POLICY BRIEF

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Solar PV for Enhancing Electricity Access in Kenya: What Policies are Required?

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Authors

Benard O. Muok
African Centre for Technology Studies (ACTS)
b.muok@acts-net.org; bmuok@yahoo.com

Willis Makokha
Kenya Industrial Research and Development Institute (KIRDI)

Debajit Palit
The Energy and Resources Institute (TERI), India
debajitp@teri.res.in

Introduction

Modern energy services are crucial to human well-being and to a country's economic development; and yet globally over 1.3 billion people are without access to electricity and 2.6 billion people are without clean cooking facilities. More than 95 per cent of these people are either in Sub-Saharan African or developing Asia and 84 per cent are in rural areas (International Energy Agency, 2015). Sub-Saharan Africa is rich in energy resources but very poor in energy supply, making the region have highest access deficit in electrification rate, only just managing to stay abreast of population growth. Making reliable and affordable energy widely available is therefore critical to the development of the region that accounts for 13 per cent of the world's population but only 4 per cent of its energy demand (OECD/IEA 2014).

Although investment in modern energy supply (pre-dominantly electricity) is on the rise, these gains are outpaced by the population growth. To date, more than 620 million people still live without access to electricity and nearly 730 million people use hazardous and inefficient forms of cooking, a reliance that affects women and children disproportionately (IEA 2014) as well as contributes to environmental degradation. While the national average access to grid power connection is estimated at 32 per cent, the rural populations having access is only about 5 per cent (Zhou 2014).

Kenya continues to rely heavily on traditional biomass for most of its primary energy needs. It is estimated that biomass contributes 76 per cent of its primary energy needs (DGICK 2013). The human cost of relying on traditional biomass energy for household cooking is well documented; newly published data from the World Health Organization showed that 4.3 million people died in 2012 worldwide due to cardiovascular and respiratory diseases linked to household air pollution, almost all in low and middle income countries (WHO 2014).

The country's electricity generation is currently based on large-scale hydro power, fossil fuels, and recent focus on geothermal, while other renewable energy sources play only a minor role (GoK 2015). At the same time, the resource potential for various renewable energy technologies (such as wind and solar energy) is deemed fairly substantial. However, despite the advantages that increased use of such 'new' renewable resources, such as wind and solar (as opposed to Kenyan well-established hydro power and geothermal), could potentially bring to the country in terms of energy access to spur rural development, the uptake of renewable energy continues to be low.

Solar Energy in Kenya

Among all the renewables for providing energy access, solar energy holds a big promise. From 2000–10, solar photovoltaic (PV) was the fastest growing renewable power technology worldwide (OECD/IEA 2011). Rural electrification using solar PV has been emerging as a viable option for the developing countries. PV systems not only provide reliable, clean, and environment-friendly energy but also create employment opportunities in the vicinity of its operation (UNEP 2014). The Kenyan solar energy market is one of the most advanced in Eastern Africa, and indeed in Africa. Traced back through the 1980s, it is one of the classic examples of a market driven largely by the private sector. It is estimated that the overall solar market has increased by more than 100 per cent in Kenya within the past decade with the current size of the market now in the range of approximately 8–10 MWp (GoK 2015; Hankins *et al.* 2009). Solar market development in Kenya has also been aided by the global fall in the solar PV prices over the last decade (Figure 1).

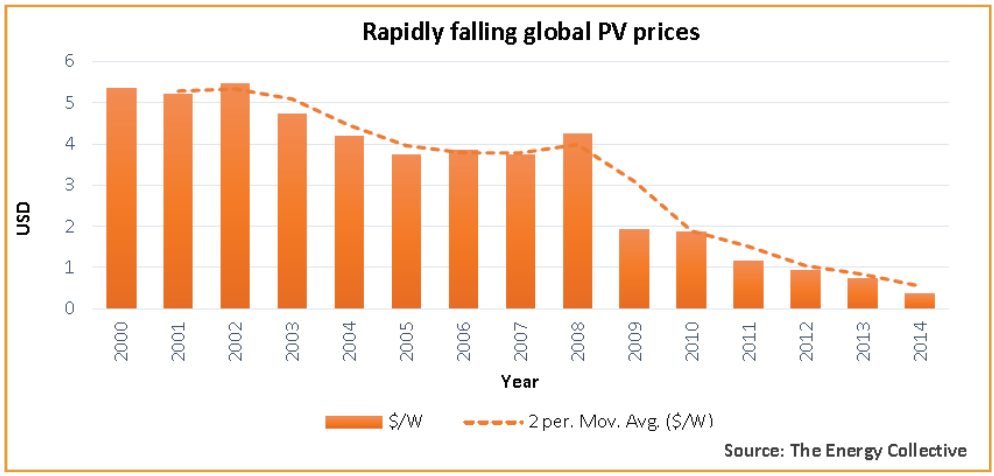

Figure 1: The global PV module prices learning curve, 2000–14

Similar to solar PV, distributed electricity storage is also getting cheaper largely due to mass production of batteries for electric vehicles and introduction of new technologies (Figure 2). Kenya having high grid electricity connection cost, solar PV and batteries joining forces (both for solar micro-grid or stand alone systems) has the potential to make the electric grid optional for many customers—without compromising reliability and possibly at prices cheaper than utility retail electricity.

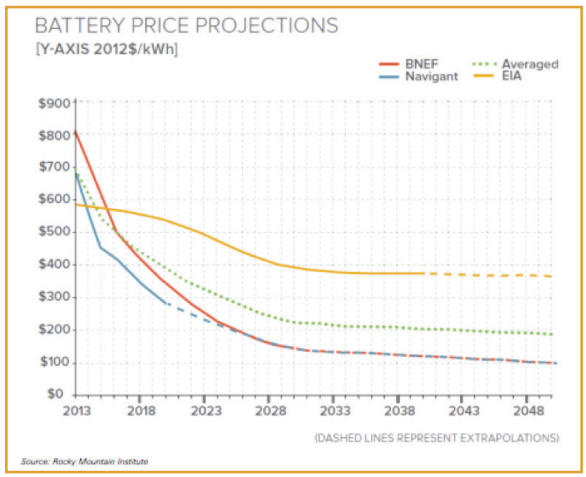

Figure 2: Battery price projections (2013–48)

Need for an Enabling Solar Policy for Enhancing Electricity Access

Despite the high potential of energy generation through solar and market growth over the years, the country is still not sufficiently exploiting its solar energy resources for the benefit of its people. A number of barriers have been mentioned as responsible, which include but are not limited to awareness about the technology, capacity (both technical and end users) and end user, and value chain financing (Makokha 2015). All these issues are directly or indirectly related to policy framework. In all countries such as Germany, Spain, Bangladesh, India, and Japan, the market success has been driven by policy support, which has grown considerably in the last decade. Policies continue to evolve to address market developments and reduce costs (OECD/IEA 2011).

The Kenya government has been intensifying efforts to tackle the numerous regulatory and political barriers that are holding back investment in domestic energy supply. The earlier efforts started with Electric Power in 1997, and this was followed by the Sessional Paper number 4 of 2004 and Energy Act of 2006, which has liberalized the electricity production. The latter two documents set the agenda for renewable energy production in Kenya. They were also instrumental in creating various institutions. For example, the Act provided the legal framework for the establishment of the Energy Regulatory Commission (ERC) as the single energy sector regulatory agency with responsibility for economic and technical regulation of the electric power, renewable energy, and petroleum sub-sectors. Since 2010, when the new constitution was adopted, the country has been revising the energy policy to align with the new constitution. The latest version is Energy Bill (2015) which is in parliament for debate and adoption. The draft Bill borrows a great deal from the Sessional Paper of 2004 in addition to introducing nuclear energy into the mix, establishing institutions for energy efficiency, renewable energy, and energy research among others. Table 1 shows the current targets set by the government.

Suffice to mention that the government also published the Solar Regulation 2012 for licensing solar dealers and technicians. The Solar Photovoltaics System Regulations, gazetted by the Kenya ERC in September 2012, requires technical capacities/ training for designing and installation of solar PV

TABLE 1: SUMMARY TARGETS SET FOR ON-GRID RENEWABLE ENERGY (RE) SUPPLY

RE	Current 2014 (MW)[1]	2017 (MW)[2]	Up to 2020[3] (MW)	2021–25 (MW)	2026–30[4] (MW)
Large hydro[5]	802		+700		
Small hydro	25	50	+50	+100	+300
Total hydro	827	794			
Geothermal	593	1,887	1,887	+3,000	5,500
Wind	25.5	500	+1,000	+2,000	+3,000
Solar PV	4	100	+100[6]	+200	+500
Co-generation	38	44	+200[7]	+800	+1,200
Municipal waste		50	+50[8]	+100	+300
Biogas	0.175				+20

Notes: +100 indicate what government will facilitate as capacity additions to existing ones in the Draft National Energy Policy (2015). The others are set target in the 5000+ MW Investment Prospectus.

[1] As of November 2014 (ERC website), biogas and solar PV include some off-grid capacity.
[2] 5,000+ MW Investment Prospectus Document.
[3] Vision 2030 mid-term plans.
[4] Kenya's vision 2030.
[5] Some authorities do not consider large-scale hydro to fit within the renewable category. This is an ongoing debate.
[6] 200 MW by 2022.
[7] 800 MW by 2022.
[8] 100 MW by 2022.

systems. The three different classes recognized are Class T1: for single PV module or single battery DC system of up to 100 Wp; Class T2: for medium size PV systems, that is, multiple modules of up to 300 Wp or multiple batteries that may include an inverter; and Class T3: for advanced, including grid connected and hybrid solar PV systems.

Another important instrument in the solar market is the publication of Feed-in-Tarrifs (FiTs) policy of 2012, which is a revision of 2008 and 2010 versions. The policy was intended to attract investment in renewable energy and standardized power purchase agreements for embedded power[9] for solar, biogas, biomass, wind, and small hydro and geothermal technologies. The potential introduction of net metering, which is currently under active discussion, is another initiative that is expected to increase the investment on solar PV and other technologies further.

Though much effort has been made in policy development, there remain numerous important policy issues that need to be addressed urgently to enable sustainable solar market development in the country. It is against this background that the African Centre for Technology Studies (ACTS) in partnership with The Energy and Resources Institute (TERI), India, with support from the United Kingdom Department for International Development commissioned a study to investigate the impact of policy on solar market development in Kenya.

Study Approach

The methodology used primarily involved desk studies and consultation with stakeholders. Consultation was done with stakeholders including but not limited to governments, NGOs, private sector, entrepreneurs, and academicians. The policies reviewed included energy related policies and other national policies with direct or indirect impact to solar energy development. Constraints and challenges were identified and the outcomes used to come up with a report. The report then was presented to the stakeholders' workshop, organized on June 2, 2015 in Nairobi, to deliberate and come up with precise policy recommendations to be taken up with policymakers at both the country and national levels. Experts representing industry, policy researchers, academics, NGOs, financing institutes, etc., attended the stakeholders' workshop so as to take care for all interest groups.

Solar PV Development in Kenya

The Kenyan market can be divided into three broad segments. The first and biggest segment encompasses domestic and small-scale commercial PV applications. Their typical capacity is well below 100 Wp. The second segment comprises systems purchased by institutional buyers, such as governments or donors. These systems are predominantly used to provide electricity for off-grid social uses. They can sometimes be bigger than 100 Wp. The third segment conventionally consists of telecoms and signalling systems that tend to be much larger in size and where a public entity acts as the buyer (ESDA 2003). Table 2 describes further details on solar PV market segments.

Government programmes

The government, through Kenya Power Ltd (KPL), has been running off-grid thermal generators in areas that are not connected to the national grid. For the past few years, these station are being changed to use renewable energy, mainly wind and solar by incorporating hybrid systems. Though its main mandate is to distribute and retails electricity throughout Kenya, the company is also involved in off-grid power production from solar, wind, and hybrid systems. Some of the sites are Mandera (300 kWp solar), Elwak (50 kWp solar), Habasuieni (30 kWp solar and 50 kWe wind), Lodwar (60 kWp solar), Merti (10 kWp solar), Hola (60 kWp solar), and Marsabit (500 kWe wind). All these are hybrid systems with diesel generators. KPL have also been providing solar lanterns to communities around their installations as part of their corporate social responsibility activities. The villages covered include Nasiger (Lodwar), Lagbogol (Wajir), and Merti (Isiolo), where 100 lanterns have been provided in each village. KPL and the Ministry of Energy are implementing a

[9] Distributed power generators that are connected to the electricity network.

TABLE 2: CHARACTERISTICS OF FIVE DIFFERENT SOLAR PV MARKET SEGMENTS

Technology and products	Market segments	Installed capacity/size	Owners and buyers
Small pico-systems: solar lanterns, LED lamps, solar chargers	Lighting and charging of batteries and mobile phones in mainly non-electrified areas	1–10 Wp	Private (over the counter) consumer devices
Solar Home Systems (SHS)	Off-grid electricity demand in private homes in dispersed settlements, in smaller non-electrified villages and on the outskirts of electrified towns and villages far from existing distribution lines	10–100 Wp	Residential SHS (private households), ESCOs
Stand-alone 'institutional PV systems'	Institutions located in villages without grid or mini-grid or on the outskirts of grid-electrified villages	50–500 Wp	Government/municipal procurement for public institutions (schools, hospitals, health clinics)
Telecommunications and tourism	Powering telecom BTS, link sites, and remote tele-centres, and basic electricity supply (mainly lighting) for rural lodges and hotels	0.2–15 KWp	Procurement by commercial companies in the telecom and tourism sectors (e.g., telecom service providers, hotel owners, etc.)
Mini-grids (e.g., hybrid PV diesel)	Villages and towns located far from existing grid	5 kW–1 MWp	Utilities, cooperatives (community based), ESCOs (village electrification projects)
Large-scale, grid-connected PV systems	Expansion of production capacity in existing grid	1–50 MWp	Utilities, IPPs (incl. foreign investors)

Notes: Base Transceiver Station (BTS); Energy Service Companies (ESCO); Independent Power Producer (IPP); Light-emitting Diode (LED); Solar Home Systems (SHS).

Picture 1: An Energy shop in Oloitokitok, Kenya

lighting programme aimed at installing solar systems to schools, health facilities, and administrative centres in the country. By the end of the 2008/2009 Financial Year, more than 240 schools and dispensaries had been connected. In addition, KPL is also implementing a Nordic Energy Facility funded solar PV programme to set up more than 800 solar charging stations with a cumulative capacity to recharge around 24,000 solar lanterns for renting to community.

Private sector programme

The Kenyan solar energy market is one of the most advanced in Eastern Africa, and indeed in Africa. Traced back through the 1980s, it is one of the classic examples of a market driven largely by the private sector. The 'Kenyan experience' therefore often serves as a model for market of solar electrification and is well researched in its impacts on and interaction with the development of Kenya's economy as a whole (e.g., Byrne *et al.* 2014). Yet after more than three decades of market growth, reliable recent data on the solar energy market of Kenya is hard to come by, but Ondraczek (2013) and Newell *et al.* (2014) give an estimate of an installed capacity of around 10 MWp and over 300,000 solar home systems in the Kenyan market. This has been due to a vibrant private market that is considered one of the most dynamic per capita solar markets historically. Recent years have also seen the growth of a market for pico-solar products—essentially, solar lanterns that, in some products, also have provision for charging a mobile phone and powering a radio. The market for solar home systems is similar to that for various types of over-the-counter consumer products that need to be installed by a technician but are readily available in specialized shops.

Policy Recommendations

Despite the recent advancement of solar market in Kenya, which has seen the country being rated as having one of the highest solar home system installations per capita in the world, there are a number of policy issues that need to be addressed to create a sustainable solar market.

This policy brief is a summary of recommendation based on the study conducted by ACTS–TERI and adopted during the stakeholders' workshop in Nairobi, Kenya:

- Develop fiscal policies geared towards supporting and/or attracting sustainable investment. Policies should provide incentives, such as favourable tax regimes to industry and flexible incentives to the poor while also implementing environmental and social safeguards, through case by case impact assessments, to ensure such incentives are not exploitative or detrimental.
- Strengthen capacities across entire value chain and develop necessary infrastructure and technical capacity at the local level for developing the last mile distribution channel and providing after-sales service. In many cases users have had an experience with poor-quality products or inadequate after-sales, which is bringing bad reputation to the solar solutions.
- Establish quality control systems for the purpose of protecting the market from counterfeits and sub-standard products. National minimum standards are required for all solar products to increase end user awareness regarding health and performance efficiency as well as quality issues, such as durability and safety.
- Introduce off-grid electricity policy and regulations targeting mini- and micro-grids. The policy should ensure that small energy service companies and household solar electricity generators benefit from the net metering programme. The current 500 kW minimum cap for FiTs is high and excludes small scale producers, such as rooftop installations, which are representative of the poor and most needy segment of the Kenyan solar PV market.
- Review FiTs to be competitive with international rates to be able to attract investors. Also to go with this, there is the need to simplify the PPA process for ease of starting of new businesses. The idea of one-stop shop should also be revived and operationalized.

- To scale-up the efficient solar market, the government should promote all types of appropriate financing mechanisms, including grants for research and development as well as suitable low-interest and long-tenure loans and investment financing for supporting and scaling-up successful initiatives.
- Develop a financing mechanism to support research and development of solar market. This should include a deliberate attempt to attract private sector financing.
- For the private sector to play a key role in production of renewable energy, especially solar PV, Kenya needs to establish sustainable renewable energy technologies financing programmes. These may range from the creation of a national fund for solar and renewable energy projects financed by a modest tax on fossil fuels to credit schemes specifically aimed at developing renewable energy industries and endowment funding of renewable energy agencies. Most renewable energy technologies (especially those that can be locally manufactured) require subsidies in the initial stages but can become financially sustainable once they reach a certain level of diffusion.

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For more information contact:

Debajit Palit, Associate Director
The Energy and Resources Institute (TERI)
Darbari Seth Block, IHC Complex, Lodhi Road,
New Delhi-110 003, India
Tel: 2468 2100 or 4150 4900 *Fax:* 2468 2144 or 2468 2145
India +91 Delhi (0) 11
Web: www.teriin.org
E-mail: debajitp@teri.res.in

Dr Benard Muok, Director of Programmes
African Centre for Technology Studies (ACTS)
Gigiri Court No:49, Off United Nations Crescent
Nairobi, Kenya
Tel: +254710607210 or +254737916566
Web: www.acts-net.org
Email: b.muok@acts-net.org
bmuok@yahoo.com

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