

DRIVING ENVIRONMENTAL PROTECTION THROUGH ECO-INNOVATION SYSTEMS TO BUILD HUMAN CAPITAL AND GREEN ECONOMY IN AFRICA

This is a drawn theme in which there are three topical issues where training will take place as follows:

1. Waste Management and Bioenergy Training Workshop: Exploring Challenges and Opportunities for Africa
2. Clean energy in rural Africa
3. Pollution control and clean air

The first in the series is a Waste Management and Bioenergy Training Workshop: Exploring Challenges and Opportunities for Africa. The capacity building workshop was held from the 30th June to 1st July and was attended by about 80 scientists and entrepreneurs from across Africa.

The training was structured to morning and after noon session where many topical issues relating to waste waste management and bioenergy were discussed. The session continued with teaching and practical demonstration of case studies, interactive session with mentimeter, expert panel discussion and among others. The topics taught includes:

1. Valorising wastes to produce energy using eco-innovative thinking
2. The Anaerobic Digestion Process and Biogas
3. Participants and Stakeholder Interactions
4. Bioenergy residues in agriculture – supporting soil and food security
5. Waste Management and Bioenergy Business Models
6. Waste management and bioenergy case studies
7. Eco-Innovation and Knowledge Transfer Models
8. Waste Management and Biogas: Alignment with AGENDA 2063 and the UN SGDs
9. An SDG Alignment Activity
10. Waste management and bioenergy case studies - 3 case studies

The Panel Discussion Session and Mentimeter Engagement was on the biggest challenges to the development of a sustainable waste-energy-food paradigm in African countries and how can these be mitigated? The panellists were topnotch scientists and entrepreneurs in bioenergy in Africa.

AN OVERVIEW OF THE TRAINING WORKSHOP

The population of Sub-Sharan Africa (SSA) is approximately 1 billion people, with an annual increase of around 2-4% per year, it has been estimated that that the population will have doubled by 2050. More than 40% of the population live in extreme poverty (poverty headcount ratio at \$1.90 a day as defined by the World Bank, 2012). For the past 25 years,

SSA has also experienced an increase of rural to urban migration. These rapidly changing demographics impact on many aspects of society including education, housing, land use and ownership, unemployment and in the availability and accessibility of energy.

Energy generation and accessibility is crucial to the continued development within SSA directly affecting the lives and livelihoods of those living in both urban and rural environments. In urban situations, much of the energy has come from the oil and gas sectors, while in rural settings there has been much greater reliance on biomass burning mainly in the form of fuelwood. In both settings, there are clear links to (i) environmental damage, (ii) illness and human health, (iii) unsustainable energy sources, (iv) cost, and (v) subject to the fluctuations of international markets, especially for oil and gas. With the continued rise in populations and the reduction in traditional energy sources, energy security is under threat in SSA. Countries within SSA are looking for more efficient and affordable household energy that can support rural and urban environments. This is particularly pertinent to Africa's poor generally and to certain groups within, namely women and young people. Further, bioenergy could help to combat deforestation, land degradation, and desertification. In this context, there have been various bioenergy initiatives implemented to increase access of rural and peri-urban populations to clean and sustainable energy.

There are many definitions of what bioenergy is but, for simplicity's sake, it can be described as 'the conversion of biomass resources: agricultural and forest residues, including fuelwood and charcoal; organic municipal waste; energy crops (e.g. *Miscanthus*, *Jatropha*), into heat through burning or as useful energy carriers, such as liquids (e.g. bioethanol, biodiesel) and gas (e.g. biogas, methane), which can be used to produce heat, power, transport fuels and electricity (European Commission, 2015). Our focus however is on the valorisation of organic wastes and use in bioenergy through the production of 'biogas' as a result of anaerobic digestion.

Bioenergy also offers ways to facilitate sustainable waste management, resource use efficiency, flexibility in process outputs (solid fuel, heat/power, gas and liquid fuels) and generation of by-products of agronomic value i.e. digestate. Despite all of these positives, there are concerns regarding the actual viability and stability of the biogas sector and its environmental and socio-economic sustainability, specifically in terms of potential competition with food security, the potential to exacerbate inequality, cause large scale land acquisitions by local elites, land access and tenure and may contribute to exploitative labour relations. This opens up a need to understand the sustainable business models around the biogas and waste management sector.

In order to tackle these challenges and respond to these questions, there is need for solution-driven research in this space. However, ensuring that research is undertaken for impact in Africa requires the collaborative partnership between academia and industry, which is addressed under an eco-innovation model and in alignment with the UN Sustainable Development Goals.

Against this backdrop, the African Union Scientific Technical and Research Commission, in strategic partnership with Lancaster University UK, Igbinedion University Nigeria, the Nigerian Environmental Society and Obour Institutes Egypt is co-hosting an international training workshop on biogas and waste management with the following objectives:

1. To highlight the fundamentals and principles of waste management and bioenergy production and in Africa against the backdrop of international models.
2. To explore the challenges and opportunities in the biogas and waste management industry in Africa through the exploration of different business models.

3. To showcase success stories and case studies of biogas and waste management projects that have been implemented in Africa and how the lessons can be appropriated for enhanced impact and increased uptake.
4. To highlight the principles of eco-innovation and its applications for solution driven research in Africa against the backdrop of the UN Sustainable Development Goals and the African Union Agenda 2063 and the Science Technology and Innovation Strategy for Africa 2014 – 2024 (STISA 2024)
5. To provide an opportunity and platform for increased pan-African collaborations especially with stakeholders in the waste management and bioenergy sector and the exploration of the impact of policy, gender and other subject matter to this important industry.

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