KeSEBAE NEWS

NEWSLETTER OF THE KENYA SOCIETY OF ENVIRONMENTAL, BIOLOGICAL AND AGRICULTURAL ENGINEERS

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Greenhouse Engineering

Basically greenhouse is a structure where crops are grown under controlled environmental conditions. They range in sizes depending on the scale of production.

Commercial glass greenhouses are sophisticated and utilized for growing high value crops such as flowers and vegetables. These are composed of systems for heating, cooling, lighting and screening and are computerized to optimize plant growth conditions.

The history of greenhouses traces back to the times of the Roman emperor Tiberius who made it a routine to eat a cucumber vegetable on a daily basis. This forced the Roman gardeners to device ways of making sure this vegetable was available for the emperor daily. They planted the cucumbers in wheeled carts that were put in the sun during the day and later wheeled inside the house to ensure they remained warm throughout the night. The cucumber houses were glazed with sheets or oiled clothes.



The first greenhouse

The concept of heated greenhouses has evolved over the centuries. This has been seen in the early literature works of a Korean physician in the 1450s detailing vegetable cultivation under an artificial heated environment using the traditional Korean underfloor heating system for maintaining both heat and humidity, its walls made of cobs to insulate the heat as well as a transparent oiled window for light penetration and for protection from external environment.



Growing vanilla orchid in a greenhouse, 19th Century

The major setback with these early designs of greenhouses was the issue

of balancing heat and humidity within the systems.

The improvements in greenhouse design continued through the 17th century as technology advanced leading to manufacturing of better quality glass as well as improvements in construction techniques.

By the 20th century the famous geodesic dome-shaped greenhouse design was invented. Following the availability of wider polythene films, larger greenhouse structures were constructed.



A modern automated greenhouse

In principal, greenhouses operates whereby the transparent roofs and walls absorbs the incident solar radiation which is then absorbed by floor and other elements together with its contents making it warmer raising the inside temperature.

Some of the most important components of a greenhouse include: *Ventilation:* This is mainly required for

humidity and temperature regulation to an optimum level, ensuring movement of air and prevents pathogen build-up. This is achieved by installing recirculation fans.

Lighting which is achieved by allowing light to enter the greenhouse during the day with some greenhouses having LED light which are utilized during the night.

Heating and cooling: Heating can be done through harnessing solar energy and releasing it during cooler times. However, cooling is mainly done by opening the windows. Window actuators can automatically open the windows as a result of temperature difference.

Carbon (iv) oxide enrichment: This can only be done when carbon (iv)

oxide has become a limiting factor to plant growth.

Greenhouse farming allows for offseason crop production and if growing high value crops is what you are into, greenhouses is the way to go.

Call for papers

The Kenya Society of Environmental, Biological and Agricultural Engineers invites researchers to submit original research works formatted according to the JEAE format for review and publication

Kenya's Dirty Air – The Silent Killer

E. Oranga

I once engaged a friend who had never been here on his thought of the country. I was glad to learn of his interest in the country's rich biodiversity and scenic beauty. He desires to see the rolling hills and valleys, the expanses of grasslands and the rich Kenyan culture and food.



Lake Nakuru National Park

What he was not aware of is the existence of heavy air pollution Kenyan urban centers. From cars roaming with their catalytic converters eliminated, random rubbish fires, large waste fields, industrial releases and cooking stoves that use biofuels, Kenya is right in the middle of an air pollution crisis, mainly in its towns.

Air pollutants consist of gaseous, liquid, or solid substances that, when present in sufficient concentration, for a sufficient time, and under certain conditions, tend to interfere with human comfort, health or welfare, and cause environmental damage. Air pollution is the leading cause of respiratory diseases such as chronic obstructive pulmonary disease (COPD), lung cancer, pulmonary heart disease and bronchitis. It is estimated that approximately 5-7 million people die prematurely globally every year due to air pollution, accounting to about 10% of global deaths annually with Africa accounting for about 20% of this. In Kenya, more than 18,000 premature deaths are linked to air pollution. Reducing air pollution levels globally can therefore improve human health today and among future generations.



Industrial gas Discharge

Air pollution may be categorized as either indoor or outdoor. Indoor air pollution is mainly caused household fuel (fuelwood, kerosene and charcoal, among others). Outdoor air pollution on the other hand is caused by human activities such as manufacturing and extraction, transportation, waste management and agricultural and forestry practices.

Across Kenya, 61.9% of households use paraffin for lighting. The counties recording high usage of paraffin of over 90% at household level include Vihiga, Bomet, Nandi, Migori,

Kakamega, Busia, Bungoma, Siaya and Homabay. However, less than 40% of households in Nairobi, Samburu, Marsabit and Mombasa Counties use paraffin for lighting. Usage of paraffin for lighting is low in ASAL counties who mainly rely on wood fuel both for cooking and lighting.



Traffic Jam in Nairobi

On the other hand, outdoor air pollution is estimated to affect about 4.3% of the national population are exposed to PM<2.5. County data on the same is however unavailable. PM<2.5 refers to the fine particulate Page 2 of 5

matter, measured in micrograms per cubic metre ($\mu g/m^3$). The World Health Organisation (WHO) guideline for outdoor air pollution provides annual limit of PM<2.5 less than 10 µg/m3. However, the national average for PM <2.5 has been reported as 25.8 micrograms per cubic meter [µg/m3] which is more than twice the recommended levels. Nairobi's Industrial Area has recorded annual mean of 35 μ g/m³ and 75 μ g/m³ for daily means. These particles pause a health risk as they can penetrate and lodge deep inside the lungs.

A part from $PM_{2.5}$, other parameters that affect air quality especially in urban arears include Sulphur Dioxide (SO₂), Nitrogen oxides (NOx), Carbon Monoxide (CO), Ozone (O₃) and Volatile Organic Compounds (VOCs). In 2017, UNEP established that the City of Nairobi falls below the WHO standards for all these parameters.

Proposed Remedies

Efforts to reduce the levels of pollutions have been the centre of debates for a long time, yet not much has been done amid constructive expertise proposals. Yet at the heart of it all, strict policies and regulations aimed at restricting the amount of pollutants released could be the most realistic approach.

Section 147 of the EMCA Cap 147 mandates NEMA and the County Governments to enact regulations deemed necessary to enforce the various provisions of the Act. Indeed the Environmental Management and Coordination (Air Quality) Regulations, 2009 were enacted by NEMA pursuant to these regulations. However, the enforcement of the Regulations has been ineffective in several aspects as both the Counties and the Authority lack the necessary resources to perform this function.

The general belief is that the current state of policy approaches is inadequately structured to resolve the incoherence between national government and county governments. Indeed, only strict nationwide guidelines to avert air pollution will save the coming generations from the adverse effects of air pollution

What worsens Kenya's air pollution situation is lack of reliable data and information regarding air pollution exposure by the environmental structures in Kenya. It is unacceptable that we rely on international organizations such as Health Effects Institute (HEI) and WHO for such pollution data. Indeed it is time to consider some of the following interventions:

- a. Capacity enhancement at NEMA to monitor and regularly report to Parliament and the general public on issues of air quality. Such public reports may include issuance of regular air quality alerts.
- b. Amendment of the Regulations to make it mandatory for Counties to file regular reports to the Authority on the quality of air within their jurisdictions. This will demand that all counties allocate necessary resources to effect the same
- c. Kenyan cities to develop a traffic management system that minimizes vehicular pollution by improving public transport systems and reduction of private vehicles accessing urban areas
- Enactment of policy and d. relevant legislation targeting importation and maintenance of vehicles, machines and equipment that have the potential to pollute the environment. Such policy may lower age of imported machinery, set minimum pollution standards for generators and other machinery and put in place monitoring mechanisms for polluters.

IEK NEWS

IEK HOLDS ANNUAL INTERNATIONAL CONFERENCE

The Institution of Engineers of Kenya (IEK) held its Annual International Conference on 3-6 September 2019 at Leisure Lodge, Diani in Kwale County. The theme of the conference was "Overcoming the 21st Century Challenges: Implementing sustainable regional and local development agenda taking into account global best practices". KeSEBAE members actively participated at the conference with our Engineer Kennedy Makudiuh presenting a paper titled "Enhancing Food Security through Rice Production in Kenya: Producing Efficiently with less Drudgery through Mechanisation". IEK Council Appoints Eng. Prof. Ayub Gitau to Membership Committee

IEK Council has also appointed Eng. Prof. Ayub Gitau to serve as a member of their Membership Committee. We, at KeSEBAE, congratulate Eng. Prof. Gitau and wish him the very best. We hope he will use the opportunity to advance the interests of KeSEBAE at IEK.



Eng. Prof. Ayub Gitau, the Vice Chair of KeSEBAE appointed as a member of the Membership Committee of the IEK Council

KeSEBAE ANNUAL CONFERENCE 2019

Theme: Engineering the Big 4 Agenda

Venue: University of Nairobi Towers

Date: Thursday 14 – Friday 15 November 2019

Background

The Government of Kenya has initiated an ambitious development programme known as the "Big 4 Agenda" that prioritizes the following key areas: food security, affordable housing, manufacturing, and affordable healthcare for all. The Kenya Society of Environmental, Biological and Agricultural Engineers (KeSEBAE) recognizes the important role Engineers can play towards the achievement of these Agenda.

In this year's KeSEBAE Annual Conference, nine (9) sub-themes have been identified as vital to the success of this programme. :

Sub-themes

- 1. Engineering for Food Security
- 2. Engineering for climate change
- 3. Engineering the environment
- 4. Engineering our irrigation
- 5. Energy for the Big 4 Agenda
- 6. Engineering our infrastructure
- 7. Engineering our water and sanitation systems
- 8. Engineering and technical education
- 9. Socioeconomics of the Big 4 Agenda

Call for Papers

The Society wishes to invite researchers with complete works on any relevant topics under the above subthemes. Authors are invited to submit abstracts of their research papers to:

Eng. (Dr.) Duncan Mbuge Email: <u>info@kesebae.or.ke</u>

Conference Structure

Key note speeches, platform presentations, plenary discussions, poster presentations and exhibitions

Registration

The participants are required to register by paying a conference fee of KES. 5,000 (regular participants) and KES. 1,000 (students) through the payment information below.

Conference materials to be submitted as follows:

- Abstracts October 31, 2019
- PowerPoint and poster presentation November 8, 2019
- Full papers for publication November 21, 2019

MPESA: PAYBILL: 303030 Account no.: 2038150696

BANK: Kenya Society of Env. Bio. & Agric. Engineers Barclays Bank of Kenya University Branch Account no.: 2038150696

Please, submit evidence of payment to 0726305273

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KeSEBAE Lecture Series

The Editor

The KeSEBAE series of lectures for this year are as tabled. All lectures to be held at the University of Nairobi Towers from 5.00pm.



Call for membership

The Kenya Society of Environmental, Biological and Agricultural Engineers invite interested individuals to register as members of the society.

EDITORIAL

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