RE TRENDS EAST AFRICA

Tracking regional renewable energy developments

Quarter 1, 2015

Opening Thoughts

Welcome to ASD's first newsletter of 2015 (and the 5th of our series!).

This quarter we focus on wind in East Africa. The Aeolus Kinangop and Turkana Wind projects have both been in the news recently. Actual construction of both projects appears to be on-going. At the same time, Ethiopia has quietly taken the lead in East African wind installations, completing over 170MW of wind projects in the last 18 months. Read below.

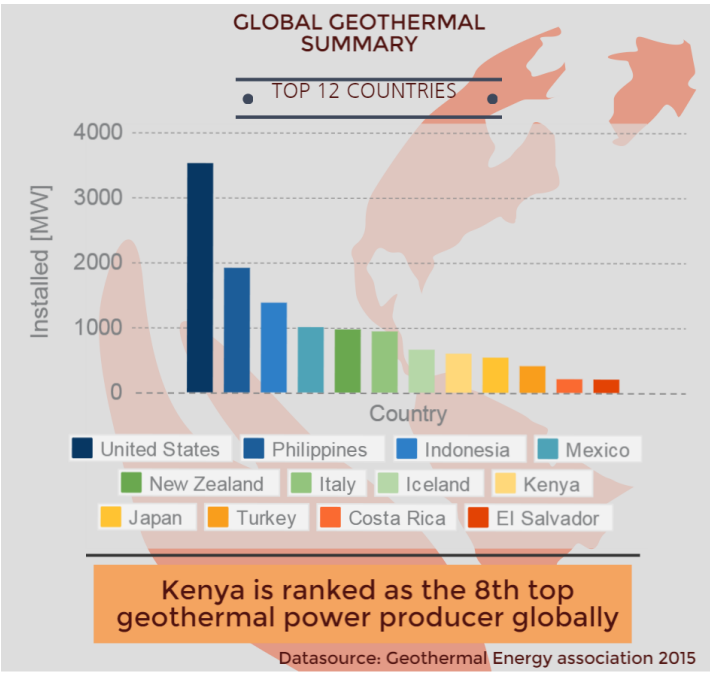
In this issue, we also have a look at geothermal numbers, what happened to small-scale off-grid wind in the region, and we feature our usual tweet summary of interesting renewable developments.

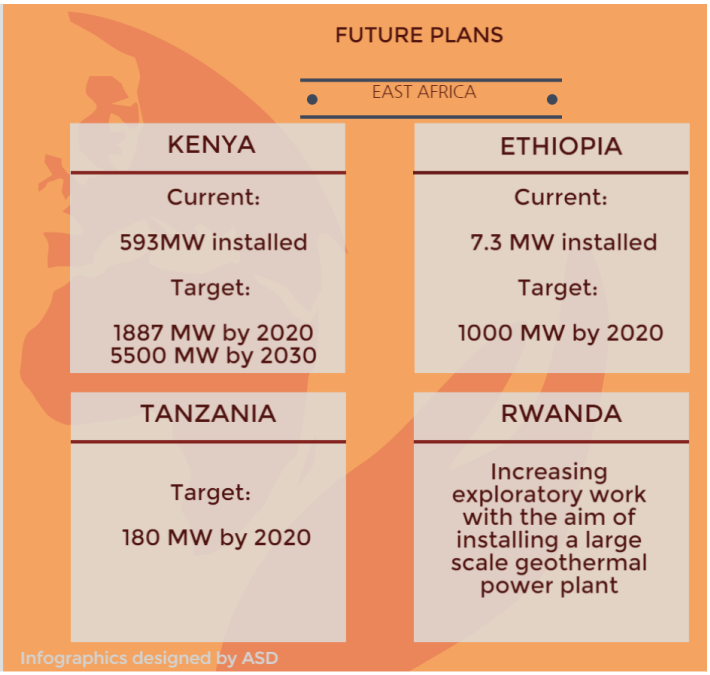
We welcome comments and criticism of our articles and content. Happy reading.

Mark Hankins

ASD fielded 13 marathoners at this year's Beyond Zero Campaign Marathon. Two completed 21km, majority did 10km and others 2km. ASD supports the initiative as we look forward to participate again next year.

Energy Numbers: Eastern Africa looking to geothermal to diversify its generation mix





On the lookout: On-grid wind in Eastern Africa — where are the megawatts?

On-grid wind continues to grow globally, having added 35GW in 2013 to bring the global wind installed capacity to above 318GW by the end of 2013, according to the REN 21 2014 Global Status Report. Wind technology now has a 2.9% share of the global electricity production among renewable energy technologies, which is expected to increase in the coming years. In Eastern Africa, the combined wind installed capacity currently stands at 196.5MW, in an area largely dominated by hydropower. The region lags behind in wind technology despite the fact that some countries, especially those in the horn of Africa, have huge wind potential. However, trends are beginning to change as we witness large scale wind projects being commissioned in Ethiopia and hundreds of megawatt in the pipeline across Ethiopia, Kenya and Tanzania.

Below is an overview of the region's on-grid wind sector, with a focus on the most active countries in wind technology.

Country	Policy Environment	Pipeline Projects
Ethiopia: 171MW  With an installed capacity of 171MW, Ethiopia holds the mantle for the largest wind installed capacity in the Eastern Africa region and appears 3rd on the continent. In 2012 the 51 MW Adama 1 wind project became the largest wind farm in the region. In 2013 it was surpassed by the 120 MW Ashegonda Wind Farm, which is currently the largest wind farm in Africa. Ethiopia has an estimated wind exploitable reserve of 1,350 GW and an average wind speed of over 7m/s.	▪ The state owned Ethiopian Electric Power Corporation (EEPCo) holds a monopoly in energy generation therefore locking out independent power producers (IPP) from developing wind projects. ▪ Currently doesn't have a wind feed-in-tariff policy. ▪ Through its 5 Years Growth and Transformation Plan the country has set a target of 890 MW of power from wind, which at this time looks very ambitious. Ethiopia also targets to have 7,000 MW of wind by 2030, at 30% of its targeted electricity generation mix.	▪ Adame 2 wind project, which will have a total installed capacity of 153MW, is reported to be about 80% complete. The project is being financed by China Exim Bank. ▪ French power firm Vergnet Group SA is conducting feasibility studies for the expansion of Ashegonda Wind Farm by 10-40MW. ▪ An ambitions 300MW Aysha wind farm is planned to be constructed in 3 phases near Ethiopia-Djibouti border. The project is part of 5 Years Growth and Transformation Plan The 1st phase (120MW) has already been approved by EEPCo. ▪ Other proposed wind projects include Assela (100MW), Debra Berham (100MW) and Mossobo (42MW).
Kenya: 25.5MW  Kenya has a total wind installed capacity of 25.5MW, which is just 1% of the total installed generating capacity according to Energy Regulatory Commission (ERC) data. This is after the expansion of the 5.1MW Ngong wind farm by Spanish consortium of Iberdrola and Gamesa and Belgium's TPF-Econoler, which added 20.4MW that was commissioned in late 2014. The government has also been undertaking wind data logging to collect site-specific data. As early as 2003, the Ministry of Energy developed the Kenya Wind Atlas, which estimates on-grid potential at over 1,000MW. The Atlas shows many parts of Kenya (especially ASAL areas) have wind speeds of 8-14m/s, which can support commercial electricity generation. High potential sites include Marsabit, Ngong, Laisamis, Turkana, Samburu and coastal regions.	▪ Kenya has had a feed-in tariff (FiT) policy since 2012, and allows IPP to generate power and sell it to Kenya Power under a negotiated Power Purchase Agreement (PPA). ▪ The wind FiT is placed at 0.11 US$/ kWh for all projects between 0.5MW and 500MW. ▪ Kenya targets 635MW of wind by 2017 under its ambitious 5,000+ MW investment prospectus, out of which over 510MW will be from IPPs. ▪ Under Its economic growth blueprint, Vision 2030, the country targets 3000MW wind installed capacity, which will make up 15% of the total electricity generation mix.	▪ Kinangop wind project is slated to become the 1st utility scale wind project done by an IPP. The 60 MW wind farm was planned to be completed by June 2015, but local politics that have dogged it may see it delayed. ▪ The 300 MW Lake Turkana Wind Project (LTWP) is set to become the largest wind project in sub-Saharan Africa once completed. According to the project proponents, it is planned to start generating 50-90MW by end of 2015 and be fully operational by the end of 2016. In 2014 LTWP won African Renewables Deal of the Year at IJ Global awards. ▪ Prunus Ngong 50 MW Wind Project which was planned to be completed by 2016 is still ongoing, but may face delay in completion. The project is part of government's 5,000+ MW plan. ▪ 100 MW Kipeto wind farm, another 5,000+ MW pipeline project planned to be commissioned in 2016 has started construction by General Electric. ▪ Other proposed wind projects include: 50MW Limuru by Trancentury Group, 40MW by Blueseas in Meru County, 36MW by Seasons Windpower in Embu County and 100MW by Kengen in Meru County.

Tanzania 	Tanzania has no grid scale installed wind capacity despite its huge wind potential. However, the country is moving to add wind on its electricity generation mix as seen through the proposed Singida projects. Much of the wind resources is said to be located along the coastline, highland plateau regions of the Rift Valley, on the plains and around the Great Lakes. According to its 2012 Scaling-Up Renewable Energy Programme report, wind assessments are showing areas of Kititimo (Singida) and Makambako (Iringa) to have wind speeds of 9.9 and 8.9 m/s respectively, which is viable for commercial grid scale wind projects.	▪ The government allows Small Power Producers (SPPs) to sell generated electricity to Tanzania Electric Supply Company (Tanesco), through Standardised Power Purchase Agreements (SPPA) using the Standardised Power Purchase Tariff (SPPT). ▪ The SPPT is non-technology specific and designed for Small Power Producers (SPP) of 100 kW to 10 MW, above which the FiT is negotiable. Distribution can be to the national grid or Tanesco isolated mini-grid. Payments are given for the duration of 15 years where the national utility has the obligation to buy from SPP. ▪ The main grid SPPT stands at 197.31 TZS/kWh, adjusted to 236.78 TZS/kWh during dry season and 177.58 TZS/kWh during wet season. The isolated grid SPPT is given at 482.64 TZS/kWh. ▪ The Tanzania Power Sector Master Plan (PSMP) targets 100MW of Wind installed by 2016/2017.	▪ The two Singida Wind Power projects are set to pioneer on grid wind in Tanzania. The two projects are: ○ The Wind East Africa Limited 100MW wind power project is being done by Aldwych International Limited and Six Telecoms Limited. The project is planned to be expanded to 200MW after the completion of the 1st phase. ○ The 50MW Geo Wind Power project, planned to be completed by 2016 and later scaled up to 300MW in consequent phases. China Exim Bank has already given $132 million to cover the 1st phase.
Uganda 	In Uganda, data from the meteorological department has shown national wind speeds with potential for commercial electricity generation, especially in the south western districts of Kabaale, Ntungamo, Kisoro and around Mt Elgon and Karamoja. However, more feasibility studies need to be conducted to provide more accurate data for use by the wind developers as metrological data is not always conclusive.	▪ The country has a Renewable Energy Feed-in-Tariff (REFiT) and in 2013 introduced the innovative Global Energy Transfer Feed in Tariff (GET FIT) to stimulate renewable energy projects. However, the GET FIT programme has not included a premium for wind projects, hence they operate at the set REFIT of 0.124 US$/kWh.	▪ So far there is no major wind power project in pipeline although a number of them are being mentioned, including a 20MW wind plant in Tororo. ▪ A local initiative in Koome islands, Mukono district by Uganda Veterans Wind Power Initiative has been doing pilot wind projects using locally sourced material but has not yet reached grid scale level.
Djibouti, Eritrea and Somalia These horn of Africa countries are said to hold a significan wind resource potential, both onshore and offshore. Available information shows that 50 percent of Somali territory has wind speeds suitable for commercial power production. The region has a large area of shallow sea along its coastline, which is suitable for offshore wind power generation. However, comprehensive wind studies are yet to conducted across the region to conclusively give the region's potential. Isolated studies have shown many areas across the Horn of Africa as having commercially viable wind resources.	▪ Somalia has no electricity utility and at the same time lacks comprehensive energy policies as it continues to face political instability. Fossil fuel generators, which are owned by private companies that also use their own grid, are the only source of electricity. This has made electricity in Somalia among the most expensive in the world. However, the more stable Somaliland has seen a number of small scale wind projects being done, especially for institutional use. In 2014 the US Agency for International Development (USAID) handed over a 100kW wind farm at Hargeisa airport to the Somaliland administration. ▪ Eritrea and Dhibouti are moving to diversify their generation mix, which has seen growth in the interest on wind power.	▪ Pilot commercial wind project planned in Berbera, Somaliland, to power cold chains for the fishing industry. ▪ Development of real-time wind map for potential renewable energy investors being done in Somaliland. Modern wind monitoring stations have already been set up in Hargeisa, Borama, Berbera and Burao. ▪ 750kW wind pilot project being done by UNDP and the Government of Eritrea at the port city of Assab. ▪ Djibouti's electricity utility has signed a memorandum of understanding with Qatar Petroleum International (QPI) to conduct a feasibility study for a 60MW wind power plant near Lake Assal. Another 40MW wind and solar farm is planned near Lake Goubet.

The expanded 25.5MW Ngong hills wind farm.

Featured story: What happened to off-grid wind in East Africa?

Mark Hankins explores the demise of small scale off-grid wind generation in East Africa

Today, there is quite a bit of active investment of large-scale wind in Kenya and the region. We are likely to see over 500MW of installed wind projects by 2020 (as explained in the rest of the newsletter). So, despite an encouraging future for "big" wind, and despite excellent wind resources, installation of smaller, off-grid wind projects is at an all-time low. It is harder than ever to find a decent small wind generator - or the skills to install and maintain it. So, what happened?

In the 1980s at Shauri Moyo Nairobi, local fundis could convert an old Land Rover alternator and scrap metal into a working wind generator. As unwieldy as it might have been, such a generator was a symbol of the ingenuity of the Kenya Jua Kali sector. Finding a locally-made wind generator in the field was not particularly unusual. Likewise, a generation ago, there were millions of farm wind pumps in South Africa, Australia and the US, providing water for cattle and remote communities. Even in Kenya, a local company --- Bobs Harries --- was assembling and installing mechanical wind pumps for the local market (they installed 500 over 15 years and are still in business). Wind pumps and generators were valued because they were

An installed off-grid standalone wind generator in Kenya.

rugged and they alleviated the need for constant fuel purchases. Between 1990 and 2010, steady demand for off-grid wind generators in the region created a small but stable niche area for specialist wind suppliers. International imported brands such as Southwest Wind, Bergey, Rutland and Ampair found their way into the local market through a handful of local suppliers.

There was considerable demand for local manufacture during the 1990s and investment and support found its way to entrepreneurs that could build local equipment. Websites showed celebratory examples of small wind generators crafted in workshops in Kisumu, Nairobi and elsewhere. Craftskills, WindGen and Access-Energy manufactured equipment locally and installed systems. Primary markets were NGOs, small commercial groups and up-market off-grid households. Winafrique worked with Safaricom to install over 100 Bergey wind generators in telecom base stations all over the country.

However, after 2010 much of the manufacture of wind equipment moved to China, where hundreds of companies entered a rapidly growing local and global market. The rapid fall in world solar PV prices made PV much more competitive against small wind. Competition from the Far East forced many European and US small wind companies out of business. Many East African companies were unable to track the transition of wind equipment supply to the Far East. With so many Chinese companies selling product, it was difficult to establish which would provide quality and be around for the long term.

"In fact, there are many interesting new developments that make small-scale wind worth re-visiting"

The profitable wind power niche market lost its footing. In the end, the final blow to off-grid wind was the dramatic fall in PV prices. When PV was priced over $4.50/watt, wind looked attractive. However, solar rapidly fell to below $1/watt and this fourfold drop over three years made solar into a no brainer investment. For the same amount of cash, a customer could purchase a full array of modules --- with no moving parts --- and not have to think about the expenses of a wind installation. As well, the complexity of wind power is problematic: expensive wind towers, controls and rectifiers, dump loads, multiple moving parts, and the need for some type of continued hands-on maintenance.

The demise of the off-grid wind sector doesn't mean that small-scale wind power doesn't have a role. In fact, there are many interesting new developments that make small-scale wind worth re-visiting. New wind technologies --- in particular vertical axis wind machines --- are creating products that can overcome many of the maintenance problems that plagued earlier systems. New solid-state controls and inverters can efficiently integrate wind into solar or diesel power systems. Wind electric is now competitive with mechanical power for pumping water. As well, where there is wind, a wind generator is a great choice as a power source in a mini-grid. Wind complements solar power extremely well; it is often available at night, it is less easy to steal a wind power system, and, where there are steady high winds, it can deliver higher returns.

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If you are considering small wind, keep the following in mind:

1. You need adequate wind resources. Unless you live in a very windy place, you are likely to be better off investing in solar PV. To be cost effective, you need an annual average wind speed above 5 m/s (11 mph) at the turbine hub height. It may not sound like much, but this is quite windy.

2. Select a good product and a respectable installing company. There is a huge variety of small wind generator product. Quality in product varies. Do your homework when selecting. Unlike PV, wind generators need to be properly mounted on towers and they need to be installed with equipment that controls the generator in high wind speeds. Your installer needs to know what he or she is doing.

3. Select a good site. Besides having good winds, you also need to make sure that the tower is not put up in areas near obstructions (trees, buildings) or turbulence. You shouldn't install wind turbines on or near buildings.

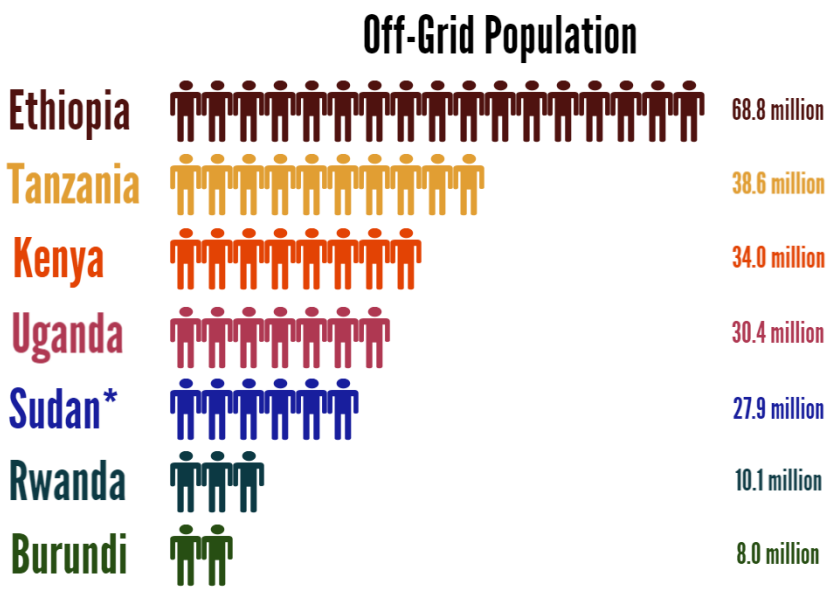
4. Keep track of the net metering policy. If you can decrease battery size and off-set electricity bills with wind power, suddenly the economics of wind power are improved. Net metering policy in Europe and the US helped grow the wind and solar industry. Such policy will do so in East Africa as well.

Contact ASD for more information on small wind.

ASD tweets - follow us on @solarkenya

1. Burundi: GWG signs $1m grant for solar field
2. M-Kopa solar power kits connecting 20,000 off-grid Ugandan homes
3. Ethiopia's giant Gibe hydro plant, Africa's tallest dam, to produce electricity by August
4. Wind in Tanzania.
5. Solar PV prices continue to fall.
6. Gigawatt Global, responsible for East Africa's first solar field, nominated for Nobel Prize
7. The 10 dumb myths of solar installers
8. Can solar power help bring millions out of the dark?
9. More Solar Pay As You Go developments. Tanzania.
10. Green Energy Africa setting up 40MW solar plant
11. Tanzania announces One Million Solar Homes initiative
12. Solar4Africa completes Kenya's 1st "pay as you use" PV project.
13. Uganda turning animal waste-to-power
14. Sustainable Energy Fund for Africa to support solar-hybrid mini-grids in rural growth centres in Tanzania
15. Ethiopia adds a further 1 870 MW with Gigel Gibe III Hydroelectric Project
16. Africa's quiet solar revolution
17. 3000 energy audits to be done in Kenya
18. Uganda: Results of GETFIT Round 1 announced. 20MW PV.

Infographic: Eastern Africa off-grid population in numbers



The Eastern Africa region has about 52.4 million households living off-grid. Ethiopia leads with 17.5 million, followed by Tanzania, Kenya and Uganda at 8.3, 7.8, and 6.5 million respectively. Djibouti and Eritrea have the least number of off-grid households at 0.2 and 0.9 million respectively.

** Sudan given as both Sudan and South Sudan* *Infographics by ASD* *Data Source: OBIN, 2014*

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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