

RE TRENDS EAST AFRICA

Tracking regional renewable energy developments

Quarter 1, 2017



Opening Thoughts

This issue of RE Trends focuses on mini-grids in East Africa. Since we started in 2010, ASD has been an advocate of mini-grids. When we collaborated with Basecamp Foundation in Naboisho Conservancy in 2011 to install a 12 kW hybrid system, we saw the role that interlinked mini-grids and stand-alone systems can play in off-grid areas, especially when the systems are well-designed and maintained. The pioneer project, which was funded by EEP, was a bit before its time, given that mini-grid power was not then a mainstream topic. However, the operators of Koyagi Guiding School, Eagleview Camp, five schools and clinics, and the hundreds of households that obtained electricity clearly saw the future of off-grid power in the project. Alberto Rodriguez's colorful photo (see below) of the Naboisho project is widely-used by mini-grid promoters.

Today, mini-grids are increasingly recognized as an important utensil in the rural electrification tool kit. Governments, donors, investors and private companies throughout East Africa are getting involved in mini-grid implementation. In this issue, we provide an overview of the sector and we look at mini-grid policies, projects and progress in various East

African countries. As well, we interview Sam Slaughter of PowerGen, one of East Africa's mini-grid gurus.

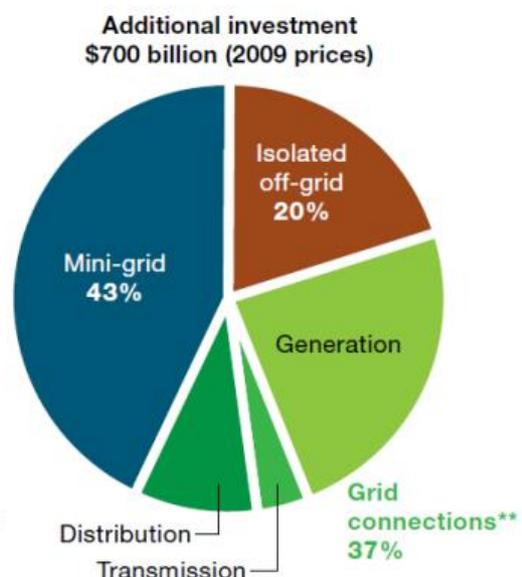
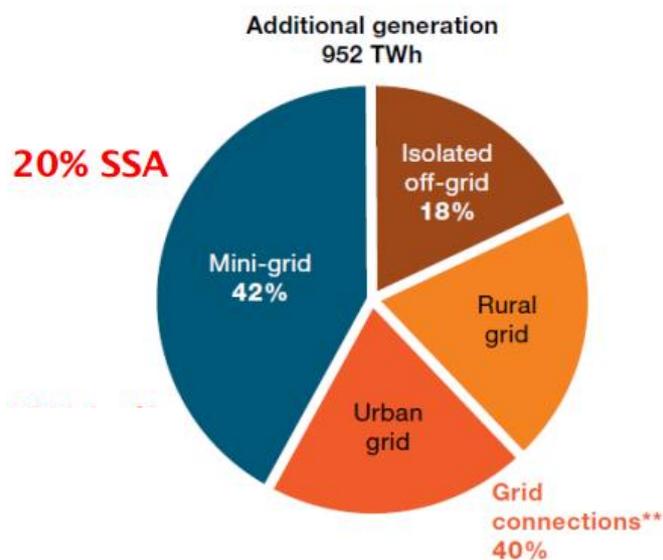
Happy reading and please do contact us at ASD!

Mark Hankins
CEO
African Solar Designs, Ltd.



Solar shading analysis training with Johnny Weiss (co-founder, Solar Energy International)

Energy numbers: The place of mini-grids



**Includes generation, transmission and distribution in urban and rural areas
Source: SEFA – Universal Energy Access 2030

On the lookout: Mini-grids development in East Africa — time to roll out.



ASD provided start-to-finish energy solution for Eagleview tourism site in Naboisho Conservancy, including identification of appropriate installation sites, system design, procurement, installation, and training to both local technicians and community members.

Mini-grid solutions are increasingly accepted by policymakers as a viable electricity access options. For off-grid areas, mini-grids fill the gap between grid extension and stand-alone solar systems. Advancements in Green Mini-Grid (GMG) technology and off-grid opportunities are creating considerable interest in the region, as evidenced by the rollout of multi-million dollar programmes by development partners, investors and banks.

Mini-grid solutions are not new concepts in East Africa. The national governments in Kenya, Uganda and Tanzania have been operating isolated diesel-based mini-grids through the power utility companies for years now. Virtually all of Somalia runs on mini-grids. What is new today is the green power, the exciting new technologies and new business models that have the potential to transform the role of GMGs in rural electrification.

There are a number of donor-assisted mini-grid projects in the region. As well, a variety of private sector players have been piloting mini-grid business models. These include Rafiki Power, PowerCorner, Husk Power, Jumeme, PowerGen, Powerhive, Rift Valley Energy, Steama.Co, TTA, INENSUS and Devergy.

Despite increasing interest in the GMG sector, actual growth of GMG projects on the ground has been slow. According to many players, the major impediment to growth is the lack of government appreciation the role of private sector-led mini-grids in rural electrification strategies and the lack of explicit support for private players. Considering an estimated 90% of subsidized public expenditure on electricity access infrastructure in the region goes to grid extension¹, private

mini-grid players must fund business expansions themselves --- or use grant funding as a lifeline.

Uncertain policy environments have made investment and financing of mini-grid businesses difficult. Moreover, the commercial viability of mini-grid business models remains unclear because they cannot compete against state utilities.

Nevertheless, interest in mini-grid development across the region continues to grow, as witnessed by various on-going initiatives. The good news is that, after years of discussion about mini-grids, policy makers are starting to fully acknowledge their important role.

Increasing support is being made available to the private sector from development agencies, banks, investors and even government. For example, in the beginning of March, a £30M AFD/DFID “Green Mini-Grid Facility” was launched in Kenya. There is also a Kenya Electricity Modernization Project (KEMP) and Kenya Off-Grid Solar Project (KOSAP) that are at various stages of development, both supported by the World Bank. In Tanzania and Rwanda, a \$90M AfDB-funded Sustainable Energy Fund for Africa (SEFA) supports mini-grids and, in Somaliland, a several million dollar initiative is helping to incorporate renewables into local mini-grids.

The recently launched report, *Lights Power Action: Electrifying Africa* from Kofi Annan’s Africa Progress Panel underscores the importance of the role that the mini-grids will play in solving Africa’s energy crisis. The report urges governments to put in place the incentives needed to encourage greater investment in off-grid and mini-grid systems, protect consumers, and facilitate demand among disadvantaged groups.



Country	Support Programme/Plans	Policy Situation	Number of Mini-Grids
<p>Kenya</p>  <p>National grid is concentrated on the south, where a large majority of the population is found and in a pattern that follows the Kenya–Uganda railway line. The national electrification rate stands at 56%. Out of the 47 counties in Kenya, 14 are listed as underserved (these are counties in the North of Kenya, some parts of the coast and Narok County in the South). A number of programs are being rolled out to support private sector led mini-grid developments. The ongoing last mile electricity connectivity program identifies mini-grids as the most viable least cost electrification strategy for the under-electrified regions.</p>	<ul style="list-style-type: none"> • Green Mini-Grid Facility (GMG) Kenya (£30 million). Funded by DFID with support from AFD. Targets the private sector. • Kenya Electricity Modernization Project (KEMP) — \$11 million program funded by World Bank. • Kenya Off-Grid Solar Project (KOSAP) (still in design phase) — funded by the World Bank. • Mini grids support Programme REA (€15 million) — funded by KfW. • Results Based Financing (RBF) for Mini-Grids (€2.1 million) managed by GIZ ProSolar and funded by DFID. • Power Africa—USTDA (SSA wide). Development Innovation Ventures (DIV). Three grant stages: \$150,000 proof of concept; \$1.5 million testing at scale; \$15 million on widespread implementation. 	<ul style="list-style-type: none"> • Requirement as per Energy Act 2006 indicate that, installed capacity >3MW should be licensed, while installed capacity <3MW should get a permit. However, Energy Act 2015 specifies that all installed capacity should have a license. • Existing laws do not give exclusivity to any single distributor, including KPLC. In practice, however, the national utility company manages and operates remote mini-grids around the country. • In general, Kenya has no mini-grid specific regulations. 	<ul style="list-style-type: none"> • There are 21 government-run mini-grid stations with a collective capacity of 24.8 MW. REA owns 19 of the mini-grid stations, which are managed by two other government companies, Kenya Generating Company (KenGen) and Kenya Power Company. 10 mini-grids are under construction mainly in the northern part of the country • In recent years, the private sector has played an active role in mini-grid development. There are about 15+ private sector owned mini/ micro-grids operational across Kenya. Key players in the Kenyan market are: PowerGen, SteamaCo, and PowerHive.
<p>Burundi</p>  <p>Burundi faces a high and growing demand for electrical energy. Like many other African countries, electrification rates are low. Only about 5% of population is connected to the national grid. As part of its energy access program, the government is keen to integrate mini-grids (especially hydro-based) in its energy access strategy.</p>	<ul style="list-style-type: none"> • Rural Electrification programme. Funded by OPEC Fund for International Development (\$500,000) • Power Africa, Beyond the Grid Initiative €20 million between 2016-2018 • Gigawatt Global Mini-Grid Pilots. Funded by EEP S&EA • MASES Burundi (Mini-grids in Africa for Solar Energy Service) —Funded by EEP S&EA 	<ul style="list-style-type: none"> • Burundi has established a legislative and regulatory framework for structuring the energy sector and promoting participation of private investors. • Law No. 1/014 of 1 August 2000 relates to the liberalization and regulation of the public services of electricity • Burundi has no mini-grid specific policy. 	<ul style="list-style-type: none"> • 7 diesel mini-grids are operational, managed by REDIGESO. • Private sector involvement in mini-grid space in Burundi is active.
<p>Rwanda</p>  <p>The national electrification rate remains below 27%, mainly concentrated in commercial and strategic towns. In order to improve the sustainability of rural electricity supply, the Government of Rwanda is encouraging local private firms to design, finance, and construct their own micro-hydro plants through a Public Private Partnership (PPP) programme. Hydro-powered mini- and micro-grids currently provide 4.5MW of off-grid capacity. The government is planning an additional 18MW of small-scale and mini-hydro projects by 2025</p>	<ul style="list-style-type: none"> • Rwanda Green Mini-Grid Country Programme under the Sustainable Energy Fund for Africa(SEFA)-funded by the African Development Bank (US\$ 90 million) • Solar Mini Grid Development in Rwanda EVdev 2009-2019 (€ 750,000). • Scaling up Off Grid Energy in Rwanda (SOGER). SIDA-funded programme that runs between July 2016 and June 2019. Targeting 77,000 households. 	<ul style="list-style-type: none"> • Regulatory framework in Rwanda favors private sector involvement in mini-grid power supply, but in practice power transmission and distribution remain the sole responsibility of EWSA. • A standard IPP and PPA approval mechanism is in place, as is a Feed in Tariff scheme favoring renewable energy. • The Electricity Law was approved by the Parliament in 2011. The regulatory body, RURA, issues licenses to power producers, distributors, and transmitters 	<ul style="list-style-type: none"> • The government through Rwandan Energy Group (REG) has over 20+ hydro micro grids and village mini-grids. However, there has been a plan to privatize them. • 3 private micro-hydro plants are operational (1 MW combined) and another 6 projects are on the pipeline. • In 2016, the government announced a plan to install 100 solar mini-grids to provide power to rural areas.

Country	Support Programme/Plans	Policy Situation	Number of Mini-Grids
<p>Tanzania</p>  <p>Access to the grid electricity is mainly concentrated in urban and a peri-urban areas. IEA (2016) estimates that 30% of the population in the country is connected to the national grid. Over the year, the government of Tanzania has made an effort to improve the regulatory environment with an aim of involving the private sector in electricity generation. By 2020, the government targets over 40,000 households in 160 villages across the country to be connected with electricity through mini-grids.</p>	<ul style="list-style-type: none"> • Sustainable Energy Fund for Africa (SEFA), funded by the African Development Bank. (USD 90 million targeting multiple countries) • Global Facility on mini-grid—ESMAP over \$90 million in more than 5 countries • Scaling-up Renewable Energy in Low Income Countries Program \$5 million- IFC from the World Bank Group 	<ul style="list-style-type: none"> • Comparatively, Tanzania has a more advanced policy and regulatory framework for small power projects, including mini-grid developments. • A mini-grid information portal supported by IFC is in place. 	<ul style="list-style-type: none"> • TANESCO is running 21 diesel based off-grid stations supplying isolated mini-grids with capacities ranging from 400KW to 12 MW • There is an active private sector involvement in Tanzania mini-grid space. • About 21+ private sector mini-grids are in place. The main actors are PowerGen, NextGen, EA-power, Symbion and TANWATT • REA have 90+ off-grid electrification projects in the pipeline, many of which involve mini-grid development.
<p>Uganda</p>  <p>In 2016, the national grid electrification rate was at 19%. The government is keen to leverage from the PPP to expand electrification in rural and other under-electrified districts. The government is planning to use mini-grids in electrifying the island communities of Lake Victoria, a complement to the mini-grid sector in the country.</p>	<ul style="list-style-type: none"> • Decentralized Renewables Development Program by AfDB- SREP (US\$26.1 million) 	<ul style="list-style-type: none"> • Partial regulatory framework and basic financial instruments are in place for mini-grid power generation. 	<ul style="list-style-type: none"> • 3 diesel-based mini-grids, 2 micro-hydro mini-grids and 1 hybrid mini-grid run by the Government • A number of private companies are also active in the sector. Husk Power systems and PowerGen have 10+ micro-grids in Uganda. • 10 hydro-based mini-grids are on the pipeline.
<p>Somalia/Somaliland</p>  <p>Somalia electricity supply is entirely through privately owned mini-grids. The country has no centralized grid. After central grids broke down, following the collapse of the central Government, mini-grid development has been driven by both commercial and community-service interest. In 2013, the World Bank estimated the overall electricity access rate to be about 15%.</p>	<ul style="list-style-type: none"> • Energy Security and Resource Efficiency in Somaliland (ESRES) – hybrid mini-grid development. (£2.5 million) • The Energy Sector Action/Investment Programme (ESAIP) by AfDB will provide short-term assistance to maintain, rehabilitate and/or develop basic energy infrastructure in Somalia. (\$803 million). 	<ul style="list-style-type: none"> • Mini-grids are primarily managed by the private sector. • Instability and a lack of a strong central government means there is no strong legal and regulatory framework. However, Somaliland has been developing its energy policies and laws with support from donors and development agencies. 	<p>All of Somalia runs on private mini-grids.</p> <p>The total installed mini-grid capacity is around 103MW.</p>

Featured story: *Where is the mini-grid sector heading to?*

Interview with Sam Slaughter, CEO of PowerGen



Sam Slaughter, CEO, PowerGen

ASD interviewed Sam Slaughter on the current situation of the regional mini-grid sector and its prospects in years to come.

Sam is co-founder and CEO of PowerGen Renewable Energy, a micro-grid builder, developer, and operator based in Kenya and Tanzania. Over the past 6 years, PowerGen has installed several hundred renewable power systems throughout 7 East African countries, including over 40 micro-grids. Prior to PowerGen, Sam's work experience included time with UBS Investment Bank, VCharge Energy, and Harvard University's Trustman Fellowship. Sam is a graduate of Harvard's School of Engineering and Applied Sciences, where he received a bachelor's degree in Mechanical and Materials Engineering.

Below is the excerpt of our interview.

Q: Technology has an important role to play in the effectiveness and success of mini-grids. What are your thoughts on the latest advancements in mini-grid technology and how is this going to impact the East African off-grid market?

A: Technology is a critical enabler for the micro-grid business model, and at the same time helps to justify the need for mini-grids in the first place. Technologies like smart metering (which improve customer service and reduce revenue collection friction) and solar (which is downwardly-scalable) provide the technical basis for mini-grids to operate viably. More broadly, the rapidly evolving technology landscape in the power sector means that private mini-grids have a critical role to play as a vector for new innovative technologies to reach the market.

Q: What is the biggest challenge to scaling-up mini-grid business models in the EAC region and what is the role of innovation in overcoming this?

A: The challenge in East Africa isn't so much with mini-grids, as with private utilities. Mini-grids are already being used to good effect in areas like northern Kenya, where Kenya Power runs roughly 20 such systems. The real challenge is creating a space for scaling up privately operated utilities, which can exist as far-from-grid mini-grids or near-grid Small Power Distributors (SPDs). Technology plays a critical role here in allowing small, distributed power networks to operate as or more efficiently than the main grid. The big public incumbents can leverage scale to bring down costs, smaller private utilities must leverage technology to achieve the same goal.

Q: In the past, Government rural energy agencies, lenders and other financial institutions have been reluctant to finance private sector-led mini-grid projects in the region. Do you think this situation is changing?

A: There seems to be increasing acknowledgement from sector stakeholders that the private sector is complementary to the public utility and can help regional countries achieve their energy access goals. Private utilities are able to bring additional capital, operational efficiencies, technologies, customer service, and demand stimulation efforts to the sector. Citizens and power users all stand to benefit from such involvement.

Q: There are a number of mini-grid programmes planned and in place in Tanzania and Kenya. As a participant in both markets, can you say something about PowerGen's role in planning and implementing these programmes? How can these programmes be improved to increase their impact?

A: Along with the rest of the sector – which is made up of an impressive and cooperative group of companies who all want to see the problem of energy access in East Africa fixed in the most efficient way possible – PowerGen is aiming to offer input on how programs in the region can ensure that space is created for the private sector in the utility market. Programs like the DFID-funded RBF program in Tanzania, the DFID-funded Green Mini Grid program in Kenya, and the World Bank's K-OSAP program in Kenya will help to play key sector-defining roles in the years ahead. In order to better unify the voice of the industry, as a sector we are also in the process of establishing the African Mini-Grid Developers Association (AMDA), which will start with chapters in Kenya and Tanzania.

Q: How do you compare Kenya’s policies, plans and programs compared with other East African market? Which country in the region has the most progressive mini-grid policies?

A: Each country in the region has a policy perspective which reflects the current state of its power infrastructure and institutions. Tanzania has policies which are fairly liberal for small micro-utilities which are far from the grid, but has some policy challenges in other related areas. Kenya has a very strong power system backbone through Kenya Power, so much more thought in the south of Kenya is about how private mini-grids can exist close to – or even connected to – the main grid. The remote north of Kenya receives a different set of solutions and approaches because of how sparse and remote it is. The policies in Rwanda are progressive and there are strong support mechanisms in place, but in such a small country the questions of near-grid operation and grid-integration are still insufficiently resolved. Uganda’s concession model has been good for companies like Umeme with urban load centers, but challenging for concessionaires with rural territories. I wouldn’t say any one country is more

progressive than the others, but they have all taken their own approaches based on the situations on the ground, and all have more progress to make to achieve the energy futures they are aspiring to.

Q: In a nutshell, where do you think the East African mini-grid market is heading in the short-term, medium-term and long-term?

A: East Africa has a remarkable opportunity to build the Energy System of the Future in the region ahead of the rest of the world. The power business is changing all over the world as a result of distributed generation, embedded storage (including electric vehicles), smart metering, and the Internet of Things. The future grid will look like a multi-directional mesh network balancing among consumption, storage, and generation nodes. Legacy utility business models will need to adapt to this new future. In East Africa we have the unique opportunity to build this future energy system from the ground up – from the grid edge inwards. Private utilities have a critical role to play as driver to realizing this vision.

ASD Team in Action!!!



ASD has been active in the 1st quarter of 2017, both in engineering and advisory work.

We have completed a GIZ project on Analysis of Rooftop Solar PV Potential for Captive Use and Embedded Generation in the Commercial and Industrial Sector in Kenya and a World Bank project on Market Assessment of Modern Off-Grid Lighting Products in Somalia/Somaliland. We are currently implementing a World Bank project on Assessment of the Governing Factors Which Affect the Scaling-Up and Sustainability of Solar and Wind Water Pumping Systems in Ethiopia. Together with Ariya Capital, we look forward to the installation of embedded solar PV systems at flower farms (well over 1.6MW in total) in the coming months under the USAID Powering Agriculture project.

ASD Tweets - follow us on [@solarkenya](https://twitter.com/solarkenya)

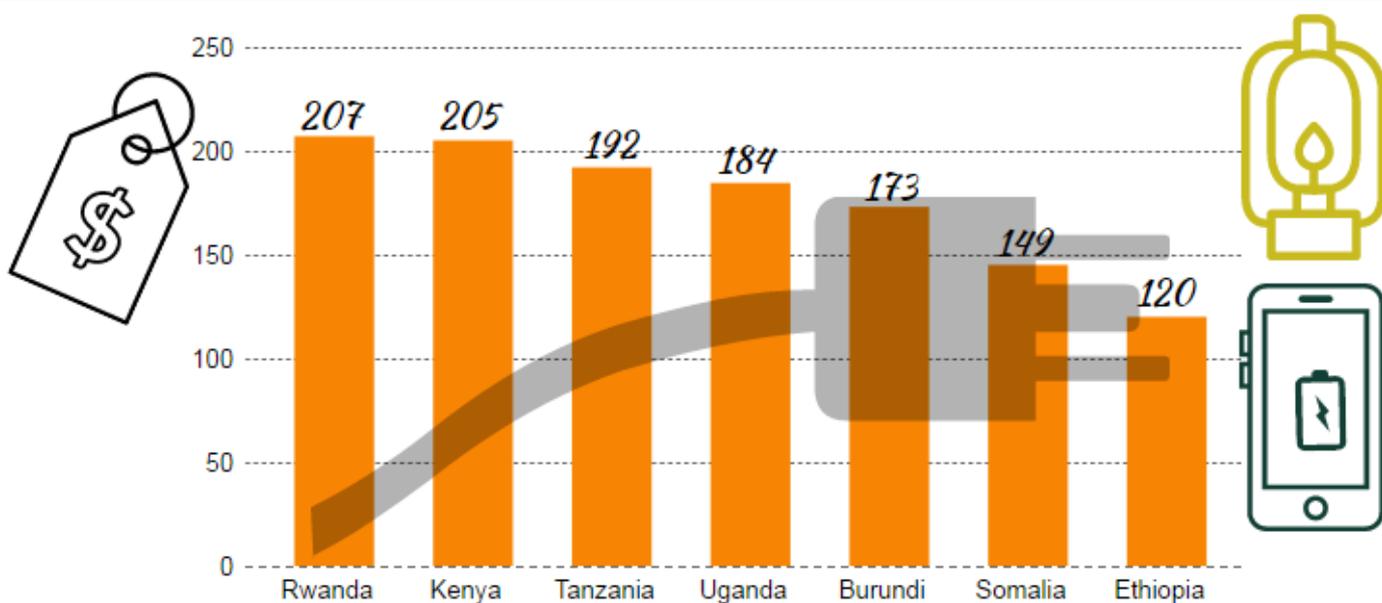
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2. [Africa's energy gap: The costs of the divide.](#)
3. [Bill Gates talks off-grid solar success: 5 Reasons I'm optimistic about Africa](#)
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“We need to accelerate Africa’s energy transition...Traditional approaches to extending the grid are no longer viable as the main option for African countries...”
— Kofi Annan

Infographic: Cost of lighting and phone charging in off-grid areas

What off-grid households spend per annum on lighting and mobile phone charging (US\$)



Source: IRENA (2016), Solar PV in Africa — Costs and Markets

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 energy sector with a focus on commercial and rural energy solutions.

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