RE TRENDS EAST AFRICA

Tracking regional renewable energy developments

Quarter 3, 2014

Opening Thoughts

Welcome to the African Solar Designs quarterly newsletter!

We were excited to hear about Rwanda's recent opening of an 8.5 MW solar farm in September. We were also excited to hear about Uganda's GETFiT programme, which is likely to result in tens of MWs in 2015.

At the same time, like most other regional solar developers, companies and advocates, we'd like to see projects move even faster.

In this issue, we focus on the development of the grid-connect PV sector in East Africa. "On the lookout" examines the status of grid connect policy, projects and pipelines in 7 East African countries. When exploring why grid-connect PV hasn't moved faster in the region, we uncovered some confusion about grid-connect PV among key players and decision makers. So, while ASD is absolutely optimistic about solar's regional future, we believe that more education and advocacy is necessary to make things happen on the ground.

Our feature story debunks 8 myths about solar in Africa, providing a tool kit of arguments and internet links that will help like-minded advocates make a case for green energy. Happy reading and happy campaigning. We appreciate your comments and ideas for future topics.

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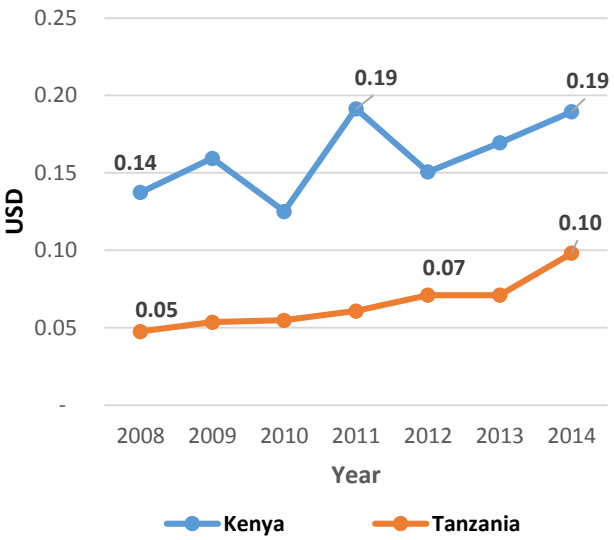
Energy Numbers

Commercial electricity tariffs in Kenya & Tanzania ($/kWh)



Source: Regulas and EWURA

Kenya and Tanzania commercial electricity tariffs have been rising for six years. Added geothermal capacity will reduce Kenya tariffs in the short term.

Rwanda opens 8.5 MW grid utility solar plant

In September 2014, Rwanda opened the first utility scale solar PV plant in East Africa. The Norfund supported project was completed by Gigawatt Global Cooperatief, Scatec Solar and Afritec Energy.

Source: Afritec Energy

On the lookout: Grid connect solar PV in East Africa

Global solar PV growth is robust with more than half of the 139 GW total global capacity installed since 2012. At the same time the price of solar PV modules has fallen radically: from 76$/W in 1977 to below 0.80$/W in 2013. Though South Africa is moving quickly towards 1 GW of installed solar, East Africa has been much slower to develop its solar resources.

Interest in on-grid PV is rising, as seen from the number of grid tied projects under development and from the many new on-grid solar PV policies. Rwanda leads the region, with almost 9 MW of newly installed grid connect PV, and more on the way. Uganda expects to implement its newly developed GETFIT programme shortly. Kenya and Tanzania also have ambitious plans but have been slower to move on the ground.

The table below provides a summary of East African current experience with solar PV on the policy and implementation level.

Country	Policy	In-place projects	Pipeline projects
Rwanda 	✓ Draft regulations on on-grid solar developed, awaiting stakeholder discussion. ✓ Feed-in-tariff for solar under development	✓ 8.5 MWp project by Gigawatt Global ✓ 250 kWp Mt Jali Solaire PV project ✓ 30 kWp system at Nelson Mandela Education Centre	✓ 10 MWp projects proposed ✓ Afritech Energy is proposing a 1MW next year ✓ Grid study necessary for PV additions after next 10MW
Uganda 	✓ **2013**: Global Energy Transfer Feed in Tariff (GET FIT) launched. Offers support RE projects up to 10MW. ✓ **2012**: Government removed $0.32 PV Feed-in-Tariff. ✓ ERA considers unsolicited bids if tariff below weighted average cost of generation.	✓ 15 kW system at Kids of Africa, Entebbe ✓ Numerous small grid connect embedded systems	✓ GETFIT programme to award 20 MWp in 2015. ✓ 1.6 MW hybrid solar-thermal project in Kalangala. ✓ ERA has granted feasibility study permits for 49 MW.
Kenya 	✓ 2014: Government studying new auction system ✓ Solar specific standard feed-in-tariff for on-grid electricity of $US0.12/kWh for 0.5MW to 40 MW projects. ✓ **2012**: Solar PV regulations passed. Net metering policy under discussion	✓ More than 10 grid-tied projects totalling over 2.5 MWp. Mostly embedded systems as FiTs have not been awarded.	✓ >15 solar PV Power purchase applications totalling over 750 MWp in pipeline based on FiT.
Tanzania 	✓ No solar specific feed-in-tariff though new FiT drafts are being considered ✓ Standardised Power Purchase Tariff available for small power producers generating between 100kW and 10MW on and off-grid.	✓ Numerous small grid connect embedded systems	✓ Nextgen planning 2MWp plant in Kigoma (isolated grid-connect) ✓ Windpower Serengeti ,1 MWp plant in Mpaka ✓ >10 MWp grid-tied projects proposed
Ethiopia 	✓ Government finalising Feed-in-Tariff proposals.		✓ Three solar power stations totalling 300MW in planning stages (American investors)
Djibouti 	✓ Undertaking reforms in the electricity sector targeting 87-100% renewable energy mix.	✓ 30kWp system SOS Djibouti ✓ 300 KWp JICA supported system at CERD.	✓ Government planning 2 grid connect PV projects totalling up to 45MW
Burundi 	✓ Government providing incentives to renewable energy projects.	✓ 403 kWp system at University Hospital of Kamenge in Bujumbura. Owned by the government.	✓ EAC-supported Study of opportunities for small-scale grid-connect PV underway

Featured story: Debunking 8 Myths about Solar in East Africa

We've heard it all before. East Africa has a huge solar energy potential. It has some of the most expensive electricity in the world combined with the lowest rural energy access. Its grids urgently need low cost electricity. We have available land area for PV installations. Solar energy is green and free and environmentally benign…

So, at a time when the solar industry is among the fastest growing sectors on the planet (IEA estimates that solar could supply 27% of world electricity demand by 2050), we still aren't seeing substantial solar investment in East Africa. Globally, more than 40 GW was installed in 2013 --- and South Africa is the only African country considered to be a serious player.

Part of the problem is a lack of marketing and advocacy. Though entrenched interests still push traditional solutions, African solar lacks agencies advocating, educating, promoting and fighting for on and off-grid solutions. Without a doubt, in Germany, the US, UK and Japan, vocal proponents of solar paved the way for the industry. Africa also needs knowledgeable planners, consumers, business, civil society, utilities to make solar happen.

This tool kit provides some ammunition for those who want to build the solar industry.

Myth 1: Solar is only for the off-grid poor

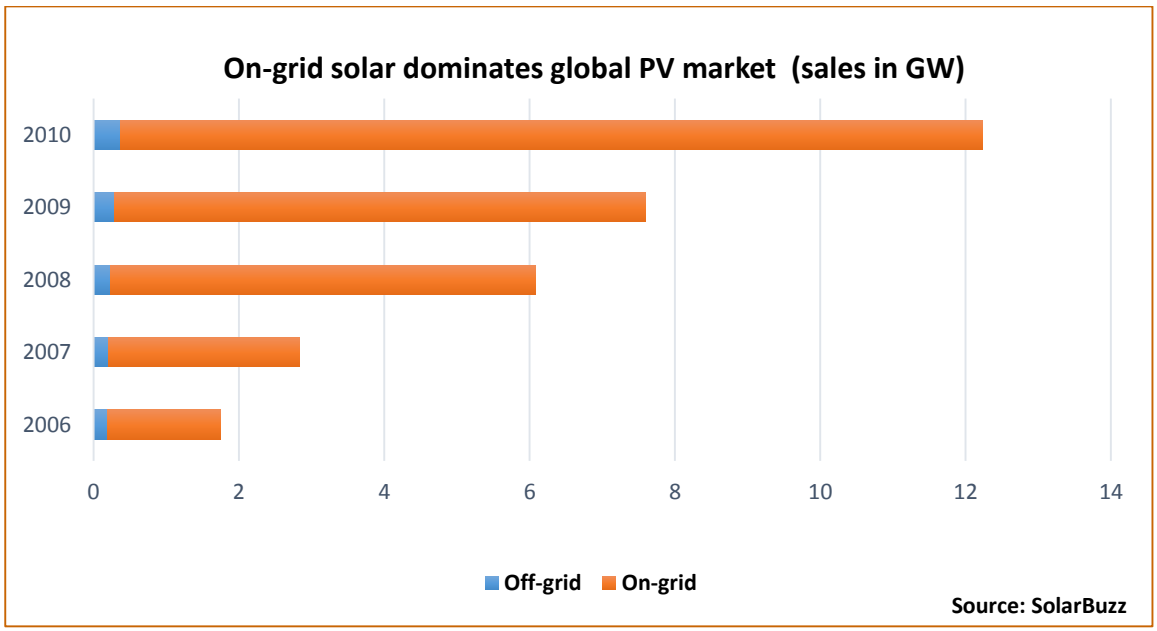
Especially among policy makers and donors in Africa, solar PV is often misunderstood as a tool for remote locations and poor people only. This is not to say that solar hasn't been great for increasing energy access. Using sustainable market mechanisms, solar lanterns and solar home systems have played a major role in off-grid rural electrification. Today tens of millions of people are using off-grid solar. So yes, let's wholeheartedly support access programs because the cost of not having electricity is the highest price low-income groups have to pay.

But let's also look at the big picture. Building a PV sector in Africa for the rural poor only is a bit like building a transport sector using bicycles --- with no lorries, trains or automobiles. In the west, the development of PV has included middle class households, factories, municipal buildings and multi-megawatt solar projects. This massive investment has, over 20 years, shifted solar business worldwide from 99% off-grid to 99% on-grid and grown it into a leading worldwide industry. While this transformation occurred in the west, little attention was paid to growth of the African PV industry or its importance to overall development.

> The cost of not having electricity is the highest price low-income groups have to pay

On this continent with abundant solar resources, rising middle classes, and rapidly expanding cities, solar must be a desired and demanded power source. And this demand must be created, as it is with every other consumer product and service. Solar demand was created in Germany, California and the UK, where PV was marketed as a green investment for people who care about the environment and who want a carbon-free future.

For East Africa, solar needs a marketing makeover. Instead of being seen as a second-class product for poor people in remote places who cannot afford the grid, it must be seen as a key driver of a prosperous emerging economy. It must be a desired commodity, sold positively to growing green business sectors and to the middle classes. It must be seen as a product that works well and saves money. To succeed, solar must be "cool" for all population segments.



Myth 2: On-grid solar PV is too expensive for African consumers

Arguments against solar power on the grid almost always include "high costs". Given the steep downward trajectory of PV prices since 2012, the good news is that the costs of solar PV are less and less of a barrier to consumers and developers. But consumers and decision-makers are still unfamiliar with the growing worldwide importance and lowered costs of solar. Falling PV prices have taken many by surprise.

So where are we in October 2014?

- Today, solar modules purchased in bulk cost between $0.60 and $1.00. Less than $0.40 per watt is within sight.
- Installed on-grid systems with inverters, labour, mark-ups, and other equipment cost between $2 to $5 per watt.
- Utility scale PV projects (>500kW) provide power for $0.10 to $0.15 per kWh
- Smaller grid-connect systems provide power at between $0.13 to $0.18 per kWh.
- Off-grid systems, because of the extra cost of batteries, go for $5 to $12 per watt and on the order of $0.20 to $0.40 per kWh

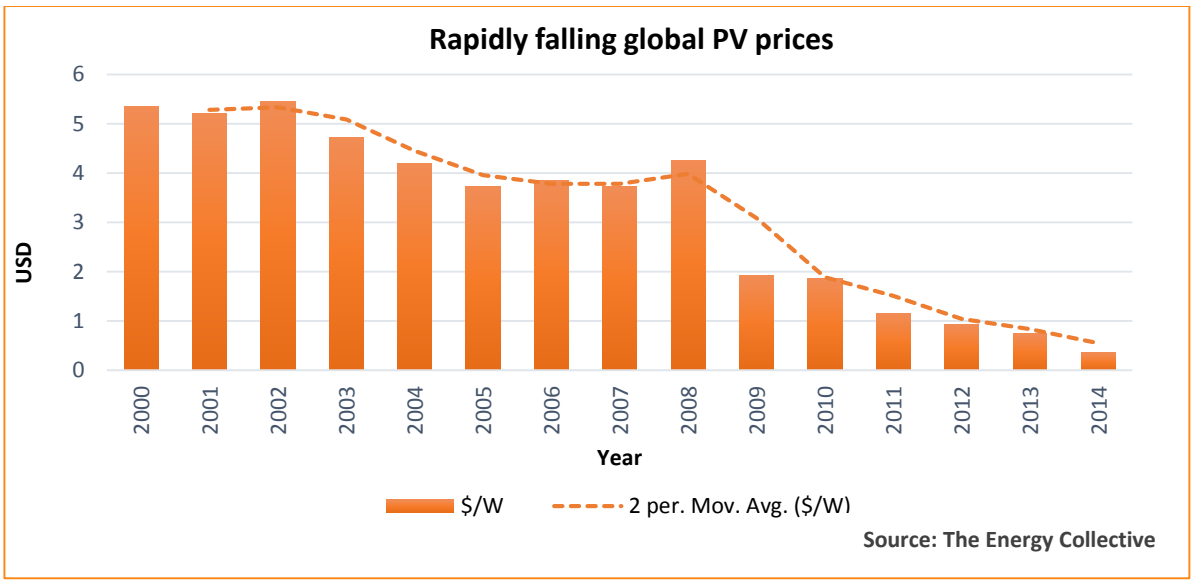
From the point of view of the East African retail customer, solar has reached "grid parity". The lifetime cost per kilowatt-hour of PV electricity installed on-grid in residential or commercial sites is lower than East African utility electricity. So, if solar electricity costs less than that supplied by many regional utilities, why isn't it being installed by everyone?

- First, solar costs are all up-front, so it is hard for consumers to finance lifetime costs. Unlike Europe, the US and Japan, local solar PV consumers have not yet benefited from accessible incentives (such as FiTs or net-metering) or finance packages.
- Secondly, only a few businesses have developed solar products or services on-grid. PV in East Africa is an off-grid, "jua kali" and over-the-counter market.
- Thirdly, low consumer understanding and an undeveloped regulatory environment is a barrier to growth of demand for on-grid PV
- Finally, the economics of solar favour smaller decentralized installations (i.e. in residences or businesses) but the policies and regulations of East African utilities favour large investments and developers.

Things are changing rapidly. Megawatt-scale solar projects are operational (in Rwanda and Kenya) or underway all over East Africa. Consumers are waking up and investing. Financial institutions are realizing that there are opportunities in the solar sector. So, there is reason to have a positive outlook. Make sure doubters about grid-connect solar know that:

- Costs have come down enough for solar to be considered as a serious power source worldwide. A solar array installed at the point of use will provide electricity at a lower lifetime cost today than grid power.
- Smaller systems for residences and commercial sites often have faster returns than megawatt projects based on power purchase agreements. Consumers that install solar modules on their roofs gain a far higher benefit than developers that are paid feed-in tariffs.
- If solar PV electricity must be stored in batteries then solar system costs are much higher (because of the need to purchase and replace batteries). The best place to store excess solar is on the grid.
- The involvement of financial institutions in large and small solar installations will greatly speed up the sector's growth. Not only do banks help build the market, they are instrumental in convincing policy makers to allow solar.

A solar array installed at the point of use will provide electricity at a lower lifetime cost today than grid power



Myth 3: African grids are too unstable for solar PV

In the past, power sector engineers dismissed solar PV for African grids by saying that solar cannot be easily injected into unstable grids. Fluctuating voltages and frequencies, they said, would simply not allow solar PV systems to work harmoniously. The gist of the argument is that in places like Germany, stable grids easily take up solar but erratic African grids make inverters unable to inject power, rendering the solar power useless.

Let's look at the big picture. In 2013, almost 40 GW of solar PV was installed globally and virtually all of this was grid-connect. Solar is a big part of global grid expansion (in the US, in Germany and in Japan). South Africa will have a gigawatt of solar PV in place by mid-2015.

Of course, before connecting a small or large PV system to the grid, it is critical that designers understand the quality of the grid. There are some places where solar simply cannot feed into the grid. It is important to carry out a grid study wherever a PV system is to be installed on the grid. But still, pioneer grid-connect systems in Kenya and Rwanda have been working well for over 5 years.

In 2013, almost 40 GW of solar PV was installed globally and virtually all of this was grid-connect

The argument can just as easily be turned the other way. First, many new inverters can actually help to stabilize a weak grid. For example, a several MW grid-connect PV or hundreds of smaller grid-connect systems, can actually stabilize voltages of grids at the end of the line. Secondly, the idea of decentralized smart-grid systems with large and small-scale batteries that provide stability for grid systems is no longer science fiction. Thirdly, distributed solar (as well as other renewables) should be considered part of efforts to improve distribution systems. In short, solar PV in smart grids can actually increase the reliability of the grid --- this is something that utilities should embrace in Africa.

Myth 4: Daytime solar is not useful on-grid. We need power at night.

Grid electricity engineers frequently raise the argument that on-grid solar PV is not useful because it is not available in the peak evening demand periods. Because solar energy is only available during the day, it has less value for the grid, they say. And they are correct that solar needs to be complemented by other power sources when the sun is not shining.

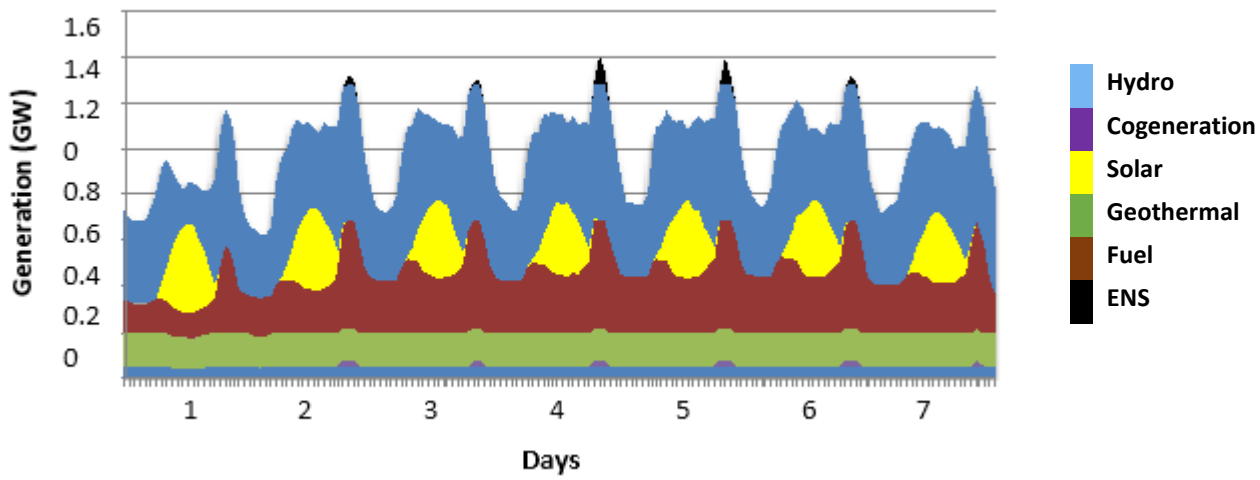
Solar works well for factories or businesses that operate during the day

We are lucky, though. East African countries rely on a variety of sources of power: hydro (which provides the base load), natural gas, geothermal and thermal (i.e. diesel power). Wind and biomass power are beginning to provide inputs. Of these sources, hydro is the preferred option --- it is available around the clock, it can easily be dispatched where required it is lowest cost and most flexible.

Despite its intermittent nature, solar is a valuable power component of a balanced grid:

- Much of the economic growth and consequent power demand will take place during the day. Solar is well-placed to supply this growth. Solar works well for factories or businesses that operate during the day.
- Solar complements hydro power. Kenya, Tanzania and Rwanda all suffer from limited hydro power during dry periods. Injecting solar power enables power planners to manage the hydro power in reservoirs, using them for daytime power storage.
- Power sectors operate best when they have a diverse set of options. If all you have is hydro and petroleum power, you are at the mercy of the price of fuel and the rainy season. Solar is far more predictable.
- Solar off-sets and is lower cost than diesel-generators.

Solar has a place on the Kenyan grid



The figure shows how solar PV (yellow) can help save hydro and fuel use during daylight hours (source: Amy Rose et al)

Myth 5: Decentralized solar is bad for the grid because it upsets utility company business models

Some power companies fear that customers will generate their own power and not buy from the power company. Is it a legitimate fear? The German experience has shown that adding solar and wind to the grid disrupts traditional power company business models. In Europe and the US, power companies that over-invested in gas and coal suffered from the quick development of the solar and wind sector. In truth, utility business models will change and not only because of decentralized solar. Consumers want procedures, such as net-metering, that will enable them to benefit from investments in solar power. Power companies are often reluctant to accept such changes .

> Instead of shortsightedly looking at profit margins, East African utilities should look at the best needs of rate-payers.

But change is not necessarily a bad thing. New business models can increase business opportunities and make a sector better! The future of the electricity sector is likely to develop in a similar fashion to cellular communication and mobile money markets, to the benefit of a vast majority of customers. Technology is unleashing new ways to do business that put much more control in the hands of small companies and individuals.

Most would say that cellular phones changed telecom business models in a positive way. Solar power sources can benefit the power sector in similar ways. First, at a time when there is a lack of power sector investment, they can bring in new investors. Secondly, they can bring in more players and create new opportunities. Thirdly, solar PV will give customers more choice. Finally, distributed sources can bring stability to the grid, reducing the need for huge investments in transmission and distribution.

Solar prices will come down even more, empowering consumers on and off-grid. So, instead of shortsightedly looking at profit margins, East African utilities should look at the best needs of rate-payers. They should set targets for solar development, help it become a player and seek to find ways to incorporate solar into their own business models. They should work with Government and big business to facilitate the change to cleaner, more decentralized and distributed electricity systems.

Myth 6: Cheaper solar technologies are coming. It's better to wait than to invest now.

New technologies are driving down PV costs. Our options will increase dramatically over time. The next generation will see storage technologies that fundamentally change the way we look at on-grid solar systems. Indeed, over the past 5 years, changes in solar PV, inverter, battery, charge regulation and lighting technology have revolutionized the solar business.

> If we want to be a player, we must develop the sector now

But it makes no sense to hold off investment until the changes come. To be a leader in any technology, be it telecommunication, transportation or power generation, a country must invest in the new technologies and continually innovate as they improve. Safaricom did not wait until the cell phone technology was fully mature --- look at the difference between cell phones of the 90's and today. It invested, continued to invest as technology improved and was a lead innovator of mobile money!

We need to invest and innovate in the solar sector today. If we delay investing in a solar business infrastructure, East Africa will have no solar engineers at the time we need them. If we want to be a player, we must develop the sector now so that we have a base of human and technology capacity to build upon as the opportunities in the sector increase.

Strathmore University, Nairobi. Kenyan consumers already investing in solar

Firm	Size	Year
SOS Children Home	60KWp	2011
UN Headquarters	550kWp	2011
Uhuru Flowers	72kWp	2013
Tambuzi Farm	60kWp	2013
Timaflor Ltd	100kWp	2014
Kitumbi Tea Factory	15kWp	2014
Williamson Tea	1MWp	2014
Strathmore	600kWp	2014

Myth 7: Solar is being pushed on Africa by western environmentalists

There are several problems with this line of thought. First, it presents solar and renewables as if they were "bad medicine" that we are forced to take. A non-preferred option. Secondly, it presumes that alternatives such as coal or LNG, if cheaper, are also somehow superior, and that they do not have other costs (greenhouse gas emissions, degraded land, etc.). Thirdly, it suggests that, because the US, China and Europe polluted the world and made a mess of it, Africa somehow should have its own turn to foul the environment. Let's answer these one at a time:

Solar electricity is a quality power source that has a place in every grid in the world. Whether or not a country chooses to invest in traditional sources, it should have a plan for developing its solar power resources. The downward trajectory of solar power prices demands that sunny Africa make a plan to maximize its exploitation. The question is not whether to use solar, but how much.

> The question is not whether to use solar, but how much

Should East Africa be investing in coal, even if it has substantial resources? An environmentalist view is that Africa absolutely needs to build a carbon-free future. Coal should not be part of any long-term future energy supply --- all of the world is looking for bridges to a sustainable future. Let's build on what we have and get to 100% green power. If over 65% of the region's electricity is green now, let's be ambitious, build on that and get to 100%!

We must leapfrog the dirty-development path of other countries, not emulate it. In China 75 cities are dirtier than Los Angeles. We've seen the pictures and CNN stories. Do we want this for East Africa? We don't need the dirty air and the scarred tracts of land that come with extracting coal from the ground. Global CO_2 levels were at 396 ppm in 2013, a 3% rise over 2012 (the fastest rise in carbon dioxide levels in 30 years). If we grow our economies, then we must lower the environmental cost of this growth, especially the carbon emissions.

As African economies grow, they need to be leaders, not followers, in reducing carbon emissions. Reliance on the continent's abundant hydro, solar, wind, geothermal and biomass resources will help make this transition. Besides the positive climate change impacts, green economies also have long-term health, foreign exchange, security and stability advantages.

Myth 8: There is not enough land for solar near to the grid

One way to develop solar projects is to identify large tracts of land, secure power purchase agreements and to place fields of panels on the land to produce power. It takes on the order of twenty football fields of solar arrays to generate 10MW of electricity. Megawatt solar power is the "standard" business model approach for the development of solar, and as much as 75% of the global capacity for solar will be installed this way in 2014.

> Rooftops of houses, institutions, apartments, parking lots and factories offer space that can be used productively to generate green power when and where it is needed

The other grid-connect PV approach is for households and commercial locations to install smaller solar on roof-tops or vacant land. Germany, Japan, the US, Italy and Australia have led the smaller scale roof-top approach. In Germany, 1.4 million PV systems generated 7% of the country's electricity in the first half 2014, the majority of them less than 50kW. Smaller systems, which rely on net metering or feed-in tariff schemes, are also important because they employ local solar companies, something that is key for creating jobs. While supplying power into the grid, household and commercial systems can provide back-up power sources of electricity for periods when the grid is down, something that is of interest in areas where the grid is weak or unstable.

Thus, even though future trends favour an increasing portion of solar investments that are megawatt in scale, there is a clear long-term role for smaller systems in East Africa that can be mounted in cities on rooftops. Rooftops of houses, institutions, apartments, parking lots and factories offer space that can be used productively to generate green power when and where it is needed. So, yes, lets do the megaprojects, but lets also use the available rooftop space. We can do both.

Strategic mounting of solar arrays on rooftops can greatly reduce use of land

Summary

From the above discussion, we have 8 strong arguments in favors of more grid connected solar energy:

1. Solar benefits all population segments, not only off-grid low income groups.
2. Solar is economic now and costs continue to fall rapidly.
3. Solar can help to create a stable grid.
4. Though solar is only available during the day, it provides an important overall component of grid power.
5. Instead of blocking solar, power companies need to embrace it and to consider how solar and distributed power can benefit their business models.
6. We need to invest in solar sectors now to build our skill base for the coming solar age.
7. Solar is not an alternative being pushed by environmentalists. It is part of the green energy future.
8. There's plenty of space for solar arrays, even where land is scarce. Roofs, carports and public spaces can be used to generate electricity in urban areas.

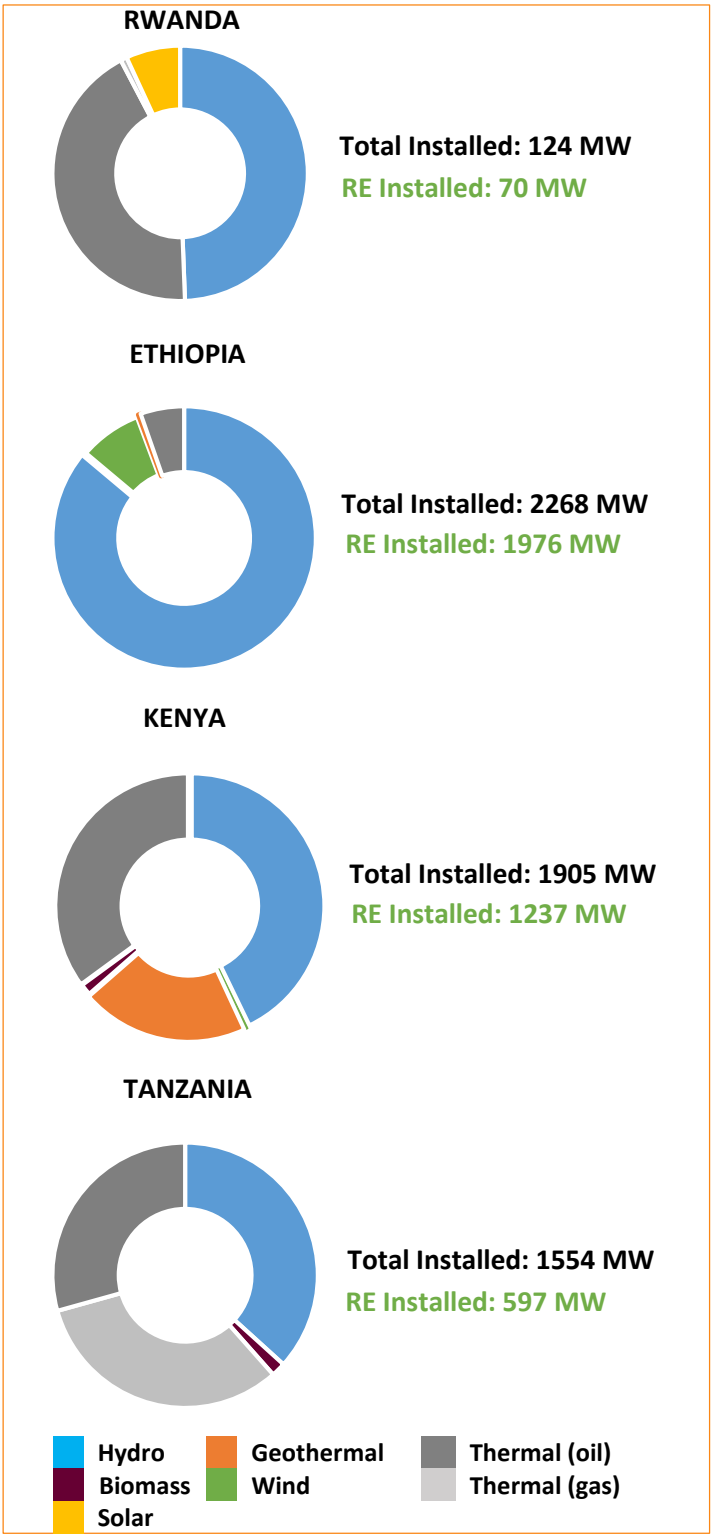
Let's actively dispel the myths that limit the role of solar in Africa's energy picture. Solar is part of the future. Let's make room for it at the table now.

ASD Tweets - follow us on @solarkenya

1. Analysts: Africa enjoys renewables investment surge
2. Could Africa be the Global Epicenter of Renewable Energy by 2030?
3. Kenya Boosts Wind Power in Its Renewable Energy Mix
4. GE to Invest Billion in Africa by 2018
5. 140MW Geothermal added to grid. KenGen bets on additional power to cut energy costs
6. Kenyan institutions look to solar to cut on high power costs
7. Net-Metering: The Great Debate
8. Solar energy technology for those with no access to electricity
9. REN21 Global Status Report 2014: Solar PV = 1/3 Of New Renewable Power Capacity In 2013
10. 8.5 MW!! Rwanda Solar Grid Capitalizes on Limited Sunshine
11. U.N. Draft Report Lists Unchecked Emissions' Risks
12. Beyond PV Industry Consolidation: Investment Opportunities Abound in a Mature Market Environment
13. Expert Says We Can Reduce Fossil Fuel Use 80% With Existing Technology

How green are east African grids?

Electricity installed capacity in 4 Eastern African countries



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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