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WELCOME

...to the 15th Issue of the Green Business Gazette.



WELCOME to Issue 15 of the Green Business Gazette, which happens to be the first issue of the year 2023. Over the past 3 years, Green Business Gazette continues to be the leading light when it comes to sustainability information. We take a deep dive into the Special Issue on Food Security. Due to the unprecedented effects of climate change on food security, many families face a bleak future. We encourage the adoption of climate smart agriculture in this issue as a way to hedge against the effects of climate change.

The rise of small grains in sub-saharan Africa, is offering relief to farmers and households, from a nutritive perspective and also from a climate adaptation perspective. In the age of erratic rainfall, small grains are remaining resilient. The issue also features the impact of livestock on climate change as well as how livestock is going to be impacted.

The quest for a green economy is scaled-up in the issue as we talk about reducing food waste that is proliferating around the world. Post-harvest loss is also on the rise and we encourage the deployment of agro-processing technologies in farming communities in order to eliminate the losses of food. The current issue of the Green Business Gazette offers new forms of livelihoods such as beekeeping, in line with ensuring that communities evolve and adapt to climate change.

On the sidelines of the focus on food security we map out new frontiers of green hydrogen in the Issue 15 of the Green Business Gazette as possible pathways for ensuring a Green Economy. We assess the impact of infrastructure on environmental sustainability. It may take small little steps, but at the end of the day, a Green Economy is possible. Let's play our part. Be part of the Green Transformation. Together we can green the economy!

Tawanda Collins Muzamwese
EDITOR-IN-CHIEF

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ON THE COVER

↓
Livestock
Production
or Emission
Reduction

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SMALL GRAINS GIVE HOPE TO FARMERS IN THE WAKE OF CLIMATE CHANGE

■ Tawanda Collins Muzamwese

Kizito, a subsistence farmer, takes a tour of his dilapidated maize field in the wake of yet another season where rainfall is unpredictable. Each year he has to rely on hybrid seeds from multinational and international companies as well as loads of agrochemicals such as fertilisers and herbicides. Although he inherited the farming field from his parents, it is becoming increasingly evident that farming is becoming a burden to him. The cereal crop yields are dwindling. Kizito and his fellow kinsman are now thinking of shifting towards small grain crops instead of traditional cereal crops such as maize which are vulnerable to climate shocks.



Small grain crops such as sorghum, millet, rapoko, finger millet and cowpeas are gaining popularity. Some of these crops have been grown in our rural communities for centuries. These crops are drought resistant and can survive in dry conditions. This is especially key in the current situation where climate change has become a major developmental challenge and rainwater is becoming scarce.

Some farming communities have no financial investments to support irrigation activities, hence the need to have a crop regime which is water efficient. Cowpeas can easily be intercropped with maize, sorghum, millet and cassava. Many nutritional meals can be made using cowpeas in both rural and urban set-ups. The strength of small grain legumes such as cowpeas is the ability to fix nitrogen and boost nutritive value.

A number of by-products are also made through the further processing of small grain crops. Traditional cross breeds can also be done to reduce the dependency on expensive seed crop varieties.

Although small grains are being promoted, there is also a resistance to their adoption as many people find comfort in traditional crops which they are used to growing. Governments, agricultural extension and research centres should step up efforts in order to encourage the adoption of small grains.



Many people in Africa wait till they start experiencing ill-health for them to adopt small grains. However, rather than waiting till their health is compromised, it is essential to prioritise consumption and growth of small grains now before health complications arise later.

The key benefit associated with the small grains is that there is no intensive management of the crops as they can grow under fine soil tilth and in conditions of distress. They also are able to adapt to arrangements of intercropping. In order for Africa to strengthen its food security, it must strengthen the work on small grains. Local knowledge about growth and management exists across the continent.

To Kizito, the rural farmer and other aspiring farmers it is time to rethink and consider the role of small grains in Africa's transition towards food security. Let us feed Africa - grain by grain!



LIVESTOCK PRODUCTION OR EMISSION REDUCTION

■ Wadzanai Diana Manyame

The world has always known that we get most of our milk from cattle and quality beef comes from cattle. Over the years, beef has been the mostly consumed type for meat as it can be used to make different by-products such as mince, sausages and beef polony. It is also good for barbeque, grilling, stewing and can be served with many starches. On the African continent, it is commonly consumed an average of 3 to 4 times a week depending on the affordability of that particular household. It is listed as a recommended source of protein and is required if one is to be said to be consuming a healthy diet.



Milk is mainly produced from cattle, though goat milk is starting to gain popularity, mainly in the cosmetics field and not as a source of food. There are a lot of milk products on the market that depend solely on cow milk production and these products constitute a healthy diet suitable for both children and adults. Basic products such as fresh milk, sour milk, dairy juices, yoghurts and luxury products such as cheese, ice cream among other products that need milk to be made such as cakes, bread, scones and many other confectioneries, all rely on the availability of milk produce from cattle farms. Cattle contribute immensely to the food and nutritional value chain and can be regarded as an anchor to a healthy diet. Now imagine a world without cattle.

Studies have over the years proven that cattle and most ruminants contribute immensely to the release of greenhouse gases and thereby contributing to climate change. About a third of human induced emissions are

said to come from livestock production. This is mainly due to the cattle diet and digestion process of ruminants, where a lot of methane is generated and is released in gaseous form from the burps and manure of ruminants into the atmosphere. The bigger the cattle herd or livestock the more the methane released meaning on large plots where hundreds or even thousands of livestock is being kept high amounts of methane are being released into the atmosphere and adding onto the greenhouse gases. Methane gas is regarded as more potent when compared to carbon dioxide.

The world is in a war against climate change and each year members to the United Nations Framework on Climate Change Convention convene at the Conference of Parties to discuss matters around climate change. The main issues are centered on how best to mitigate climate change through reducing emissions at source by combating processes that



release greenhouse gases and also how best to adapt to climate change phenomenon in the case of climate induced events. Livestock production comes as a matter of mitigation where elimination of methane gas from livestock production has to be done either by stopping cattle production or finding means to ensure that little or no methane is being produced. This can be done largely by finding alternatives to the livestock diet.

Studies are being done on

alternatives to the already existing livestock diet. This includes adding supplements that slow down the production of methane, adding more corn to the diet instead of grass and finding ways to capture the methane. Despite the fact that nothing solid has been set on alternatives, countries in Europe have already started putting policies and legislations on livestock production and this has caused an uprising especially with farmers who have lived their lives knowing livestock farming as their source of livelihoods. People have been able to survive to date because of

the returns they get from cattle farming, the meat that they eat, the milk they drink and also other by-products that come from cattle such as leather.

One then wonders the practicability of such measures especially in livestock farming, where some livelihoods are solely dependent on livestock farming especially in Africa and bringing it back home, in agroecological regions 4 and 5 of Zimbabwe, where crop farming does not thrive because of the climate conditions and livestock farming has been the main cash cow.

Food security, nutrition balance and livelihoods are under threat unfortunately there seems to be no better side of the coin. Where if climate change is not combated, the world will suffer climate induced phenomenon and if livestock production is to be stopped, the world will still suffer from food insecurity and malnutrition.

The question then becomes,

“Is it going to be food availability or climate change mitigation?”.

POST-HARVEST LOSS GIVES AFRICAN FARMERS A HEADACHE

■ Tawanda Collins Muzamwese

Every farmer aspires to have a maximum yield from any food production undertaken. Unfortunately, post-harvest loss contributes between 30-50% of the yield loss. Whilst millions of people are in search of food, post-harvest loss is a paradox to the Sustainable Development Goal of Ending Hunger.



Ensuring that grain storage and other crop storage options are fast tracked, helps to reduce Post-Harvest Loss (PHL). The advent of renewable energy also makes possibilities such as solar drying, solar refrigeration and other food storage techniques. Production of agricultural produce further away from markets, requires construction of processing facilities near the production areas. Many crops are deteriorating before reaching markets.

Policy and technological interventions are necessary in order to limit post-harvest loss in developing and transition countries. Governments are urged to promote value addition and beneficiation of food products in such a way that there is no accumulation of food waste.

In addition, it is not possible to process all food as some consumers require it fresh. The trade-off of using preservation

chemicals is also a thorn in the flesh in many jurisdictions.

Post-Harvest loss can be in two dimensions namely qualitative and quantitative. The quantitative dimension relates to the amount of harvest that can be lost. On the other hand, qualitative relates to the deterioration of food in terms of its nutritional quality. Inadequate infrastructure and lack of a value-chain approach are key barriers in the prevention of post-harvest loss.

As Africa grows towards development, post-harvest loss has to be dealt with. The urgency of food is imminent given the food crisis that has been heightened by the geopolitical conflict between Ukraine and Russia, both of which play a role in global food production. Climate change also presents new challenges to farmers. As a result, there is no room for post-harvest loss, if we are to attain sustainable development and feed the continent.

INVASIVE SPECIES THREATENING LIVELIHOODS

■ Wadzanai Diana Manyame

Climate change exacerbates the effect of invasive species on agricultural production and therefore could affect the food security of a region or nation if left unabated. Invasive species are foreign and unwanted organisms which can be in the form of pests, parasites or plants that invade an area and exponentially spread taking over the native organisms and affecting their growth and survival. In most cases they proliferate to the extent that the natives die out and become non-existent in their own area.

Invasive species are mostly resilient to harsh weather conditions and can survive and thrive anywhere they inhabit which is unlikely of most native crops. In the light of climate change and changing weather patterns, the proliferation of invasive species is being favoured compared to native crops that might find it difficult to thrive in drought-like conditions or erratic rains conditions. Climate change interacts with stressors that affect the distribution, and control of invasive species. Climate change plays a part in the transportation and distribution of invasive species, it alters climatic constraints on invasive species and it affects the effectiveness of control strategies. It aids in what is called the invasive pathway.



Invasive species, invade and affect growth and function of the natural inhabitants in the affected area thereby threatening agriculture and food security. A case was recorded in Zimbabwe of the invasion by *Opuntia Fulgida* in the Matebeleland South Province. 1500 households were severely affected in the districts of Gwanda and Beitbridge where an envisaged total of 2355 hectares of land has been invaded by *Opuntia Fulgida* taking up land that could be used for cattle and animal rearing and farming of drought resistant crops.



It is therefore important to ensure sustainable agricultural practices and always ensure that agricultural spaces are monitored for unwanted species in good time. A record of all invasive species should be kept including ways to manage and eliminate them. Studies and research should be done on the common species that invade Zimbabwe. This is because it has been noted that, the challenge with most invasive species is that they cannot be easily eliminated by chemical pesticides or herbicides. They implant themselves and spread in a way that makes it difficult for such methods to be used as it involves risking the general public and the remaining crops or livestock. Biological methods have to be devised to which involve the use of bacteria, other



plants or pests that feed on that specie or that can introduce a toxin on that specie and alter or destroy its survival mechanism. A case of *Opuntia Fulgida* is an example where biological means had to be employed as the specie had proliferated a large area of land. The cochineal insect (*Dactylopius* spp) was introduced onto the plant and through its sap sucking techniques, the plant dries out and eventually dies. It is believed that the saliva of the insect contains toxins that act on the plant.

It is therefore important to take note of such climate induced phenomenon, they affect livelihoods through reduced agricultural production. This tempers with progress in achieving sustainable development goal two and three on zero hunger and good health and wellbeing. Communities lose livestock and crops leaving them with not enough food and a source of income till the next season. Hunger and poverty become a daily song.



LIVESTOCK SURVIVAL

IN THE VEIN OF CLIMATE CHANGE

■ Tawanda Collins Muzamwese

Many scholars blame the livestock sector for causing climate change. Little consideration is given to the fact that the rearing of animals for meat and milk production has supported society since antiquity. The sector is now seriously under siege due to climate change. In this treatise we delve into the issues which will affect the livestock and dairy sector in the age of climate change.

With the soaring temperatures, animals will struggle to survive and more fatalities will occur before the animals reach the point of slaughter. An increase in the prevalence of diseases that affect animals is also inevitable. As a result, the health of animals will be affected by weather conditions.

Furthermore there is a growing realisation that the availability of animal feed will greatly dwindle in the age of climate change. Growing feed in extreme weather conditions will continue to be difficult due to the sweltering heat.

The increase in water scarcity, will also become a headache to the survival of animals which rely on water for survival. Milk yields per animal are also envisaged to be affected if proper feeding techniques are not implemented.

Drought tolerance of animals varies and there are some animals which are more prone to droughts and famine than others. Therefore, if the frequency of droughts is to increase, there shall be a higher chance of animal mortality, thereby having ripple effects on the food security situation in countries across the world.

The stalemate that exists is how the livestock sector can be sustained in the age of climate change, whilst also reducing its impact on climate change. It is a fallacy that we can entirely survive on vegetarian diets and no milk. These products play a very important nutritive role for both children and adults. In addition, they are sources of livelihoods to millions of families across the world. How we orient the livestock and dairy sector will determine if they can facilitate a Green Economy. Without agriculture, sustainability remains a pipe-dream.

BEE-KEEPING OFFERS ALTERNATIVE LIVELIHOODS IN THE AGE OF CLIMATE CHANGE

■ Tawanda Collins Muzamwese

Climate change is here to stay and there is no place to hide for many societies across the world. As the global catastrophe gains momentum, many communities are finding it difficult to sustain agricultural activities. Erratic rainfall, low yields, high temperatures continue to be hindrances to effective crop growth. Some farmers are finding bee-keeping as a possible practise to sustain their lives whilst selling honey to generate income.



With proper planning, training and effective hives, it is very possible to have a good regime of hives that produce a constant amount of honey for a viable business.

Honey is quite a valuable product which has natural and therapeutic properties. Some honey is even sold internationally due to its very high quality. There are also a number of bi-products that can be manufactured in the value chain, such as wax.

Bees are not easy to keep but with proper personal protective equipment such as bee suits, it is possible to manage them.

The main message to bee-keepers includes the need to develop markets and also undertake bee-keeping as a business and not as a hobby. Monetisation of honey production through beekeeping can establish new enterprises and create jobs in communities.

Bee-keeping needs to be considered as a thriving enterprise and not as a hobby for it to be sustainable. New factors affect the viability of bee keeping and these include changing weather patterns, high bee death and start-up costs. In certain areas the lack of markets for honey also affect bee farmers.

Stakeholders involved in beekeeping are discouraged from burning forests during bee harvesting and also from burning tyres. It is also not good to cut down trees during bee harvesting. An urgent call for sustainability is necessary, if beekeeping is to take us out of poverty, in the quest to adapt to climate change.

Rather than waiting for the rain which may never come, bee-keeping is becoming highly popular as an alternative livelihood source to agriculture. Whether it will be sustainable or not - the future will tell whether the sweet gold makes the dimes.



SUSTAINABLE FOOD SYSTEMS AND CLIMATE CHANGE

■ From the Editor's Desk

Climate change is becoming a global challenge of unprecedented proportions. Without proper planning, the world will be thrown into an abyss of struggle in the context of food security. The way we grow food should change in light of climate change to become more adaptable and resilient.

Climate Smart Agriculture (CSA) is a key ingredient to limit the effects of climate change on crop production. Conservation agricultural practices such as mulching, limited soil disturbance and water efficient irrigation techniques are all means of strengthening resilience to climate shocks.

Farmers cannot continue with business as usual and implement old farming methods, when in actual fact the amount of rainfall is becoming erratic. New models of farming should mainstream climate change, disaster preparedness and response, in order to ensure that there is improved preparedness to disasters.

In order to meet import requirements of developed countries, it is also being demanded that the value chain be sustainable. There is no other time than now to move towards sustainable food systems. Shockingly, several stakeholders still believe that climate change is a hoax and that it will end one day, from the look of things, there is no relief in sight. As for now, we need to brace up for more climate shocks and implement climate smart agriculture.



CHEMICALS IN FOOD CAUSES CONCERN

■ Editorial Team

The agricultural value chain produces crops, livestock and poultry products for global consumption. In many parts of the world it anchors economic development. Without agriculture, people will starve. However, there is an increasing trend of the overuse of chemicals in agricultural systems. If this is not controlled there may be challenges in human health and safety.

Common chemicals used in agriculture include pesticides, fertilisers, insecticides among other chemicals with the ability to annihilate unwanted organisms. If chemicals are in very high concentrations they can bio-accumulate in the ecosystem, causing reproductive and developmental effects as well as acute toxicity.

Chemicals should not be overused and where they are used a proper hazard identification and risk assessment should be done. Toxicity of chemicals can occur in the short term and this is regarded as acute toxicity. In another dimension it can occur as chronic toxicity where adverse effects build up overtime and manifest later.

A large number of customers are moving away from chemical intensive food products towards natural ones in order to safeguard and improve their health.

A wide range of methods can be implemented to reduce and prevent the usage of chemicals. These include crop rotations, Integrated Pest Management and natural enemies. As food production is boosted, human health should be a priority.





FOOD WASTE RISES

Across the world, generation of food waste is increasing. Although many people are living in poverty and hunger, some still find it possible to dispose food. A total of 33% of global food is wasted in many ways such as post-harvest loss and also through waste food from leftovers.

Post-harvest loss is existing as a result of poor market research and lack of storage facilities for harvested food. There is a high amount of food that is not consumed and ends up becoming an environmental nuisance.

Proper scheduling of meals as well as optimising food quantities is necessary. Governments should also manage food distribution in proportion to the need. Individuals should train their children to avoid being wasteful when it comes to food. Food should be treated with value and as a resource, given the effort in its value chain. Toxic subsidies that make food valueless should be done with so that everyone understands the value of food. Technological support to farmers is also a key enabler of food sustainability.

IMPACTS OF INFRASTRUCTURE DEVELOPMENT ON ECOSYSTEMS



■ Oliver Mutasa

Over the years we have heard of the positive impacts of projects on livelihoods and communities, but not much has been said about the negative impacts these projects might have on the same communities and livelihoods. This is not because people do not know of the possibilities but sometimes people do not just want to talk about it. I have conducted ecological surveys around the country and have seen projects progressing without much attention being paid on the residual impacts these projects might have in the long run. Mining projects are some of the projects to pay attention to when considering the welfare of the ecosystem. Both large scale and small-scale mining projects result in the development of pits, trenches and shafts and these are a cause of concern in communities as they end up running a risk of trapping livestock and people.



Impacts of neglected rehabilitation have never been so practical until I came face to face with a tortoise that was trapped in railway infrastructure. This wake-up call came when I was conducting an Environmental and Social Impact Assessment (ESIA) for the Chirumanzu Rural District Council at Mvuma for their sewer reticulation system, on the 18th of December 2022. I was walking along a stretch of a railway line close to the proposed site that was earmarked for the sewer ponds, with our Ecologist Blessing Nyungu, we had just walked for a stretch of about 200m along the railway, and stumbled upon a sad sight. We discovered that the railway line that was not been operational since the collapse of Athens and Falcon gold-copper mines in Mvuma was trapping small animals such as tortoises.



Tortoises are reptiles of the family Testudinidae of the order Testudines. Like other turtles, tortoises have a shell to protect them from predation and other threats, however the shell has not done enough to ransom the precious reptile from the effect of being trapped in the railway line. The trapping has been necessitated by differences in levels of aggregates that is, higher outside the rail bars and lower inside the rail bars. This allows the small animals to crawl over the railway bars but then find it difficult to find their way back into the outside space of the railway.

During the 200m walk, we discovered twelve (12) dead tortoises, with some looking like they had recently died. In the same expedition, we managed to rescue six (6) tortoises that we released back into the wild without assurance that they would not come back to the trap. This finding is a tip of potential impacts of projects on ecosystems.

One then wonders, how many more dead tortoises we were going to encounter if we had continued on the route for about a kilometre, also considering the life of the railway line, how many have died and decomposed due to this trapping effect of the railway line. Some projects continue to have negative impacts even after they have reached closure stage.

It is therefore important to ensure that proper closure and decommissioning of projects is done once a project no longer has the potential for resuscitation to allow for the environment to be restored to its pristine state and make room for ecosystem development again.

It is postulated that of the 360 turtle and tortoise species currently recognized, more than half of them meet the criteria for "threatened with extinction" on the International Union for Conservation of Nature's (IUCN) Red List of Threatened Species and just over a third of the species are in such a dismal state that they qualify for the Red List's two most dire categories: endangered and critically endangered.



Craig Stanford, the chair of Tortoise and Freshwater Turtle Specialist Group at the IUCN and lead author testified that, turtles and tortoises are one of the most threatened groups of animals in the world. "There is simply no other group of animals of several hundred species where more than half of them are staring down extinction. That's just extraordinary," Stanford says.

There are several other reasons for a decline in tortoise population especially in Africa. One of the most notable ones include habitat loss. It is said that more than 90 percent of the geometric tortoise's former habitat has been destroyed, making it critically endangered and one of the rarest land tortoises left on earth.

In conclusion, this railway and other tragedies call for conservationists and engineers to come up with railway designs that a not a barrier to small animals. This will save our ecosystems from such impacts of infrastructure development. When companies are scrambling to have a good image by lowering their carbon footprint they also have to work on ensuring that they minimize their ecological footprint during operations right up to decommissioning of their projects.



“THE FUTURE OF ENGINEERING MATERIALS IN HINDSIGHT”

A CRITIQUE ON THE EVOLUTION OF ENGINEERING MATERIALS

■ Rindai Mahoso

THE TREND

The evolution of engineering materials can be traced from as early as when mankind first realized the need to use tools for survival and to aid in the improvement of the quality of life, from the use of timber and stone to the present day where there are specialized materials for almost any purpose, the journey of this evolution is nothing short of remarkable. The “symbiotic” relationship between technological advancements and engineering material evolution is evident throughout the timeline of civilization. This is where the two ends feed each other in a seemingly-never-ending cycle and as such, the impact of the evolution of engineering materials can never be understated.

The beginning of the 20th century saw a cultural

shift in the manner in which engineering materials evolved. Before this turning point, the rule of thumb was with the advent of a new material came with it a technological revolution of sorts. This happened with wood, stone, steel and plastics. Each material came with variations in applications and at times drastic changes in the outlook of the world as a whole. The modern era however, brought a change in the technology and engineering trends in relation to the engineering material evolution. These changes have thus necessitated this deeper look at how things have unfolded. The evolution of engineering materials will be looked at from different vantage points to portray how the process has taken place with the main aim of coming up with an impactful foresight for the future of material development and ultimately technological advancement.

General use impact

The general trend through the years has been towards material analysis and design at a smaller scale which has provided major insight but has of late produced very little in terms of mainstream practicality. Research trends have progressively shifted from the milli scale to the nano scale and in some instances even the picoscale, but the resultant materials have been largely impractical to the mainstream market. A stark example being carbon fibre, which is a modern micro to nano scale designed composite material known to be 'as strong as steel but as light as paper', thus naturally promising great versatility and limitless applications in engineering practice. Disappointingly, the material has remained largely inaccessible to mainstream users since its discovery in the 1950s mainly because of its price tag which sits at a minimum of 10 times that of aluminium and more than 20 times that of steel per tonne; which are the conventional structural materials. This has seen carbon fibre's applications being limited to high end applications and specialty products. The greatest innovations done with carbon fibre are mainly in the aviation and spacecraft fields where the need for light-weighting is paramount and cost demanded can easily be met. In comparison, steel was discovered around the 13th Century and from the beginning it has shown its worth in accessibility, availability and versatility with hundreds of alloys and grades of steel for different engineering uses from structural to aesthetic. It has been widely regarded as the most important engineering material and over and above all it has been analysed and designed at a milli, micro and even nano scale yet still maintained its relevance in the macro scale applications.



This trend can be generally seen across the early engineering materials and the modern ones. In the past, the engineering materials were simple but had high application versatility and impactful effects, in the current 21st century era, new engineering materials are top tier, specialized and complex but they fail to make same impact as past materials had. It then can be argued that there hasn't been a conscious effort to reconnect these deeply designed materials to the basic use. This has arguably led to the slowdown of technological advancement in the physical sphere as compared to the digital sphere.

From extraction to synthesis

The greatest shift however in the story of engineering material evolution was in their manner of manufacture from the early days to modern times. It can be noted that although all materials have an origin in extraction of a natural resource at some point, the traditional engineering materials were mostly raw materials taken from nature and refined to isolate the desired material. Cases in point include iron, copper, gold, silicon, latex, timber and many more. The aforementioned shift that came with contemporary materials began with the birth of the modern petroleum industry around 1859 and the versatility that petroleum brought with it as it is the basis of the synthesis of an endless number of petroleum-based chemicals and in particular

polymers. This brought about the pivoting point between the era of mere extraction of resources for usable material, to the era of synthesis of new, purpose designed materials. This turnaround combined with advances in machine technology and electronics set the stage for the possibility to design materials at a nano scale and a molecular scale so as to design them purely to the practitioner's desired purpose. In particular, the ability to design and manipulate materials at a nano scale has been a game changer, giving birth to a whole new field of expertise which has brought forward a plethora of possibilities; from the design of nanorobots, to smart materials that have inherent characteristics embedded in them from their primal molecular backbone. The nanomaterial revolution brings hopes for an exciting future in the engineering sphere as it also brings about a whole new dimension to engineering design.

Examples of the marvels that have come out of the synthesis era of engineering material development are attested in the spread of specialised materials, from specialised polymers to the design and synthesis of hybrid and composite materials. It can be clear that if there is one thing the evolution of engineering materials has the correct bearings on, it is the shift from pure extraction, to synthesis, to the bright future of smart materials which are perhaps even regenerative. Surely the case is strong to continue in this trajectory.

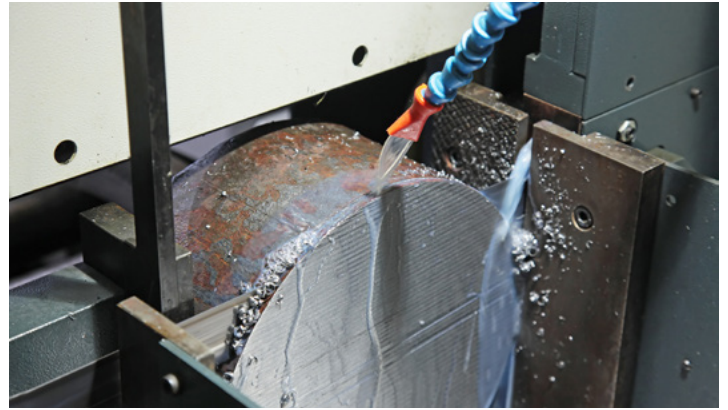
Focus on sustainability

The final salient point in the analogy of the evolution of engineering materials is the question of sustainability. The trends in the engineering field have been mainly to be more cognisant of sustainability in all areas of engineering, with a field of engineering even being coined 'Sustainability Engineering'. Albeit this being a noble cause and trend that ought to be applauded and encouraged, the concept has not been applied enough in some spheres, especially so in the area of engineering materials. It can be noted that from the era of extraction of materials from nature, massive degradation of ecosystems from extractive processes have left telling scars on the face of the earth as to how damaging these methods on a large scale have been. Forests have been cleared and many water bodies have been left to die through mining and extractive methods. The shift to synthesis of materials, especially the petroleum-based materials did not solve this inherent problem with extractive methods, it instead brought with it major sustainability problem as well in the form of waste management. Polymer waste is one of the biggest pollution problems of our era coupled with the different manners of toxic waste that come from the manufacturing processes of engineering materials in general, whether extracted or synthesised. Therefore, it can be noted that the sustainability problems from extraction, manufacturing processes to disposal have caused us to be at the point which we find ourselves today, showing that clearly sustainability has not evolved for the better in tandem with engineering materials.



It is to be noted however that despite the overall clear struggle with this problem, it is not without gallant efforts being made to rewrite the stories of modern materials so they may be more inherently sustainable for example recycling, increasing biodegradability and designs for end of life use. The role for embedding sustainability in design cannot be understated and such strides are being seen in the design of modern nanomaterials and their possible applications.

Another worrying trend in the 21st Century is that of many sustainability targeted products which use non-green or unsustainable materials in their manufacture. Classic examples are electric cars and led lightbulbs. It can be noted that in as much as these products are solving problems in terms of power consumption and emissions, the design for end of life can almost always be



brought to question with these products being major drivers for e-waste stockpiles. This trend brings to the fore the issue of conscious life cycle design not just in the material design but also in the intended applications.

Discussion

It can then be seen and somehow agreed that, in terms of the design and use of engineering materials, we are at an all-important crossroads, where conscious decisions need to be made for the sincere assurance of a sustainable future.

The first suggestion to be made would be for the case of the "need for material reverse evolution for the advancement of technology". This would mean taking back most modern materials which have seen themselves landing their use only to the technologically elite, and finding ways to make them more accessible to the mainstream. There shouldn't be a reason why the world at large should not benefit from the advantages of carbon fibre, or technologies for composite material synthesis for instance. This availability of the technologies and material to the mainstream will surely accelerate the rate of innovation and open up discourse around issues of sustainability.

There is also need for honesty and analysis of designs and materials used especially in the name of sustainability. The most effective way would be to analyse all materials and products through their inherent life cycles, from extraction/synthesis to disposal. In an era of material design the nanoscale is taking centre stage. It surely is a possibility to come up with more honestly sustainable solutions to the problems we currently face as a planet. These suggestions could pave way to the right way of doing green business.



THE DIFFERENT COLORS OF HYDROGEN

■ Wadzanai Diana Manyame

The earth is a place surrounded by so much energy. Different kinds of energy flow through it from different sources. Humans have managed to discover some of them and we have put these to use. Over the years, populations have grown, demand has increased and also discoveries have also been made that some of the energy sources despite them providing for energy and saving the world, actually do not save the world but in fact present it to a danger that the world might fail to recover from. This article discusses one of the energy sources that exists in the form of a chemical element, Hydrogen. It delves on what hydrogen is and how energy is formed from hydrogen and most importantly the different colors of hydrogen and why the different colors. This comes after interest has been noted to be growing in the generation and use of green hydrogen. Studies and projects are being done in Sub-Saharan Africa to assess the applicability of generating green hydrogen as well as its socioeconomic impacts. Energy from hydrogen is not a new concept though not widely used but the green part of it might be. One would the ask a question, 'What makes the hydrogen green?'. This will be discussed in detail in the articles to follow.

Hydrogen occurs as one of the simplest elements on earth. It is represented by the symbol H and has an atomic number 1. The hydrogen atom bears a nucleus with a proton that has one unit of positive electrical charge and a negatively charged electron. In standard conditions hydrogen is a gas of diatomic molecules and bears the symbol H₂. Hydrogen is nonmetallic, colorless, light, tasteless, highly combustible and tasteless. It burns with oxygen to form water (H₂O). It is the most abundant substance on earth constituting about 75% of matter but only takes up to 0.14% of the earth's crusts' weight. It occurs in water and the atmosphere. In water it can be rivers, dams, lakes, oceans, icepacks, underground water sources and anywhere where water exists. Almost all carbon compounds contain hydrogen therefore it can also be found in vegetable and animal tissue as well as in petroleum. The element hydrogen has three known isotopes which all have 3 significant properties namely protium, deuterium and tritium. Protium is generally called hydrogen whilst deuterium and tritium are known as heavy hydrogen. Deuterium and tritium constitute a proton and a neutron, 2 neutrons in the case of tritium and a percentage of the ordinary mixture of hydrogen. These two are of more interest to fusion energy. Fusion energy has been explored in Issue 11 of the GBH.



Hydrogen allows the transport of energy in a usable form, making it an energy carrier. It can store and deliver a tremendous amount of energy. It is a clean burning fuel that only produces electricity, water and heat. The sun which is the mostly highly powered star in the universe is largely made out of hydrogen gas (H₂) and helium gas (He). Hydrogen though abundant as an element on earth, it does not exist in isolation. It combines with oxygen to form water and carbon to form hydrocarbons found in different substances such as petroleum, coal and natural gas. To retrieve it and use it must be produced from another substance and this process also requires energy. To say it bluntly, it needs a primary source of energy to be produced and these can either be solar power, wind power,

hydroelectricity, thermal power, nuclear power or gas. It is therefore the specifics of the production process, including the energy source used that determine the color of hydrogen. These colors define the sustainability of the production process.

Hydrogen processing can be done through steam methane reforming, electrolysis, biological processes and other processes such as photobiological, photoelectrochemical, photovoltaic-driven electrolysis and solar thermochemical processes.

There are 5 distinct colors of hydrogen. These are blue hydrogen, grey hydrogen, green hydrogen, pink hydrogen and yellow hydrogen.

GREY HYDROGEN **Thermal Reformation** This process has been the most practiced form of hydrogen production. In this process natural gas is split into hydrogen and carbon dioxide through a process called steam methane reforming or auto thermal reforming. The hydrogen gas is collected whilst the carbon dioxide is released into the atmosphere.

BLUE HYDROGEN **Steam Reformation** This is when natural gas is split into hydrogen and carbon dioxide through a process called steam methane reforming or auto thermal reforming. The hydrogen gas is captured and stored and so is the carbon dioxide through a process called carbon capture usage and storage.

GREEN HYDROGEN **Electrolysis** Hydrogen is produced by splitting water using a process called electrolysis. This process also produces oxygen as a byproduct which can safely be released into the atmosphere with no negative impacts to the environment. However, to produce this hydrogen energy as green hydrogen, a renewable source of power is required to perform the electrolysis.

PINK HYDROGEN **Electrolysis** Using nuclear energy as the primary source of energy, electrolysis of water is performed to produce hydrogen and oxygen as a byproduct.

YELLOW HYDROGEN **Electrolysis** To produce yellow hydrogen only solar energy is used to power the electrolysis process which splits the hydrogen and oxygen molecules in water.

The color of hydrogen is determined by its production process, primary energy source, its socioeconomic impacts and environmental impacts.

AFRICAN YOUTH SURVEY 2022 REVEALS HIGH LEVELS OF CLIMATE CONCERNS

■ Wallace Mawire

Climate change is increasingly a concern for many people across globally. An African Youth Survey held across 15 countries has revealed high levels of climate concerns and dissatisfaction with government response.

Coinciding with the 27th United Nations Climate Change Conference of the Parties (COP27) in Sharm El Sheikh, Egypt, findings from the African Youth Survey 2022 reveal that nearly three quarters, 72% of Africa's young people consider climate change a major concern impacting their future with the highest levels of concern found in Malawi, Kenya, Ghana, Zambia, while only 46% of respondents are satisfied with their government's handling of the crisis, with dissatisfaction the highest in South Africa, Angola, Sudan, Nigeria.

While a recent report by the United Nations Children's Fund (UNICEF) and the World Health Organization (WHO) indicates that there are over 398 million people in Africa without access to reliable sources of drinking water, and over 900 million youth lacking access to adequate hygiene services, the African Youth Survey finds that a third polled, 34% find it difficult to access clean water on a daily basis and over one third, 35% also spend more than a quarter of their income on buying clean water. Slightly above half reported that they garner their drinking water from a tap or sink in their home, 57%.

Ultimately, nearly half, 49% of African youth polled believe

that climate change will greatly impact future generations on the continent of Africa.

Commissioned by the Ichikowitz Family Foundation, a leading African NGO, the Youth Survey of 4,500 face-to-face interviews with young Africans aged 18–24 revealed that 78% are worried about increasing levels of pollution. Seventy-two percent (72%) are highly concerned with the increasing frequency and severity of extreme environmental events top countries include Rwanda (90%), Ghana (89%) and Ethiopia (88%).

Seventy seven percent (77%) are concerned that climate change will lead to an increase in infestation and crop destruction from insects, greatest concern was expressed from Ethiopia (91%), Malawi (91%) and Kenya (88%). Seventy four percent (74%) worry that climate change is destroying natural habitats critical for wildlife, farming. Countries indicating the greatest worry include Ethiopia (87%), Malawi (86%) and Rwanda (83%). Seventy two percent (72%) are concerned by extreme heat waves or cold spells that last for abnormally long periods, top countries including Ghana (85%), Kenya (85%) and the DRC (80%).

In line with those concerns,

Africa's youth, according to the Survey, want to see their governments doing more to address climate change by reducing carbon emissions and adopting green energy solutions.

Eighty five percent (85%) of African youth polled believe that their government needs to be more proactive in addressing climate change whilst eighty four percent (84%) believe their governments should be working harder to adopt green energy solutions and eighty one percent (81%) believing that their governments ultimately need to make a more concerted effort to reducing carbon emissions.

Ivor Ichikowitz, Chairman of the Ichikowitz Foundation and sponsor of the African Youth Survey, stated that, "It is ironic that while playing host continent this year to the pomp and circumstance of COP27, an event annually bringing together world leaders from the policymaking community to work on practical solutions to bring lasting change in the name of eco-justice, Africa tragically remains the most vulnerable to climate change, while contributing the least emissions."

Africa's youth are at the clear and present frontlines of the ramifications of this direct

threat, facing drought, flooding, extreme temperatures and the destruction of their natural habitats compounded by the correlative challenge of food insecurity. They are willing to put up with this uneven epidemic no longer.

"We see their reaction in the intuitive, constructive, and innovative solutions they seek to bring as the green industrialists of the future, but also in their mass migration abroad, which poses a challenge to communities around the world. Shedding light on our next generation's ambitions, attitudes, their concerns and sounding the alarm where and when necessary. This is a motivating force for us and why we carry out the African Youth Survey each year," Ichikowitz said.

Indeed, not only expressing trepidation about the impact on their surrounding communities and future generations on the continent, Africa's young people feel strongly that climate change will harm them personally and are ready to act. Sixty-seven (67%) of the continent's young people actively support, participate in or donate to environmental causes. Sixty four percent (64%) are actively working towards reducing their own carbon footprint.

72%

of Africa's young people consider climate change a major concern impacting their future



Dr. Richard Munang, Africa Regional Climate Change Coordinator at the United Nations (UN) Environment Programme (UNEP), stated that, "A key deduction from this survey is that climate change needs a whole of society approach to respond to it. It is not just a matter of calling for action from the government, but also a matter of introspection. Young people, for example, as the biggest non-state actor constituency in Africa and individual citizens, need to ask themselves what they can do, using what is accessible to them, beyond the traditional calls to government".

"Several countries across Africa have instituted dedicated climate change laws and policies, with some having up to 26 pieces of legislation and policies addressing matters of environment and climate change. This is commendable, but is this enough? No. It is time for constituencies of implementers, the non-state actors, including the youth, individual citizens and the informal sector to be engaged and take a thorough look at these policies and see what is in them that they can start implementing from an enterprising dimension with what they already have. It takes two to tango, and climate action is no different. It takes complementarity between actors, both state and non-state," Dr Munang said.

SA Rwandan born founder of the youth environment Non-Governmental-Organization (NGO) 'Green Fighter' Ineza Umuhoza Grace, stated that, "The African Youth Survey finds that a vast majority of youth in Africa are deeply concerned about the extreme increase of environmental events taking place on and proving the vulnerability of our continent.



Our youth are suggesting that their governments should do more in addressing climate change, adopting green energy solutions to reduce carbon emissions. They are dissatisfied with efforts of leadership to-date. The survey proves our continent's commitment and the next generation's willingness to be leading global actors in environmental activism. Action and support for the youth movement in order to generate myriad projects, is necessary to have measurable impacts across African communities and beyond," Umuhoza Grace said.



Held annually, the African Youth Survey investigates the views, hopes and aspirations of the continent's young people on the most pressing, contemporary issues that they face. In addition to findings on addressing climate change, topics range from the impact and legacy of COVID-19 to contemporary education, the embrace of the digital revolution and the rise of e-commerce; from perspectives on maintaining stability against terrorism, crime and other threats to security and peace, migration and refugee issues; from appreciation for democracy to community

tolerance; from tackling corruption to fostering a conducive environment for entrepreneurship and innovation to thrive; from opinions on the economic potential of the newly-formed African Continental Free Trade Area (AfCFTA) to perceptions of foreign influencers, such as Chinese President Xi Jinping and the Biden Administration of the United States.

This year's study was administered to 4,500 young African men and women, aged 18-24, across the major urban and rural centers of Angola, Congo Brazzaville, the Democratic Republic of Congo (DRC), Ethiopia, Gabon, Ghana, Kenya, Malawi, Mozambique, Nigeria, Rwanda, South Africa, Sudan, Uganda, and Zambia.

The Ichikowitz Family Foundation is based in Johannesburg and was founded upon the belief that Africa's potential can be unlocked through education, the respect for human rights, a better understanding of Africa's dynamic history and the conservation of its rich biodiversity. It is committed to the kind of active citizenship that promotes the preservation of Africa's heritage, the conservation of its environment, and the empowerment of Africa's youth.

Founded in 2010, the Foundation uses various channels such as award-winning films, music, research, publications and art to foster dialogue between people, to be a torchbearer for innovation and to build a continent where people are encouraged to dream big and achieve the impossible. Key programmes include: the African Oral History Archive, the African Youth Survey, #IamConstitution and the protection of endangered species.

GREEN BUSINESS'S GAZETTE





SAVING THE ENVIRONMENT WITH ORGANIC FERTILIZERS

■ Calvin Manika

Along with his two kids, Maxwell Chiradza (55), removes dung from his cattle kraal. They will put the dung into the scotch cart and proceed to the fields after excavating and creating heaps of it. Chiradza claims that he has been doing this for the past ten years, and as a result, the quality of his soil and harvest have increased.

Before the start of the rainy season, Chiradza and other farmers in the rural areas typically collect cow manure after winter ploughing. He claims that he discovered that dung was an effective organic fertilizer by reading some agricultural literature. "I took it from there and started practising it. Most of the chemical fertilizers we used do have help in increasing our yields but they pose great damage to the soils and the environment. In soils, one should consider not only about the plant but, also other living organisms. They cannot survive under excessive use of chemicals," said Chiradza.

Many people now support the use of organic fertilizers where applicable as a means of halting further soil and land degradation. Farmers and environmentalists view organic fertilizers as a community-wide, environmentally friendly answer. Fertilizers are

typically delivered to the ground through depositing in soil for uptake by plant roots or through leaves in order to encourage plant growth and health. Fertilizers come in both organic and inorganic varieties. Fertilizers typically comprise six macronutrients: magnesium, phosphorus, calcium, nitrogen, sulphur, and potassium.

According to agrochemists, overusing chemical fertilizers can lead to problems like waterlogging. Occasionally, crops cannot utilize all of the chemicals, which causes runoff or subsurface leaching. Tinaye Mhungu, an agrochemist said that excessive use of nitrogen fertilizer use may cause pest problems by boosting the fitness and birth rate of some pests. "Algal blooms, which cause high rates of fish and other aquatic animal mortality, are one of the harmful repercussions of applying too much fertilizer," says Mhungu.

It is possible to apply organic fertilizers too liberally, according to scientists. Increased significant and natural storage mechanisms are provided to soils by organic fertilizers. "The use of inorganic fertilizers is primarily responsible for the problem of overfertilization. Large amounts of artificial fertilizer are used, these massive amounts of chemical fertilizers are harmful in nature and have an impact on soil nutrients," says Michael Duma, an Agricultural Scientist.

In addition to the organic fertilizers that the vast majority of villagers use, businesses like Orgfert also produce organic enriched fertilizer blends. They combine raw materials for chemical or inorganic fertilizer with high quality biodegradable organics that are granulated, professionally prepared, and blended.

The benefits of using organically produced fertilizers include maintaining and enhancing soil structure, increasing soil fertility and restoring soil fertility. According to Orgfert, organically enhanced fertilizers are more environmentally beneficial since they lessen environmental chemical contamination.

"Organic fertilizers give crops an adequate supply of secondary nutrients, micronutrients, and primary nutrients like nitrogen, phosphorous, and potassium. The productivity and growth quality of crops can be increased economically and successfully by using organic enriched fertilizers," according to a statement from Orgfert.

Two types of organic fertilizers exist. The most well-known naturally occurring organic fertilizers are guano, peat, seaweed, slurry, worm castings, and manure. Crops made from green manure are also raised to enrich the soil with nutrients.



Organic fertilizers also include naturally occurring minerals such as mine rock phosphate, sulphate of potash, and limestone.

Composted organic fertilizers, according to experts, include compost, blood meal, bone meal, seaweed extracts, natural enzyme-digested proteins, fish meal, and feather meal. Tobacco, tomatoes, potatoes, onions, maize, wheat, vegetables, flowers, lawn, cotton, groundnuts, sunflowers, and soy beans are just a few examples of the crops that are grown with organic fertilizers.

In order to achieve good growth with lower nutrient densities while wasting less, organic fertilizers mobilize the soil's already-existing nutrients, releasing nutrients more gradually and steadily, preventing a boom-and-bust cycle. Additionally, the constant use of artificial fertilizers is associated with a number of long-term issues that organic farming avoids.

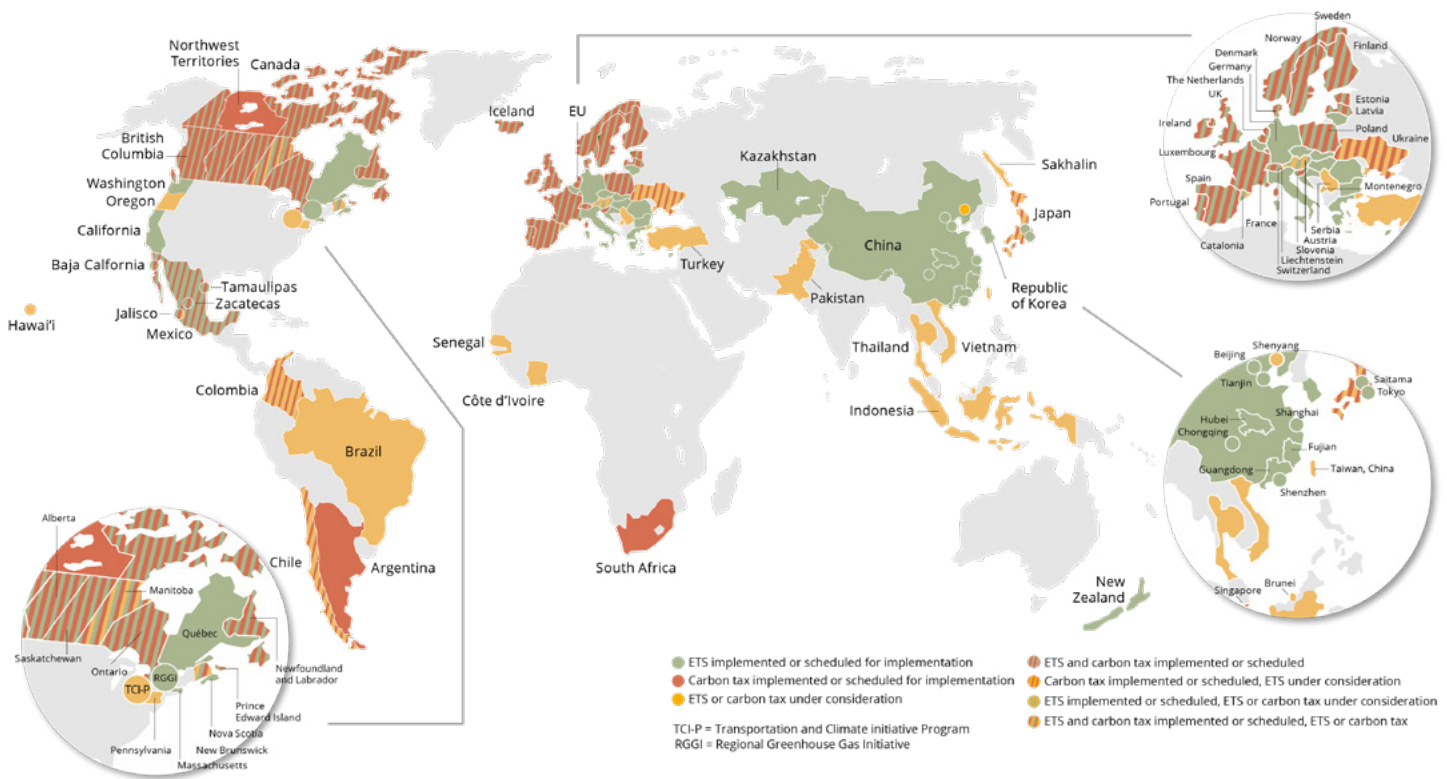
According to chemist Clive Marozva, one of the main



drawbacks of organic fertilizers is that they contain a more diluted source of nutrients than inorganic fertilizers. This means that when significant amounts of nutrients are needed for profitable yields, organic fertilizers must be used in very large quantities.

"Organic fertilizers compositions

frequently vary greatly, making it challenging to apply nutrients precisely to match plant growth. Thus, organic fertilizers are more cost-effective for small-scale horticulture or domestic gardens, but large-scale agricultural often relies on inorganic fertilizers," says Marozva.



WHAT DOES CARBON EMISSIONS TRADING MEAN?

■ Wadzanai Diana Manyame

Just like with every other thing in the world, there are no equals. This is how nature is and we have to find means to accept, adapt and capitalise on that. There are different groups of countries that have ratified to the UNFCCC and these are mainly defined as economically developed and emitting or less economically developed and vulnerable. When issues of climate change are talked about heads turn more now than before.

Individuals and corporates are becoming more aware of the phenomenon and the issues around it. At each COP negotiations are done and new systems are suggested to try and steer interest and motivate players to contribute towards climate mitigation and adaptation. The developing world despite being the most vulnerable is also being presented with a number of opportunities that they can capitalise on. All the corporate leaders want to hear is how much they will gain or get from an activity otherwise they will not pay attention to it. Issues of increased tax on products that have a higher carbon footprint, issues of climate finance and carbon trading have had these

leaders scratching their heads and trying to figure out how to navigate each and every one of it. Coming home, interest has grown on carbon trading and most private sectors want to know how they can get involved and how they can benefit from it to grow their business sustainably. The question is do they really know what carbon trading is, what it means and what one needs to be a qualified trader and at what stage you start earning significant returns. This article explains what carbon trading is and in the issues to come we will be unfolding and following matters around carbon markets and critiquing the process and its ability to reduce greenhouse gas emissions.

Carbon trading which can also be termed carbon emissions trading is a system that has been put in place to impart an economic incentive to reduce emissions. It is also a type of carbon pricing that is meant to cater for the social price of carbon and externalities. It's a mechanism meant manage greenhouse gas emissions by emitters through setting an agreeable limit to emissions and having players acquire rights to emit by purchasing permits or carbon credits that allow them to emit within that cap. The trading model uses a scheme called 'cap and trade' where a government or intergovernmental body sets a limit on emissions which can be termed a cap over a specific period of time. If a player emits more than the permitted cap they have to buy more permits, that is they experience an extra cost to emit more and if a player emits less, they are welcome to sell off their unutilised permits to those emitting more for cash, and thereby gain an incentive of emitting less which benefits their organization. Carbon trading was adapted from the cap and trade regulatory approach that was successfully used to reduce sulphur pollution in the 1990s. The cap is legal and the government or intergovernmental body grants a fixed number of permits to those releasing the emissions. The permits or credits are authorised by governments after agreeing and legalising the amount of emissions permissible from significant sources of carbon, the cap, and are traded on defined and authorised markets. One tradable carbon credit equals one tonne of carbon dioxide or the equivalent amount of a different greenhouse gas reduced or sequestered.

The cap and trade system is the most commonly used and currently, the European Union is the world's biggest carbon trader with the European Union Emissions Trading System (EU ETS). Another system that also exists in carbon trading involves the use of offset credits. Credits are a complementary source of permissions to pollute and these can be acquired from countries or industries outside the set emission cap. This is mostly happening with countries in the developing world where the economy is still developing and the amount of emissions being released are less than those being released by the players in the developed world who run large corporate and huge manufacturing companies. Emitters in the developed world buy credits from those in the developing world (by paying them money to invest or for an already done investment in cleaner technologies or any mitigation project) which allow them to emit more than their emissions cap in their organisations or manufacturing industries. The logic is that the emitter would have paid someone else somewhere to reduce their greenhouse gas emissions instead. Offsets credits are not meant to reduce emissions; they merely replace them. The emitter continues to emit contributing to global warming only that they will not feel very guilty about it.



Emissions trading was initially set out in Article 17 of the Kyoto Protocol and this has been driving carbon trading. Discussions continued and still continue on how best to make carbon trading a system that will yield results to help the world achieve its 2030 goal among the UNFCCC Parties. A resolution was made at COP 26 in Glasgow to approve and adopt Article 6 of the Paris Agreement which speaks to the market and non-market mechanisms of carbon trading. More discussions will follow on carbon markets, other trading units on the market.

ZIMBABWE POWER CUTS

– A THREAT TO BIODIVERSITY

■ Calvin Manika

Electricity remains a challenge in Zimbabwe as the country struggles to meet the demand. Amidst climate change, the balance between solving power cuts and climate change mitigation becomes a thin line. Without electricity and low adoption methods of renewable energy across the country, the majority of people are going for the firewood, paraffin, charcoal and liquid petroleum gas.

The availability of firewood and charcoal is increasing in the informal market, evident from the blackout phase Zimbabwe is going through, but, for Irvine Mwenje, an environmentalist, the abundance of firewood and charcoal in the streets means more deforestation and pollution.

“Firewood on the street sides indicates that trees have been felled, usually illegally and without replacement. The use of the firewood and charcoal produces gasses which contribute to the ozone layer depletion,” said Mwenje.

Electricity is seen as the backbone of contemporary life, particularly in urban areas where it is needed for nearly everything. Due to electricity shortages, there is a strong demand for energy to power various activities, from household chores to the manufacturing sector. Selling firewood has been regarded as a dual indicator of the vendors’ own attempts to make a living while also supplying fuel.

Speaking on the depletion of the Zimbabwean quota in the Zambezi River Authority (ZRA), authorities said the water levels allocated for Zimbabwe have become low and the levels are expected to rise from February 2023. In the face of climate change experts say, the reason for the low water levels is an attribute of climate change due to low rainfall received across Africa.

“We have seen minimal rainfall in most of the sub-Saharan countries compared to previous years, which is alarming because it shows how the effects of climate change are harming our agriculture, industries, and now energy development and power generation. The power outages will also accelerate environmental damage since people would resort to desperate measures to survive, even in an environmentally unfriendly manner,” said Rudo Magwegwe, a climate change mitigation advocate.



Zimbabwe's energy production is reliant on the Hwange thermal power plant and the Kariba hydro power project. Due to equipment failures and other technical difficulties, Hwange Thermal Power Station has not been reliable. The freshly improved Kariba plant's chances of producing power have hit a brick wall because Zimbabwe is now prohibited from producing any more electricity by the regulatory body.

Climate change specialists note that, the irregularity in temperature and precipitation caused by climate change, which is gravely damaging resources in Southern African countries, is the cause of Africa's low water levels.

Droughts have traditionally interrupted hydropower production, resulting in power allocating. Zimbabwe electricity needs are around 2000 megawatts (MW). At full capacity Kariba hydropower station produces 1050 MW and Hwange Thermal Power Station 920 MW. However, the two power stations hardly meet half of the country's demand.

The proliferation of LP gas stations in metropolitan areas is evidence of Zimbabwe's high demand for energy and the necessity for the government to regulate the industry and support the production of renewable energy sources like solar electricity.

Zimbabwe started a rural electrification program at the turn of the millennium, led by the Rural Electrification Agency (REA), a ZESA subsidiary, for illuminating rural areas and halting deforestation. The program received praise, but the inability to electrify all rural areas combined with recent power outages, have been seen as endangering the ecology and undermining the green revolution's achievements through deforestation.

"Lack of electricity forces people to use unconventional energy sources, some of which are harmful to the environment. Examples include using charcoal, coal, and firewood, all of which degrade the environment, put biodiversity in danger," said Magwegwe.

A key topic discussed during COP27 in Egypt was the energy crisis in Africa. Zimbabwe used to restock on electricity from South Africa and Mozambique in the past. Zimbabwe's national grid is now suffering from a severe electrical shortfall as a result of the load shedding that is currently occurring in South Africa.

The International Energy Agency (IEA) says Africa requires \$190 billion to attain its climate and energy goals between 2026 and 2030. The International Energy Agency is encouraging African countries that two-thirds of the investment be from clean energy.



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