SCIENCE WITH AFRICA II,
INFRASTRUCTURE: ENERGY, TRANSPORT, AND WATER SESSIONS

MINUTES OF FIRST SESSION (BS1D)
DATE: WEDNESDAY 23 JUNE 2010-06-23
CR6, UNCC, ADDIS ABABA, ETHIOPIA

Facilitator: Prof. Shem O. Wandiga, Managing Trustee, Center for Science and Technology Innovations

Rapporteur: Dr. Alejandra Palermo, Royal Society of Chemistry, and Dr Wilfred Lombe, ECA

OPENING REMARKS
Mr Joseph Atta-Mensah, OIC of the Regional Integration, Infrastructure and Trade division at ECA welcomed the participants to the session and gave a quick overview of the work division. He looked forward to the outcomes of the session energy, transport, and water as they were of importance to the division. With that he introduced the Facilitator who called in the presenters to be succinct, especially in outlining their recommendations..

Presentation on "African Water Quality" – Dr Simon Cook and Mr Steve Nitifo
Dr Cook drew the attention of the participants to the link between food security and water. The exponential population growth had led to food and water crisis. This had been exacerbated by increasing global levels of water stress over the years leading to serious droughts in many parts of Africa. Water scarcity and access particularly affected the poor who are always vulnerable to hazards. In respect of solutions, Dr Cook pointed to the large untapped potential for rain fed agriculture and the supply of basic infrastructure. Solutions need to focus on two major areas namely, technological including storage and treatment, and institutional enablers, such as creating village water communities; training management; empowerment; behavioural change; and improving the regulatory framework.

In discussion, participants stressed the need to recognise the full socio-economic value of water and its various uses. Management and efficiency were both use dependent. Participants also observed that there was a plethora of water treatment plants. This needs further review with to identify appropriate modules whose components are amenable to local fabrication. They further stressed that education and training, especially at point of use was a collective responsibility. African scientists have a major opportunity to develop and apply technologies to enable communities to access and manage clean water.

Way forward. It was proposed to develop the capacity of African scientists to meet the particular challenges in African river basins. These activities should be linked to larger implementation projects of monitoring and management in a number of African countries

Projects:

The Pan African Chemistry Network identified two actionable goals:

- National Water Quality Monitoring Networks (NWQMN)
- Capacity building to increase adoption of water treatment technologies

National Water Quality Monitoring Networks

Purpose: Networking scientists with users, private and public sector, funders and policy makers to develop a clear understanding of water quality issues in African communities and the technological options to improve it. Provide the scientific capability to monitor water quality, develop and support centres of excellence in analytical chemistry in universities.
Activities: To set up a round-table to review the problems of water quality in different regions of Africa, and develop a fundable implementation plan to establish a WQMN in three or more nations, using technologies appropriate to rural and urban communities. To identify fundable R&D needs for specific problems, *e.g.* SODISWATER.
Outputs: A fundable plan to build the African WQNM, *e.g.* creating centres of excellence with the right skills and equipment, as PACN is currently developing in Nairobi and Addis. A network of public and private partners ready to roll-out the network, once funded.
Cost*: Workshops, regional consultation meetings and reporting, centres of excellence. Plan development. Approx: USD 200K pa*

Capacity building to increase adoption of water treatment technologies

Purpose: To increase the capacity of African science and technology to develop and implement "fit for purpose" water treatment technologies.
Activities: Technical review of the full range of water treatment technologies, the perceived and potential value of clean water to African communities, identifying who pays, who gains and who administers and legislative and funding arrangements.
Regional field and lab schools: Scientists and field technicians work with communities to trial water treatment technologies, to seek cost-effective methods of analysis, data management and reporting and to learn the realities and identify opportunities for new technologies.
Annual updates: Back-to-back meetings to review new technical insights and analysis of conditions and to clarify the messages to policy-makers.
Output: A community of field-experienced scientists and technicians, connected with suppliers, policy-makers and local administrators, as well as technologies that are "fit for purpose".
Cost*: Review, field and lab schools (3/yr), annual updates over 3 years: Approx: USD 200K pa*

Presentation on "Adaptation Options to Climate Change and Variability on Water Resources in Africa by Prof. Jonathan Matondo

Professor Matondo pointed out that climate will always change for a variety of anthropogenic reasons. Global warming has led to decreased rainfall resulting in frequent droughts, as has for example occurred in western, eastern and southern Africa. Global warming has, however, also increased the incidence of floods in parts of Africa. Current projects point to increased water scarcity and reduced precipitation, thus increasing food insecurity and possible rise in conflicts as most rivers basins in Africa are trans-national. The rise in sea levels could submerge some coastal cities and cause damage to infrastructure and the environment, thus increasing Africa's financial burdens.

Short term adaptation measures include: the efficient use of existing water resources; recycling of wastewater; rainwater harvesting; use of groundwater; and implementing the IWRM. The latter requires protocols and river basin authorities. Longer term adaptation measures include the construction of storage and inter-basin water transfers and building desalination plants. Professor Matondo stressed the need for cooperation, and befits that raise from it. These include better environmental management; increased agricultural yields and developmental benefits arising from hydropower generation and integrated water management systems.
Turning to policy suggestions, Professor Matondo recommended the establishment (and strengthen existing) river basin institutions; mainstreaming climate change adaptation options into national development plans; providing for minimum water levels to conserve the environment, mainstreaming gender in water management, strengthening national and regional capacities for water management; and encouraging the exchange of data.

Presentation on "Adapting the Smart Grid concept to the African context as a new tool for climate change mitigation through integration of renewable resources into mainstream power supply" - Dr. A.B. Sebitosi

Dr Sebitosi stated that energy is necessary for development. The bulk of current energy needs is met from thermal power generators. These are a major consumer of water therefore the conflict between energy and water is real. Current energy systems are historically not energy-efficient. The vision for the Smart Grid has three elements: enabling active consumer participation in management of their power requirements; adoption of alternative generation sources; delivering a fully automated, remotely configurable and self healing power distribution network.

Current available options include improving the efficiency of current grid systems. This speaks to demand side management, particularly increasing energy conservation through behavioural change. From the viewpoint of investing in infrastructure, it is worth noting that energy cannot be warehoused and investment should target regional areas demand, as transmission always results in major losses. There should also be a greater use of sustainable renewable energy sources to replace fossil fuels. More important than technology, prudent planning is required matching generation capacities with demand and adopting integrated resources planning tools. The latter requires a multi-disciplinary approach to encourage innovative solutions such as staggering work hours, or creating rapid transit systems which cut down urban based automotive congestion and environmental pollution. IRP decision modeling requires clear objectives, collecting data, developing demand forecasts, and developing plans that address the most likely contingencies. Performance indices would also be required for ssecurity of supply, economic growth, human well being and environmental protection. A good area for research attention is ssustainable energy management in urban water and waste water systems.

In discussion participants observed that there is no single solution to solve the energy challenge, some countries such as South Africa, Egypt and Algeria are implementing nuclear energy approaches.
The study focused mainly on management of energy resources in urban areas but as the majority of Africans live in rural areas, this should be considered during planning and power development.

Also participants reinforced the need to produce energy from waste and sewage. Brazil has decided to provide biofuels know-how technologies to developing countries via ICS UNIDO and NANOAFNET.
It was also pointed out that in Europe it is a legal requirement for every river basin to have a river management plan which is legally enforced at the European Union level and a similar approach should be considered in the continent.

Presentation on "Entrepreneurship Education for scientists and Engineers in Africa" Dr. Pushpendra K Jain

Most African economies have traditionally been raw materials based resulting in a lack of technological and industrial development which ultimately leads to economic under-development, poverty and unemployment. STI is a natural outcome of values added processing raw materials leading to self employment opportunities through entrepreneurial ventures. Some African governments have created special funds and agencies to facilitate entrepreneurship and business development, but educational institutions should also have a role to train scientists and engineers in entrepreneurial skills. Because of the lack of research infrastructure only non-IP driven science based entrepreneurship can be promoted amongst science and engineering graduated. IP driven entrepreneurship can be implemented successfully only after the quality of science, education is improved and infrastructure for quality research and innovation has been created. By the time a vibrant research and innovation infrastructure is in place, the first generation of non-IP entrepreneurs will have matured to provide support to the IP sector.

Some of the challenges observed were the level of tertiary education in science and technology; the admission selection methods and that the lack of opportunities for science graduates to finding a good job which makes them less committed and motivated.

Enabling factors and challenges: African research councils are not able to provide the necessary to funds long term research. Research and innovation infrastructure are underdeveloped; there is a lack of adequate equipment leading to mainly theoretical research at universities. Academic-industry collaboration is almost non-existent and in most cases only contractual. Industrial base is weak, with nearly no in-house R&D. There is a communication gap between policy makers and the academic. There is a lack of access to scientific information (books, journals, reference material). There is exacerbated by the lack of networking opportunities which may lead to collaboration. Awareness of technology transfer process is also lagging.

In discussion participants recommended targeting the youth in part to develop science entrepreneurship with campaigns targeting basic levels of education. For example, in Rwanda entrepreneurship is part of the curriculum from secondary school onwards.
They also suggested including the private sector in developing entrepreneurship courses and curricula.

Because of the lack of research infrastructure, at present and in the near future only non-IP driven science based entrepreneurship can be promoted successfully.
IP-driven entrepreneurship can be implemented successfully only after the quality of science education is improved, and infrastructure for quality research and innovation has been created.

By the time a vibrant research & innovation infrastructure is in place, the first generation of non-IP entrepreneurs will have matured to provide support to the IP sector.

Projects:
1 Organise regional training workshops for researchers and innovators

2 Introduce entrepreneurship courses in science and engineering curriculum

3 Provide access to available online short courses

MINUTES OF SECOND SESSION (BS2C)
DATE: THURSDAY 24 JUNE 2010
CR6, UNCC, ADDIS ABABA, ETHIOPIA

FACILITATOR: PROF. ABDERAHIM DOUMAR, DIRECTOR ACRT, SENEGAL

RAPPORTEUR: DR. ALEJANDRA PALERMO, ROYAL SOCIETY OF CHEMISTRY AND DR WILFRED LOMBE, ECA

Presentation on "Opportunities for innovation in the clean energy space – based on the Kenyan situation" Dr Charles Muchunku

Currently thermal capacity represents the major source of energy but the cost of this has been recently increasing significantly. Policies options are focused on economic and social users of energy and do not emphasise the household level both at urban and rural levels. There are opportunities in this sector to innovate by:
1—introducing energy efficiency in buildings, including industry
2—fuel switching particularly for industrial uses
3—grid connection to renewable energy, *e.g.* energy from waste, wind farms, small scale mini-hydroplants and solar systems.
Dr Muchunku outlined the innovation pathway which includes the following basic steps:

- from basic research and development
- technology specification
- market demonstration and commercialisation
- market penetration

Turning into challenges, so called the valley of death, Dr Muchunku stated that the drivers for innovation are price and efficiency and these are particularly weak in case of risky technologies so not many researchers are embarked into energy research. Policies to narrowing the innovation gap include:

- the need of marketing engagement programmes such as accelerated "field tests" and technological incubators
- strategic deployment policies such as feed-in tariffs, technology/fuel mandates
- barrier removal to create a level plane field, *e.g.* subsidised kerosene prevents the development of other fuels in some African countries

The importance of international collaborations was also stressed as a way of innovation.

In discussion, the participants questioned whether we are looking for African solutions or solutions for Africa. It was debated that we should sacrifice the latter and find solutions wherever they come from as long as they are appropriate for Africa. For example, under the Envirofit project the Shell Foundation provided US 25 M to design and develop fuel efficient simple stove and 10 million of these have been distributed over the last 5 years.

In respect of solar energy, technologies for photovoltaics have been rapidly evolving towards cheaper and more efficient semiconductors. This should substantially bring down the cost of solar panels in comparison to the current silicon wafer technology. Aspects of this research include nanotubes and new coating or composite materials, such as copper-germanium semiconductors and polymers.
It was also pointed out that energy problems are similar across the continent. Governments should sacrifice part of the earnings to develop new technologies and this could/should be done in collaboration with other countries. Multidisciplinary and multinational teams are important to tackle the energy challenge to avoid reinventing the wheel—these also provide a way to build scientific and technological capacity and accelerate the solution of problems.

Presentation on "Transit transportation challenges and innovative prospects" - Mr Yaya Yedan, Ghana

Mr Yedan outlined the challenges of transportation in Africa, and exampled West Africa where intra-community and international trade is important but is constrained by poor infrastructure. The railway systems are not well developed and the member states are dependent on road transport which has security issues and require a physical escort.

As a result, recent developments have included computerised transit clearance systems but the challenge of security and escorts still remains. This leads to increase paperwork, slowing down transit times as well and increasing transit fees.
Innovation systems proposed include the introduction of the GCM based electronic systems as well as satellite vehicle tracking. The results are being a reduction in human escorts and paperwork as well as transit times. However, the checking points have not been reduced for security reasons. The way forward is to implement these innovations in the entire West African region, with RECs leading the harmonisation and integration efforts.

Mr Yedan recommended the expansion of e-monitoring of cargo traffic to the regional level with technologies determined by cost/effective benefit
The participants observed that real integration was constrained by problems related by governance. They emphasised the role of leadership, especially in regional integration efforts in addressing this. The participants also noted that e-tracking of vehicles prevents deviation of trucks thus providing enhance security. While e-tracking is predominantly private, governments have a major role to play as traffic data is required for monitoring axle load as well as for designing road infrastructure and safety procedures.

Presentation on "Rethinking renewable energy development in Africa: a sustainable framework for consumers" Dr Phillip Olla

Dr Olla stated that there is conclusive evidence from research projects around the globe that renewable energy technology can ease poverty in rural communities by providing a means for locals to generate the energy required to support their business activities and generate new employment opportunities. The energy generated can not only be used for basic needs such as cooking, heating and lighting, but it can also power computers in schools, provide the energy need to work machinery and drive innovation. The availability of clean energy will reduce the time that people need to collect fuel from traditional sources, *e.g.* fire woods. It can eliminate health problems caused by pollution from burning traditional fuels indoors. It can also improve health by providing energy to refrigerate food and medicines, sterilize medical equipment and supply fresh water and sewage services needed to reduce infectious diseases.

Dr Olla presented a framework that requires collaboration between universities and local entrepreneurs by providing standards, technology and tools to deploy renewable technologies, namely PURE FUND (Develop a Productive Use of Renewable Energy Fund). The Fund in collaboration with other sources of funding, such as ASTIEF, can be used to provide the scale that would reduce the cost of PV panels for local entrepreneurs. Other sources of funds could be microfinancing and philanthropic avenues. PURE fund could also be used to leverage private sector investment. Scale is important to cost reduction and therefore regional bodies such as ECOWAS and UN projects should be used to bring up the required scales of economy.

In discussion, participants were concerned by the restricted time scale of the project (12 weeks) given African circumstances particularly in the rural areas where the consultation process and actual implementation may take several years. Participants further observed that the rate of rural electrification is very low and the current focus is on mega projects (for instance solar and wind farms). The solution is to combine both mega and small localised energy solution which will provide energy to rural and urban areas. It was also observed that affordability in rural communities is a real issue and that cost reduction in solar panels is a key consideration. In this context, Dr Olla stressed that PURE provides energy solutions for commercial activities as opposed to the social aspects of rural development. PURE is not a pilot or a research project but uses existing technologies. A key aspect is bringing in the local content and in this way maximising the use of local material and ultimately providing sources of employment.

It was noted that NGOs had been involved in projects similar to this in scope but the academic community is usually not involved. To this end, participants observed that students in Ghana were producing energy from solar farms and feeding it into the grid. Involvement of the academics is feasible as shown. Carbon credits can bring money to increase scales of the economy and this should be explored further. It was also observed that government can be major sources of funds but this requires political will and commitment.

Alejandra Palermo, 25 June 201