

UNU-MERIT / UNIDO / KEEI Policy Workshop on Green Technology in Africa 14 June 2013

Prof [René Kemp](#), UNU-MERIT

On 14 June 2013 at the Silver Springs Hotel, Nairobi, Kenya, researchers from the GT in Africa project met with Kenyan policy makers to discuss research findings and policy issues. The meeting was hosted by ATPS. This report offers a summary of the workshop.¹

Prof Kevin Urama (director of ATPS) opened the meeting with a word of welcome and discussion of the new energy industrialization process.



All participants were asked to introduce themselves. After this Prof René Kemp of UNU-MERIT (project leader) welcomed everyone and offered a short presentation about the project, in terms of the objectives, scope and research methods and questions.

He explained that the objectives of the project were:

1. To identify the status of green technology diffusion, and understand what drives green technology investments and greening industry in Africa.

¹ An overview of the programme and list of participants can be found at the end of the report.

2. Determine the need and possibilities for technical cooperation (with e.g., Korea)

With the following scope:

- Renewable energy technology (RET) markets of Nigeria and Kenya
- Adoption of energy efficiency (EE) measures and RET in cassava and maize sectors in Nigeria and Kenya respectively.
- Exploratory/scoping study that would serve as a basis for a future comprehensive study of green tech diffusion in Africa.

Key **questions** for the project and workshop were:

1. What is the status of green technology (RET and EE) diffusion, and how far are green industries developed in Africa?
2. Which factors underlie/constrain green technological choices?
3. What are the prospects for a rapid and sustained diffusion of green technology in the African continent and what could be done to accelerate this diffusion?

The presentation of Prof Kemp was followed by two presentations from project researchers. Jacinta Ndichu talked about renewable energy technology markets in Kenya and Nigeria.



In her presentation, Jacinta started off by saying that the market of renewable energy technology is characterized by different products offerings in terms of technology with a few firms offering RET related services. Majority of firms supplied more than one RE technology with most of them offering some initial training and after sales services.

Solar

- Solar PV Panels

- Solar water heating systems
- Solar lamps, battery chargers, solar fridges, solar powered pumps, portable lanterns and lamps etc
- Batteries, inverters, chargers
- LED Lamps

Biomass

- Ethanol → co-gen, electricity, ethanol gel
- Biogas
- Briquettes

Hydro

Wind

→ Hybrid sources: Solar-wind, wind-diesel

→ Services Offered: Feasibility studies, maintenance, installations, finance, energy audits.

A first analysis of the surveys under RET sellers in Kenya revealed that RET is sourced from various countries: Australia, Canada, China, France, Germany, Greece, India, Italy, Kenya, S. Korea, Spain, Netherlands, Taiwan, Turkey, UK, USA. China and India are the most important suppliers for solar products. RETs developed/manufactured in Kenya include:

- Ubbink E. A. (NL) in Naivasha, Kenya, the only solar panels assembler in Eastern & Central Africa
- Briquetting Machines (small scale)
- Biogas digesters
- Ethanol gel
- Mini Hydros

Other findings about the supply side of the market are:

- Most suppliers tend to import/produce & supply more than one type of RET;
- Financial services are being offered thru' arrangements with FIs
- A few firms specialize in technical support services only
 - ✓ Feasibility Studies
 - ✓ Consultancy Services
 - ✓ Energy Audits
 - ✓ Funding for RE through equity
- Very few production facilities despite technical expertise:
- One designer contracted a Chinese manufacturer to produce
- Another teamed up with a leading plastic tank producer
- A foreign investor used a partnership to launch a marketing network in the region

Key Drivers for adoption of RET were:

- Unreliable power supply, limited grid access
- Volatility of exchange rates & fuel prices
- Import Duty & VAT exemptions, BUT.....
 - Exemption hurts local production
 - Some business models unable to benefit from it
 - Definition exempted REs not comprehensive, eg ethanol & LED lights with fittings

- Feed in Tariff → **yet to benefit suppliers?** ²
- Financial arrangement (small solar items & biogas digesters) – A number of firms are in discussions with FI or have secured arrangements for financing technologies.

Challenges in the RET market were:

- ✓ Access to finance – Both for importer/developer & users
- ✓ Competition from low quality products
- ✓ FiT low – the prices offered under the FiT are low relative to cost of development.
- ✓ Lack of technology information eg biogas
- ✓ High cost of production in the sugar sector
- ✓ Low skills among technicians & electricians
- ✓ Financial arrangements contract negotiations lengthy
- ✓ Independent Power Provider approval slow

Opportunities identified consisted of:

- Use of bagasse to produce energy
- More efficient combustion technologies to save on fuel eg wood gasification process
- Promotion of rice husks, maize stovers, macadamia shells, coconut shells, palm oil kernels, ** with the exception of the tea sector where factories have sustainable forests, the volume of feedstock is low implying opportunities are more small scale use.
- Promotion of sorghum production
- Tighter environmental regulation in industrial production

From the interviews with business the following suggestions for policy were obtained:

- Facilitate access to finance
- Improve FiT rates
- Proper implementation of existing RE policy
- Include biogas, ethanol by products from duty, VAT
- Support local production
- Improve land policies
- Proper implementation of PPAs
- Reduce administrative process for exemption filing
- Eliminate sub standard goods

She also discussed the specific case of MotoPoa stove and Ethanol Gel by Consumer Choice Limited, a start up company whose owner is a transporter of technical alcohol, who identified a market opportunity for it in the form of an ethanol gel burned in stove, specially designed for this purpose. The stove was produced in China for a cost of 3.3USD (290 Kes), sold to distributors for a cost of 1500Kes and retailing for 2400 Kes (29 USD). Because TA is subject to a duty of Kes.120/litre in Kenya, the gel is produced in Tanzania. Before

² From 2 interviewees we heard that the cost of developing RE projects is high and that the cost of selling electricity to KPLC under the FIT is low making it unattractive to implement projects. Furthermore, IPP contracts with KPLC span about two decades with no chance of re-negotiations. Companies who had signed contracts with KPLC did not benefit from the new revised tariffs, which was a source of dissatisfaction.

operations started, sugar producers disposed TA into the environment. Environmental regulation forced them to store it up – didn't know what to do with it. CCL spotted opportunity. One litre of gel burns 4.5 times longer than 1 litre of kerosene stove. It does not spread bad odours but emits a nice aroma thanks to lemon grass, which has the additional benefit that it acts as mosquito repellent. If the duty on TA and VAT would be reduced it could be produced in Kenya and thus be benefitting the Kenyan economy as well as Kenyan society through

- ✓ Lower disease incidences
- ✓ Employment creation
- ✓ Reduced land degradation and related hazards
- ✓ Forest restoration

After selling the ethanol gel along with the stove developed by the Tanzanian based firm, Consumers' Choice Limited noticed weaknesses in the design of the stove and sought to rectify this. Consumers' Choice Limited identified a potential manufacturer in China and sent a representative to design and test to satisfaction, a better new stove. The result was an improved version that proved to not only much simpler, easy to use, efficient and safer than the earlier model, but also even better than compared to the kerosene stove. Its fuel tank is not pressurized and is extinguished by turning a lever to cover the tank ridding it of oxygen. This makes it superior in terms of security given the number of reported incidences of fires particularly in poor households.

Consumers' Choice Limited is optimistic about the future. Feedbacks from the market indicate an interest in lighting gel fuelled appliances and so collaboration with the local university is ongoing for product development. Major hurdles that stand in way of fuel switch within the firm's target socio-economic strata are the high price of the stove (29 USD due to import duties, VAT and high margins for sellers) the relatively high price of the gel compared to kerosene (170Kes compared to 90-100Kes) and low income levels of the target group (the very poor, people using kerosene, a non-taxed fuel). To address the price challenge, the firm is currently asking the government for a waiver of alcohol excise tax, import duty, VAT applicable on its products and related inputs and says it is optimistic about obtaining such concessions. In this it is helped by the Climate Innovation Center in Nairobi, offering incubation services in the form of office space, specially seminars, access to experts and government.

If the product becomes a success, supply constraints of technical alcohol may cause the company to look for alternative sources of supply. Sorghum could be used for this purpose, which is already grown in Kenya and whose production could be expanded.

The second presentation about research findings was by Prof John Adeoti about the adoption of energy efficiency (EE) measures and RET in the cassava industry in Nigeria and the maize industry in Kenya. The reason for focussing on these two sectors is:

- Both crops are key food crops, with local markets
- Both crops are locally processed with the help of local agroprocessing capability
- Potential for employment generation in the value chain
- Nigeria is largest world producer, 45 million ton pa
- Maize in Kenya is also a major food crop and very important for food security

The reason for focussing on energy efficiency is that in both sectors energy costs are a significant cost category and reducing such costs helps to generate wealth. There may also be development benefits in terms of energy efficiency markets.

The following types of energy efficiency measures were identified in the study:

Cassava Processing (Nigeria)	Maize milling (Kenya)
<ul style="list-style-type: none"> • Change in power machines for graters involving fuel (e.g. petrol vs. diesel engines) • Improvement in heat exchangers • Change fossil fuel to wood biomass sources (e.g. charcoal, wood chippings, etc) • Energy house keeping measures 	<ul style="list-style-type: none"> • Changing old mortars to new ones • Installation 'power factor' • Energy housekeeping measures • Energy auditing (only two large firms) • Use of conveyor belt sensors (one large firm)

In contrast to RET, the sources of EE technology were primarily local (i.e., African):

Source of technology	Frequency	Percent
Locally fabricated equipment	47	77.0
Combination of local and foreign equipment	10	16.4

Completely foreign technology equipment	4	6.6
Total	61 1 missing case	100.0
Only 7 out of 61 firms have equipment with foreign tech. component		

The most important driver for EE adoption is cost-savings, and the most important facilitating factor is in-house knowledge about energy management. Government incentives for EE adoption is the most important reason for adoption in 11.7% of the cases.

Most important driver of EE adoption	frequency	Percent
Our in-house knowledge about energy management	17	28.3
Technical expertise locally available	2	3.3
Need for cost savings	26	43.3
Government incentives for EE measures	7	11.7
Support from development partners	6	10.0

85.5% of the companies said that locally available knowledge was a relevant factor for adoption. Support from development partners was mentioned by 34.1% of the respondents as a relevant factor.

Drivers of EE adoption	frequency	percent
Our in-house knowledge about energy mgt.	55	90.2
Technical expertise locally available	54	85.5
Need for cost savings	51	83.6
Requirement by parent company	3	4.9

Energy regulatory requirement	2	3.3
Environmental regulation	13	21.3
EE measure adoption by other firm(s)	9	14.8
Government incentives for EE measures	16	26.2
Advocacy or campaign by environmental NGOs	2	3.3
Support from development partners	5	34.1

Various barriers worked against adoption of RET in Kenya and Nigeria. In the answer categories, high costs of financing the RE project and lack of support or government incentive for adopting EE measures were indicated as the most important barriers.

Barriers to EE adoption	frequency	percent
High cost of financing the EE project	27	46.6
Uncertainty about the effectiveness of the EE project	1	1.7
Lack of technical capability	1	1.7
Lack of information on appropriate EE measures	6	10.3
Lack of support or government incentive for adopting EE measures	21	36.2

Few firms have adopted sophisticated energy-saving technologies. It is normal for firms to have adopted good housekeeping and small process changes. Fuel substitution was considered by several companies but few have actually undertaken this. An interesting case

of fuel substitution is the substitution of palm kernel shell and shaft briquette for coal, which is being considered by a cassava company in Nigeria. The motivations are economic. It was consuming 2 tons of coal per hour to fire a boiler. The coal was expensive (N30,000 per kg), and sourced from a location 400km away. The firm is located in a rural setting with substantial local oil palm processing. Palm shaft and palm kernel shell are waste products from the extraction of palm oil from the palm fruit and the palm kernel oil from the palm fruit seed. The successful substitution of the palm kernel shell and shaft briquette for coal has resulted in creation of jobs for some rural folks who are engaged in gathering the palm kernel shells and shafts. It has also improved the technical capability of the firm in adaptation of the boiler facility to use palm kernel shells and shaft briquette instead of coal.

In the discussion after the presentations, policy maker said they recognized the drivers and barriers in the presentations. Costing was mentioned as a capability issue relevant for innovation. It was considered an issue for education and training. It was also being observed that the new energy bill in Kenya took care of some issues identified as problems. For example the new bill includes a revised set of Feed in Tariff (FiT), more attuned to technologies. One thing the FiT cannot realistically do is to make renewable energy competitive for all energy-using companies. The goal is simply to promote RE. A new concept championed by government is net metering who also introduced mandatory regulations for energy management, with the aims of stimulating RE and EE.

Solar water heaters and sewage waste were said to constitute big opportunities to promote. They constitute low costs options for producing heat, helping to reduce the use of firewood.

We also had a discussion about the greenness of green technologies, where it was said that this needed to be assessed (in a lifecycle framework) rather than assumed.

A contentious issue on which no agreement was reached is the issue of intellectual property rights (IPR). It was said that Africa should have access to the knowledge embodied in the newest technologies. What a change in IPR will bring is not entirely clear. It was concluded that Africa should try to get the best of two worlds: benefit from technology transfer combined with the use of indigenous knowledge and technologies. For the African context, many of the old technologies (for example, in waste management) were considered to be appropriate for the present situation and a plea was made to have a technology museum for them.

On the issue of barriers it was said that we should look at the *interaction* of barriers: how they jointly create a blocking mechanism working against adoption. When costs of adoption are high we should investigate what factors make those costs high. The ethanol gel may serve as an example here. The price of the gel is considerably above that of kerosene (170Kes vs 90-100Kes), but kerosene is not taxed and has a lower energy efficiency. The

costs of the stove are high because of excise taxes and because retailers taking high margins. This points to structural barriers such as inefficient retailing system and unequal tax treatment of energy sources. Poor production capacity is also revealed as a relevant factor: If the stove was produced in Africa there would be no excise duties and shipping costs. What this learns is that besides the barriers mentioned by interviewees there are other barriers not listed in the closed answer categories having to do with the structure and efficiency of the economy which have to be considered in the analysis. A more efficient economy would serve to alleviate various barriers. Simple questions about barriers may have compound answers. The innovation system model helps to identify barriers and opportunities in a systematic analysis.

In the afternoon, participants had a discussion about the key questions of the project and additional ones. The discussion part was introduced by a short presentation by René Kemp, consisting of additional questions and a number of statements meant to spark discussion.

The additional questions were:

- Are there opportunities for green technology in Kenya (Africa) beyond those that we identified in the project?
- What green technology options offer the greatest development benefits?
- What role for (foreign) technical cooperation?
- What can government effectively do? Is government part of the problem? Does it have the right knowledge and capabilities to intervene?

The statements for discussion were:

1. The greatest opportunities for green investment in Kenya lie in the bio-economy (making use of organic waste as a cheap feedstock).
2. Government should orient itself to green innovators and incubate green innovation start ups.
3. Options which require massive subsidies for deployment should be avoided (they create boom & bust cycles because policy support cannot be sustained)
4. Technical cooperation is nice and well, but *with who* and *in what form*?
5. Government should create special points for interaction with green innovators to learn about their problems and ideas for policy change (“one-stop shops”)
6. The education sector is too little involved in green business (they should be brought into interaction with green innovators)
7. It is more easy to get funding for big, expensive projects than for projects less than 1 million KES

8. Reducing subsidies for fossil fuels is a long and difficult process and will not bring much in terms of fostering green growth (alternative measures are needed).

The following conclusions surfaced from the discussion:

- The creation of special points for interaction with green innovators to learn about their problems and ideas for policy was considered useful for identifying the actual problems, how they interact with each other (problems) and their root causes. Focus should be on innovation systems not singular problems.
- Collaborative efforts between private sector and foreign investors should be based on a legal framework.
- Education should be well integrated into national innovation systems. This requires a framework to link private sector to education systems.
- Capabilities are key to development. Development of indigenous capacity is very much needed. This can be done bottom-up and in a more strategic way, with the help of technical assistance programmes.
- Structural adjustment policies have been very harmful for Africa. Austerity programmes undermined the education system.
- The value of cluster policies in the African context is doubtful: several African countries had cluster policies but they did not result in the rise of new sectors, nor did they stop the decline of existing sectors. The same may hold true for science parks.
- One of the problems of Africa is low levels of purchasing power and Africans preferring to buy non-African products for reasons of perceived quality and image.
- A nation's development cannot be based on the development of one sector.
- Innovation is not an important concern for government (only rhetorically it is committed to innovation).
- Policies are created in silos. Policy coordination is needed.
- Political leadership is urgently needed for economic development and the creation of new markets, where Korea was used as a positive example of managed development through a national plan of action involving the president, ministers, business and development experts, with the president and ministers taking an active stance.
- Part of the problems have to do with poor infrastructures and poor institutions. In Africa the formal institutions (such as the government administration) do not work. People rely on personal contacts based on personal trust.
- Weakly enforced environmental problems are another problem.
- Green procurement can be used to stimulate RET but one of the problems with green procurement is that sellers charge high prices to the government (twice the normal price). Tenders are a possible way to get around this problem.
- Everywhere in the value chain people try to maximize profits, which undermines economic efficiency throughout the economy and the diffusion of RET.

- Government programmes that deal with just one barrier are unlikely to be successful. An example is the PV market transformation initiative (PV MTI) where a 5 million USD fund remained unused.
- For policy ownership and acceptance, interaction with stakeholders is desirable.
- Incubator activities appear very useful for start-up companies (the Climate Innovation Center is doing a good job which is very much appreciated by entrepreneurs)
- It is difficult to get money for projects between 0.5 and 1 million euro (0.6-1.3 million USD). Experience from a biogas digester company is that equity fund managers and some green funds are only interested in large projects. Worldbank through its Green Climate Funds was giving 'small' loans which were for 50 mio dollars.
- There is a need for technical cooperation and assistance with foreign companies, governments and research and education institutes. Some cooperation already exists. For example, the Ministry of Environment liaises with the Korean government in the area of waste to energy.

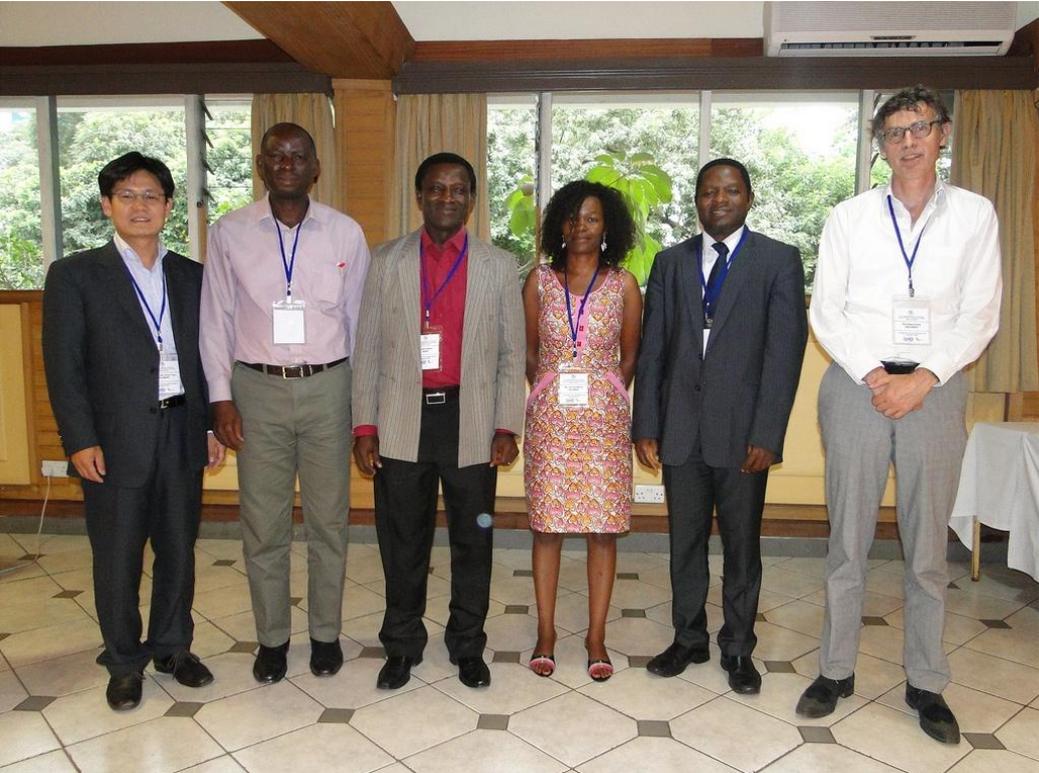
Answers to the key research questions of the project are summarized in the following table.

Status of RET Diffusion	Factor underlie/constrain green choices	Govt action to Support diffusion
<p>-low levels of penetration</p> <p>-Embryonic phase of diffusion in Cameroon</p> <p>-solar is perceived a success in Kenya but servicing 400,000 people out of 40 mio</p> <p>--RETs expensive for the poor and the well off have already access to modern sources of energy</p> <p>-Lack awareness amongst users.....also in the case of Foreign investors eg the case of Corn Products Ltd (wet millers)</p>	<p>-Under developed countries energy infrastructure</p> <p>-interest from donors, govt in green growths in Kenya</p> <p>-Low investment in R&D, low knowledge levels</p> <p>- Subsidies may not offer results in RETS but could assist in learning experienthrough failures & challenges.</p> <p>Subsidies + or -</p> <p>-green global funds availability</p> <p>-The high cost of greening the economy.</p> <p>-Raw material availability</p> <p>-Lack of systematic implementation of policies</p> <p>- FiT too low especially for expensive TEs eg Solar. Kenya Nuts Ltd wanted to Co-gen macadamia nuts but the costs were prohibitive.</p> <p>-Government premises around the country could offer opportunities for private sector by providing largescale RETprojectsbut market responses may offer different results.</p> <p>-Rapid drops in solar products did not result in price reductions. Traders with huge stocks still sell at older higher prices as opposed to 60-70kes/Kw---> info asymmetry and market distortions resulting in abnormal profits</p> <p>-Brown economy acting as a constraint on the green economy</p>	<p>-Use RET to strengthen environmental existing regulations as well as create new policies.</p> <p>-Leading by example →Develop green procurement policies, like happened in Israel for solar water heaters.</p> <p>-Support local consumption and green consumption using policy tools, capitalising on expanding population and middle class.</p> <p>-Make use of indigenous production systems for African markets</p> <p>-Policy formulation & implementation that responds to existing socio-cultural and economic contexts.</p> <p>-Support national innovation systems to promote development of local content eg MotoPoa products.</p> <p>-Link education to private sector activities</p> <p>-Business skills in the private sector notably in MSEs.</p> <p>-Trade and non-trade barrier elimination</p> <p>-Promote quality production, branding.</p>

A group photo of the participants at workshop.



A group photo of the research team:



PROGRAMME FOR POLICY MAKERS MEETING
UNIDO / UNU-MERIT / KEEI project “Diffusion Strategy of Green Technology and Green Industry in Africa”

Venue: Silver Springs Hotel, Nairobi, Kenya

Time	Topic/Presentations	Presenter(s)
09:00 – 09:30 am	Morning coffee/tea	
09:30 – 09:45 am	Welcome Remarks	Prof Kevin Urama , ATPS Executive Director
09:45 – 10:00am	Introduction to the UNIDO / UNU-MERIT / KEEI project	Prof René Kemp , Project Leader, UNU-MERIT, The Netherlands
10:00 – 10:15 am	Short round of introductions	All
10:15 – 10:45 am	Presentation of results of Renewable Energy Technology (RET) diffusion in Kenya and Nigeria	Ms. Jacinta Ndichu , UNU- MERIT, The Netherlands
10:45 – 11:15 am	Discussion of results by policy makers and agency workers	All
<i>11:15 – 11:30 am</i>	<i>Tea/Coffee Break</i>	
11:30 – 12:00 noon	Presentation of results of Energy Efficiency adoption in the maize/cassava sectors in Nigeria and Kenya	Dr. John Adeoti , NISER, Nigeria
12:00 – 12:30 pm	Discussion of results by policy makers and agency workers	All
<i>12:30 – 02:00 pm</i>	<i>Lunch</i>	
02:00 – 03:30 pm	Discussion of questions about possibilities and limits of national support programmes, international aid and cooperation, success stories, non-success stories, dilemma’s for policy, useful strategies for Korean government	Questions introduced by Prof René Kemp (UNU-MERIT) and Dr. Byung Nae Dave Yang (UNIDO) Moderator: Prof. Kevin Urama , ATPS
03:30 – 03:40 pm	Concluding Remarks	Prof. Kevin Urama, Prof. René Kemp

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