RE TRENDS EAST AFRICA

Tracking regional renewable energy developments

Quarter 2, 2015

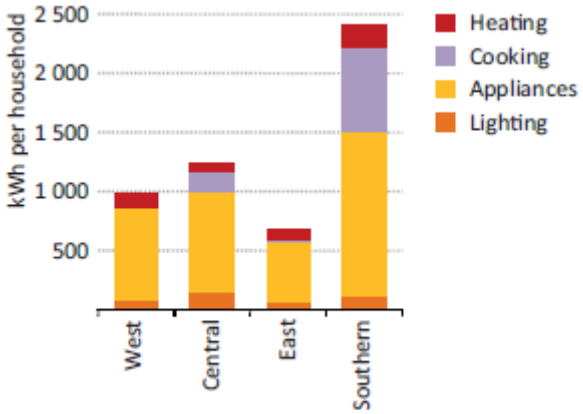
Opening Thoughts

Welcome to our 2015 Quarter 2 Newsletter! This is the 6th issue in our series of *RE Trends East Africa.*

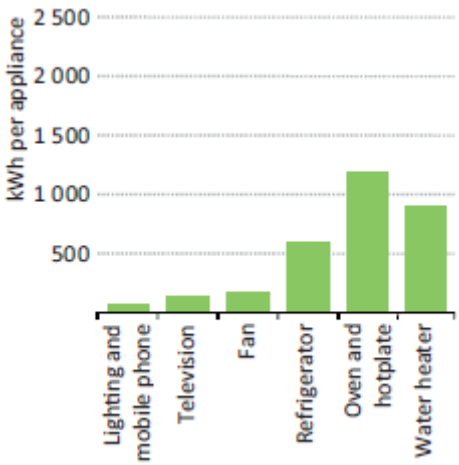
In this issue we take a look at the East African biomass energy sector and the opportunities therein. Mark Hankins also delves into the recently released Encyclical Letter by Pope Francis, *On the Care of Our Common Home*, and what it means to the Eastern Africa region. As usual we have included energy numbers to give an analytical perspective on the sector. But first let us take a look at the just-concluded trip by U.S president Barack Obama to the region. Enjoy your read!

Energy Numbers

Annual regional average electricity consumption per household in sub-Saharan Africa (2012)



Indicative consumption level by electronic appliance in sub-Saharan Africa (2012)



Source for both figures: IEA Africa Energy Outlook, 2014

Obama and Energy in East Africa

On his visit to Kenya and Ethiopia Obama addressed the renewable energy and energy access sectors prominently. The main reason for his visit was the Global Entrepreneurship Summit (GES), which brought investors and entrepreneurs from all over the world to Nairobi. In itself, the choice of Kenya as the 2015 GES venue signalled that the US is supporting new approaches to African challenges, and perhaps that entrepreneurial approaches to energy issues will be more welcome. During the opening ceremony, both President Obama and President Kenyatta highlighted the important role of solar companies in off-grid rural electricity access. There was quite a bit on Power Africa in the Obama media discussions.

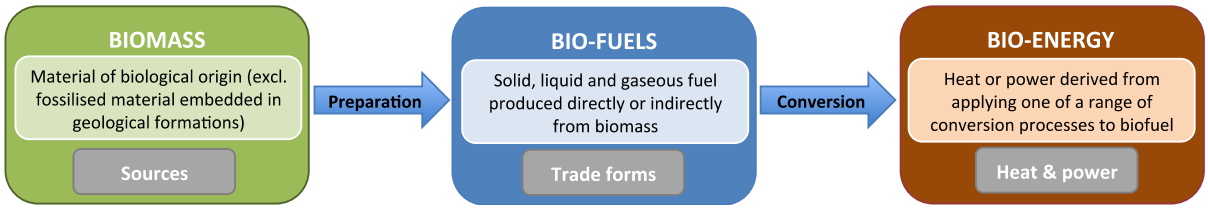
- One of the most circulated images of the summit was that of President Obama chatting with M-Kopa Solar's customer relationship manager at a demonstration off-grid kiosk (M-Kopa and Off-Grid Electric are both benefiting from Obama's Power Africa initiative).
- **Kipeto Wind Power Project** in Kajiado agreed to terms during the visit. It involved agreement on $233 million in debt financing to support construction and operation of the project. Loan agreements with the Overseas Private Investment Corporation (OPIC, the U.S. Government's development finance institution) are key components of Power Africa.
- **SkyPower and the Kenyan Ministry of Energy and Petroleum** announced the signing of a Sh220 billion deal to develop a 1,000 megawatt Kenyan solar power project over the next five years. The agreement will include a solar PV fabrication and assembly plant and 4 phases of solar farm developments.
- During their press brief at State House Nairobi, President Obama was pressed to explain the slow start of Power Africa project (The New York Times called it "sputtering"). In his response he maintained that it takes a long time for power deals to get completed and even longer for construction of infrastructure to take place.
- Ethiopia agreed to the first Power Purchase Agreement (PPA) deal. The agreement between Corbett Geothermal and the Ethiopian government will see geothermal power supplied to the national grid at a rate of 7.53 USD/kWh. The project is expected to benefit from the Power Africa initiative.

Power Africa is learning that there are many approaches to growing energy access and building out Africa's power grids. The different approaches require different technologies, business models and finance tools. Even Obama would agree that it's hard to fit the complicated nature of rolling out renewable deals and building energy access into sound bites.

On the lookout: On-grid biomass electricity — time to gain confidence

Currently global bio-power installed capacity stands at 93 GW, up by 5GW in 2014 (REN21 Renewables 2015 Global Status Report). United States, Germany, China, Brazil and Japan lead in the production of biomass electricity, with a total of 222.9 TWh produced in 2014. Solid biomass is the most commonly used feedstock for electricity generation (75% of global supply), followed by biogas (17%), municipal solid waste (7%), and liquid biofuels (1%).

Biomass power generation technologies use a range of fuel sources and conversion methods. Some of the wording and definitions around feedstock production and energy conversion along biomass value chains are used interchangeably and inconsistently. The figure below illustrates bio-energy definitions as approved by the Food and Agriculture Organization (FAO).



Three of the major conversion technologies in use are:

- Cogeneration – also known as combined heat and power (CHP) – uses wood chips, forest residues and bagasse to simultaneously produce both heat and electricity.
- Anaerobic digestion (AD) converts biomass feedstocks with high moisture content into biogas, which is then used as fuel to run turbines for electricity generation. Agricultural and municipal waste are the most commonly used feedstocks for AD.
- Biomass gasification involves converting biomass into a producer gas that can be burned in a simple or combined-cycle gas turbine to generate electricity.

These various conversion technologies pose an opportunity to farms and industries in the East African region to generate electricity using industrial and agricultural waste. Research shows many parts of the region have readily available feedstocks in form of forest residues, industrial waste, agricultural waste and municipal waste that can viably be used for electricity generation, and the fact that most feedstock can be stored for later use offers this technology an advantage – "dispatchability" – over intermittent solar and wind resources.

The region has yet to see strong uptake of biomass power generation, however. In areas without surplus, feedstock might not be readily available through the year and specific feedstocks, such as forest residue, are facing pressure from human activities and population expansion. An overview of Kenya, Uganda and Tanzania on-grid bio-power projects is given below:

Country	Pipeline capacity and sector outlook
Kenya: Installed capacity 38MW  Kenya's current biomass installed capacity is from bagasse fuelled co-generation at Mumias sugar factory (the plant is currently not generating due to on-going financial problems). The country has a feed-in-tariff (FiT) policy that includes biomass power generation by Private Power Producers (PPP). The tariff is set at **0.10 US $/kWh** for projects between 0.2MW and 40MW.	• Tropical power's 2.6MW Gorge Farm biogas plant is set to become the first biogas plant to supply electricity to the national grid. The Biojoule-constructed plant is complete, awaiting final approval from the Energy Regulatory Commission before commissioning. • Cummins Cogeneration is at the final stages of constructing an 8.4MW co-gen plant in Baringo that will use the invasive *Prosopis julifloria* tree ("mathenge") as feedstock. • Kwale International Sugar Company Limited is negotiating a power purchase agreement with the Kenyan Government for an 18MW co-generation plant. • Fruit processor Del Monte is planning a 5MW biogas plant at its Thika pineapple farm. FiTs have created a demand for biomass power, though some developers complain about the lack of clear process. The Energy Regulatory Commission (ERC) put the total potential for cogeneration in Kenya at over 300MW. This potential is largely in the sugar industry, estimated at 193MW, although currently only Mumia's Sugar has a cogeneration plant.

 **Tanzania:** Installed capacity 35MW The 4MW TANWAT power plant is the largest biomass electricity plant in Tanzania. It uses sawmill wastes to generate electricity for its own consumption and supply to the TANESCO grid in Njombe. Tanzania has a non-technology-specific FiT commonly known as Standardized Power Purchase Tariff (SPPT) for small power producers of 100 KW up to 10 MW (above which the FiT is negotiable).	• Bagamoyo EcoEnergy Ltd is planning electricity generation from its special purpose project in Bagamoyo, that will include sugar, ethanol and power production. According to the United Nations Environmental Programme (UNEP), Tanzania has a substantial potential for biomass electricity through cogeneration, mainly because of large sugarcane plantations in addition to forest and other agricultural residues.	The estimated cogeneration potential is more than 315 GWh per year, which is about 11% of current national electricity generation. The current energy generation potential from excess bagasse in sugar mills alone is about 99 GWh per year, approximately 3.5% of the national electricity generation.
 **Uganda**: installed capacity 36 MW All current capacity is from bagasse cogeneration at Kakira sugar factory. Uganda's GETFIT programme allows private power produces to get premiums on sale of power to the national grid. This is in line with its Renewable Energy Feed-in-Tariff (REFiT) that has been in place since 2007 and was revised in 2012. Under GETFIT, biomass rates are US$0.081/kWh for bagasse, US$0.103/kWh for biomass and $0.115 US$/kWh for biogas-generated electricity.	• Kakira Sugar factory has been generating 22MW of power and feeding 14MW to the national grid. It is undergoing expansion which will see it increase power generation to 52MW, of which 32MW will be exported to the national grid through the GETFIT programme. • True North power is planning 1MW biomass gasification plant in Uganda using agricultural waste feedstock.	The Uganda sugar industry holds a big potential for cogeneration, estimated at 173.43GWh per year. At the same time the vast agricultural sector offers potential for bio-energy generation using agricultural waste as feedstock. Uganda's National Renewable Energy Policy of 2007 estimated biomass could supply up to 1,640MW of electricity if fully exploited.

Featured story: East Africa's Coming Carbon Showdown

Written by Mark Hankins

When the pope, the world's leading moral authority, issues an encyclical addressing the looming dangers of climate change and carbon emissions, it's time for grown-ups in the room to take serious note. The Laudato Si encyclical's scope is broad, perhaps the hardest hitting single climate document by a non-activist leader yet. It addresses an array of climate issues in moral light: development aid and energy access, carbon trading, historical responsibility, the slow pace of political action and the contribution of rampant consumerism to environmental degradation. It does not mince words about fossil fuels:

> "We know that technology based on the use of highly polluting fossil fuels - especially coal, but also oil and, to a lesser degree, gas - needs to be progressively replaced without delay."

How ironic that, as the Holy See rings in the end of the fossil fuel era, East African countries are poised to begin. It is, of course, about economic growth and money. So, though the regions' leaders are used to such harassment from environmentalists, it is another thing altogether to hear sermons from the pulpit about putting the brakes on fossil fuel development. Especially when church leaders speak of "moral duties" to change environmentally-incorrect behaviour.

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Until recently sub-Sahara Africa has been given a "pass" when it comes to carbon emissions. In international dialogues, the "politically correct" position has been that, first, developing countries did not cause this mess, secondly they need to focus on building out energy access to their populations and thirdly their poor are most at risk to the ravages of climate change. So, as "victims", Africa was given free rein to grow carbon use. Today, as global CO2 concentrations spiral rapidly towards levels beyond internationally-agreed budgets, the thinking is changing. Decreasing costs of renewable energy are changing rhetoric: new talk is about leap-frogging carbon intensive infrastructure and moving directly to green economies.

On the ground, though, energy --- like roads --- has much to do with economic development and security. Being "green" is only one of the calculations factored in by planners. East Africa's growing economies need low cost electricity to move forward. Economic planners want to add perhaps

30,000 MW of power to the regions' grids in the next 20 years to fuel growth. And, although there is a lot of green energy in the ambitious expansion plans, there are also a lot of coal, oil-fired power and natural gas.

Today, as South Africa runs on it and Mozambique exploits massive fields, East Africa is investing in coal-fired power plants for large portions of its electricity budget. Kenya and Uganda are looking to build refineries and pipe petroleum from underground reserves to the industrial developments at the coast. Indian Ocean gas wells are being drilled from Beira to Lamu. This appetite to extract carbon is driven by entrenched local and international business entities with little regard for the UNFCC, global carbon budgets and papal decrees. One wonders if there is a danger of the region going down the wrong energy path.

We have a "moral duty" to change our environmentally-incorrect behaviour and save our warming globe.

Photo courtesy of Religion Data Archives.

It is not surprising, therefore, that the leader of a local NGO scrutinizing Uganda's petroleum sector was called in by national security. His group was getting some bureaucratic backs up. In Government eyes, energy is a security concern and no NGO has the right to get in the way. "Who is funding you?" they wanted to know. Given the way environmentalists slowed down Bujagali dam, the last thing Uganda wants is international interference with its petroleum industry. Kenya and Tanzania have similar sovereign sentiments.

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Regional governments are right be worried. First, because there is a growing international consensus about the need for real action to reduce global emissions. With the daily litany of global drought, hurricane, heat wave and flooding, scientists are no longer needed to warn us about climate change. Even the Pope knows we are over 400 ppm and headed towards a 4°C temperature rise. Given the science, the unfolding weather events, and signs of life and leadership from Obama and China, we may have an enforceable agreement at the Paris COP meeting this November.

Any such agreement will make extractive fossil fuel industries uncomfortable. The call from environmentalists is quite clear: Keep reserves in the ground. Using apartheid-era tactics, campaigners are urging groups to divest from fossil fuel and to put their money in green energy. As in anti-apartheid days, there is a ground swell of support. Groups that range from Stanford University to Rockefeller Foundation, from Norwegian trust funds to Cambridge University, are divesting from petroleum.

It is this second implication that should worry regional leaders and investors. The world --- and, yes, international capital --- is slowly turning away from carbon fuels. With this change comes a fall in the value of fossil fuel assets. China's appetite for coal has peaked, and, simultaneously the value of top coal companies in the US is plummeting. Because of nervous investors, Australia is having trouble getting a new coal export harbour funded. Closer to home, oil companies are cutting costs and hedging --- and petroleum developments are behind schedule. Think this isn't related to the "Keep It in the Ground Campaign" and investor apprehension? Think again. If international agreements happen, there will be stranded fossil fuel assets.

The good news is that, as fossil fuel appetites peak, investment is shifting. In most parts of the world, wind and solar are booming. In 2014, $270 billion was invested in renewables and much more green finance is coming. 657 GW of global renewables were installed, not including hydro. Even in East Africa, renewables are moving forward. Kenya is a global geothermal leader, farms are popping up all over the Horn of Africa to harness its ample wind and Ethiopia is completing the largest African hydropower roll-out ever. Off-grid in rural areas, solar power lights up millions of households. Though slower in Africa than elsewhere, the shift is occurring. We are only seeing the beginning of what is possible.

During his interview with security chiefs, the Ugandan NGO leader said he had no quarrel with them. He agreed, energy is indeed a security issue. In fact, he told them, the potential carbon emissions and pollution from poorly-executed large-scale fossil fuel developments are the worlds' primary security issue.

He likened the fossil fuel industry to a huge mango tree standing over our global household. "You see", he said, "This tree is growing so big that it risks collapsing atop the house". And he had some sound advice: "If we cannot remove the tree because we need the mangos, does it not makes sense to prune a few limbs before the tree falls on top of the house?" and, perhaps, to plant 1000 small trees --- distributed energy sources --- in many regions rather than relying on just one tree?

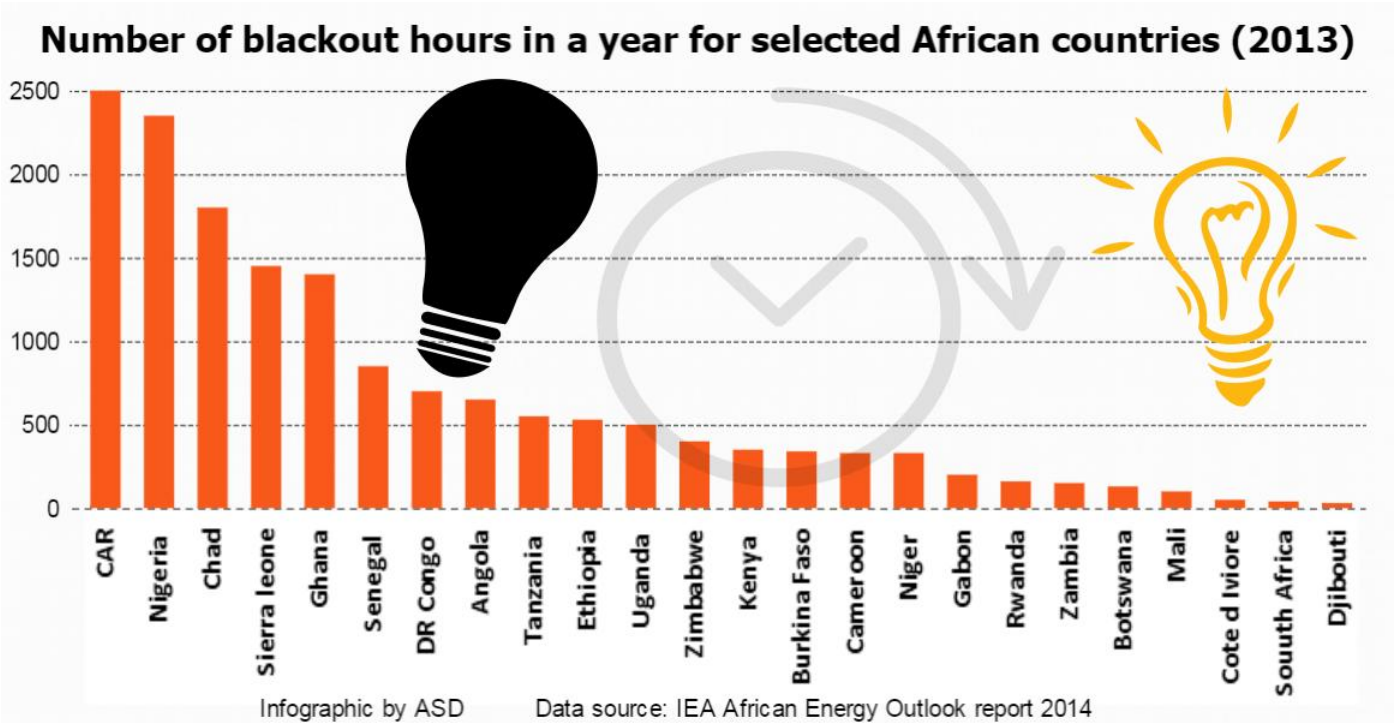
This article was published as a lead opinion piece in the East African Newspaper on June 27, 2015

ASD tweets - follow us on @solarkenya

1. This is huge! Solar power passes 1% global threshold
2. Kenya announces 1-Gigawatt solar energy deal, will cost a record $2.2 billion
3. Largest Solar Carport in Africa here in Nairobi ...
4. Wind power: KenGen develops 400MW plant
5. The R&B Star Akon and an Emirates Foundation Invest in a Solar Energy Work Force for Africa
6. Despite $7 billion to 'Power Africa,' why the continent is still in the dark. Decentralised or centralised solutions?
7. What's holding back Africa's renewable energy entrepreneurs?
8. Solar hits new record low price, under 4 cents/kwh. 'Only thing that can compete is wind'
9. Kenya signs Sh220bn solar power deal with US company
10. World Bank warns Kenya on coal energy
11. Obama thinks solar power will boost Kenya; Kenyans aren't so sure
12. Wind power: MoU signed for Djibouti's first wind farm

President Obama at an M-kopa makeshift solar powered kiosk during the Global Entrepreneurial Summit (GES) in Nairobi. M-kopa is among the off-grid energy businesses supported by president Obama's Power Africa initiative. Photo courtesy of AFP Photos.

Infographic: The challenge of power outages in sub-Saharan Africa



About this newsletter

RE TRENDS EAST AFRICA is a quarterly newsletter produced by ASD in a deliberate move to share its knowledge and expertise of the East African region that spans over 25 years. We cover emerging innovations and technologies and showcase energy trends in the region to paint a picture of the sector and the direction it is taking. At ASD we provide a range of technical, consultancy and capacity building assistance in the renewable

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