition.



KEREA

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ublink



New energy conservation rules take effect

By ADRIAN ODHIAMBO

Property owners and developers face a shake-up as new regulations on energy conservation and management take effect.

The Energy Regulatory Commission (ERC) director-general, Kaburu Mwirichia, said the Energy (Solar Water Heating) Regulations, 2012 have formally come into force and property owners and developers should comply.

The regulations require that all premises within the jurisdiction of local authorities with hot water requirements of a capacity exceeding 100 litres per day install and use solar heating systems within five years from the date the rules come into force.

“An owner of premises, architect and an engineer engaged in the design, construction, extension or alteration of premises shall incorporate solar water heating systems in all new premises designs and extensions or alterations to existing premises,” Mr Mwirichia said in a circular.

According to the regulations an electric power distributor or supplier shall not provide electricity supply to premises where a solar water heating system has not been installed in accordance with the new rules.

“A person shall not undertake any solar water heating system installation work unless the person is licensed by the Energy Regulatory Commission as a solar

water heating system technician or a contractor,” the regulator said.

Mr Mwirichia said the Energy (Energy Management) Regulations, 2012 have also come into force, boosting the Government’s push for energy conservation. These regulations require that all designated energy consuming facilities carry out energy audits at least once every three years by auditors licenced by ERC.

“All energy audit reports, implementation plans and energy policies shall be submitted to ERC. The designated facilities will be required to implement at least 50 per cent of the energy audit recommendations within three years,” the regulator said.

Energy conservation has gained prominence in the country in the wake of growing strain on existing resources. The country’s peak electricity demand has almost doubled to about 1,200 Megawatts, in less than ten years.

The energy sector, though critical in boosting the country’s development, has registered slow growth due to the high initial capital outlay and inability to mobilise adequate financial resources to undertake massive investment.

The Government has vowed to open the energy sector to bigger participation by the private sector to help boost the country’s power generation capacity.

“A person shall not undertake any solar water heating system installation work unless the person is licensed by the Energy Regulatory Commission as a solar water heating system technician or a contractor.”

AfDB launches the construction of Ethiopia, Kenya high-voltage power lines

By Correspondent

The African Development Bank (AfDB) has launched the construction of a 1,068 kilometer high-voltage electricity highway to be built between Kenya and Ethiopia.

The project, which includes the development of converter stations at Wolayta-Sodo (Ethiopia) and Suswa (Kenya) substations, involves the construction of transmission lines of about 437 kilometers in Ethiopia and about 631 kilometers in Kenya. When complete, the high-voltage electricity highway, whose construction is expected to take less than five years, will have a transfer capacity of up to 2,000 MW in either direction.

"This project establishes power trade between Ethiopia and Kenya and the wider East Africa region. It not only improves electricity access at affordable prices and enhances cross-border trade, but also provides an important opportunity to generate revenues for countries having excess power generation capacity, as is the case for Ethiopia," said Gabriel Negatu, AfDB regional director for East Africa Resource Centre.

AfDB, World Bank, the Governments of Ethiopia and Kenya will finance the project with the multinational lender providing \$338 million in financing. The World Bank will provide \$684 million, the Government of Kenya \$88 million, the Government of Ethiopia \$32 million while an additional \$118 million is expected from the French Development Agency which has expressed interest in the project.

"The direct beneficiaries of the project are households, businesses, and industries in communities located in Kenya, the direct off-takers of the power. The interconnection with Ethiopia will ensure access to reliable and affordable energy to around 870,000 households by 2018," said Mr Negatu.

AfDB's financing will cover the total cost of the transmission line subcomponent, and part of the cost of the converter station subcomponent in Ethiopia and part of the cost of the transmission line subcomponent in Kenya. The multinational lender's financing will also cover the total cost of consultancy services for supervision and management for Ethiopia and Kenya, as well as part of the cost of capacity building component in Ethiopia and in Kenya.

World Bank's financing will cover the total cost of the subcomponent converter stations, total cost of transmission system reinforcement in Kenya, a major part converter stations in Ethiopia as well as part of the cost of capacity building component in Ethiopia and in Kenya.

Financing from French Development Agency is expected to cover part of the transmission line subcomponent for Kenya.

Reference: <http://www.afdb.org/en/news-and-events/>



Lighting Africa makes an impact

About seven million people without electricity in Africa are enjoying access to high quality, clean lighting as a result of the joint efforts of Lighting Africa and its partners.

Recent results indicate that the programme's partner companies sold more than 600,000 lanterns in the six months to December 2012. Cumulatively, the sales of quality-assured solar lights in 2012 grew by 120 per cent over 2011 volumes.

"This continued bullish growth in sales volumes bespeaks a massive unmet need for clean lighting in rural unelectrified Africa, and presents a vast business opportunity for investors and entrepreneurs," says Lighting Africa's IFC programme manager, Itotia Njagi. Between 35 per cent and 40 per cent of people in Africa are connected to national electricity grids, the rest relying on expensive, polluting fuels such as kerosene for their lighting needs.

According to Lighting Africa's soon-to-be published Market Trends Report, the Africa off-grid lighting market has been recording a doubling of sales of quality-assured solar lighting products every year for the last three years.

Source: IFC/World Bank: <http://www1.ifc.org/>

Sameer Africa seeks to cut energy costs

Firm plans using solar as part of the solution

By Correspondent

Nairobi bourse listed tyre maker, Sameer Africa, is exploring the feasibility of installing a solar and coal powered steam generation facility at its main factory, to help cut its reliance on expensive and unreliable power in Kenya.

Allan Walmsley, managing director of the Nairobi Securities Exchange (NSE), listed company in disclosures contained in the company's latest annual report, has said that the company is seeking to cut costs through the project.

The company has joined other listed companies such as Bamburi Cement and unlisted firms such as snacks and spices manufacturer, Tropical Heat, which are seeking cheaper and more reliable sources of energy to supplement or even replace current energy sources.

"We will explore the possibility of introducing a solar energy and coal - fired steam generation facility for the factory on Mombasa Road, which we anticipate will reduce energy consumption significantly from 2014 onwards," said Mr Walmsley in the disclosures.

Although the company did not disclose how much it will be spending on the project's cost of sales, which will typically include energy costs have been on an upward trend.

Cost of sales for Sameer Africa rose by a marginal 4.64 per cent to Ksh3 billion for the period ended December last year from Ksh2.8 billion for the period ended December 2011.

Bamburi Cement, which has operations in Kenya and Uganda and which is also listed on the NSE has also disclosed that it is has turned to using biomass fuels to reduce the cost of energy at its plants.

John Simba, chairman of Bamburi Cement in disclosures of the latest annual report for the period ended December last year ahead of its annual general meeting in June 2013, said its power expenses have been aggravated by a sharp increase at its Uganda operations.

Uganda's Electricity Regulatory Authority, at the beginning of last year implemented the removal of subsidies which resulted in a 36.02 per cent increase in the cost of every unit of electricity used to Ush524.50 from Ush385.60 for domestic consumers.

Commercial consumers saw their costs go up by 35.97 per cent to Ush487.60 from Ush358.60.

The cost of a unit of electricity for large industries went up by 69.26 per cent to Ush312.80 from Ush184.80 while the cost for medium industries rose by 37.73 per cent to Ush458.9 from Ush333.2 per unit.

"We were able to mitigate this cost increase through increased alternative fuel substitution at the Uganda plant using biomass fuels such as coffee husks, rice husks and palm kernel waste," said Dr Simba.

US Firm to Build Third 16MW Geothermal Plant at Olkaria III

By ADRIAN ODHIAMBO

US energy firm, Ormat Technologies, plans to build an additional 16 megawatt (MW) geothermal plant within the Olkaria block to boost the country's energy output from steam sources.

The company said it will build a third plant within Naivasha's Olkaria III site as demand for reliable energy sources increased. The project is scheduled for completion in 2014.

The completion of the third plant will see the company's production capacity at the Olkaria III complex reach about 100MW.

The firm's second geothermal plant within the Olkaria block began operations with supplies being sold to the national grid thanks to a 20-year power purchase agreement with Kenya Power.

"Ormat benefited significantly from implementing a multi-phased development strategy with Olkaria III and our success in Kenya exemplifies the value of this approach. Drawing knowledge from each phase of development to improve project and plant performance as we methodically expand has allowed us to maximize efficiency and reduce risk," said Dita Bronicki, chief executive officer of Ormat in a statement.

Ormat financed the second 36 MW plant, as well as the first two phases of the complex completed in 2000 and 2009, with a \$265 million debt facility provided by the Overseas Private Investment Corporation (OPIC). OPIC will also finance the construction of Plant 3 with another \$45 million debt facility.

Kenya has embarked on renewable power generation projects in a bid to reduce dependence on unreliable

rain-fed hydroelectric, and thermal power. The country's peak electricity demand has risen to about 1,200 megawatts, compared with 780 megawatts in 2002, driven by economic growth. Kenya is heavily reliant on hydro-based sources for its power generation, it has potential to its energy sufficiency through other sources such as coal, steam and wind.

As part of a strategy to tackle the shortfall in electricity supplies, Kenya is going big on geothermal to improve supplies and cut its energy costs. East Africa's largest economy has potential to produce 7,000 MW of power from geothermal and is targeting production of at least 5,000 MW by 2030, estimates the Energy Ministry.

Experts say though expensive to drill and develop initially, geothermal is over time more reliable than both hydro and thermal powers, which are prone to the changes of weather and high international fuel prices.

The Government plans to open the energy sector to bigger participation by the private sector to help boost the country's power generation capacity.

The country's peak electricity demand has risen to about 1,200 megawatts, compared with 780 megawatts in 2002, driven by economic growth.

Billions for geothermal

Kenya is seeking to generate at least 5,000MW from its vast geothermal resource by 2030.

By Steve Mbogo

The investment includes financing to the Geothermal Development Company (GDC) that has announced 2014 as the deadline for the completion of drilling 120 wells to help the country produce at least 400 megawatts (MW) of electricity at Menengai near Nakuru Town in the Rift Valley.

“GDC is drilling 120 wells at the Menengai Geothermal Project to provide investors with enough steam for power plants. The work is expected to be complete by 2014,” said Dr. Silas Simiyu, the managing director of the state-owned firm. “GDC is now offering another 800MW worth of investment at the Lake Bogoria-Silale Bloc to interested investors,” he said.

The company was formed in 2009 by the Government to accelerate exploration and drilling of the vast geothermal resource in the Rift Valley to enable the country benefit more from cheaper renewable energy.

GDC drills the wells for steam which it rents to private companies to generate electricity and connect it to the national grid. The feed-in tariffs enable investors to participate in electricity generation projects.

“Our work is to offer investors a risk-free alternative by providing them with ready steam. All they need to do is to construct power plants and produce electricity,” said Dr. Simiyu. “Investors can participate in generation by investing in geothermal wellheads that make it easier and cheaper to tap geothermal steam and generate power.”

Kenya has opted to use geothermal wellhead generators to reduce the time it takes to generate electricity from geothermal steam wells from four years to less than a year. This is to increase the share of cheaper power sources in its energy mix. Geothermal wellheads are smaller power-producing units that generate 5 to 10 megawatts.

They are cheaper and easy to install on the top of a geothermal well and they therefore come in handy in early tapping of electricity during the waiting time for the construction of bigger geothermal power plants.

Geothermal experts from the GDC said the wellhead generator unit provides interventions required in Kenya’s power sub-sector to mitigate some of the challenges that limit its development like delay in

GDC drills the wells for steam which it rents to private companies to generate electricity and connect it to the national grid.



raising adequate financing to set up bigger plans to high power output. They are crucial in providing additional power at the time of large scale geothermal resource development.

The challenge of raising capital to finance bigger power plants is being felt by the Kenya Government that is now having ready geothermal steam capable of generating 430MW of electricity. The unutilised steam is currently going to waste despite investments of nearly US\$329 million used by the Government for drilling purposes in the last seven years.

The wellheads are also expected to come in handy when Kenya starts another round of large-scale

The project is expected to place Kenya on the global geothermal map as it will be the world's biggest in terms of power output.

geothermal wells drilling which are expected to have steam output that is capable of generating 560 megawatts (MW).

KenGen, for instance, intends to use the wellheads to generate 65MW of electricity within the shortest time possible, according to the company's managing director, Eddy Njoroge.

KenGen has been running a pilot project of a geothermal wellhead.

Billions for geothermal

This is the first time the technology is being used in Kenya and its officials say the performance of the facility is encouraging.

GDC says geothermal remains the cheapest power source costing 7 US cents to produce compared to 8 US cents for biomass, 88 US cents is for wind power, 14.1 US cents for hydro and 35 US cents for solar per kilowatt hour.

This is why Kenya is planning to increase its geothermal mix from the current 13.2 per cent to 30 per cent of the total energy mix by 2014, the Scaling-Up Renewable Energy Programme (SREP), the country's energy investment plan.

The report developed last year indicates hydro sources that are vulnerable to rainfall patterns dominate Kenya energy mix at 52.1 per cent followed by the expensive thermal sources at 32.5 per cent, which geothermal is planned to reduce considerably.

KenGen and GDC are pursuing a two-pronged geothermal drilling approach to raise the country's geothermal output from the current under 200MW to at least 1,000MW by 2018.

The two companies have opted to pursue public-private-partnership (PPPs) deals to reduce the time it takes for the Government-owned corporations to secure loans needed for geothermal power plants. For instance, private players have been invited to place bids for concessions of the steam wells where they will come in with wellheads and have guaranteed power purchase agreement with the Kenya Power and Lighting Company (KPLC).

However, GDC, being a state corporation, has been facing challenges of accessing development loans because it does not have the independence to enable it directly borrow, even from generous lenders like Chinese banks.

But its business plan of concessions, after successful drilling, cushions it from the delayed financing risk.

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This however means the Government must continue spending more on drilling, over the US\$329 million it has spent on the project. Energy ministry officials said additional US\$705 million will be spent on a new round of drilling.

Mid last year, Kenya launched its biggest investment in geothermal power generation, a 280 megawatts plant at Olkaria. The nearly US\$950 million project will be completed in December 2014, enabling geothermal to contribute 30 per cent to the country's energy mix. The project is expected to place Kenya on the global geothermal map as it will be the world's biggest in terms of power output.

It will also bring the country closer to claiming one of the top positions in terms of global geothermal output, now rivalled by the United States of America at 3,000MW and Philippines at 2,000MW. Kenya is seeking to generate at least 5,000MW from its vast geothermal resource by 2030.

The project is expected to place Kenya on the global geothermal map as it will be the world's biggest in terms of power output.

M-pesa solar energy deal

Light up your home for only Ksh 40 daily

By Steve Mbogo

Buying solar lighting equipment by low-income households in Kenya has been made easier, thanks to an innovative financing model by mobile phone service provider Safaricom.

The pay-as-you-go model requires solar lighting equipment users to pay a KSh2,500 deposit and only KSh40 per day for a year.

The new model is likely to enable more Kenyans afford cleaner lighting solutions and lead to further reduction in the use of kerosene and improve the living standards of low-income earners. Lack of financing opportunities has been identified as one of the reasons limiting access to solar lighting equipment.

Safaricom is in partnership with M-KOPA - the first ever GSM enabled pay-as-you-go solar solution in the world where customers pay their instalments Safaricom's using its mobile money transfer service.

Using embedded Safaricom enabled sim cards, M-KOPA Solar allows a customer to enjoy the use of a D.Light solar home system, while paying the daily installments via M-pesa for a year. After paying the deposit, customers pay for usage at their convenience.

This credit-sale model targets low-income households in rural areas that are using kerosene for lighting and bureaus for charging mobile phones.

"The barrier to large-scale adoption of solar lighting has been the high upfront cost of a home system, which makes it unaffordable to the majority of Kenyans. Indeed, the penetration of solar lighting products in Africa remains less than 2 per cent. M-KOPA Solar has been developed to remove this

barrier by making solar home systems affordable and accessible to low-income consumers," said Safaricom CEO, Bob Collymore.

M-KOPA Solar enables one to get the D.Light Solar, a high quality product that combines 3 bright bulbs and a mobile phone charging to meet the needs of the average Kenyan family. It has a one year warranty and a product lifespan of 7 to 10 years.

"As with M-pesa, M-KOPA has been designed specifically to suit the needs and budgets of Kenyan consumers. By working with Safaricom, we can spread this new service to all parts of Kenya," said Nick Hughes, chairman of M-KOPA and former global head of M-PESA for Vodafone Group.

Jesse Moore, the M-KOPA managing director, hailed the M-KOPA Solar solution as a great step forward in promoting the clean energy agenda.

"M-KOPA succeeds when our customers save money. We already have over 1,000 customers in Kenya, with a wide majority telling us how good it feels to save money while getting far better lighting than with kerosene and the convenience of mobile phone charging at home. We look forward to bringing better lighting at a lower cost - to tens of thousands of homes over the coming year," he said.

According to Moore, M-KOPA Solar is currently available at tens of shops in some major towns and plans are underway to make them available all over the country.

Since 2010, M-KOPA has helped Kenyans acquire solar power products by offering innovative payment and distribution modes.

Using embedded Safaricom enabled sim cards, M-KOPA Solar allows a customer to enjoy the use of a D.light solar home system, while paying daily installments of KSh40 via M-pesa for a year.

Kenya leads EA region in solar panels assembly

Interview by Steve Mbogo

Ubbink solar panel assembly plant is conspicuous on Moi South Lake Road in Naivasha. And the dividends the company has brought to Kenya are enormous.

May 2013 marks the start of third year of Ubbink East Africa operations in Kenya. Located in Naivasha, the company is the first solar module manufacturer in the region.

The company manufactures solar modules of various capacities ranging from 13 watts to 125 watts.

In the second quarter of 2013, the company will start manufacturing higher capacity solar panels that can be used in development of solar power farms. Company officials said demand is high for panels of higher output.

The Ubbink East Africa production facility is part of the joint venture between Ubbink and distribution partner Chloride Exide, the largest battery and renewable energy distributor in East Africa.

The establishment of the plant had financial support from the Dutch Government through a private sector investing programme (PSI), which is keen

on stimulating sustainable economic growth in developing countries by supporting innovative projects.

Beyond enabling availability of quality solar panels in the East Africa region, the plant has become a reference point for investors, especially those in Europe, and who are interested in investing in Kenya. "Every so often, we receive visitors from Europe particularly interested in setting up their plants in Kenya. They want to be sure that it can be done here; that it's not only in Malaysia or Philippines that such facilities can function well," said Haijo Kuper, the Ubbink director. Ubbink assembles solar panels of up to 120 watts. It started operations in Kenya in 2009 with an initial funding of KSh200 million. The plant is one of the best reference points showcasing Kenya's favourable renewable energy policy that has seen accelerated investments across the renewable energy sources.

"We decided to come to Kenya, and more so in Africa, because of the promising market opportunities here. But the bigger reason is to facilitate technology transfer. Right now, all our 50 employees here are experts in solar panel assembly, skills they did not have before we came in," said Kuper.

Every month, an average of 20 solar panel dealers from across Africa visit the factory to learn the basics of solar panel assembly. And in every quarter of each year, the factory accepts visitors from a university or a technical institution from across the East African region.

The company is the first of its kind in Eastern, Central and the Horn of Africa regions. It is a subsidiary of Central Tech, a solar panel production company based in Germany and listed at the Frankfurt Stock Exchange. The local entity, however, has minority local shareholding.

So far, Kuper says business experience in Kenya is better and he expects it to get better with time. "The market is growing. In East Africa, solar panels market has been growing faster than the economy in the past two decades," he added. Starting next year, Ubbink will start manufacturing solar panels of 200 kilowatts and above.

"We have received inquiries from customers who want to set small on-projects. This is indicative of the solar market growth," he said.

The investment in on-grid solar projects is encouraged by the existing feed-in tariffs. According to the Ministry of Energy's Feed-



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in Tariffs Policy, investors in solar energy enjoy a fixed tariff not exceeding US cents 20.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the connection point.

This tariff applies for 20 years from the date of the first commissioning of the solar power plant. The tariff applies to the first 100 MW of power generated using solar resource fixed tariff not exceeding US cents 10.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the connection point for 20 years from the date of the first commissioning of the plant, for the first 50MW of non-firm power generating solar-based power plants developed in the country.

The above tariff also applies to individual solar power plants whose effective generation capacity are equal to or more than 500kW and does not exceed 10MW. Due to Kenya's strategic location along the equator, the daily average solar radiation is above 6 kilowatt hours per square

metre, one of the best in the world.

The company said it expects inquiries from more clients who want to invest in on-grid projects. Unlike in Africa where consumption of solar panel is largely for off-grid projects, more than 99 per cent of solar panels manufactured for European and Asia market are for on-grid projects, a feature likely to be replicated in Africa as countries in the continent continue to review their renewable energy policies.

Ubbink's presence in Kenya is seen as an encouraging factor in the growing confidence of consumers to solar panels. Clients enjoy a 25-year warranty, are assured of service and can get needed volumes on a need-basis. In the two years the company has been in existence, it has sold solar panels capable of producing 2 megawatts of electricity across Kenya, Uganda, Tanzania and South Sudan.

Next year, the company projects to sell solar panels with combined output of 2.5 megawatts.

According to Kuper, the average off-grid solar market for EAC is about 10 megawatts although he is quick to add that there are essentially estimations because there is lack of data to make better informed conclusions.

While EAC Governments have zero-rated duty on solar products, Kuper said his challenge as the assembler is that he has to pay duty on all his locally sourced inputs. This makes his products uncompetitive compared to imports applied to the first 100 MW of power generated using solar resource fixed tariff not exceeding US cents 10.0 per Kilowatt-hour of electrical energy supplied in bulk to the grid operator at the connection point for 20 years from the date of the first commissioning of the plant, for the first 50MW of non-firm power generating solar-based power plants developed in the country.



Kenya adopts grid-tie solar PV

By Staff Writer

Just under two years ago, in November 2011, Henry Gichungi, deputy manager, of Off-grid Power Stations, Kenya Power said: "Grid-tie solar generation is a new technology in Kenya and the country has a lot of potential especially in the off-grid areas. Kenya Power is keen on training its staff in readiness for the adoption of this new technology."

He made these remarks when the German Solar Academy Nairobi launched the second edition of a one week training for East African engineers and artisans in photovoltaic technology, initiated by three German companies: Energiebau Solarstromsysteme GmbH, SCHOTT Solar AG and SMA Solar Technology AG.

Subsequently, Gichungi presented a Progress Report on Use Of Renewable Energy in Off-Grid Areas, showing that three grid-tie plants had been commissioned by end of 2011—at SOS Children's Village, Mombasa (60kW); at UNEP in Nairobi (515 kW) and at Merti (10kW), owned by Kenya Power. He also made reference to several other solar grid-tie plants then under construction at Habaswein—30kW, Hola—60kW, Elwak – 50kW, Lodwar – 60kW and Mandera 300 kW.

In March 2013, Gichungi reiterated his comments stating that, "Kenya's geographical location astride the equator gives it a unique advantage for a solar energy market."

Grid-tie solar is therefore no longer a new terminology in Kenya. Indeed the Government underpinned this with the publishing in December 2012, of revised feed-in tariffs for renewable energy including solar, in order to "attract private sector capital in solar energy resource electricity generation."

A grid-tie system is a semi-autonomous electricity generation system which links to the main power grid. When excess electricity is generated it is fed to the grid and when the generation is insufficient the difference is drawn from the grid.

In February 2013, a report in *The East African*, stated that a "solar power farm has been switched on in Timau, Nanyuki, 230 kilometres north of Nairobi, paving the way for more commercial solar power farms in the country." The report quoted Ivan Freeman, owner of Uhuru Flowers, saying that the 72 MW plant that cost Ksh15 million will reduce power costs by 80 per cent. It was implemented by Azimuth Power Ltd (Kenya) and is estimated to have a 5-year return on investment time frame.

The installation at SOS Children's Village in Mombasa was the first Solar PV Grid-tie project in Kenya. It was developed by a German solar company, Centrosolar and came online in 2011. The SoS Children's Village management says the solar system has cut their electricity bill by more than half.

Ms Donnah, the village's communication officer, said the electricity bill has reduced from an average of KSh250,000 per month to between KSh50,000 and KSh100,000. "During the day, we use about 30kWh and put about 30kWh into the grid. At night when there is no solar, we use from the grid. We only pay if what we have used from the grid exceeds what we have input," she said.

Net-metering allows a no-cost method of effectively banking excess electricity production for future credit. It is generally a consumer-based renewable energy incentive.

According to a report titled, "Grid Connection of Solar PV: Technical and Economical Assessment of Net-Metering in Kenya", compiled by GIZ on behalf of the German Federal Ministry of Economics and Technology, "Kenya's solar potential lies untapped." The assessment concludes that due to escalating power costs, net-metered solar will be the lowest cost option for many consumers by 2014.

Tea factory scores big in energy generation, savings

By Steve Mbogo

Imenti's mini-hydro electricity plant had enabled farmers to save at least KSh50 million in electricity costs by June last year, since it started operating in December 2008. "In the financial year ending June 2010, we managed to save electricity costs of KSh18 million and in the same year between March and June, we sold electricity worth Sh1.8 million to the Kenya Power and Lighting," said the factory manager Peter Kambutu.



The mini-hydro project was installed by the Kenya Tea Development Agency (KTDA), a company contracted to manage tea factories for Kenya's estimated 500,000 small-scale tea farmers. KTDA plans to replicate the success of the Imenti facility across the tea belt by developing 10 mini-hydro projects in the next two years as part of the progressive introduction of a mini-hydro project for every Kenyan tea factory.

In September last year, KTDA awarded Sri Lankan firm, VS Hydro, the tender to construct a 5MW hydropower plant for four factories in Nyeri at a cost of ksh1.3 billion (\$15 million). "Each of the factories uses about 0.5 megawatts of power, which means they have more to sell to the Kenya Power and Lighting Company," said Lucas Maina, the general manager of KTDA Power Company, the subsidiary managing the hydro-power plant on behalf of the farmers.

The Imenti facility was financed by farmers through debt and savings to the tune of ksh200 million. With an annual average income of ksh20 million – in electricity savings and sale to KPLC – it will take about 10 years for farmers to start getting a return on their investment. "But we are now seeing a shorter time before recouping our investment because the payment for electricity by KPLC has been increasing," said Mr Kambutu.

At Imenti, the factory's electricity bill was ksh21 million in financial year 2007/08 and ksh25.7 million in the financial year 2008/09. In the financial year ending June 2010, the bill rose to ksh36 million because of the drought that led to rationing of electricity and the dependency on power from independent power producers who were using expensive diesel. But that last 12 months to September 2010. It saw the factory generate its own power worth Sh18 million, meaning the total bill paid to KPLC was Sh18 million, a reduction from previous electricity bills despite a drastic increase in the cost of electricity.

The mini-hydro currently produces 1 MW of electricity, although the installed capacity is double the output. The challenge is usually how water levels at rivers Mariba and Thingithu, the main inlets, are low. "Farmers upstream are doing

lot of irrigation and this is affecting the river levels, especially during the drier season. If we get more water, our generation capacity will double," said Mr Kambutu. All the 64 KTDA-managed tea factories currently use electricity from the national grid – whose cost is affected by diesel prices when hydro dam levels are low, as well as the prices of wood and furnace oil, the other substitutes.

KTDA has also been blamed for environmental degradation after it resulted to using wood. This was apparently depleting agro-forests in tea growing areas, as climatic conditions needed by tea are sustained by trees. A cost analysis done by the KTDA showed that electricity is the lowest cost energy component of processing green tea into black tea. Production costs using hydro are KSh4 per green leaf, while coal is KSh7, wood is KSh5, and furnace oil is KSh25.

But the costs are still lower if tea farmers produce the electricity using local resources like rivers – as in the case of Imenti Tea Factory. The agency has worked on a financing model that raises 35 per cent of the investment through equity from farmers and 65 per cent through debt. Deductions from farmers to make the 35 per cent equity started during the 2010 annual bonus payment. "KTDA plans to invest in 10 mini-hydro projects and progressively establish a mini-hydro project for each factory in long term," said Mr. Lucas Maina, who is also the head of projects at the Kenya Tea Development Agency. Although tea earnings for small holder farmers rose by 12 per cent to KSh45.3 billion this year compared the income faces threats from volatile oil prices and environmental consequences of using wood fuel.

Energy is a major cost of tea production, accounting for 30 per cent of total production cost per kilogramme of green leaf at the factory level. The tea factories use electricity from the national grid, whose cost is affected by prices of diesel used by Independent Power Producers during the season when hydro dam levels are low.

KTDA said it also plans to use coal once its mining commences in Kitui and Meru in Eastern province. The Government has invited bids for coal exploration.



Lake Turkana wind power project finally set to take off

By Steve Mbogo

After several years of false starts, the Lake Turkana Wind Power Project can finally start. This is after the Africa Development Bank confirmed its approval of a €115 million (just over ksh12 billion) in financing for the project in Kenya's Lake Turkana region.



The Lake Turkana Wind Power (LTWP), one of Kenya's largest clean energy farms, has received a major boost after a major multinational development bank approved funding for the project.

African Development Bank (AfDB) approved debt worth over Ksh12 billion in financing for the wind power farm which will be put up in the Lake Turkana region in northern Kenya.

AfDB expects that the project will add 300Mw to power generation capacity and that this will benefit the country by supplying clean and affordable energy, a move that is expected to reduce the overall energy cost to consumers.

In addition to the power generation capacity, the wind power project will include the operation of 365 turbines of 850KW capacity each on a site, covering 40,000 acres (162 km²) located in Loyangalani District, Marsabit West County, approximately 50km north of South Horr Township.

"This zero-emission project will contribute in filling the energy gap in the country, enhancing energy diversification and saving 16,000,000 tons of CO₂ emissions compared to a fossil fuel fired power plant," said Gabriel Negatu, AfDB regional director for the East Africa Resource Centre.

He said that the project will be implemented by Lake Turkana Wind Power, a special purpose vehicle, created in September 2006. Investors involved in the project include Kemperman Paardekooper & Partners Africa, Aldwych International, and The Investment Fund for Developing Countries of Denmark, Norfund and Vestas Wind Systems AS.

As a result of the project, the Great Rift Valley region will be connected to the rest of the country through the improved infrastructure linked to the wind farm, including a road, fiber-optic cable and electrification.

AfDB said in a press release that, "none of this would be possible without the commitment of the Government of Kenya. Catalytic to this investment is the fact that the Government of Kenya will construct the 428-km transmission line required to evacuate power from the project site to the national grid. To this end, the Government of Kenya has secured financing from the Spanish Government."

"Financing by AfDB for LTWP is a major milestone in the development of the project. It is also proof that financial close is now in sight," said Carlo Van Wageningen, chairman LTWP.

AfDB, which is the mandated lead arranger for the project will rise over US\$165.1 million in senior debt and a further US\$75.4 million of subordinated debt and provide a partial risk guarantee for the project against the risk of delays in the construction of the transmission line.

LTWP aims to provide the approximately 300Mw low cost wind power to national grid, equivalent to approximately 20 per cent of Kenya's current installed electricity generating capacity. It is expected to cost approximately Ksh70 billion (€600 million).



Off-grid lighting products selling like hot cakes

By Correspondent

Sales of quality lighting products increased by 120 per cent in 2012 over 2011 in Sub-Saharan Africa, according to the Lighting Africa programme.

The off-grid lighting products largely use solar to light homes in rural areas where there is no access to mains electricity. They are also used in informal settlements.



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The sales data was released by Lighting Africa, a joint programme of IFC and the World Bank that seeks to accelerate the development of commercial off-grid lighting markets in Sub-Saharan Africa.

Lighting Africa attributes the jump in sales in Africa, by 120% compared to 2011, to the consumer education on the importance of cleaner energy and micro-loans for low-income earners to purchase the lamps.

Consumers are better equipped to make buying decisions in today's market. Lighting Africa's consumer education campaign, which works to generate consumer awareness around the benefits of clean and affordable off-grid lighting, has now reached 22 million people in rural Kenya and Ghana, according to results published by Lighting Africa in February 2013.

To address the upfront costs bottleneck for consumers, Lighting Africa works with micro-finance institutions to provide consumer finance. Currently, five micro-finance institutions (MFIs) in Kenya and two in Ghana are providing finance to consumers in rural areas.

The Lighting Africa programme was initially hit by a consumer confidence crisis following flooding of the target Africa market with low quality solar and LED-light lighting equipments that discouraged consumers.

But Lighting Africa is testing the quality of off-grid lighting products, meaning that consumers buying quality-verified products are guaranteed of quality. Six new products passed Lighting Africa quality tests recently, bringing the number of good quality and affordable lanterns available in the market to over 50.

The programme is part of the efforts by development groups and governments, mostly in Africa, to reduce

dependence of carbon emitting and expensive kerosene as fuel for lighting.

The World Bank estimates that African poor rural households and small businesses that are off-grid currently spend 10 billion dollars on lighting annually and this figure will grow to over 12 billion dollars by 2015.

"Consumers not connected to national electricity grids who are using kerosene, candles or battery



powered torches are sending a clear message of their desire for affordable, high quality lighting products," said Itotia Njagi, IFC's Lighting Africa programme manager.

Despite this impressive growth, however, modern lanterns are only being used by 2 to 3 per cent of the potential African consumers without electricity, who number about 600 million.

The World Bank estimates that poor African rural households and small businesses that are off-grid currently spend US\$10 billion on lighting annually

DEEP-East Africa Supports Over 900 Energy Enterprises

Interview by Steve Mbogo, with additional content by Staff Writer

Project shows the way through a business and technology training and mentoring process that can be replicated Africa-wide; but market conditions make standardisation a ‘futile’ exercise, claim entrepreneurs

Developing Energy Enterprises Project Africa (DEEP EA Project) is an energy enterprise development innovation that has supported micro and small energy enterprises and outperformed its initial aims.

“It is a project that can be replicated all over Africa,” said Eng. James Wakaba, the Regional Manager Africa for GVEP International, in an interview. “Its aim was to deliver energy access to 1.8 million people in Kenya, Tanzania and Uganda by the time of its completion. This target was achieved in April 2012, 10 months ahead of schedule,” he said.

The project has been implemented by GVEP International as the lead organisation and partners — IT Power, Practical Action, CRSPK (Aga Khan Foundation), Gender and Energy Research & Training (GERT), Emerging Markets Economics (EMEA) and the East Africa Energy Technology Development Network (EAETDN).

The 900 micro and small energy enterprises that participated in the

project are now involved in the manufacture and supply of clean cooking stoves, solar PV products and services, clean fuel briquettes and biogas systems.

According to the ACP-EU Energy Facility, the project has so far created 2,000 jobs in the region, enabled 2 million people to access improved energy products and services, and enabled 1,300 households to receive income from employment in supported energy enterprises.

Samual Njagi, an artisan based in Mariakani, Mombasa, is one of the beneficiaries. Njagi attended a DEEP course in February 2009. There, he learned new business management skills. Later, he was invited to a DEEP EA business mentor training, too. He now uses the skills he acquired to provide support and advice to a group of 12 artisans working on improved cooking stoves production in the area. He has become more innovative too. He obtained a design for a gasifier stove that produces charcoal while simultaneously cooking food.

Using his metal working prowess, Njagi has replicated the stove and added this to his stock.

“Innovations and gains happening in the renewable energy sector will not be achieved without the support of the Government,” says Wakaba. “Policywise, Kenya has done better than most Sub-Saharan countries, though some like the neighbouring Uganda have been further ahead with a stand-alone renewable energy policy,” he said. He, however, cautions that implementation of renewable energy programmes remains sluggish.

“The private sector is a latecomer in the process as previous policy restrictions limited its involvement, and subsidies in energy dampened prices. However, it is quickly catching up as evidenced by investment in geothermal, the most vibrant solar sector in the region, lots of small project developments in wind and micro-hydro and hundreds of businesses in solar lamps, improved cooking stoves, phone charging, biogas,” said Wakaba.

The role of the private sector is however hindered by, among other factors, lack of sector specific standards for some of the renewable energy products. According to IT Power, an international renewable energy and climate change consulting firm that has been responsible for technical training and technology mentoring in the DEEP EA Project, standardisation in the cookstoves sector as a bottleneck.

IT Power points out that standardisation can increase opportunities for the entrepreneur in terms of access to larger markets driven by customer satisfaction, leading to higher sales, repeat business and referrals. For this to be realised, an entrepreneur needs to attain the national mark of quality.

During the early years of the DEEP EA Project, enterprises were given indirect support by the project, towards attaining this quality seal. They were trained on product quality and sensitized on the need to attain the mark, with the expectation that they would automatically proceed to acquire the mark, having known its advantages.

However, the outcome differed from expectations: There was slow progress and most entrepreneurs did not make much progress towards attaining the national mark of quality.

A revised strategy was therefore adopted. Direct technical and administrative support was provided by IT Power through a target approach; standardisation role models would be developed as examples to encourage other entrepreneurs. The project hence assisted selected improved cookstoves entrepreneurs in overcoming hurdles at different stages of the preparation and application process set by national standards bodies in Kenya, Uganda and Tanzania.

Assistance availed

- > Support towards registration of business names.
- > Support towards implementation and adherence to the specific provisions on quality standards.
- > Administrative support towards application for the mark of quality.
- > Linkage for training by the National Standards Body (in Uganda and Tanzania).
- > Financial support related to payments for name search, business name registration, and quality mark applications. In Uganda, entrepreneurs were also financially facilitated for training by the national standards body.
- > Logistical support – submission of applications and follow-up with business registration and standards offices.

In Kenya, IT Power found that the process costs is estimated at KES 6,900, comprising business name search at KES 100 per name (2-3 names per entrepreneur), business name registration at KES 800, and application for the mark of

quality at KES 5,800. Comparative costs are about UGX 840,000 in Uganda. In Tanzania, however, the process and costs have not been defined by the standards body, hence the total cost is unclear.

Challenges – Entrepreneur Level

Production cost implications:

Some entrepreneurs have not been able to meet production standards requirements as they are pre-occupied in reduction of production costs. Raising quality standards in most cases requires a higher level of investment in production technology and human resources.

Cost benefit analysis

Cost (time and money) of acquiring the quality mark tends to exceed the perceived or expected financial benefit consequent to acquisition of the quality mark.

Most entrepreneurs are still able to sell all their products without the mark, hence do not see any added value in attaining the quality mark.

Application process and cost

Most small entrepreneurs express the feeling that the application and approval process is too expensive for their level of operations. They are not able to raise the requisite funds from their business operations.

Fear of business formalisation

Some entrepreneurs are still reluctant to register their business due to fear of getting into statutory obligations such as taxation, annual returns and audits. Many prefer to keep their businesses informal, or if registered, only at the local level with social services departments and not with the registrar of companies. In Tanzania, lack of plot or block numbers which is a requirement in the business name registration process complicates matters further. Most cookstoves entrepreneurs operate in temporary business locations either on the road side, in an open market place or in rental houses. They also exhibit unwillingness to provide business location details due to regulatory implications, mostly taxation.

Price limitations and competition

Many entrepreneurs indicated that they would not be able to pass on the increased cost of production to end-users due to affordability considerations and competition.

Challenges – Market Environment

End users lack awareness on quality standards and importance of the quality mark. Hence they do not necessarily prioritise purchase of goods with the mark of quality over other products. Furthermore, most retailers (other than large stores like supermarkets) do not insist on such a mark of quality, leading to low perceived relevance of the mark. Thus most entrepreneurs directly targeting end-users through micro retailers do not see the need for the quality mark. One entrepreneur in Kenya stated that even though certified, he felt the effort was futile, at the local retail market as he has not realized the benefit of having the quality mark.

Challenges – Operating Environment

In Tanzania, the centralized registration offices (BRELA and Tanzania Bureau of Standards - TBS) pose a challenge for entrepreneurs from the Lake Zone of Mwanza as they have to travel to Dar es Salaam for the standardisation procedures. Therefore travel costs have a high input on the total cost of attaining the mark.

Evolving Standards Framework

Most policies, regulations and standards related to cookstoves and briquettes in the region are still in the development stage or where done, have not been backed with the necessary equipment to undertake testing for certification.

LESSONS FOR THE FUTURE

Certification needs to be market driven. The benefits of acquiring the quality mark must outweigh related costs. Consumer education on quality standards needs significant enhancement. Finally, there is need for substantial handholding of the small entrepreneurs through the process, and even co-finance as an incentive.

Givewatts Kenya

Article submitted by Correspondent

Givewatts Kenya is a charity set up to allow people in the country and around the world give watts of renewable energy to those who need it. This would be through public institutions such as rural schools and medical centres in Kenya, where kerosene and firewood are the main sources of lighting.

In the pilot projects carried out by Givewatts, money has been raised to provide solar lanterns, under the management of the parent-teacher associations, to schools. The lanterns are provided to pupils who sign them out, take them home for evening study, and bring them back to the school the next day for recharging at the school.

By targeting public institutions, Givewatts seeks to address energy access in rural areas, without distorting markets or stifling local entrepreneurship. Small inputs can make large differences. In this case, the provision of solar lanterns to schools:

- Provides the opportunity for pupils to access better quality lighting for a few extra hours in a day and increasing their chances for better grades;
- Reduces the respiratory and eye related problems

that arise from repeated use of kerosene and firewood for lighting; and

- Reduces school and household expenditure on kerosene, releasing the money for other uses.

Installations will not be restricted to solar lanterns or lighting applications – there are arrays of technologies available – but as an initial diffusion strategy for Givewatts, good quality solar lanterns are easy and quick to deploy, they are functional and robust.

Indeed, the BBC's radio series "A History of the World in 100 Objects" features solar lanterns as object number 100, that "may yet – who knows? – play a key role in solving the world's energy problems."

The case below provides a flavour of the work that Givewatts will be expanding upon this year and beyond.

Just around the corner, we drive straight into a herd of buffalo. A big bad tempered mean old buffalo stops in its tracks and eyeballs us. There's a bit of banter that goes on upfront in the vehicle and then a delightful explosion of giggles. Ben turns around and says, "There's a funny story about a big bad tempered mean old buffalo just like this one."

Givewatts values your comments, contributions and suggestions, please visit www.givewatts.org and get in touch with us at anjali@givewatts.org



"Err..." chorus a number of slightly nervous sounding voices in the back of the vehicle.

Ben continues, "The buffalo chased twelve lions away from their fresh kill. It even tossed one of them up in the air with its horns. The lions scampered away like little rabbits! Can you imagine? Twelve lions!"

We're on our way to Tumaini School, driving through the Ol Kinyei conservancy, 17,500 acres of land set aside by a Maasai community for the purposes of wildlife conservation. The conservancy is on the fringes of the Maasai Mara Reserve and is an important initiative in winning land back into conservation whilst providing an economic return that is competitive against other possible agricultural uses of the land. Ben and Simon are both part of the community that owns the land and are our hosts and guides during the trip.

There is a hard edge between wildlife conservation and people who live in close proximity to protected areas. The reality is that whilst the country as a whole benefits from the billions of shillings of revenue resulting in tourism activity in the Maasai Mara, it hasn't translated into direct benefits to many people who face the hard edge every day of their lives.

This is perhaps a discussion for a different time and place, but Ol Kinyei subverts that status quo, factoring in the principle that the wellbeing of the people is inextricably linked to wildlife conservation.

It's one thing to meet a herd of buffalo sitting in a four wheel drive vehicle with enough horse power to out-run any bad tempered ones, it's quite another if you are a student, walking your way home from school after dark. There's no electricity access in this area. Lighting after dark for homework or house errands is by firewood or kerosene lanterns; "Sorry teacher, I accidentally burnt my homework" is a reality and not a lame excuse.

Sollatek SOLAR

ONE STOP SOLAR SHOP



MOMBASA MALINDI RD, OPP. BAMBURI CEMENT FACTORY P.O. Box 34246, Mombasa 80118

Mobile : 0733 610753 / 0733 615727 or 0725 546865 / 0722 764643

wireless: 0203501671 / 2 Fax : 020 3501673

Email: sales@sollatek.co.ke

Web site: www.sollatek.co.ke

EYECATCHE

It's so very striking here that something as simple as a solar lantern can help to open up the opportunity for a few extra hours a day, whether at home or at school. Access to the solar lanterns, unfortunately, isn't quite so simple, and this is where Givewatts can help, in collaboration with partners such as Gamewatchers. That's why we're here, and once the buffalo herd let us pass, we were on our way to meet with Oloibur Murt and Tumaini school to plan the way forward for installations of lanterns at the schools. The intention is that the lanterns will be managed by the school's parent-teacher association. They will be used both in the classrooms and on a rotational basis for pupils to take home and use for study, so they do not have to stay late at school.

Givewatts travelled to Ol Kinyei in early June 2012. A follow-up trip was made in mid-June, during which 150 lanterns were installed at Oloibur Murt Primary School and 50 lanterns were installed at Tumaini Primary School.

Biogas 'wave' gains momentum



KENDBIP installations edge closer to the programme's target 8,000 mark, according to information from KENFAP.

By Staff Writer

When the Kenya National Domestic Biogas Programme (KENDBIP) was launched in 2009, there was guarded optimism that Kenya's biogas sector was set for unparalleled growth. Given that past efforts by both donors and Government had previously been eluded by success, it was hoped that the new private-sector led approach would bear fruit. And it has done just that, and even exceeded expectations.

The Kenya National Federation of Agricultural Producers (KENFAP), led by its CEO Dr. John K. Mutunga, has in its capacity as the National Implementing Agency (NIA) for KENDBIP steered the installation of over 7,200 digestors under the programme. This surpasses by far the total number of digestors estimated to have been installed in the country since independence to 2009 when the programme started. According to KENDBIP's Programme Manager, Mr. George Nyamu, the programme is now planning to push this number further by adding another 25,000 units between 2014 and 2018.

The need for biogas

Out of a total population of approximately 40 million, 77 percent of Kenyans live in rural areas where traditional biomass (mainly wood fuel) has remained the leading source of energy (both for cooking, and at times for lighting). Other sources used by the bulk of the rural population include charcoal, dung and agricultural residues. There are 8 million farmers, out of which more than 1.8 million are small holder farmers practising dairy farming, providing a huge potential for biogas. In 2007, in the context of Biogas for Better Life, the Shell Foundation commissioned and funded a feasibility study to examine the potential for a

national domestic biogas programme in Kenya. The study "Promoting Biogas Systems in Kenya" dated October 2007*, was carried out by ETC UK, in collaboration with ETC Energy, ETC East Africa, and local consultants Integral Advisory Ltd. It gives a comprehensive analysis of Kenya's biogas sector.

The study indicated a potential for domestic biogas of 200,000 households with a reach of 65,000 households in ten years. The simple payback period of a smaller biogas installations (below 8M³) averages two years. Actual fuel savings depend heavily on the type of fuel that is replaced by biogas (charcoal, firewood or kerosene) and the extent to which these fuels are purchased or collected for free (that is, households putting in labour only). Potential annual domestic energy savings can be up to €330 per annum.

Putting technical support and the user at the centre

KENDBIP commenced in July 2009 with a target of 8,000 bio digestors in Kenya by 2013. Hivos acts as fund and programme manager from its regional office in Nairobi, while SNV provides capacity-developing services and knowledge management at supra-national level. The programme is guided by a master strategy document (the Programme Implementation Document or PID**), a 'living' instrument which is adjusted to suit emerging market conditions. The Fund Manager ABPP at HIVOS is Jean Marc Sika, while Caroline Toroitich is the Advisor, Renewable Energy (Biogas) at SNV responsible for KENDBIP capacity-developing and knowledge management services.

KENDBIP re-introduced the technology through a 'sector approach', taking lessons from previous projects and Government efforts. In this Programme, the private sector is considered as the key pillar to successful implementation. This approach puts the (potential) user in the centre, while services are provided by the private sector (construction, extension and financing). The key drivers of the current strong wave of installations countrywide are the end users who benefit from KENDBIP publicity, awareness creation, good

* http://www.snvworld.org/sites/www.snvworld.org/files/publications/feasibility_study_of_promoting_biogas_kenya_2007.pdf

quality reputation and a system installation labour subsidy. They combine with Biogas Construction Enterprises (BCEs) and small and microenterprises (ranging from sole proprietors with up to 5 employees to limited companies employing more than 8 employees) to form a formidable private sector mix that has seen soaring installations.

The BCEs, sole proprietors and micro enterprises are trained, supervised and mentored by KENDBIP, using the extensive KENFAP network as the logistical and administrative backbone. In addition, implementing partners (IPs) affiliated to KENDBIP take the network even deeper into the rural areas.

Subsidy

The programme provides each end user with a fixed subsidy of KSh 25,000 to make the system more affordable to a larger population base. On average, the cost of a biogas digester under

KENDBIP is about KSh 100,000. A circular released in April to Implementing Partners (IPs) of KENDBIP by Mr. Nyamu, however, indicates that the subsidy amount will be reduced to KSh 18,750 with effect from July this year and abolished altogether from 2014. This is in line with the financial prudence of the programme as well as market sustainability and programme exit plans.

Mr. Nyamu further advises the IPs and other stakeholders to start "reviewing the current biogas technology promotion strategies and re-packaging of biogas promotional messages. They were as well advised to review the development of farmer friendly biogas credit products to ensure access to plant installation credit, cost reduction strategies including materials and labour costs, and to avail suitable alternative digester designs to make plants affordable to farmers.

HOW IT STARTED

KENDBIP's origins can be traced to the May 2007 Biogas for Better Life Initiative Conference at Safari Park Nairobi. At the conclusion of the conference, a number of local energy stakeholders met on the sidelines and agreed to form a Kenyan initiative for biogas. They established a task force.

In December 2008, the Directorate General for International Cooperation (DGIS) under the Netherlands Ministry of Foreign Affairs, approved funding for the Africa Biogas Partnership Programme (ABPP). DGIS entrusted the implementation to two Dutch development NGOs, the Humanist Institute for Cooperation with Developing Countries (Hivos) and the Netherlands Development Organisation (SNV).

The two, in turn, chose to work with the already existing local Task Force. So in June 2008, the Kenya Biogas Task Force reconstituted into the current broad based Kenya National Biogas Initiative Committee (KENBIC), chaired by Eng. Isaac Kiva from Kenya's Ministry of Energy (MoE).

It's main objective is the realisation of a successful national biogas programme — a mandate it is still fulfilling to date.



Biogas

For Improved Livelihood

Kenya National Domestic Biogas Programme
Tel: 020 6008324 / 0719635516
www.kenfapbiogas.org
biogas@kenfap.org

The biogas model promoted by KENDBIP is 'KENBIM' model, created by Kenyan biogas stakeholders as a hybrid version of the CAMARTEC and AKUT models. It is a fixed dome bio digester design, with a focus on the 4M³ to 12M³ biogas plant sizes. The rationale for smaller bio digesters was comprehensively analysed in the Kenya Biogas Feasibility Study which noted better rates of return and payback periods for smaller digestors.

Recent developments in the sector and sustained growth realized over last two years have attracted many entrepreneurs. Experiences over this period have provided the programme with valuable lessons and challenges that require to be studied to inform future decisions.

One of the key concern areas of the programme is the high cost of digester, which leave the technology out of reach for most of the (poor) rural population. The introduction of the ISSB (inter locking stabilized soil blocks) technology is one of the solutions to this problem, with early indication of up to 30 per cent cost savings. Solid state digesters which use 80 per cent less water than the standard digesters, are also under consideration. Further, the demand for larger plant sizes has continued to grow to meet the energy needs for larger and commercial farmers and families or for additional uses.

More recently, other digester designs and technologies have been proposed for evaluation by the programme. These include plastic digesters, of which some pilot plants have been installed for monitoring, floating drum digesters and an assortment of other flexi-plastic digesters.

A major headache in past biogas projects was biogas system failure. KENDBIP seems to have overcome this through a quality management system implemented by KENDBIP and its Implementing Partners (IP). A study commissioned in 2012 confirmed satisfactory performance, with biogas plants ranking from excellent to moderate performance, and an overall score exceeding 90 per cent in all regions of the country, major challenge, however is piping.

Currently, a number of local manufacturers are involved in the fabrication of appliances - primarily stoves and to some extent lamps. This is to a very small scale, through and is to service or meet specific demands of clients who prefer the locally fabricated appliances.

Another challenge is, none of these fabricators produces appliances for distribution outside their local areas. This low capacity development of appliances fabrications is attributed to the market preference to the imported appliances, mainly from China and which provide the clients with options for choice. The demand for the more robust locally fabricated appliances is growing as the market realizes the short durability of these imported appliances which is further shortened by the local cooking habits.

There is however still need to initiate with relevant partners a process of development/production of an acceptable local stove and lamp that will address the problems described above and support testing and modification of the local *jua kali* appliances improving both their performance and aesthetics thus more acceptable by the market.

Key highlights

- Some 7,600 domestic digesters installed.
- Some 540 masons trained and active in the sector.
- 170 masons received BDS and entrepreneurship training.
- A national sector association that brings together all sector actors – the Association of Biogas Sector – Kenya, with grassroots structures formed and registered.
- National domestic biogas standards draft complete.
- Development of partnerships on biogas credit central for sustainability – new partnerships with KWFT, Micro Africa, Mumias Sugar etc.
- Development of a national biogas training curriculum at advanced stage, in partnership with NITA and KIE, among other institutions.
- Evaluation of alternative digester designs including plastic digesters ongoing – to give farmers options.
- Evaluation of cost reduction strategies to improve affordability of digesters ongoing.
- Programme Phase I extended to December 2014, with changes in subsidy policy.
- Preparation of KENDBIP II Strategy ongoing. Project Implementation Document (PID) finalized. This is to run from 2014 to 2018, and targets to install 25,000 digesters.
- Another autonomous programme seeking to promote use of bioslurry from digesters to enhance coffee production approved. Known as 4s@scale – with support from Dutch Government and partnership of Ecom, a leading coffee marketing agency. This will install 16,000 digesters among coffee farmers from 2013 to 2018.
- Programme PoA Carbon financing (CDM) registered – will provide future co-finance.

Key Challenges

- Quality management and enforcement among some masons/contractors.
- Absence of national biogas standards.
- Increasing prices of construction materials.
- High credit cost/unavailability of biogas specific credit.
- High cost of biogas/appliances partly due to unfavourable tax regime.

Kenya now home to continental climate hub

Africa's first Climate Innovation Centre launched at Strathmore University

By Steve Mbogo



For renewable energy enthusiasts in Kenya, the launch of the Climate Change Innovation Centre is the promise that will catalyse accelerated emergence of genius climate related novelty, akin to that happening in the Kenya's Information Communication Technology (ICT) sector.

“Our expectations are that inventions developed at the Climate Change Innovation Centre will help reduce Greenhouse gas emissions and global warming. Solutions expected include technologies that will aid in transitioning the county from kerosene for lighting to ethanol or biofuel-based energy. This will save 30 to 50 per cent in energy costs, while bringing a positive effect on the environment and users' health,” said James Wakaba, the Regional Director (Africa) for Global Village Energy Partnership (GVEP) International. “The centre will assist Kenyans with projects that access carbon credits,” he says.

At least 70 businesses will be successfully incubated, which are estimated to save 400,000 tonnes of carbon dioxide emissions. "This will earn at least US\$2 million in carbon credits if it is all registered," adds Wakaba. The Climate Change Innovation Centre is expected to have a big impact in accelerating development of projects that help reduce the emissions of the destructive global warming gases while performing similar functions, and in an efficient manner.

Key businesses that are expected to benefit include those that plan to produce energy from wind, biomass, biofuels, small hydro and solar photovoltaics. The centre will also reward projects that facilitate energy efficiency. "This is the innovators paradise as they are given incubation facilities, great business and technical advice, prototyping facilities, proof of concept grants, access to information (technology, market and finance), mentoring and linkage to investment funding," says Wakaba, whose organisation is a partner in the centre's project.

The centre was launched on September 26, 2012 and is hosted by the Strathmore Business School, in collaboration with GVEP, PwC and the Kenya Industrial Research and Development Institute (KIRDI).

The Kenya Climate Change Innovation Centre is supported by infoDev (World Bank) in partnership with the Danish and British (via UKAid) Governments. It will be seeded by a contribution of US\$15 million for five years. It is the first of seven climate change innovation centres to support climate technology innovation in developing countries, with the other centres slated for India, South Africa, Vietnam, Morocco, Ethiopia, and the Caribbean. The centre works to accelerate locally owned and locally developed climate solutions to reduce greenhouse gas emissions, improve climate resiliency and bring economic development through high-growth sectors such as renewable energy, agriculture, clean water and energy efficiency.

The Kenya Climate Change Innovation Centre will offer financing and other services to local climate innovators and entrepreneurs to boost locally sourced green technologies. It is expected to support up to 70 sustainable climate technology ventures in the first five years, and is set out to generate 4,600 direct and 24,000 jobs in total

within 10 years. Favourable Government policy on renewable energy is seen as one of the key drivers of innovation in climate smart and energy efficient technologies in Kenya. From the remotest villages where Kenyans are trying to develop energy efficiency stoves made from mud, to the corridors of universities and corporate offices like Mumias Sugar Company that is using bagasse, a residual product from cane milling, to generate electricity, climate smart innovation bug appears to have bitten Kenya.

The innovations are also driven by demand. Only about 20 per cent of Kenyans have access to grid electricity. Organisations like the Kenya Tea Development Agency (KTDA) are finding it better to use the river resource in tea growing areas to develop mini-hydro projects that will eventually provide cheaper electricity.

Sugar companies are planning to increase investment in energy generation using bagasse. According to the Kenya Sugar Board, the industry has the potential to generate up to 190MW of electricity from this source, which is currently under-exploited. Opportunities also exist in producing ethanol to blend with petrol to enable Kenya reduce its oil import bill. Blending was to start in September 2010 but lack of adequate volumes of ethanol was one of the reasons the plan has been put off.

The Climate Change Innovation Centre will trigger new investments to enable the country produce more ethanol and help save the nearly US\$2.5 it uses to import oil annually, as states to the Central Bank of Kenya.

Key businesses that are expected to benefit include those that plan to produce energy from wind, biomass, biofuels, small hydro and solar photovoltaics

Biomass Briquettes for Industrial Applications

By Lean Energy Solutions



plant operations, we are able to offer a comprehensive approach to Energy Efficiency Management Programme.

Over time, the company has expanded its product portfolio to include manufacturing of Lean Briqs (Briquettes from sugarcane bagasse) and we are now diversifying in providing solutions in the solar field.

So, what is an Energy Audit and how can it benefit a company?

An Energy Audit is a comprehensive study of equipments, processes and operations with the objective of identifying energy saving opportunities that can help reduce the energy bills of an organisation without impacting production volumes, quality or safety. The energy audit also helps in benchmarking the energy consumption of an organisation with

other comparable organisations.

The deliverable of the energy audit is a report that provides analyses of energy consumption trends, detailed description of energy saving measures, quantification of energy cost savings, investments required and payback periods. The energy saving measures may include recommendations to improve energy efficiency, substitution of conventional fossil fuels by green fuels and use of renewable energy.

Boiler Conversion and Agromass Briquetting

Biomass Briquetting is the process of converting low bulk density biomass into high density and energy concentrated fuel briquettes.

Lean Energy Solutions Limited was incorporated in Kenya in 2007 to enhance clients' competitiveness through provision of consultancy services in energy management, kaizen and project management.

We are part of Lean Solutions Group, which comprises Lean Energy Solutions Ltd, Lean Solutions (T) Ltd and Lean Solutions Nairobi. Lean Energy Solutions Ltd. has established itself as a top of the range consulting firm in energy management in East Africa.

Lean Solutions Group caters for Energy Management Solutions for small and medium sector enterprises as well as large companies. By combining traditionally separate disciplines of consulting, project development, project management and

Briquettes are ready substitute of coal/wood in industrial boiler and brick kiln for thermal application. They are a green source of energy, renewable in nature, eco-friendly, non-polluting and economical. The process of converting biomass to solid fuel is also non-polluting. No addition of any binder/ chemicals is required; so it is 100 per cent natural. In boiler conversions, the boiler is converted from fossil-fuel fired to Lean Briqs (Briquettes) fired. These fossil fuels include the Industrial Diesel Oil (IDO), Furnace Oil and Heavy Fuel Oil.

Hot water generators, furnaces for hot air generators, thermic oil heaters, dryers, etc. running on fossil fuel, can also be converted.

How the project works

We do the conversions on BOOT basis i.e. (Build, Own, Operate and Transfer) for a contractual period of 7 to 10 years depending upon the investment. What this means is that we undertake the duty of completely transforming client's boiler by installing a furnace, pre-heater, ID fan and other accessories at our own

cost with the client having not invested anything at all in the project.

We also ensure a constant supply and firing of the briquettes and smooth generation of steam as per our client's requirements.

Billing is done based on corresponding fossil fuel cost for the generation of steam/flue gas/hot water.

So, how does the conversion benefit the client?

The client does not invest on the project and a discount will be given on this billing depending on the type of fuel and current fuel costs. The client is given a billing pattern and up to 25 percent savings can be achieved. Some of our clients that we have done this boiler conversion project for include:

- Universal Corporation Limited
- Equator Bottlers Ltd
- Spin Knit Ltd
- Flamingo Tiles
- Osho Chemicals

Convert Your Boiler from Fossil Fuel to lean Briqs

Project runs on BOOT-Build, Own, Operate & Transfer

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KEREA PARTNERS WITH BRIGHT PROJECT TO DELIVER COURSES



The opening ceremony of the ToT course

KEREA and JKUAT teamed up recently to build Solar PV training capacity of Technical Training Institutions countrywide, under the JICA supported BRIGHT Project. **Evans Gitahi**, a Research Assistant, with the project explores this partnership.

On 10th December 2012, 20 tutors from technical training institutions countrywide gathered at the Institute of Energy and Environmental Technology (IEET) at Jomo Kenyatta University of Agriculture and Technology (JKUAT) for a two-week intensive course on solar photovoltaics (PV). The training was jointly facilitated by Kenya Renewable Energy Association (KEREA) and BRIGHT project (a technical cooperation between JKUAT and JICA).

In a needs assessment study commissioned by the BRIGHT project, it was found that in tertiary training institutions surveyed nationally, only about 15 percent of the lecturers in electrical engineering and other related departments are trained in renewable energy (RE) technologies. Further still, the quality and quantity of training equipment in most institutions is largely inadequate, with about a third of them lacking any RE training equipment.

The Kenyan Government has taken an active role to enable the development of alternative sources of energy. In September 2012, the Government gazetted

THE ENERGY (SOLAR PHOTOVOLTAIC SYSTEMS) REGULATIONS, 2012. The new regulations stipulate that all technicians involved in the installation of solar PVs must acquire a license from the Energy Regulatory Commission (ERC) after undertaking an industrial trade test to be administered by the National Industrial Training Authority (NITA). This will ensure that the quality of the solar installations in the country are up to standard and will not fail the consumers who sacrifice to invest in this form of renewable energy.

In response to the above requirement, and in order to give the technicians a reliable and accessible opportunity for quality training, KEREA with the assistance of United Nations Development Programme (UNDP) consulted widely with the Ministry of Energy (MoE), the ERC, NITA and other stakeholders in the RE sector to develop a comprehensive curriculum for technical training institutes (TTIs) on solar PV.

Presently, solar PV is not offered as an independent course in these institutions but as a unit in the

*We contribute to Rural Electrification
in Kenya using Green Energy*



BRIGHT PROJECT



The Project for Capacity Development for Promoting Rural Electrification Using Renewable Energy

Introduction

BRIGHT Project is a technical cooperation between Jomo Kenyatta University of Agriculture and Technology (JKUAT) and Japan International Cooperation Agency (JICA) to develop the capacity of JKUAT in Research & Development, Education and Training in the field of rural electrification using renewable energy, in collaboration with other stakeholders.

BRIGHT Project has adopted a two-pronged approach to

1. Promote BRIGHT rural areas using renewable (green) energy.
2. Build a network of BRIGHT stakeholders (academic, private, public) in green energy.

Components of the Project

- 1) Research and Development (R&D) in JKUAT.
- 2) Improving education (coursework and/or student research) in JKUAT.
- 3) Strategic plan to improve training programs in renewable energy for the general public.
- 4) Promotion & Formation of Academic-Private-Public Platform.

Project Period

Four years from August 2011 (Record of Discussion signed on July 7, 2011)

Primary organization of the Project

Kenyan side

JKUAT; Institute of Energy and Environmental Technology (IEET)

Japanese side

JICA (Two Long-term experts, Short-term experts from Ashikaga Institute of Technology (AIT), Osaka City University (OCU) and others in various fields)

Progress

Currently, several research projects in renewable energy have already been initiated at JKUAT in collaboration with AIT and OCU. Researchers in the IEET in collaboration with the Mechanical and Physics departments at JKUAT, with support from their Japanese counterparts, are undertaking research in wind energy, solar PV, biomass and hydro-power.

Progress on these projects will be communicated periodically to all stakeholders.

Contacts

P.O. Box 62000-00200, Nairobi, Kenya, 2nd Floor IEET Building

Tel: 020-2573056

Email: Bright.project@yahoo.com

***BRIGHT: For Better life for people in Rural areas and Intellectual
network on Green energy and its Hands-on Technology***

electrical engineering curriculum under the Kenya Institute of Education (KIE) syllabus.

KEREA, through the help of UNDP, will supply the institutes with appropriate equipment to ensure that the technicians get hands-on practical knowledge of the technology. KEREA also partnered with the BRIGHT project to provide a ToT course for the tutors in the TTIs in order to efficiently roll out hands-on training to the technicians.

BRIGHT Project facilitated the development of this intensive ToT course by convening experts from the IEET, Electrical & Electronic Engineering department of JKUAT and in consultation with other local and international experts in solar PV technology. BRIGHT Project also prepared materials and equipment used for the training and also ensured that the course was free for the first 20 tutors drawn from ten tertiary institutions countrywide.

It is expected that the tutors who undertake the ToT course will offer short courses in their respective institutions to meet the current demand of about

800 to 1,000 unlicensed solar PV technicians in the country; and for more in future.

One of the participants in the training course, Mr. S.O. Diero from RIAT (Ramogi Institute of Advanced Technology) in Kisumu, had this to say about the course: “It has exposed us more to this area of solar PV technology and especially on the practical aspects and application in the rural setting.”

The Director of IEET at JKUAT, Dr. R. Kinyua, who is also the Project Manager of BRIGHT Project expressed his gratitude to all the organisers of the ToT. “I am very glad that this ToT course was successful and I thank all the people who have been working hard behind the scenes to make it so.

Through BRIGHT project, we want to make JKUAT, and specifically IEET the hub for renewable energy in Kenya, and this ToT course is a step in the right direction.”

In the future, IEET will be holding the course regularly for tutors from other institutions and other interested parties.



It is expected that the tutors who undertake the ToT course will offer short courses in their respective institutions to meet the current demand of about 800 to 1,000 licensed solar PV technicians.

The tutors of TTIs getting practical lessons

PPEO sets new energy measuring ways

One billion people in the developing world are deprived of access to effective healthcare due to a lack of access to energy, according to a report launched by development charity Practical Action.

On 15th May 2013 Practical Action launched the latest edition of its Poor People's Energy Outlook (PPEO) in Nairobi, which sets out a new way of measuring people's access to energy to ensure the poorest

borrowed 3000 BDT (25 Pounds) and seek treatment at the hospital. But the doctor couldn't save the child and did a minor operation. He asked us to come again for follow-up but we don't have money to continue the treatment. Now I am in so much pain, doctor said I have infection in my uterus.

"As long I live I will have to bear the pain. Sometimes I think that if there were electricity in our community health centre, my fate might be different. But for the last 22 years we could not get any electricity, who knows many years will pass by before it becomes reality".

This is a typical story from a community health care centre in Bangladesh, where electricity is scarce. Health centres are lit by candlelight, where minimal services like using sterilised medical equipment, access to regular professional qualified staff and even the security of the health centre at night; cannot be guaranteed. These medical centres often can't use the basic medical appliances they have because no electricity is available to power them.

Practical Action's PPEO report sets out a new way of measuring the way the poorest people access energy. Current measurements only take in to account large scale, grid-based energy and ignore the needs of poor people who need sustainable, appropriate solutions to energy poverty. The new measurements that Practical Action has developed in partnership with the UN and World Bank mean that we can better understand the needs of how poor people use energy and so resources can be properly directed to have the biggest impact on people's lives.

The system developed by Practical Action is thought to be so effective that the United Nation's has adopted it as part of its Sustainable Energy for all initiative, meaning that all 65 countries signed up to the movement will legally have to adopt the system which will change the lives of millions.

This year's report focuses on energy for community services such as schools, health centres and hospitals. The charity works with communities around the world who are only just gaining access to electricity for these purposes for the first time in their lives.



around the world are not ignored.

Without access to energy medical centres and hospitals cannot function effectively, life-saving vaccinations can't be stored, there is no light after sunset to carry out procedures and important medical equipment such as ultrasound machines and operating equipment cannot be used meaning women can lose their babies, and even their lives in childbirth:

Asma is a housewife living Danggi Village of North Channel Union, Bangladesh. A couple of months ago, pregnant Asma slipped and fell whilst collecting water: "My child was not moving. In our community health centre there is no X-ray or sonography, the only option is Faridpur Hospital. For poor people like us city hospital treatment is expensive. Then we

ERC Means Business

WITH THE ENERGY (SOLAR PHOTOVOLTAIC SYSTEMS) REGULATIONS, 2012

New regulations will level the operating environment for solar energy enterprises

Compiled by Staff Writer



The regulations were gazetted on 28th September, 2012, under the THE ENERGY ACT, 2006, through LEGAL NOTICE NO. 103. They “shall apply to a solar PV system manufacturer, importer, vendor, technician, contractor, system owner, a solar PV system installation and consumer devices.”

Some excerpts of the regulations

The regulations stipulate that “a person shall not design or install any solar PV system unless he is licensed by the Commission.” In addition, “a person shall not engage in the business of manufacture of any solar PV system and components unless he applies for and obtains a licence from the Commission.” Further, “a person shall not import, distribute, promote, sell or install any solar PV system unless he is licensed by the Commission as a vendor.” The Commission shall maintain a register of all licensed solar PV systems manufacturers, importers, vendors, technicians and contractors, which shall be available for inspection by the public during working hours free of charge.

To be licensed by the Commission as a technician, a person shall be required to have the prescribed minimum qualifications and experience. The licenses are categorised into three classes: (1) work for small systems or single battery DC system of up to 100 Wp; (2) work for medium systems or multiple batteries which may include an inverter; and (3) work for advanced, including grid connected and hybrid systems.

For entrepreneurs who wish to conduct the solar PV business but are not professionals in the fields, the regulations state, “that person shall be required to have in his employment, a licensed Solar PV system technician.”

A solar PV system technician or contractor shall issue an installation completion certificate, showing as a minimum, the date of installation, details of the person installing, details of the owner, the location, capacity and warranty upon the commissioning of the solar PV system. All manufacturers, importers, vendors, technicians and contractors shall provide with the Commission information on the annual sales volumes in watts, and value of solar PV systems and components manufactured, sold and installed, by the 31st March of the year following the manufacture, sale or installation.

An offence shall be deemed to have been committed and shall, on conviction, be liable to a fine not exceeding one million shillings, or to imprisonment for a term not exceeding one year, or to both, if any person by himself, servant, or agent undertakes or carries out any solar PV system manufacture, import, vending or installation work without being the holder of a licence then in force appropriate to the work undertaken or carried out or without being under the direction of such a license-holder.

Still waiting for an investor-friendly RE Feed-in-Tariff Policy

KEREA weighs in on renewable energy FIT policy environment

The feed-in tariff policy was supposed to open the floodgates for investment in grid connected renewables in Kenya. Its objective was to facilitate resource mobilisation, reduce transaction and administrative costs and delays by eliminating the conventional bidding processes. Though it was a noble approach, it was both half-hearted and presumptive. — KEREA

Although it was based on the argument that renewable energy would increase Kenya's energy security while at the same time relieving the costly burden of fossil fuel-based generation; the feed-in-tariff was unwilling to appreciate that the renewables were never going to come cheap.

At the same time, it was presumed that through a generic model, based on data from renewable energy projects in other countries, it could determine what a suitable tariff would be for a given renewable energy technology. The result has been a pipeline of renewable energy projects totalling 1,780MW; an insignificant portion of which has reached financial closure.

The private sector's issues with the feed-in tariff are around how they were estimated in the first place, how they could possibly be representative considering that each generation site is unique and that they are not viable or attractive enough to encourage investment.

The Government's challenge on the other hand is finding the balance between attracting investment in renewables without significantly increasing the cost of electricity for consumers or having to resort to subsidies.

Though there is no simple solution to this challenge, there are alternative ways of looking at it. One argument made in favour of the feed-in tariff policy was that it would reduce transaction and administrative costs and delays by eliminating the conventional bidding processes.

Considering that this has not happened, perhaps it may be worthwhile to introduce a conventional bidding process. The Government could set quotas for

different kinds of renewable energies to constitute an appropriate energy mix and get project developers to submit applications to develop these projects. Projects for a given technology would then be selected based on lowest proposed tariff. Project developers would therefore be pushed to compete with each other and push the boundaries to come up with lowest possible tariffs that they felt would still be economically viable. Whatever the tariffs proposed, they would more accurately represent the actual situation than any study undertaken.

South Africa's IPP Procurement Programme is a good example of this approach and even with its challenges, it has yielded some interesting results.

In favour of the Government's concern of tying Kenyan's to long-term contracts with renewable energy IPPs supplying expensive power, is the long-run marginal cost.

The long-run marginal is essentially the future average cost of power generation as determined by the energy



Feed-in-Tariffs Policy on Wind, Biomass, Small-Hydro, Geothermal, Biogas and Solar Resource Generated Electricity

generation mix in the 2011- 2013 Least Cost Power Development Plan. It is estimated at 11.86US¢/kWh.

This number essentially states that it is unwise for the Government to agree to tariffs that exceed this value. This effectively excludes solar PV (27.49US¢/kWh) and wind (16.66US¢/kWh) as well as biomass, biogas and hydro capacities of 1MW or less as potential sources of electricity generation in Kenya. NB: these RE tariffs are extracted from a Government commissioned study, "The Technical and Economic Study for Development of Small Scale Grid Connected Renewable Energy in Kenya." The question, however is, why ignore a possible solution on the basis of a long-term prediction that is not guaranteed?

Thermal-based generation currently accounts for 37.5 per cent of the total electricity consumed. The increased use of thermal-generated power in Kenya has seen consumers pay more in electricity bills, inflated by a surcharge meant to reimburse generators money spent on diesel for running the plants.

In Oct 2012, this surcharge rose to KSh6.08/kWh. Considering that an estimated 6,000GWh of electricity is sold by KPLC annually, this translates to KSh36.5 billion a year spent by Kenyans on fuel for electricity generation.

Using the highest possible estimated renewable energy tariff, i.e. for solar PV, it would still be possible to purchase 25 per cent of the Kenya's annual energy needs (1,500GWh of electricity) from solar PV from this annual fuel expenditure alone. So, imagine the possibilities for other renewables.

In 1999, thermal generated power accounted for 23 per cent of installed capacity; today, 13 years later, it accounts for 36 per cent. Even in the optimistic Least Cost Power Development Plan, the percentage of thermal - based generation is only expected to drop to 21 per cent in 2020.

How much will we achieve by waiting?

Excerpts from the Policy document

Compiled by Staff Writer

Kenya's Feed-in-Tariffs Policy for wind, biomass and small hydro was first published in March 2008 following approval by the Public Procurement Oversight Authority. The 2008 FiT Policy covered wind, small hydro and biomass sources, for plants with capacities not exceeding 50 MW, 10 MW, and 40 MW respectively. The policy has been revised twice, in January 2010 and in December 2012.

A Feed-in-Tariff is the pre-determined tariff at which a power producer agrees to sell renewable energy generated electricity to an off-taker for a given period of time. It is an instrument for promoting generation of electricity from renewable energy sources.

The Government of Kenya recognises that renewable energy sources (RES) which include wind, biomass, small hydros, geothermal, biogas, solar and municipal waste energy, have potential to generate income and employment, over and above contributing to the electricity supply and diversification of generation sources.

The National Energy Policy as enunciated in Sessional Paper No.4 of 2004 and operationalized by the Energy Act No. 12 of 2006, encourages implementation of these indigenous renewable energy sources to enhance the country's electricity supply capacity.

The Sessional Paper incorporates strategies to promote the contribution of the renewable energy sources in generation of electricity.

Following tariff revisions for wind and biomass, and new tariffs for geothermal, biogas and solar resources, in the 2010 edition, “potential developers of biomass and biogas generated electricity have shown interest in developing generation projects. However, the tariffs have not been attractive enough to progress these potential projects to PPA negotiation stage and funding. The lower capacity limit for biogas plants necessitated review to accommodate smaller biogas plants,” says the Policy document. “The feedback from the PPA negotiation process has necessitated review of some of the policy clauses for clarity and also to ease interpretation of the policy as well as negotiation and implementation of Power Purchase Agreements.”

The document further states that, “There is increased interest for investment in solar energy resource to supply the national grid. However, the 1st Revision January 2010 tariffs policy had no provision for grid connected solar energy. A comprehensive review of FiT Policy was therefore initiated in late 2011.

Small Grid-connect RE Projects (up to 10 MW)

For grid connected renewable generators of up to 10 MW (ten megawatts) of installed capacity the power purchase agreement will be a Standardised PPA. While the tariffs offered are technology-specific, the Standardised PPA is technology-neutral.

The following policy principles underlie the calculation of the FiT values:

- FiT values are calculated on a technology-specific basis using the principle of costplus reasonable investor return;
- FiT values shall not exceed the generation Long Run Marginal Costs (LRMC), as established in the Least Cost Power Development Plan (LCPD) except solar power plants for Off-grid;
- the FiT is denominated in US dollars or the equivalent for other currencies converted at the Mean Exchange Rate on the Effective Date of the Power Purchase Agreement published by Central Bank of Kenya;
- the FiT is calculated for certain specific capacity categories, with a linear interpolation being used to set the value based on the actual capacity of the project;

- The FiT applicable at the time a PPA is signed is the fixed value which will apply over the 20 year life of the PPA, except for the O&M component (the Indexed Component) of the FiT will be subject to annual indexation using the US Consumer Price Index, using the base index prevailing at the time of signing the PPA.

The cumulative capacity contribution by FiT projects of up to 10 MW shall not exceed 10 per cent of system-wide generation capacity.

Large RE projects (capacity exceeds 10 MW)

Renewable energy projects which are larger than 10 MW of installed capacity shall meet load flow/dispatch and system stability requirements. The projects to be considered under this policy would have capped capacity. For large projects involving utilisation of significant national renewable resources, Government preference is to carry out preliminary identification studies and then initiate a competitive bidding process. The basis for the PPA in the case of the larger renewable generators is the Standardised Power Purchase Agreement for generators greater than 10 MW.

The FiT values for small renewable projects (up to 10 MW of installed capacity) connected to the grid

Type	Installed Capacity (MW)	Standard FiT (US \$/kWh)
Wind	0.5-10	0.11
Hydro	0.5	0.105
	10	0.0825
Biomass	0.5-10	0.1
Biogas	0.2-10	0.1
Solar (Grid)	0.5-10	0.12
Solar (Off Grid)	0.5-10	0.2

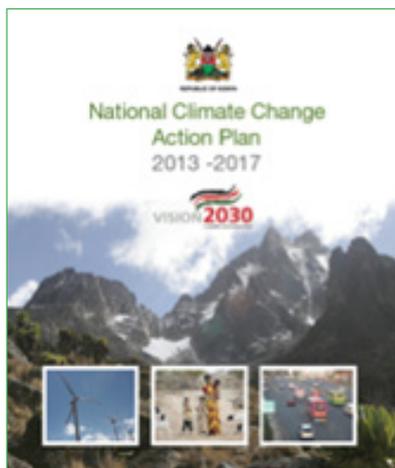
The FiT values for renewable projects above 10 MW of installed capacity

Type	Installed Capacity (MW)	Standard FiT (US \$/kWh)
Wind	10.1-50	0.11
Geothermal	35-70	0.088
Hydro	10.1-20	0.0825
Biomass	10.1-40	0.1
Solar (Grid)	10.1-40	0.12

A new dawn for Kenya's climate change management

Government injects optimism into the climate sector by launching The National Climate Change Action Plan 2013-2017

Compiled by Staff Writer



In March 2013, the Government of Kenya made a significant policy statement by launching The National Climate Change Action Plan 2013-2017, described as "Kenya's first Action Plan on climate change."

The plan aims to fully implement the National Climate Change Response Strategy (NCCRS) that was launched in 2010, and is part of Kenya's Vision 2030. One of the most outstanding components of the plan, which

should interest the private sector (including carbon project developers) and development partners alike, is the emphasis on a "Long-term National Low Carbon Climate Resilient Development Pathway."

The document states that the priority actions are those that "will make a significant impact on sustainable socio economic development, adaptation and mitigation in Kenya. They involve 'big win' opportunities that, "combine climate resilience and mitigation benefits and capture over two-thirds of the mitigation potential identified in the NCCAP low carbon assessment."

These actions encompass projects in geothermal power generation, distributed clean energy solutions, improved water resource management, restoration of forests on degraded lands, climate smart agriculture and agroforestry, and infrastructure. The Action Plan



further states that, "Possible challenges in the implementation of the low carbon climate resilient interventions have to be addressed through systematic identification and removal of barriers which would include collaborative actions and support from international climate mechanisms. Finance, technology and capacity building support can help fill information and capacity gaps and overcome financial, regulatory and policy barriers."

It also explains that the "NCCAP's low carbon analysis demonstrated that mitigation actions can contribute to low-carbon pathways in the six sectors set out in the UNFCCC: energy, transport, industry, agriculture, forestry and waste."

The resources required to actualise the Action Plan are as huge as the task ahead: one trillion Kenyan Shillings (US\$ 12.76 Billion), from 2013 to 2017. This covers estimated investment costs for adaptation to climate change impacts and to implement identified low carbon development options. "Domestic, bilateral and multilateral funding, as well as international climate finance mechanisms – such as the Green Climate Fund, Adaptation Fund and emerging funding for NAMAs and REDD+ mechanisms – are required to implement the Action Plan."

The private sector is singled out in the Action Plan's forward message which states, "it must be clear that private sector will play a significant role in tackling climate change and supporting green economic growth." Part of the Action Plan's proposals, therefore, is for the Government to "put in place the necessary enabling environment to attract climate friendly investments

in the key sectors of the economy; set up a dedicated climate fund to receive contributions, from all sources including public, private and international; and facilitate carbon trading opportunities."

With respect to carbon trade, it will be recalled that in November/December 2012 Kenya was among close to 200 countries that congregated in Doha, Qatar, for the 18th session of the Conference of the Parties to the UNFCCC and the 8th session of the Conference of the Parties serving as the Meeting of the Parties to the Kyoto Protocol, commonly referred to as the Doha Climate Change Conference. The results of the conference — which exemplify both hope and uncertainty — are still fresh in the minds of Kenyan stakeholders. There was no ambiguity about the need for all countries to reduce greenhouse gases (GHGs). Neither was the need to assist vulnerable communities to adapt to climate change contested.

"Governments... opened a gateway to necessary greater ambition and action on all levels," according to the UNFCCC. "Developed countries reiterated their commitment to deliver on promises to continue long term climate finance support to developing nations, with a view to mobilizing USD 100 billion annually from a variety of sources both for adaptation and mitigation by 2020."

Importantly, the forum adopted the second commitment period for the Kyoto Protocol, beginning on 1 January 2013 and ending on 31 December 2020, among other key transitional decisions. For Kenya, as indeed for other developing countries, this was a



Young minds keenly follow discussions at the launch of The National Climate Change Action Plan 2013-2017 in Nairobi in March 2013

critical and welcome decision as it ensures continuity and safeguards ongoing carbon projects. It also keeps intact the treaty's legal framework and established accounting models. Furthermore, it forms the needed bridge between the past climate regime and the anticipated new order.

Also notable at Doha was the agreement to work towards a new 2015 agreement that will define a single legal agreement that will peg commitments to a country's level of development, in place of the current divide between "developed" and "developing" countries.

Despite mixed reactions to the outcome of the Doha talks, on account of many unresolved issues, project developers in Kenya have not relented in their quest to establish projects that are carbon-market oriented. The new National Climate Change Action Plan 2013-2017 should further boost their morale.

Kenya, like many developing nations, has been contending with the effects of climate change, and both the Government and private sector have increasingly been agling

towards green technologies in the last couple of years.

The local resolve to undertake projects that support a positive impact on climate can be seen through actions by among other players, like Kenya's power generator, KenGen, which is investing heavily in geothermal, hydropower and combined cycle projects "could qualify under the CDM since they generate less or no carbon dioxide at all in comparison to alternative fossil fuelled plants."

KenGen developed an interest in the carbon market long before Kenya ratified the Kyoto protocol in 2005. The company's first project to be registered, in 2010, was the Olkaria III Phase 2 Geothermal Expansion Project, being the second for Kenya after the "35 MW Bagasse Based Cogeneration Project" by Mumias Sugar Company Limited (MSCL), registered in 2008. The establishment by the Government of the Geothermal Development Company (GDC) is another testimony to the Government's determination to produce cheaper and cleaner energy.

Indeed, projects in Kenya qualifying for carbon credits can only be up-scaled as they largely are in their formative stages. Those already registered are quite recent; by the end of 2010, only three had been registered: two under KenGen and one under Mumias Sugar. Currently the UNFCCC registry shows 31 projects, with Kenya as the host, as either registered (24) or requesting registration (3); of these, 15 are under Programme of Activities (PoA). Projects registered under large scale, small scale and consolidated



The launch of the National Climate Change Action Plan 2013-2017 in Nairobi in March 2013

methodologies are Olkaria III Phase 2 Geothermal Expansion Project in Kenya, "35 MW Bagasse Based Cogeneration Project" by Mumias Sugar Company Limited (MSCL), Karan Biofuel CDM project – Bioresidues briquettes supply for industrial steam production in Kenya, Aberdare Range / Mt. Kenya Small Scale Reforestation Initiative Kiriama-Kithithina Small Scale A/R Project, Corner Baridi Wind Farm.

Others are Lake Turkana 310 MW Wind Power Project, Kipeto Wind Energy Project, Nairobi River Basin Biogas Project, Aberdare Range/ Mt. Kenya Small Scale Reforestation Initiative Kamae-Kipipiri Small Scale A/R Project, Aberdare Range/ Mt. Kenya Small Scale Reforestation Initiative Kibaranyeki Small Scale A/R Project, Redevelopment of Tana Hydro Power Station Project, Optimisation of Kiambere Hydro Power Project, 60 MW Kinangop Wind Park Project, and Olkaria II Geothermal Expansion Project. Olkaria IV Geothermal Project and Olkaria I Units 4&5 Geothermal Project are listed as "requesting registration."

In total, these projects have the potential to save an estimated 3.1 million metric tonnes of CO₂ equivalent per annum.

For PoA projects, out of the 14 registered and one "requesting registration", a number of them have an estimated emission reductions in metric tonnes of CO₂ equivalent per annum between 40,000 and 64,000 MT; some are multi African country programmes, such as African Clean Energy Switch – Biogas (Kenya, Uganda, Rwanda, Ethiopia), Improved Cook Stoves for East Africa (Kenya, Uganda, Burundi), and PoA for the Reduction of emission from non-renewable fuel from cooking at household level (Kenya, Madagascar, Ethiopia, Malawi, Mozambique, Nigeria, Uganda, Zambia). Efficient Cook Stove Programme: Kenya (estimated 50,761 MT/annum) and SimGas Biogas Programme of Activities (estimated 45,156 MT/annum) are Kenya's only programmes.

It is noteworthy that carbon project development in Kenya has evolved significantly in the last five years, with the entry of foreign consultancy companies, some of which have established a base in the country. This is indicative of the perceived potential the country possesses as a source of carbon credits.

In spite of the new National Climate Change Action Plan 2013-2017 however, stakeholders will remain

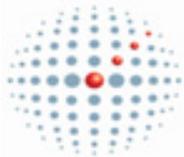
keen to follow the fate of the Kenya Climate Change Authority Bill, which was rejected by Kenya's former President Mwai Kibaki earlier this year. The bill sought to establish the Kenya Climate Change Authority (KCCA) under an Act whose objects and purposes were "to provide (a) a framework for mitigating and adapting to the effects of climate change on all sectors of the economy; (b) appropriate response strategies in relation to climate change; and (c) mechanisms for the financing, coordination and governance of matters of climate change." The bill proposed to establish the Climate Change Trust Fund through which the climate change projects and KCCA activities would have been funded.

KCCA would have been legally empowered to advise the national and county Governments on legislative and, other measures necessary for the mitigating and adapting to the effects of climate change; provide coordination between and amongst various Governmental and non-Governmental stakeholders dealing with matters related to climate change; and advise the national and county Governments on regional

and international conventions, treaties and agreements on climate change to which Kenya is a party or should be a party to and follow up the implementation of the conventions, treaties and agreements to which Kenya is a party.

It would also have powers to coordinate negotiations on climate change related issues at the local, regional and international levels, among many other key climate change related responsibilities.

Of interest to the private sector would have been the KCCA's proposed responsibility to "identify and coordinate the implementation of low carbon and green growth strategies; set targets relating to and promote the development of carbon markets; design programmes to provide for incentives relating to matters of climate change including incentives for reduced emissions from deforestation and degradation; and mobilize resources."



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KEREA

Kenya Renewable Energy Association

Compiled by KEREA

The Kenya Renewable Energy Association (KEREA) is an independent not-for-profit association dedicated to facilitating the growth and development of renewable energy business in Kenya.

KEREA was formed in August 2002 by members of the Renewable Energy Resources Technical Committee of the Kenya Bureau of Standards (KEBS) and is registered under section 10 of the Societies Act.

Amongst its key roles are promoting the interests of members of the renewable energy industry among Government, public sector, the general public and any other organisations that may impact on the development of the industry; and the creation of a forum for the dissemination and exchange of information and ideas on matters relating to renewable energy development and utilisation in Kenya.

KEREA's core activities

- > Promoting and creating awareness on renewable energy as well as providing information on renewable energy markets, market actors and technologies.
- > Supporting training, capacity building and certification of activities in the renewable energy field and accreditation of renewable energy products and service providers.
- > Research for purposes of informing advocacy and lobbying activities and to collect information on renewable energy products and markets.
- > Pro-renewable energy lobbying and advocacy to improve the business environment and encourage adoption.

- > Networking, business linkages and coordination; to facilitate and encourage synergies between various activities e.g. programmes, projects and/or initiatives in the renewable energy field.

KEREA's objectives

- > Increased awareness levels and adoption of renewable energy technologies.
- > Increase in the number of qualified renewable energy practitioners and increase in skill level and improvement in the quality of products and services provided.
- > Pro-renewable energy policies and regulations and improved business environment for renewable energy.
- > Increased coordination between actors and stakeholders when developing and implementing renewable energy initiatives.
- > Diverse KEREA membership and increased collaboration/cooperation between members and partners.

Situational analysis

With the exception of large power producers and the electricity utility, the renewable energy sector in Kenya is dominated by small to medium enterprises. Adapting of existing technologies for local conditions and low market penetration rates (due to ineffective delivery models) are key challenges facing these SMEs.

The level of interest in the renewable energy sector is increasing and there are large numbers of ongoing and proposed RE programmes, research, initiatives, projects and activities. Actors playing a key role in the sector



include the Government, development partners, NGOs and businesses associations. International suppliers and manufacturers are seeking business partnerships and investment opportunities. At the local level, suppliers are similarly looking to develop their networks with dealers, engineers/technicians and vice versa.

However, a number of challenges limit the growth and development of the sector despite these existing opportunities. Currently, there are few shared platforms and forums through which these actors can interact and network. Information sharing and exchanging of ideas is also limited, in terms of content development as well as dissemination tools.

Information for potential local and international investors is also inadequate. Market research looking at issues of market size, potential, opportunities and challenges is a key concern as most private businesses are unable or unwilling to make a significant investment in market research and often opt to invest in sectors where this information is readily available.

The needs for skilled and qualified practitioners in the renewable energy sector is increasing and becoming more defined with changes in the policy and regulatory frameworks. Without institutionalisation of renewable energy training programmes, especially at the technical training institutes level, there will always be insufficient local capacity to meet the demand for technical services required by the RE market. With the ongoing and anticipated development of regulations in the RE sector, certification of

engineers and technicians will be an important requirement. This will be difficult to achieve if there are no readily available and affordable training courses for RE technologies.

There is need to address sector challenges collectively and strategically, provide information on the market, facilitate networking and synergies between players and develop local RE skills.

Institutions committed to engage with sector stakeholders are therefore necessary and the renewable energy association has a significant role to play in the development of the RE sector in Kenya.

The burden of addressing these challenges in the energy sector cannot solely be the Government's. The importance of the private sectors' role in increasing energy access cannot be overstated. A commercial approach to provision of energy products and services is the only truly effective and sustainable approach.

Partnership between private sector and Government is therefore key to identifying innovative, cost-effective and sustainable solutions.

There is a need to address sector challenges collectively and strategically, to provide information on the market, facilitate networking and synergies between players and to develop local RE skills

KEREA

KenGen engages top gear on renewable energy crusade

By Steve Mbugua

Kengen is planning a 150 megawatts (MW) solar energy generation project in Isiolo, signaling the company's relentless push to develop cheaper renewable electricity generation sources .

The solar project will be built in two phases, the first being 50MW and the second 100MW. "The feasibility study of the project has been completed," said Eddy Njoroge, the managing director of KenGen. The project will be rolled out in a public-private partnership model through a special purpose vehicle. The estimated cost will be US\$400 million with phase one costing US\$130 million. It will have an economic lifespan of 20 years.

The project is part of the country's efforts to balance off its dominant hydro generation with other renewable energy

because of the vulnerability of hydro sources to weather patterns. Lack of enough rainfall has in the past led to power rationing.

With climate change expected to have significant impact on Kenya's rainfall patterns and volumes, it is clear that rationing is likely to persist if the dependence on hydro, which generates most of the country's electricity — about 800MW — is not reduced.

Pius Kollikho, the head of CDM projects at KenGen, explained that the company has made "significant progress" in investment plans to upscale its renewable energy generation. "A lot of progress so far; a 280MW geothermal power station is under construction, and studies have been carried out in Marsabit, Isiolo and



OLKARIA IV GEOTHERMAL POWER PLANT

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Hyundai Engineering Co., Ltd.
1000 Maruwa Street, Auckland
NEW ZEALAND
Tel: +64 9 308 9500
Fax: +64 9 308 3001

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SKM Engineering Co., Ltd.
2000 Park Courtway
1000 Maruwa Street, Auckland
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Tel: +64 9 308 9500
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Ngong indicating potential for wind power. In addition to the 5MW wind plant at Ngong, plans are underway for a 50MW wind plant in Isiolo," said Kollikho. "Geothermal remains the major focus and plans are underway to further increase geothermal development at Olkaria by an additional 560MW."

Out of the 1,231MW installed capacity, KenGen's mix of generation includes 66 per cent hydro, 21 per cent thermal, 13 per cent geothermal and less than 1 per cent wind. When hydro is considered, 80 percent of this portfolio is based on renewable energy. "Our goal is to have geothermal account for half of our fleet by 2018. This will ensure that we are able to provide renewable, reliable power supply that is not weather-dependent," said Njoroge.

To fast-track geothermal generation, the company has pioneered the use of portable geothermal power plants. A 5MW pilot unit has been commissioned. "We expect to deploy an additional 65MW of this innovative technology of portable wellhead geothermal units by 2014."

"This technological breakthrough is significant in many ways. It will allow early generation to give Kenyans power quickly before putting up conventional plants that take 8 to 10 years to implement," said Njoroge. "In the next five years, KenGen plans an investment of US\$5 billion in geothermal generation."

The company has, however, discarded plans for a co-generation project using the Dandora/Ruailandfill. The project was expected to produce 50MW but according to Kollikho, it has been found not to be financially viable.

He said some of the key challenges KenGen is facing as it seeks to upscale investments in renewable energy are upfront financing costs, especially in geothermal drilling. The ongoing and completed renewable energy projects are expected to earn KenGen billions of shillings from carbon credit sales.

KenGen's overall expansion strategy anticipates that the company will have an installed capacity of at least 3000MW by the year 2018 and to lay the foundation to expedite an additional 6000MW by 2030. The company's expansion plan is based on the national Least Cost Power Development Plan (LCPDP), which focuses on

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optimization of generation and transmission systems using the available natural resources. The LCPDP is a 20-year demand load forecast, updated biennially by a multi-stakeholder committee coordinated by the Energy Regulatory Commission (ERC). The purpose of the LCPDP is to guide stakeholders with respect to how the sub-sector plans to meet the power needs of the nation for subsistence and development at the least cost to the economy. The 2011-2031 LCPDP estimates the current peak demand to grow from 1,231MW to 16,905MW by 2031. The system expansion plan ranks geothermal as the least cost generation source for base load, which is in line with KenGen's geothermal strategy.

“We expect to deploy an additional 65MW of this innovative technology of portable wellhead geothermal units by 2014”

Waste water? No, it's energy

Author's bio: Dan Eric works with energy systems modelling and more specifically, biogas production systems. He is a graduate of Chalmers University of Technology and Universidad Politécnica de Madrid, with BSc in Mechanical Engineering and MSc in Energy Systems, respectively.

In Kenya, it is not common to talk about what is flushed down toilets or the content of septic tanks and pit latrines. It is like a blind spot, something we should not reflect upon.

Mahatma Gandhi once said: “There is no such thing as waste, only resources in the wrong place.” If managed right, wastewater can be a source of energy through biogas production and a perfect source of fertiliser and irrigation water.

Annually, one person in Kenya produces around 500 litres of urine and 40kg of faeces, which goes into the sewage together with 30,000 litres of water. If we look at the city of Nairobi, wastewater from its 5 million inhabitants could be converted into biogas with an energy content equivalent to 32 million litres of diesel fuel — enough to fuel 700 public transport 50-seater buses, every day.

The other, and perhaps more controversial, is the use of waste water as fertiliser and for irrigation. After anaerobic digestion and other hygienisation processes at a modern waste water treatment plant, waste water is in fact no longer a mix of urine and faeces, but rather a relatively odourless liquid containing all the plant nutrients that was in the waste water.

Again some hard facts: The urine and faeces from one person accumulated during one year contain around 3.5kg of nitrogen, 0.4kg of phosphorus and 1.3kg of potassium; a balanced NPK fertiliser. Looking at Nairobi, the plant nutrients in the waste water would be in the form of conventional NPK fertiliser worth around KSh3 billion.

There are, however, logistical and organisational needs to achieve this; investments in sewage collection systems and treatment plants. In order to reuse the treated wastewater for fertiliser and irrigation, the level of unwanted pollutants — strong chemicals and heavy metals — must be controlled.

The treated waste water from Nairobi is enough to irrigate around 1,000 square kilometres (400,000 acres) of arid land. The waste water would then provide recycled water equivalent to 200mm rainfall per year. If fast growing biomass such as bamboo is planted on such land, it would supply 1.5 million tonnes of biomass per year. If biodiesel crops as castor or jatropha are planted, around 250 million litres of biofuel could be produced per year.

Mega infrastructure projects of this nature do, however, often have social and environmental impacts. For sustainable development it is therefore sometimes more appropriate to start at small-scale, in order to build relevant capacity and increase understanding of associated best practice.

One possibility is to implement these kind of systems in schools, where logistics are probably easier and there is a positive natural knowledge-building effect. The biogas potential from the toilet sewage at a boarding school can contribute significantly to the school's cooking energy needs.

Already there are companies building small-scale biogas digesters in Kenya. There are, however, newer and more efficient digester types that are not yet available in Kenya.

One of the most globally active research groups on this subject is the one led by Gatze Lettinga at Wageningen University, The Netherlands. Some 30 years ago, Lettinga invented the Upstream Anaerobic Sludge Bed (UASB) which has become standard treatment for industrial wastewater in many sectors.

There are over 25,000 schools in Kenya and about 15 million students. School kitchens use charcoal and firewood equivalent to 5,000 acres of forest cover each year, leading to severe deforestation. Biogas produced from the school toilets could replace most of this cooking fuel.

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