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### About Joto Afrika

*Joto Afrika* is a series of printed briefings and online resources about climate change mitigation and adaptation actions. The series helps people understand the issues, constraints and opportunities that they face in adapting to climate change and escaping poverty. *Joto Afrika* is Swahili; it can be loosely translated to mean 'Africa is feeling the heat'.



A team installs solar powered roofing tiles on a house. Innovation is key to achieving green growth. ©Climate Innovation Centre

## Green Growth: An Overview of the Framework for Development

### Editorial

As a concept, green growth advocates for complementing actions between how we utilize our natural resources and our daily development endeavors. Furthermore, green growth orients policy and associated subsequent actions in regard to climate change issues. The United Nations sustainability website provides a historical reference to the origin of the concept. In practical terms for countries of Africa, the concept derives from Rio+20 global commitment to pursue a development approach that ensures inter-generation equity with regards to availability of natural resources and eradication of absolute poverty through green economy .

But why focus on green growth? The need arises from the fact that evidence from climate change research guides that unless human activities are tailored to minimize extravagance in the use of natural resources and other inputs at industrial and domestic scales so that increase in atmospheric temperature is maintained; on average below 2°C compared to pre-industrial period, catastrophic consequences are inevitable. This is a grim situation for Africa where the negative impacts of climate change are expected to lead to: (i) intense inter community inter-community conflicts over natural resources like pasture and water resources, (ii) famine and starvation as a result of anticipated decline in crop yields of as much as 50% (iii) increase in climate change refugees as population migrates from extensively degraded environments and overall down-turn in economic and social growth. The key remedial target is to reduce emission of Green House Gases.

Globally, policy measures and strategies have been developed to address climate change through green growth. In addition, research has led to technological innovations and inventions that are rapidly transforming production and consumption patterns to more efficient and less polluting practices. Thermal efficiency of wood-fuel stoves, improved solar generation and consumption technologies and products, water efficient technologies , and manufacturing process efficiencies due to improved process flows, "zero waste generation" and improvements in design of equipment and appliances

to ensure ease of re-manufacturing, recycling and refurbishing are some of enumerable examples. However, a glaring gap is lack of industry standard indices that enable comparing performance of different efficiency achievements. Recent examples of star rating of appliances to inform consumers of efficiency values of electric and electronic appliances and equipment are qualitative to aid consumers' purchase –decisions. Nonetheless, while these efforts are commendable, intensive research is required to develop resource – efficiency standards, indicators and indices at industrial, domestic consumption and production levels.

At national level, an assessment report on green growth done in 2014 by the United Nations Development Programme (UNDP) concludes that Kenya is already implementing various green economy initiatives. The fundamental challenge is to mainstream and align green economy activities across the social, economic and environmental spheres of society. This requires an integrated approach through the development of a strategy that identifies the costs, opportunities, trade-offs and range of policy instruments that support the transition to a green economy. Some of the key thematic areas to be considered include standards and regulations, financing, fiscal policy, and coherent and effective policy coordination.

Organizational fora such as the Kenya Sustainability Energy Day will bring key energy stakeholders to discuss strategies on taking the lead in sustainable energy development and financing clean energy projects. It is commendable that research has led to various innovations and technologies in the energy, water, agriculture sectors and value-chain supply as illustrated by articles in this issue of Joto Afrika.

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# Achieving Green Economy in Africa: What are the Options?

*Pupils at Lesiderai Primary School in Isiolo County display solar products. Solar energy can be converted into thermal or electrical energy. ©UNDP Kenya/James Ochweri*

**As the world journeys to implement the Sustainable Development Goals (SDGs), the question remains: how prepared is Africa to achieve SDGs? Will it be a missed target like the MDGs? Is Africa on the path of green economy?**

## Why Green Economy?

Green growth is described as a path of economic growth that uses natural resources in a sustainable manner. Green economy can be defined as one that results in “improved human well-being and social equity, while significantly reducing environmental risks and ecological scarcities” (UNEP 2010). In its simplest expression, a green economy is low-carbon, resource efficient, and socially inclusive development approach. In a green economy, growth in income and employment are driven by public and private investments that reduce carbon emissions and pollution, enhance energy and resource efficiency, and prevent the loss of biodiversity and ecosystem services.

Critical to attaining objectives of this approach to development, is to creating conditions for public and private investments to incorporate broader environmental and social criteria. In addition, the main indicators of economic performance, such as growth in Gross Domestic Product (GDP) should be adjusted to account for pollution, resource depletion, declining ecosystem services and the distributional consequences of natural capital loss to the poor.

A major challenge is reconciling the competing economic development aspirations of rich and poor countries in a world economy that is facing increasing negative impacts of climate change, energy insecurity and ecological scarcity. The world population continues to rise rapidly, by around 75 million people per year. Soon enough there will be 8 billion by the 2020s, and perhaps 9 billion by the early 2040s. These billions of people are looking for their foothold in the world economy. The poor are struggling to find basic food, safe water, health care, and shelter for survival. Those just above the pover-

ty line are looking for improved prosperity. Those in the high-income brackets hope that technological advances will offer them and their families even higher levels of well-being. However as we celebrate the progress made in economic growth, it is also important to understand that such growth is based on economic trajectory that relies heavily on fossil fuel and other natural resources. Yet for a species that depend on the beneficence of nature, or on what the scientists call “environmental services,” we are doing a poor job in protecting our natural capital.

A green economy can meet this challenge by offering a development path that reduces dependence on fossil fuel, promotes resource and energy efficiency and lessens environmental degradation. As economic growth and investments become less dependent on liquidating environmental assets and sacrificing environmental quality, both rich and poor countries can attain more sustainable economic development.

The concept of a green economy does not replace sustainable development; but there is a growing recognition that achieving sustainability rests almost entirely on getting the economy right. Decades of creating new wealth through a “brown economy” model based on fossil fuels have not substantially addressed social marginalisation, environmental degradation and resource depletion.

In order to achieve green growth, Africa must avoid carbon lock-in. For decades Africa development has been hugely based on the abundant natural capital base of the continent. During the past two decades Africa has embarked on a process of economic transformation. In almost every county and region, white papers have been developed to transform middle level economy as their new vision. For example in Kenya there is Vision 2030, Vision 2025 in Tanzania and Vision 2063 of the African Union. It is argued that industrial economies have been locked into fossil fuel-based energy systems through a process of technological and institutional co-evolution driv-

en by path-dependent increasing returns to scale. It is asserted that this condition, termed *carbon lock-in*, creates persistent market and policy failures that can inhibit the diffusion of carbon-saving technologies despite their apparent environmental and economic advantages. The notion of a *Techno-Institutional Complex* captures the idea that lock-in occurs through combined interactions among technological systems and governing institutions. While carbon lock-in provides a conceptual basis for understanding macro-level barriers to the diffusion of carbon-saving technologies, it also generates questions for standard economic modelling approaches that abstract away technological and institutional evolution in their elaboration.

Studies indicate that after coal and gas power, lock-in of personal, oil-based passenger transport (gasoline and diesel cars) is the most troublesome globally. Policy-makers, especially at the urban scale, need to avoid planning sprawling, car-based infrastructure. Policy-makers at all levels can adopt stringent fuel economy or CO<sub>2</sub>-intensity standards for new vehicles.

However, there is a major governance deficit in natural resources management around the world. This deficit is largest in countries that depend heavily on natural resources for development and growth. There is need to address specific needs, opportunities and challenges of the private sector with respect to green growth. Promoting entrepreneurship, addressing the investment constraints faced by women and young entrepreneurs and supporting micro, small and medium enterprises can scale up adoption of green growth policies.

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# Investing in Green Growth as a Priority

*Commercial biogas system for Tropical Power in Naivasha. The plant produces natural fertilizer that is channeled back to land. ©Victor Gathogo*

**The quantity and level of investment required to support the transition to a green economy is huge and various climate change actors have come together to support the process. This interview seeks to find out the progress made by various development partners and the private sector who have been the main drivers of the Green Growth agenda in Kenya with support from government ministries.**

## **What aspects of green growth are you involved with in Kenya?**

The Kenya Association of Manufacturers (KAM) has been supporting industries in terms of efficient energy use, energy audits and quality control. The association has been instrumental in undertaking capacity building for the members, encouraging exchange visits for members to learn best practices from each other on energy conservation measures. KAM is also involved in awareness creation on green energy at industry level, supporting industries through resource audits on water and waste water and advocating for efficiency.

## **Are there specific projects that you are involved in that address green growth?**

The association's function is focused on three key areas; energy adequacy, reliability, quality of power energy and reduction of cost.

The Centre for Energy Efficiency and Conservation (CEEC) at KAM runs an energy efficiency and conservation program designed to help companies identify energy wastage, determine saving potential and give recommendation on measures to be implemented. Some of the activities of the Centre related to green growth include: (i) Carrying out comprehensive energy audits; (ii) Identifying, developing and implementing bankable energy efficiency projects jointly with energy consumers; (iii) Awareness creation on Energy Management; (iv) Capacity Building among others.

## **What is the contribution of the private sector to uptake of green growth practices?**

The private sector in Kenya plays a catalytic role in spurring investments in technologies that facilitate industries to apply green growth principles. This has led to creation of green jobs, improved skills and knowledge on green growth as well as adoption of resource efficiency across many sectors.

## **What role is the manufacturing sector playing in tackling climate change and supporting green economy-based change?**

Over 600 energy audits have been conducted by KAM. This amounts to KShs12 billion in savings on energy due to efficient energy –use practices instituted after such audits.

An impact assessment study was carried out to assess and ascertain the energy conservation measures (ECMs) that have been deployed, quantify energy savings from these activities as well as the corresponding investment costs and identify barriers to implementation of ECMs.

Out of 100 sampled industries, 30% subsequently adopted efficiency measures that have created green jobs, contributed to reduction of CO<sub>2</sub> emissions and improved investment. The trickling effect was a saving of 17.4 GWh annually equivalent to about KShs279 million and about 4,800 tonnes CO<sub>2</sub> emission abated.

Building capacity amongst its employees and the general public on climate change and green economy has also been a focus area by KAM. Provision of affordable credit for renewable energy and energy efficiency projects has increased uptake of trainings and implementation of recommendations from energy audits.

## **Are there notable achievements in green growth in Kenya?**

The Climate Change Policy and Bill which was a joint effort of the government ministries, the private sector and civil society is still under review. The Energy Management Regulation 2012 published by the Energy Regulatory Commission (ERC) requires consumers of more than 180,000 units of electricity per year to carry out audits every three years. The policies within the energy sector are being reviewed and the climate change components have been incorporated. Counties are mainstreaming climate change into planning at county level with support from KAM. This is being piloted in seven counties and there is a possibility of up scaling to the rest of the counties.

There has also been a notable increase in green jobs. Industries have been implementing energy efficiency in water, equipment optimization and capacity building. The exchange visits have encouraged best practices in energy conservation and waste management and promoted efficient use of energy.

## **In moving forward to a green economy, what are the priority actions in line with Vision 2030 and other benchmarks set by Kenya?**

The green economy transition will support the goals of Kenya Vision 2030, by pursuing the country's development as a priority through designing green economy policies to create youth employment, especially given Kenya's demographic profile where youth constitute over 35% of the population.

## **What are the major challenges inhibiting a green economy in Kenya?**

The capital cost initially for going green was too high and therefore prohibitive. A number of local and international banks are beginning to appreciate the importance of climate change mitigation and are now funding renewable energy projects in the country. Lack of adequate knowledge on climate change has also been a challenge. In response, activities such as capacity building through trainings, seminars and workshops has bridged the knowledge gap and a number of issues such as incentives, tax measures and the minimum energy performance standards are discussed at such fora.

## **Any key lessons you have learnt in your experience over the years related to green growth?**

Transition to a green economy and the decoupling of resources should lead to an industrial growth that considers the 3 pillars of sustainable development; Society, economy and environment. Therefore Industries should embrace green growth that will promote inclusiveness in industrial development. Industries should embrace green growth. Inclusiveness in development and implementation of policies for the country is critical for successful transition to a green economy.

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*Interview was conducted by Mercy Mumo –ALIN*



# Scaling Support for Green Innovations

*Hydroponic system of agriculture.*  
@ Climate Innovation Centre

**Sub-Saharan African (SSA) countries urgently require new economic models that integrate green growth in decision making and development planning. This is because the region is among the most vulnerable to negative impacts of climate change and has limited adaptation capacity because of resource constraints and over reliance on natural resources. The media is always awash with stories of how SSA countries are being affected by intense weather related natural disasters such as droughts, floods, and storms.**

These events have wide ranging consequences, often directly destroying or limiting the gains from economic growth. Infrastructure is damaged, crops are destroyed, yields are reduced, homes destroyed and sometimes communities are displaced. Green economy provides an economic case for addressing climate change through promotion of green innovations.

The transition to a Green Economy is unlikely to be straight-forward. It requires strong leadership particularly from the government and a collaboration of all stakeholders and more so the private sector. The government will need to take the lead in creating the right enabling environment to support the up-take and diffusion of green technologies. The investment and innovative capabilities of the private sector are crucial for the transition to a green economy. With climate change as a reality, it poses a threat to resource availability; an innovative private sector that can develop disruptive products, services and technologies to adapt to climate change is required.

Unlike mitigation technologies which are concentrated in a few sectors such as energy, industry and transport, adaptation technologies are dispersed across all socio-economic sectors including water, health, agriculture and infrastructure. In addition, they should be more adaptable to local circumstances, which means that in addition to being socially acceptable they can be made less capital intensive compared to mitigation technologies. This makes them more

amenable to small-scale interventions and can therefore be easily promoted by small and medium enterprises (SMEs). Some of the green innovations required for adaptation range from water efficient irrigation systems; water recycling and purification; resilient building technologies; water management systems; drought-resilient crops; insurance tools and early warning systems.

The role of SMEs in promoting green innovations for climate change cannot be ignored. In Kenya for instance, SMEs employ up to 80 per cent of the population and accounts for about 45 per cent of the GDP. This is a common trend in other countries in Africa and hence the SME sector is very important to the economic development. SMEs are closely integrated into their communities allowing them to get products and services to hard-to-reach populations, they have local knowledge of consumer demand and supply and they can easily upgrade their current products to adapt to their customers' need and changing climate unlike large corporations. However, they face multiple challenges when trying to grow their operations including difficulties in accessing finance, lack of specialist knowledge and excessive regulatory burdens. Incubation centers like the Climate Innovation Centres (CICs) have been set up to specifically support entrepreneurs circumvent these challenges.

The CICs, supports enterprises that are developing green innovations to address local climate change challenges. The centers offer a suite of services key among them being access to financing through various stages of the technology growth cycle. At the early stage, CIC provides proof of concept grants aimed at establishing technical and commercial viability of the idea or business models through moving the technologies and products across the stages with high risk of failure. After the Proof of Concept the enterprises are assisted to access other forms of financing as the business requires chief among these being seed financing. This is aimed at supporting companies in the next

stage of their development where they require financing for further market testing and business model validation, leading to a full market roll-out. The other services that CICs provides SMEs include business advisory services and training; access to technical and office facilities; access to information and policy advice and advocacy.

The Kenya CIC for instance was the first of the CICs to be established and is an initiative supported by the World Bank's *infoDev* and funded by Danida and UKaid. It is one of the CICs being launched by *infoDev*'s Climate Technology Program (CTP). The other CICs are in Ethiopia, Ghana, South Africa, Morocco, Vietnam and the Caribbean. The role of developing partners in supporting the development and deployment of green technologies is of utmost importance. Development agencies can best support countries to make a transition to green economy effectively through supporting SMEs, providing policy advice to design and implement effective green growth policies; building human and institutional capacity; establishing international and regional cooperation; facilitating stakeholder involvement; and, communication to support green economy measures and encourage behavior change; and technical support.

Innovation is key to green growth. It helps separate growth from natural capital depletion and contributes to economic growth and job creation. Business is the driver of innovation, but governments should provide clear and stable market signals, for example through carbon pricing, better standards for green growth as well as providing mechanism for information the citizenry on the various options available to green their consumption and production.

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# Transition Towards an Inclusive Green Economy Based on SCP Practises

Workers samming and setting of leather before tanning process. © Kenya Leather Development Council

The United Nations Environment Program (UNEP) in collaboration with UNDP and UNOPS, through funding from the European Union (EU), is supporting Green Business Development in Africa under the SWITCH Africa Green Project. The project through policy support, small grants to the private sector and a networking facility aims to support African countries to transition to green economy through adoption of sustainable consumption and production (SCP) practises. The project is currently being piloted in six countries, namely Burkina Faso, Ghana, Kenya, Mauritius, South Africa and Uganda. In Kenya, through a Call for Proposals, four grantees were awarded as follows: COMESA, Leather and Leather Institute, Collaborating Center on Sustainable Production (CCSP), International Center of Insect Physiology and Ecology(ICIPE) and Kenya Private Sector Alliance (KEPSA) to a tune of USD 998,454.52. These were the awadees in 2015.

In Kenya, the project is coordinated by the Ministry of Environment, Natural Resources and Regional Development Authorities, in collaboration with a National Technical Coordination Committee (NTCC) with representation from key government Ministries/Departments/Agencies (MDAs), private sector, civil society organizations and the EU.

Green Business Development support in Kenya will contribute to the implementation of the Green Economy Strategy and Implementation Plan (GESIP) under the second Medium Term Plan 2013-2017 of Kenya's Vision 2030. This is envisaged to stimulate Sustainable Consumption and Production within Micro, Small and Medium Enterprises (MSMEs), seize opportunities in green business development, promote resource efficiency, environmental quality, create green jobs and tackle poverty. Kenya's private sector accounts for approximately 80 per cent of the GDP and provides for more than half of the wage employment. The MSMEs account for approximately two thirds of all non-agricultural jobs. This sector is constrained by low knowledge and skills; obsolete technologies and limited access to bank credits, among others.

The SWITCH Africa Green national projects in Kenya are piloting green business development in three sectors: Agriculture, Tourism and Manufacturing. Three multi-

country projects are also being implemented across the 6 pilot countries.

In [manufacturing](#), greening MSMEs leather clusters and the leather sector will contribute to improved productivity, reduction in waste production, improved management of physical and liquid waste, through recycling and reduction in the use of chemicals that have negative impact on the environment. Overall, support is being provided to develop a roadmap for improving effluent management and quantification of carbon footprint in the leather sector. The COMESA, Leather and Leather Product Institute in collaboration with the Kenya Leather Development Council are leading the project. The MSMEs in Nakuru, Nyeri, Kirinyaga, Nairobi and Kiambu counties will benefit from this project.

The project's capacity enhancement for green business development and eco-entrepreneurship in the [agricultural](#) sector aims to enhance capacity of small businesses to develop, adopt and implement appropriate frameworks for sustainable production and consumption practices for agri and agro-based MSMEs. This is undertaken by the Kenya Private Sector Alliance (KEPSA) through Kenya Agri-business and Agro-industry Alliance (KAAA) to seize opportunities for green development; increased trade and investment in green technologies nationally and at county levels. This project will benefit MSMEs in Nyandarua, Machakos, Kitui, Kiambu, Kisii, Nyamira and Tharaka Nithi counties.


In the [tourism](#) sector, the project seeks to contribute to development of sustainable tourism (SUS-Tour) through promoting customer oriented innovation and marketing of community-based tourism (CBT). This aims to improve rural livelihoods and conservation of culture and natural environment. Specifically it targets transfer of knowledge from international best practices to provide guidance for CBT development. Community based tourism (CBT) emphasizes the involvement of local communities and the control of tourism resources by local communities. Collaborating Center on Sustainable Production (CSCP), Germany in partnership with Eco Tourism Kenya and Federation of Community Based Tourism Organizations (FECTO) will support the CBT MSMEs in Baringo, Elgelyo, Marakwet, Homa Bay, Bungoma, Busia, Kajiado, Kakamega, Kilifi, Laikipia, Makueni, Nandi, Narok, Nyamira,


Nyeri, Siaya, Trans Nzoia and Uasin Gishu counties to adopt best practices in this sector.

The project promotes up-scaling [sustainable](#) commercial production of medicinal plants by community-based conservation groups. This is aimed at transforming the on-going community-based commercial production of medicinal plants and products into small and medium-sized green social enterprises through enhancing on-farm growing of the medicinal plants. This also enhances local livelihoods and environmental conservation. The International Centre of Insect Physiology and Ecology (ICIPE) in partnership with Muliru Farmers Conservation Group (MFCG) in Kakamega is implementing the project.

Under SWITCH Africa Green Multi-country projects led by the Kenya National Cleaner Production Center (KNPCPC) will support MSMEs to adopt ecologically SCP practices and patterns through industrial symbiosis. This will result in improved resource efficiency, reduced costs of production and reduced industrial pollution that will contribute to creation of green jobs, improved revenue to the MSMEs, and informed policy making and hence trigger policy reforms and environmental sustainability. The other multi-country projects by Empretec Mauritius and SEED will support the MSMEs in green business development by benchmarking and training on best practices that are adaptable for greening businesses, enhancing the capacity of business development services (BDS) and building functional markets for green products and inclusive BDs.

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# Women and Green Energy: Mitigation Impacts at Household Level

*A woman baking queen cakes using an improved charcoal oven at Nguruman in Kajiado County. ©Noah Lusaka*

**In Kenya, wood fuel and crop residues serve as the primary source of fuel. It is principally women and children who carry out the task of collecting these fuels. Increasing degradation of natural habitats that serve as sources of wood fuel leads to women spending more time and physical effort fetching wood fuel. There are serious health impacts associated with burning traditional biomass fuels. Open fires in the home produce unventilated smoke, and women and children, who are most often in the house, are exposed to high concentrations of particulate matter, carbon monoxide and other pollutants.**

While production and promotion of renewable energy products has been going on for years, penetration of these products in households and institutions is still very low. Most households still cook using firewood on inefficient three-stone-fires and kerosene for lighting. Access to clean energy for cooking and lighting is hampered by a number of challenges in the three main areas of supply, demand and an enabling environment. At the same time, women's participation in these energy markets has been low and not as profitable compared to men. Women entrepreneurs have been plagued with challenges such as limited access to financing due to lack of collateral as well as the small size of their enterprises.

Previous policy measures for instance the Sessional paper No.4 of 2004 on energy are gender-neutral with no specific mention of what will be done to eliminate gender disparities with respect to each policy measure. However, with the launch of Sustainable Energy for All in the year 2010, gender perspectives have been adequately mainstreamed in the Kenya's Action Agenda and Investment prospectus. In particular, it emphasizes that '*gender perspective has come into play especially in terms of addressing modern cooking services that reduce the burden of wood and fuel collection and decentralized solutions*'.

Practical Action Eastern Africa, in partnership with Sustainable Community Development Services (SCODE), and with the support from the International Network on Gender

and Sustainable Energy (ENERGIA) are implementing a programme with two components, namely; Women in Energy Enterprises in Kenya (WEEK) and the Advocacy for Energy and Gender in Kenya (AGEK). The project targets seven counties (Kisumu, Kakamega, Siaya, Nakuru, Nyeri, Murang'a and Nairobi). The WEEK component aims to strengthen women's capacity to effectively participate in and benefit from energy markets, both as actors and beneficiaries while the AGEK project aims to lobby and advocate for the adoption of women empowerment approaches in delivering new targets for universal modern energy access at county, national and international levels.

The WEEK project is directly targeting 730 small-scale women energy entrepreneurs operating businesses in the project target areas of Kenya and generating more income through selling of clean energy products and services and employing others. The indirect beneficiaries include 364,200 consumers including poor women, men, children and institutions in the project areas and beyond accessing and using low cost cooking fuel and fuel efficient conversion technologies (Improved Cooking Stoves).

There are 450 women, youth and men employed by the modern energy enterprises in the project area. Of these, 50% are women. The women are involved in production and selling of improved cook stoves and briquettes and selling solar energy products such as solar lanterns.

The high up-front costs of access to modern energy services affect female-headed households more severely, often over-represented in low-income quintiles. In most cases women are excluded from energy projects development, technical training and financing considering they are mainly responsible for household energy provision, and are the final end-users of household energy products. Most energy projects do not always take into consideration the gender perspective because women's access to decision making within the household and community is restricted, limiting their ability to influence processes and resource allocation on many issues including energy.

For gender aspects of the energy-poverty nexus to be adequately dealt with, two major changes must take place. First, women have to be empowered to make choices about energy. Enabling choice is linked to issues of sustainable livelihoods and poverty alleviation, including access to income generating activities. Second, it requires changes on energy supply and responsiveness by the energy sector in the provision of equipment using modern energy forms that reduce the drudgery of women's labour. Such equipment should be affordable to low income households.

Moving forward, there is need to involve women in the selection of technologies (e.g. cookstoves) and in the selection of relevant research topics in support of the Sustainable Energy for All (SE4All) targets. This includes: (i) provision of relevant training to women on business development services, (ii) water management or water storage for energy-saving purposes, (iii) biogas installation and improved cookstoves production and use, (iv) involving women as entrepreneurs in the value chain for marketing the stoves and other renewable energy technologies.

Integrating green growth in our schools curriculum will be an effective way of creating awareness right from a tender age. Secondly, strengthening interministerial committees on green growth will ensure incorporation of best practices in all the ministries hence creating awareness as well as using the media to communicate these issues. Development that is not engendered is endangered and therefore, gender mainstreaming is key in all aspects of development as energy is an enabler of development.

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# Renewable Energy Innovations at Household Level

*A woman cooking using biogas. The growing population has led to an increase in demand for energy. © Brian Inganga*

**The Paris Agreement on Climate Change underpins the importance of increasing renewable energy in developing countries. The Agreement also adopts an ambitious emission reduction target consistent with holding the increase in the global average temperature to well below 2 °C and while working towards 1.5 °C above preindustrial levels. The high mitigation ambition calls for scaling up of clean technologies, which will strengthen growth of low carbon investments across different sectors.**

The preamble and sections of the Agreement on adaptation also calls for gender equality and women empowerment, as well as adoption of gender-responsive approaches in capacity-building efforts by countries. In most developing countries and African countries in particular, opportunities to respond to energy crisis and gender needs are unexploited. Potential in renewable energy and in particular efficient use and conservation of biomass and green non-biomass solutions at rural household level is unexploited.

Over the centuries, a lot of progress has been made to exploit and to convert renewable energy resources into usable forms. Conversion methods and tools have also evolved over time but improvement of efficiencies is still evolving. Despite this progress, 700 million Africans do not have access to clean and efficient cooking methods mainly due to high costs and culture. The consequence of this according to the World Health Organization is that globally, 1.6 million annual deaths are attributed to indoor air pollution from cooking using firewood, dung and organic waste. In Africa alone, over 600,000 women and children die every year from the impacts of indoor pollution.

The goal of the UN-initiative on Sustainable Energy for All (SE4All) inspires universal access to modern cooking solutions by 2030. In particular, the Post-2015 framework on Sustainable Development Goals (SDGs) requires concerted efforts from all to lift women and children out of smoky kitchens and reduce time and money spent sourcing for fuel. Particularly relevant to clean cooking is Goal seven on access to affordable, reliable, sustainable and modern energy for all. Universal access to clean cooking solutions is also essential to attainment of many SDGs such as Goal three on reducing global mortality and improving overall wellbeing; Goal four on inclusive and equitable education for all children; and environmental sustainability as stated in Goal 13 on Climate

Change; Goal 14 on Water; Goal 15 on Land Resources and Goal 17 on International Co-operation.

The high population growth rate and energy demand for cooking requires a transformation in the way we produce, deliver and consume energy particularly at the rural household level. The current household energy system depends on biomass whose combustion according to Inter Governmental Panel on Climate Change (IPCC) accounts for 25 per cent of global black carbon emissions. Black carbon makes up a significant proportion of fine particulate matter, which is a pollutant most associated with premature death and morbidity. Non-biomass cooking solutions such as Liquefied Petroleum Gas (LPG) and biogas technology can offer renewable energy solutions in reducing organic pollutants. Studies have shown that improved cook stoves can save between 35 per cent and 80 per cent of wood or charcoal compared to traditional cooking methods.

According to the Intended Nationally Determined Contribution (INDCs) for sub-Saharan Africa, the highest greenhouse gas (GHG) abatement potential is on carbon sequestration projects. About 70 per cent of the sequestration is attributed to Land Use, Land Use Change and Forestry (LULUCF) and Agriculture, Forestry and Other Land Use (AFOLU) as well as the use of biomass energy and household food security programs. All these are areas predominantly in the domains managed by women and children especially in rural settings.

The INDCs also have specific interventions for household energy systems and associated policies with expected positive impact on both climate change mitigation and adaptation. This calls for rigor in planning, management, investment and monitoring of actions in clean cooking as well as focused financial resource-mobilization, policies that promote resource use efficiency, development non-conventional renewable energy, innovation and research as well as social equity and gender equality.

These initiatives must be supported with meaningful actions, leadership and partnership and should culminate in not only developing products and services that are cost and need efficient, but also scalable, sustainable and gender responsive.

It is therefore important for African Countries to take appropriate steps to develop national consultative mechanisms that are aligned to transition to clean cooking technologies and

gender responsive low carbon investments. To achieve these, bold, transformative and adaptive leadership in formulating green growth policies and strategies is obligatory. Concerted efforts must be made to deliver policies in all relevant sectors that incentivise and remove the biggest barriers to adoption and use of clean cooking methods. The idea is to have accessible least cost products with maximum impacts on household health, time and budget while reducing emissions and enhancing resilience.

One of the biggest barriers to adoption of clean cook stoves in Africa is culture. It is also worth noting that there is no one size fits all cook stove, and manufacturers must be encouraged to tailor their products to local culture to increase adoption rate.

Users must be the champions of this transformation as they are directly affected and understand the challenges and possible local solutions. Innovative payment systems such as easy mobile payments, household credit facilities, revolving funds as well as timely and coordinated technology transfer to users can have a significant impact in acquisition and use of clean stoves. Successful adoption of solar technology such as Women Barefoot Solar Engineers, which includes some grandmothers, who are delivering energy in rural areas, can be emulated.

Integration of benefits from clean stoves should also be included in education and curriculum to ensure awareness is increased and that people are equipped with skills and passion to implement at an early stage. Training and awareness can also be effected using innovation and demonstration centres to train local entrepreneurs and build a pool of technicians of both genders. Clean cook stoves can enhance livelihoods through local production or maintenance as well as inclusive and equitable education for more children as articulated in Goal number four of the SDGs.

Adoption of clean cookstoves is a win-win for health, environment and climate change, with several co-benefits on other sectors. We must take bold steps to reduce long term impacts and remedial costs associated with unclean cooking methods.

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# Practicing Education for Sustainable Development through Eco Schools

*The chef at St. Mary's Girls Primary School in Machakos preparing a meal using an improved energy saving jiko. © David Wandabi*

**Eco-Schools is an international initiative by the Foundation for Environmental Education (FEE) designed to encourage whole-school action on sustainable education issues developed in 1992. It is an environmental management tool, a learning resource and a recognized award scheme. As a strategy of promoting education for sustainable development, it empowers young people to take action towards an economically, socially and environmentally just world.**

The programme has been implemented in Kenya by the Kenya Organization for Environmental Education (KOE) since 2004. The KOEE is a chapter of FEE in Kenya. It aims at raising students' awareness of environmental and related sustainable development issues through classroom and outdoor study together with school and community action. It also provides an integrated system for environmental management of schools.

An Eco-School is a facility that puts environment in its totality at the center of teaching and learning, ensuring environmental concerns are part of the curriculum and day-to-day running of the school.

As a strategy for implementing Education for Sustainable Development (ESD), the Eco-schools programme focuses on achieving educational goals as well as sustainable environmental management through schools as entry points to communities. The programme empowers young people with skills and values to promote

healthy lives within their environment, enhances active learning competencies, builds capacity of teachers and creates an opportunity to implement development goals by schools.

Based upon experiences of the programme in formal education in Kenyan primary and secondary schools, it has led to improved quality of teaching and professionalism, enhanced learning environments, innovative curricular approaches, improved school management capacity, and better accountability systems as some of the key drivers of quality education.

Eco-Schools framework provides numerous opportunities to enhance learner-centred education, through contextualization of learning, through strengthening school-community interactions/partnerships and through enabling active involvement of learners in decision making. This enables creation of a nexus between formal, informal and non-formal learning.

Over 500 eco schools have set up income generating micro-projects addressing local environmental problems. The micro-projects have been used as out-of-classroom curricula teaching and neighboring communities have emulated the projects.

The programme has enhanced partnerships and networking which is a prerequisite for global efforts for combating climate change and poverty reduction. School-community cooperation, school networks and exchange programmes have also been established for dissemination

and exchange of information through visits, the local press, newsletters, television, radio and social media.

The programme has developed the first ever-Kenyan environmental education materials for teachers and learners that comply with the curriculum requirements to treat environment as a cross curricula subject. These have acted as tools and resources through which schools address their sustainability challenges. The materials have been widely acknowledged by relevant authorities in the Kenyan educational sector. The Eco-school approach has also been widely reflected in key policy papers of Kenya government such as the National Strategy for Education for Sustainable Development.

Biogas technology and rain water harvesting promoted in schools – has created jobs for artisans, clean water for schools and communities. The slurry; a by-product from the biogas is used for organic farming. Biogas technology has contributed to reduced emissions of Green House Gases (GHGs) Emissions.

The Eco-schools Programme has seen numerous schools in Kenya make gains in efforts towards reducing expenditure on energy for cooking and contributing to climate change resilience. For example, St. Mary's Girls' Primary School in Machakos County, as a component of the Eco-school Programme, conducted an environmental audit and found out that expenditure on firewood was high. The school was supported to install an energy-saving jiko as a measure to control the situation.

Consequently, the school has undergone great transformation in terms of resource efficiency and improved teaching and learning. According to the school head teacher Sister Veronica Kinyambu, the school has seen a reduction in amount of firewood used per term drop from eight lorries to about three. The project has improved the school feeding programme which has been evidenced by the growth in enrollment numbers. The programme now supports over 200 girls. Initially, the school could only support about 50. Other projects by the school emanating from the energy –saving initiative are a woodlot and goat keeping projects.

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*Pupils from Dol-dol Primary School in Laikipia County enjoy their lunch. Schools need to invest in improved energy saving jikos. ©Noah Lusaka*





# Biogas Lighting up Kwa Njenga Primary School

The administration block at Kwa Njenga Primary School. © Noah Lusaka

**In the wake of commitments by governments to provide clean energy to its populace, there is need to give incentives to private investors that can offer off grid solutions to reach households with no access to the grid. The private sector has some of the ground breaking technological innovations in renewable energy sector. Kenya is at the forefront of global efforts to combat energy poverty through innovations for community level electrification focusing on low carbon decentralized energy solutions that are in line with solid indicators in SDG 7 and Sustainable Energy for All (SE4ALL) framework by United Nations.**

Lack of proper sanitation in many school settings across the slums has been a major cause for concern in the past. Facilities that are considered necessary for learning institutions like toilets are poorly constructed due to limited resources. At the heart of Embakasi East Constituency sits Kwa Njenga Primary School in an informal settlement with a population of over 2000 pupils. During the rainy season the school toilets flood and access to the institution becomes almost impossible due to the blockage of the sewer. Students opt to stay home until the mucky waters subside. A new innovation called *bio-latrine technology* that converts human excreta through a bio-digester into energy is in use at the school as an option to clean energy access.

In 2014, Afrisol Energy Company Ltd got financial support from Power Africa that was launched by President Obama to support off-grid clean energy access in sub-Saharan Africa. In partnership with other stakeholders including Safaricom and the school commu-

nity, Afrisol Energy successfully installed a bio latrine facility in the school to improve sanitation and for production of biogas. The biogas produced is equivalent to 18 kilograms of LPG gas per day and is used to run a generator that produces 15 kilowatts of electricity. This supplements the main grid connected to the school that experiences frequent blackouts due to interference by the local community.

The project was implemented between March 2014 and July 2015 in three main phases. The implementation phase involved construction of a 12 toilet- block for boys and girls. The project employed the local community to provide unskilled labour to encourage ownership. *The second phase* involved construction of a fixed dome digester system with a capacity of 124cubic metres. The digester was then connected by pipes to the toilets block. Once the waste material enters the digester, a number of biological processes take place decomposing the waste into biogas and slurry. The biogas is methane gas that collects in the upper part of the biogas digester chamber. An outlet pipe on top of the dome was then connected to the gas storage bag of 50 cubic metres. After gas generation, the odourless slurry flows to the outlet chamber.

*The third phase* involved purchasing and installation of a biogas powered generator and wiring for electricity distribution to the classrooms and the security mask. The biogas in the storage bag was then connected to the generator where it's used as fuel. Finally an ultra violet treatment chamber was construction for recycling the waste water for flushing the toilets.

Mr. Amos Nguru, the CEO of Afrisol Energy noted that the facility has changed the lives of the school and the surrounding community. The toilets use minimal water as they are

flushed from one central point while still maintaining high standards of hygiene. The electricity generated is used to light up the school for approximately 10 hours a day and high mask light to improve security in the neighborhood at night. The school uses the power to run the computer laboratory and the administration office.

The school's headmistress Mrs. Syprine Onguka lauded the initiative terming it as a welcome relief in hygiene for the school and waste management. "Due to the blockage of the sewer line, the excreta is extracted from toilets into drums and ferried by hand carts for disposal in a nearby river polluting it! The initiative has helped a lot in retention of students in school," she noted.

Mrs. Onguka noted that the initiative supplements power supply which has been unreliable in the slum due to frequent vandalism. Kenya Power erected a transformer in the school compound but it has been subjected to illegal connections thus not being able to supply power as intended to the classrooms. "Since the inception of the new block children spend less time queuing to use the toilets and this has contributed to a conducive learning environment," said Beatrice Onchonga, a parent at the school.

Among the challenges include lack of a perimeter fence around the school that has caused insecurity. Key project installations like water pipes, taps, some parts of the generator and the 50 cubic metres gas bag holder were stolen affecting the smooth running of the project. Mr. Nguru intends to set up a bakery and a welding enterprise for income generation and to create jobs for the community.

The bio-latrine technology is a practical innovation demonstrating green growth in a school environment. The Kwa Njenga experience is worth scaling up in other schools to generate electricity and gas for cooking food therefore contributing towards reduced deforestation.

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Amos Nguru, CEO Afrisol Energy inspects the biogas generator at the school. ©Noah Lusaka



# Green Growth and Renewable Energy Development in Kenya

*A man drying briquettes before packaging. Briquettes are much cheaper and more energy efficient than charcoal, they burn for longer; produce less harmful smoke. ©Brian Inganga*

**Green growth goes beyond reducing greenhouse gas emissions (GHG) and requires development initiatives to make environmental sense in addition to making financial and economic sense. The development of renewable energy in Kenya has achieved notable successes with geothermal now playing a prominent role in supplying electricity through the main grid infrastructure at the national level. At the industrial-commercial level, several companies have invested in renewable energy generation including VegPro Group in partnership with Tropical – who have developed a 2.2-MW biogas power generation plant while Williamson Tea in partnership with Solarcentury have developed the largest solar plant in East Africa generating 1-MW of power from solar PV.**

Annual generation is estimated at 1.6 million kWh. The Kenya Tea Development Agency is also developing several small hydro plants to supplement electricity from the grid and substitute the use of expensive biomass energy for processing tea. Garden City, which is one of the leading shopping areas in Nairobi is also developing a 0.85-MW solar PV project covering their parking areas. At the household level, the uptake the solar PV lighting systems and devices has been phenomenal with innovative business models including the pay-as-you-go and lease-to-own business models becoming more prominent with an estimated 2 million solar devices sold to the market. This is expected to reduce the dependence on kerosene for lighting.

Key drivers of this growth includes a supportive policy environment with a proactive Ministry of Energy and Petroleum and regulator – the Energy Regulatory Commission, who have instituted initiatives like the Feed-in Tariff Policy, a one-stop window of licensing and permitting information through the ERC renewable energy portal, VAT and import duty exemption on solar PV equipment and willingness to continuously listen to and engage the private sector.

Although much more can be done, a lot has been achieved so far. Development agencies have also played a key role in prioritizing this sector with initiatives like the Lighting Africa (World Bank Group) to develop solar PV sector standards, raise awareness and increase knowledge on the sector; French Development Agency R-TAP and now SUNREF programs that provide technical assistance and access to finance to renewable energy and energy efficiency projects; GIZ result based financing for mini-grids and the pro-solar program; DFID's support to the climate innovation center Kenya Association of Manufacturers, green mini-grids program, among others.

This has resulted in companies like Ubbink based in Naivasha, who are the first solar PV assembly and manufacturing facility in Eastern and Central Africa. Private sector association including Kenya Renewable Energy Association (KEREAA), Kenya Private Sector Alliance (KEPSA), Association of Biomass Contractors (ABC-K) and the newly inaugurated Association of Energy Professionals in Eastern Africa (AEPEA) create platforms to channel and address energy sector issues and concerns.

Various challenges remain including access to finance for new and innovative business models (e.g. project finance for energy service companies), limited understanding of the energy demand side dynamics (the last comprehensive national demand side study was done in 2001-2 resulting in the KAMFOR report), policy gaps and constraints (e.g. the licensing procedures for private sector mini-grids), lack of viable alternatives for heating and cooking especially in rural areas (unsustainable firewood and charcoal still play a prominent role), uncertainty created by the county government structure (e.g. contributing to the stalling of the Kingangop Wind Project), access to land for renewable energy project development, among others. There are however various initiatives that are addressing most of these challenges. Overall, the forecast on renewable energy development in Kenya looks positive from the national (utility) level to the household level initiatives. Green growth in Kenya is set to be driven by renewable energy development.

EED Advisory is a boutique consulting firm with service offerings in the energy and environment space delivered through three business lines (i) sustainable energy, (ii) climate change and (iii) natural resource management. EED Advisory is involved in a several projects contributing to the green growth initiative.

For more information visit [www.eedadvisory.com](http://www.eedadvisory.com)

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## Women In Sustainable Energy and Entrepreneurship, WISEE

The Kenyan Solar photovoltaic (PV) market is among the largest and most dynamic among developing countries in Africa, with a constant growth of over 10 per cent per year over the past decade. Household solar PV systems account for 75 per cent of sales of solar PV systems sold nationally. However, market reviews and field assessments of installed systems have reported persistent complaints, underperformance or complete failure of many systems due to various reasons including poor design, installation and maintenance. To address this, the Energy Regulatory Commission (ERC) since March 2013, has been accrediting Solar PV technicians in Kenya.

As at mid-March 2016, there are 267 ERC licensed solar PV installers in Kenya. Of these only 16, or six per cent, are women. Women In Sustainable Energy and Entrepreneurship, WISEE, (pronounced "Wise") is a group comprising women engineers, trainers, technicians and entrepreneurs whose objective is to empower women to acquire,

use and promote renewable energy technologies to increase their participation in the clean energy sector and to contribute to enhancing household energy access in Eastern Africa. It is drawn from over 60 women trained in Kenya since April 2015, under a USAID-funded VOTEC Solar PV technical training programme, through a partnership between Strathmore University and Arizona State University.

As a result, several women have successfully obtained ERC accreditation; some are designing training programmes in their institutions; while others are using their newly acquired skills at their places of work or to start up their own or enhance existing solar PV businesses. WISEE is currently developing partnerships in order to conduct more technical training of women to increase their capacity to design, install and maintain clean energy technologies especially in the counties.

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# Waste to Energy: A Case for Upscaling Biogas Technology

The Nyongara Slaughter House in Dagoretti , Nairobi. Waste from the slaughter house is being converted into biogas energy. © Brian Inganga

**Waste management is a critical issue in Kenya today with every urban centre facing growing challenges. Most of this waste is biodegradable accounting for approximately 60 per cent; about 38 per cent is made up of plastic, paper, glass & metal; 20 per cent of which is recycled, mainly by waste collectors and small operators. The bio-degradable fraction goes up to 90 per cent for certain industrial sectors such as abattoirs and horticultural farms. This fraction is a good potential for biogas generation whilst the other fractions can be recycled or incinerated with energy recovery.**

The National Environment Management Authority (NEMA) has formulated a Waste Management Strategy whose aim is to achieve zero waste as a guiding principle. The strategy has been prepared to enhance public health protection, reduce waste management costs and to protect the environment. By 2030, the strategy has a goal of achieving approximately 80 per cent waste recovery through recycling, composting, setting up sanitary land - fills and conversion of waste to energy.

The Waste Management Regulations of 2006 require waste to be managed in an environmentally sound manner. Following the implementation of the Constitution of 2010, the waste collection, transportation and

disposal at dumpsites, has been devolved to the Counties. The counties have inadequate infrastructure, systems, and other resources to manage waste. Consequently, there is indiscriminate dumping, lack of waste segregation and limited recycling across the country. Less than 50 per cent of waste is collected by licensed companies. Stakeholders including the private sector have been working towards improving production and consumption systems with the goal of instituting efficient use of natural resources and other material inputs to reduce generation of waste among other objectives. Hence in 2015, the Kenya Government completed the development of a Green Economy Strategy and Implementation Plan (GESIP).

The GESIP provides a framework for transforming the country to an inclusive green economy by the year 2030. This transformation requires that all economic and social development sectors adopt a low carbon climate resilient and pollution prevention practices. With respect to waste management, this means that waste must be commercialized through conversion to useful products. The meat processing industry and the slaughterhouses in particular, found all over Kenya, provide an excellent example of opportunities to recover valuable resources from waste. Effluent consisting of blood and

gut content pollute water sources leading to waterborne diseases and endanger the environment. This contravenes effluent discharge standards often with closure threats by NEMA. Closure is the fate that befell Dagoretti's Nyongara abattoir that slaughters on average 100 cows per day. The cost of managing the abattoir waste was high. Exhausting one lorry of effluent costs KSh10,000 and for this abattoir about 15 lorry loads were exhausted every month. Consequently, a strategy that turns abattoir waste into feedstock for a biogas plant was implemented. This gas is used for cooking, heating water and generating electricity while the nutrient-rich slurry is used as fertiliser. In Nyongara, 300 kilograms of waste per day generates 9KWh of electricity. The electricity meets the abattoir's requirement with a potential to supply gas to the nearby communities.

Another slaughterhouse Keekonyokie, in Ngong, generates biogas as part of its waste management strategy. Electricity is generated from the biogas for supplying electricity to the meat cold rooms running meat processing equipment and heating water for sterilizing and washing the abattoir. Efforts are on-going to package and sell excess biogas to the local community. If this is replicated elsewhere, the likelihood of greening the environment and supplying green energy is immense.

A critical set-back is that government policies do not provide incentives for such projects to be up-scaled. Transforming to a green economy requires fiscal policies that promote innovation of technologies to manage waste and incentivize importation of waste management equipment and technologies in case of local short-falls. Therefore, incentives such as training for technology designers and operators, concessional terms for accessing finances for investing in renewable energy technologies should see green entrepreneurs emerging in the waste management sector and thousands of green jobs created.

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The biogas production facility at the Dagoretti slaughter house. ©Brian Inganga



# Pico Hydro Electricity Innovation Lighting Homes in Murang'a County

*John Magiro who has been producing 15 kilowatts of electricity for 78 households in Mihuti Village, Murang'a County. © Mercy Mumo*

**In the heart of Mihuti village Muranga County, an impressive innovation is changing the lives of many homesteads. John Magiro who is 24 years old has been producing 15 kilowatts of electricity for 78 households. The residents pay a monthly fee of KSh100 of which KSh20 is maintenance fee. When he first piloted the project in 2013, he supplied to five homesteads. Amongst these was his mother's home and within no time word spread across the village about his invention. Villagers soon trooped to his home to have their mobile phones charged.**

Magiro's family lives close to Gondo River that has a small waterfall which he identified as a potential hydroelectric source. His financial input came from the sale of rabbits and goats which Magiro reared at a small scale. From this he raised KSh6000 which he utilized in acquiring readily available materials such as old bicycle parts and simple motors to generate electricity from the waterfall. This was the beginning of Magiro Hydroelectric power plant, in Ireke Village, Kangema town in Muranga County.

His interest in electricity began while in class 4 where his curiosity on how a generator that was using fuel produced electricity. Using the same concept, he wondered how a bicycle dynamo could produce light. While in high school, he bought his first generator at KSh3500. By this time he had set up a wired post from the river to his home. After testing, he discovered that he could produce electricity.

"I wanted to eliminate the cost of fuel for the generator so I disassembled the generator and developed a mechanism to use water to turn the turbine," said Magiro. He modified the generator by installing a turbine, using a bicycle rim as the wheel. This was successful and he first produced 300 volts and has managed to regulate it to 240 volts.

The mechanism of the hydro-plant uses a very straight forward mechanical approach. Water from the river is channeled to a turbine where water is pumped into an alternator or generator. Electricity is produced and transmitted through an aluminium transmission line which is

16mm. The supply covers a radius of eight kilometers. Magiro can control the voltage of power from the turbine or from the control room which is at his homestead. As a result of the community's sense of ownership, the power plant has never been vandalized.

Families on Magiro's grid now have more disposable income. Instead of spending KSh2400 per month on kerosene to light their homes, they pay only Ksh100 per month to Magiro. Students can now study easily at night without straining. Magiro has also set up two security lights on the road that leads to his home to enable residents feel safe when walking at night.

In 2014, Magiro participated in NETFUND's Green Innovations Award and won first place in the Individual Category, earning him a place in the Incubation Program. In the program Magiro has received business training from Daystar University.

This is in addition to access to business and technical experts who advice on the technological and business components of the innovation with an aim of increasing its effectiveness. The legal aspects of business registration and negotiation of the lease are ongoing. Energy Regulatory Commission (ERC) has been brought on board to advice on the legal and standard requirements for mini hydro electricity generation. Through the Incubation program, Magiro is being facilitated with website and brand development.

The project will receive seed funding worth KSh2.38 million for the installation of a generator, turbine, Control System, pressure Pipe, stabilizer, power Line Cables, a transformer, D-Iron, Posts, Power House Revamping. Construction has already begun and once completed, Magiro will be generating 150 Kilowatts of electricity, targeting 500 homesteads.

The will translate to more electricity to power devices, individual meters for each homestead and increased income for him. In the near future he hopes to have a paybill number to facilitate easier payment of electricity. Magiro currently has five full time workers and six casuals.

In the village, an elderly man Habbakuk Shem Chege Kiragu who is 105 years old has allowed Magiro to use a section of his farm next to the river bank to lay the new water pipes. In return, Magiro has been providing him with electricity at no cost. "This young man has saved me a lot of energy related costs so why not support this venture. At the end we will all benefit with reliable power at an affordable rate," noted Chege.

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# Green Building Standards and Codes

*The UNEP and UNHABITAT Headquarters at Gigiri which is green compliant in its architecture. © UNEP flickr*

**The concept of green cities or sustainable cities is increasingly becoming popular in both the developed and developing countries. This is because it has become apparent that nature can no longer sustain human activities that over draw on natural resources either from consumption or production perspectives and hence destroy the environment. As we move towards sustainable cities, we need to have green building standards that will guide various developmental projects which in the past have been associated with wanton environmental destruction.**

One of the major drivers of growth of cities is the construction industry. Yet, this industry has also been associated with major destruction of wetlands and forest reserves, massive pollution, and high use of energy all of which threaten sustainable development.

A green building is designed to use efficiently resources like water, energy and materials in the construction and maintenance of such buildings. It is on this background that Green Africa Foundation found it necessary to come up with standards to help ensure that buildings adhere to green standards. Green Africa Building Standards was established through a consultative process that brought together various stakeholders. These included Kenya Bureau of Standards, Architectural Association of Kenya, Institution of Engineers of Kenya, Ministry of Environment, Natural Resources and Regional Development, Ministry of Public Works, Ministry of Housing, Nairobi City government, Kenya Industrial Research and Development Institute, Energy Regulatory Commission, Ministry of Roads, University of Nairobi, and Jomo Kenyatta University of Agriculture and Technology.

The stakeholders set up a board, and developed seven metrics that buildings will be evaluated on, in order to be awarded a "Green Mark" certificate based on how well they meet the set criteria. The metrics are as follows:

1. Sustainable Site and development which aims to ensure that construction and use of buildings do not affect the surrounding ecosystem.

2. Energy Efficiency which seeks to ensure that there is efficient use of energy and that use of renewable energy is promoted.
3. Materials and Resources focuses on how to ensure that construction of buildings is done in a way that minimizes depletion of material resources.
4. Water Conservation and Efficiency promotes efficient use of water as one of the most important resources needed by sustainable cities.
5. Indoor environmental air quality metrics emphasizes on the need for the buildings to be conducive for occupancy.
6. Operation and Maintenance Management metric focuses on how well these buildings can be utilized without posing threats to the surrounding environment.
7. Innovation looks at how well the building is designed to use renewable energy, minimize resource wastage, and enhances comfort for the occupants.

Currently, the certification is awarded on a voluntary basis, with the classification ranging from Bronze, Silver, Gold, Platinum, and Diamond. The Government of Kenya, through its various agencies, has pledged support for the new certification program that seeks to transform the construction sector in Nairobi and other emerging urban centers within the country. However, a lot more still needs to be done in terms of sensitization of the public and players in the construction industry about these standards and how they can be achieved.

Kenya currently uses the Leadership in Energy and Environment Design (LEED) and the Green Star certification to evaluate a building for environmental friendliness. Since the adoption of the Green Star Certification tool in Kenya, there are nearly 5 projects targeting certification and the number is set to increase in the coming years as the country embraces green innovations as the number one choice for construction. According to the green city market brief on Nairobi, there are 15 LEED registered projects in Kenya which are not yet certified as at February 2015.

However, to date they have 3 successfully LEED Certified projects which include Eaton Place (LEED for Core and Shell), Citi Bank, Eaton Place (LEED for Commercial Interiors) and World Bank, Delta Towers (LEED for Commercial Interiors).

Kenya has a number green buildings which include the UNEP Headquarters in Gigiri which is a central pillar of the UN's broader goal of reducing its greenhouse gas (GHG) emissions. Others include Two Rivers Mall-Gigiri, CocaCola headquarters (Upper Hill), Garden City Mall (Thika Road).

The Low Emission and Climate Resilient Development (LECRD) project will also be supporting the development of Kenyan green building standards to provide guidelines for new and renovated buildings to adhere to green best practices so as to reduce or eliminate the adverse impact of buildings on the environment and the occupants.

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*Solar panels at the Garden City Mall parking on Thika Road. ©Brian Inganga.*



# Mango Processing Facility Supports Kitui Farmers' Cooperative

*Women peeling mangoes at the processing factory in Kitui County. ©Noah Lusaka*

**As the world focuses on green economy approaches, farmers in the normally dry Kitui County are redirecting their energies to farming practices that are resilient to the effects of climate change. The United Nations Environment Program (UNEP) defines green economy as one that results in improved human well-being and social equity while significantly reducing environmental risks and ecological scarcities.**

The Kitui Development Centre (KDC) has supported farmers to grow mangoes as a sustainable business with national and international marketing potential. This article shares the efforts by various organizations in a partnership supporting Kitui farmers to commercialize the mango value chain in the context of green economy.

Ms Kalumu Nzuki a 63 year old woman of Wikillilye village in Kitui County started by growing 20 indigenous mango trees that gave low yields in 2010. In 2012, the Kitui Development Centre (KDC) with funding from Farm Africa, ACT! and later by National Environment Trust Fund (NETFUND) started training farmers on mango value chain. Kalumu is a member of Wii Farmers group that benefited from the project trainings on all aspects of mango production and marketing. She invested in planting over 100 grafted mangoes in an agroforestry system that gives higher yields leading to increased income. She is able to feed her family and help in paying her grand children's school fees. The family's diet has improved since she can provide the daily three meals for her family. Kalumu is among the over 800 farmers in Kitui making their livelihoods from mango farming and marketing.

## **Partnerships in developing the Mango value chain**

The Kitui Development Centre (KDC) is a Non-Governmental Organisation in Kitui County that has mobilized farmers to grow mangoes as a climate resilient tree. With financial support from Farm Africa, Act Change Transform (Act!) and National Environment Trust Fund (NETFUND), KDC registered Kitui Enterprise Promotion Company LTD (KEPCO) as a for-profit entity to process mangoes into various

products, with the aim of offering a ready market to mango growing farmers. The company is well equipped for processing fresh mangoes into four products. "We have empowered over 800 farmers with knowledge on improved mango varieties, production techniques, marketing and value addition. To ensure farmers are united and aggregate their produce, KDC facilitated the establishment of a mango farmer's cooperative society," remarked Ms. Janet Mumo, Director of KDC. Nzamka Mangoes Cooperative Society was formed in 2013 to enhance farmers' capacity to produce good quality mangoes for marketing.

According to the secretary Ms. Mwikali Mumo, the cooperative has established aggregation centres where farmers' fruits are weighed and delivered to the factory. The farmers are then paid on weekly basis. Other partners in the project include Kenya Agricultural and Livestock Research Organisation (KALRO), government Ministries of Cooperatives, Industrialization, Agriculture and Public Health.

The operations of the KEPCO mango processing factory were officially launched in October 2015 by the Kitui County Governor Dr. Julius Malombe. The factory is well equipped and processes fresh mangoes into four products; juice concentrate, mango flakes, mango powder and mango fortified flour. Several steps are involved in the processing unit. The starting point upon receiving mangoes is sorting by selecting the quality ones which are then weighed and washed using purified water. The mango seeds are then removed manually by peeling using knives and washed prior to feeding into the pulper that extracts the juice concentrate.

The concentrate is then fed into the pasteurizer for heating and adding preservatives before packaging when it has cooled. On a good day, the factory processes 400 litres of mango concentrate. To make the other products, the fresh mangoes are flaked then put in a solar drier for drying up to five per cent moisture content. They are then transferred to the biomass drier, then cooled and ready for packaging as flakes. The biomass drier uses dried mango seeds as fuel therefore conserving trees. Other products like

mango powder are further processed using a disc mill that grinds the dry flakes to powder.

Following the launch of the mango processing factory, Kitui farmers now have a ready local market for their fresh produce. They are able to earn more money since their mangoes are bought by weight as opposed to brokers who buy using un-weighed sacks. The farmers appreciate the timeliness in selling their mangoes. This has reduced post-harvest waste therefore increasing their incomes. The company operates on a 24 hour cycle and has engaged over 20 workers from the community. The mango products are readily available in the local market under the trade name 'Kitui Royal Products'. The demand is growing especially for fortified sorghum flour for making nutritious porridge for children and adults.

Increased mango trees in form of agroforestry has many environmental benefits that include; improvement of microclimate on the farm, soil and water conservation, increased carbon sinks and other ecosystem services that are beneficial to Kitui area communities.

Despite these benefits, there are some challenges. The factory relies on grid power and there being no back up system, the frequent power blackouts paralyze smooth operations. There is need to invest in a generator. Following the recent El Niño rains, the farmers experienced heavy infestation of rust disease and fruit fly pests that damaged the mangoes.

The mango value chain initiated by Kitui Development Centre is already benefiting communities, especially women farmers, contributing to wealth creation and poverty reduction. The mango tree's natural resistance to drought enables communities to earn a decent livelihood from fresh mango sales.

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# Capacity Building for Transformative Business-driven Green Growth

*Women engineers and technicians during a hands on session at the WISEE-VOCTEC training at Strathmore University in 2015.  
©Tameezan wa Gathui*

**In The Future We Want, the Rio+20 outcome recognizes the vital role of green growth, noting that: “It should contribute to eradicating poverty as well as sustained economic growth, enhancing social inclusion, improving human welfare and creating opportunities for employment and decent work for all, while maintaining the healthy functioning of the earth’s ecosystems.” (UNCSD, 2012).**

The African continent offers the greatest opportunity for integration of advanced energy and agricultural technologies that limit or actually eliminate CO2 emissions. Of the 1.2 billion people on the planet that live off the electrical grid, 95 per cent can be found in either Sub-Saharan Africa or Rural Asia; 70 per cent of agricultural production in sub-Saharan Africa is in the hands of small shareholder farmers.

Bringing access to energy and advanced agricultural techniques to this region is simultaneously a business opportunity and a moral imperative that allows for the introduction of CO2 emission reducing technologies to a vast population and by so doing contributes to transformative and sustainable economic development in Africa.

To tackle these challenges, active participation of academic institutions is needed, as enterprises reduce or change their resource use, minimize generation of waste, develop new environmentally friendly products and services, and increase their demand. Meeting these needs will be a challenge, but for the academia in the developing world, it also presents an opportunity to influence the change.

To respond to the challenge of limited entrepreneurial capacity in the area of green growth, the entrepreneurship for impact (E4Impact) MBA program run by Tangaza University College and the Catholic University of Milan has been in the news lately for the right reasons. The program is a response to one of Africa’s most pressing challenges: The need for a new brand of entrepreneurs who are able to pursue profit while addressing social, economic and environmental issues. The program in its 5th edition trains entrepreneurs to start and scale economically viable businesses with positive social and environmental impact.

The E4Impact MBA program is a “training camp” for transferring business and management skills to active and aspiring social entrepreneurs has been designed with a unique formula that combines the academic features of an MBA in entrepreneurship with actionable business tools and networking opportunities for launching fundable social enterprises.

Since its inception, 142 entrepreneurs have passed through the program, while over 65 are currently under training. A fascinating observation is that close to half of these enterprises are directly related to the two economic sectors which contribute significant quantities of Green House Gas emissions. These are agriculture, renewable and green energy.

Through the empowerment and capacity building that we have provided to them, the growth in the number of the green jobs suggests that a continuous capacity building of MSMEs in incorporating the green design in their business models is key. As seen through the successful

green jobs hackathon that we run last year with the collaboration of the International Labour Organisation (ILO), Micro Small Medium Enterprises (MSMEs) that adopt green thinking design in their business models create sustainable decent green jobs. The green business design thinking has to be incorporated in all aspects of the business value chain in order to maximize the green jobs.

To have meaningful impact, public awareness of training interventions that have positive impact for transforming business driven green growth and provision of decent green jobs is key so as to advocate for the application of green public policies by all. To this end, the E4Impact program has publicly participated and is now part of the steering committee of the annual Kenya National Green growth conference where it has shared methodology and impact forging green MSMEs, participated in the SEED African symposium to contribute in the debate on the role of Academia in spurring the growth of the green value chains and have entrepreneurs exhibiting their innovative green enterprises. Most recently, the program showcased its impact at the 2015 United Nations Climate Change Conference, COP 21 in Paris.

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The Zayed Future Energy Prize recognizes and celebrates achievements in renewable energy and sustainability that reflect impact, innovation, long-term vision and leadership to meet the global challenges of climate change, energy security and environmental degradation. The Prize rewards imaginative and cutting-edge ways to save energy, cut harmful greenhouse gas emissions and create renewable energy. The Zayed Future Energy Prize has five categories, combining to award a total of \$4 million to a variety of the world’s best solution makers, ranging from large international companies and high schools to individuals.

So what idea do you have? How are you and those around you helping to ensure a clean, liveable environment for future generations? Let the Zayed Future Energy Prize help you create a better planet! Go to [www.ZayedFutureEnergyPrize.com](http://www.ZayedFutureEnergyPrize.com) to register, enter or to find out more.

For further assistance email [info@zayedfutureenergyprize.com](mailto:info@zayedfutureenergyprize.com)



# Ministry of Environment partners with JKUAT to Support Training on Solar Energy

A solar Photovoltaic demonstration unit at JKUAT. ©JKUAT

**Jomo Kenyatta University of Agriculture and Technology (JKUAT)** is a public university with a mission to offer quality training and education in various technological fields. Based on JKUAT's strength in renewable energy training and research, the University partnered with the Ministry of Environment, Natural Resources and Regional Development Authorities to participate in the Low Emission Climate Resilient Development (LECRD) project. This project is funded by USAID through UNDP and seeks to support Kenya's efforts to pursue long-term transformative development and accelerate sustainable climate resilient economic growth, while slowing the increase of greenhouse gas emissions.

Under the project, JKUAT is tasked with implementing the output on "Enhanced access to clean and efficient energy systems". The tasks include the development of a training manual for solar

water heating, Training of Trainers on solar Photovoltaic (PV) systems and solar Thermal energy, selection and equipping of 10 Technical Training Institutes (TTIs) as training centres of excellence and awareness creation on existence of these 10 centres of excellence. The purpose of these tasks is to ensure that Kenya has at least 10 Technical Training Institutions fully equipped for training on solar PV and solar thermal energy systems.

The first group of 30 were trained from 11-22 April, 2016 at AICAD, JKUAT. The two-weeks training was on Solar Photovoltaic systems. A solar water heating training manual has been developed and the first group of trainees for the solar thermal energy course will take place in August 2016.

In addition to the LECRD project, the IEET is implementing the BRIGHT project. This is a 5-year technical cooperation project

between JKUAT and JICA whose main objective is to improve the capacity of JKUAT in renewable energy education, training, research and development for rural electrification. The target areas are solar PV technology, wind energy, biomass energy (bio- and thermo-gasification) and small hydro energy. Over 800 technicians have been trained under this project since 2012.

For more information on the project contact:

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## Kenya Climate Change Knowledge Portal

A virtual online platform in the form of a one-stop climate change portal is currently under development to ensure more widespread access to climate change information by the public. You can visit the portal on <http://lecrd.co.ke>

Feedback and suggestions to make the portal relevant can be sent to [info@lecrd.co.ke](mailto:info@lecrd.co.ke)



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