



GAUTENG PROVINCE

AGRICULTURE AND RURAL DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

2022 ANNUAL REPORT

The 4th Annual Gauteng Environmental Research Symposium



DOCUMENT DESCRIPTION

Document title

Annual Report: 4th Gauteng Environment Research Symposium, for the 2022/23 Financial Year.

Authority reference

Gauteng Environmental Research Symposium 2022

Authors

Ms. Neggie Zizile Bakwunye,
Ms. Stacey Ann Hope-Bailie (UJ),
Ms. Ndivhudza Nengovhela, and
Ms. Basani Ndindani.

Evaluation Period

2022/23 Financial Year

Copyright © 2022 Gauteng Department of Agriculture and Rural Development

Postal Address

PO Box 8769, Johannesburg 2000

Street address

Umnotho House, 56 Eloff Street, Johannesburg 2000

Website

<http://www.gauteng.gov.za/Pages/index.aspx>



GAUTENG PROVINCE
AGRICULTURE AND RURAL DEVELOPMENT
REPUBLIC OF SOUTH AFRICA

No part of this manual may be copied, transmitted or used for any purpose without the permission of Gauteng Department of Agriculture and Rural Development.



FOREWORD

Manifestations of climate change, such as an increase in temperature are an undeniable global issue that affects everyone. If countries continue with business as usual, unfortunately the cumulative effects that result from our day-to-day actions will not only be dire to the present generation but to generations and generations after. To that end, global initiatives have been set up and countries have committed to doing their bit in ensuring that the human impacts that are posed to the environment are minimised. The climate change initiatives that the symposium was based on is the Net Zero agreement. It was signed and committed to by South Africa together with 195 other parties/countries in the Paris Agreement on the 12th of December 2015 and came to effect on the 4th of November 2016 (UNFCCC 2015). The Paris Agreement is a legally binding international treaty on climate change, which includes in its text real emissions reduction commitments made by states.

The symposium focused on strengthening pathways and actions towards Net Zero commitment by 2050. This will mean a shift from conventional practice to less environmentally destructive ones. South Africa is rich in fossil fuels, but this wealth can be a burden that even

threatens the lives and health of the communities that should benefit from it. As more and more people become aware of the impacts that the burning of fossil fuels has on the climate, the environment and public health, consensus is mounting that there is a need for a shift to guarantee that we get to a place where we use zero climate endangering materials. Hence the net-zero goals that have been set to be achieved by 2050 are inseparable from a just energy transition which would help develop the places and communities that have suffered the most.

Concentrations of GHGs in the atmosphere have been rising steadily since the industrial revolution (circa 1760), mainly as a result of the burning of fossil fuels, industrial processes, deforestation and agricultural activities. An extensive global body of research from climate scientists has confirmed the relationship between human induced GHG emissions, higher global average surface temperatures and changes to the earth's climate system (IPCC, 2014; IPCC, 2018). If current trends continue, global average temperatures are likely to increase by at least 1.5°C above pre-industrial levels between 2030 and 2052.

The impacts associated with such temperature

increases are significant and far reaching; threatening people and ecosystems, as mentioned above. The impacts, which become more severe the greater the temperature increase, include sea level rise as a result of melting polar ice and glaciers, increases in the frequency and severity of extreme weather events, changing ecosystems and desertification, ocean acidification, and loss of biodiversity. The knock-on effects on human populations include health risks due to increasing temperatures and heatwaves, water shortages, food insecurity, increased spread of diseases and pests as well as damage to infrastructure due to extreme weather events. All of these impacts have economic repercussions (IPCC, 2014). The severity of impacts is not only a function of the magnitude and rate of warming that is experienced, but also geographic location and levels of development and vulnerability.

Along with other developing nations, South Africa is particularly vulnerable to the impacts of climate change. In unmitigated GHG emissions scenarios, warming of up to 5 to 8°C is projected over the interior of the country by the end of this century. Under a range of warming scenarios, drier conditions will be experienced in the west



and south of the country and wetter conditions in the east. Rainfall patterns will become more variable and unpredictable. These changes will impact on water resources and food production, and increase the vulnerability of impoverished communities, amongst others (DEA, 2013). For this reason, the South African government regards climate change as a considerable threat to the country and its socio-economic development, having the potential to undermine many of the advances made in recent years. At the same time, if climate change is to be limited through limiting the growth in global GHG emissions, with South Africa contributing its fair share to emission reductions, there will be other implications for the country. As one of the top 20 emitters globally, with a high dependency on fossil fuels, South Africa is currently responsible for substantial emissions.

There are already a number of projects by the government and the Department of Environment, Forestry and Fisheries (DFFE) in an effort to reach net-zero emissions by 2050. With South Africa being one of the leading fossil fuel providers to the global market, it is paramount that these changes happen fast but do not ruin the lives and livelihoods of those who depend on fossil fuel related industries.

EXECUTIVE SUMMARY

The Gauteng Department of Agriculture, Rural Development and Environment (GDARDE) carries the broad mandate of developing strategies, policies and programmes to respond to the challenges and potential impact of the sustainable use of the environment within the Gauteng Province. To this end, the Department hosted the 4th Annual Gauteng Environment Research Symposium (also referred to as the GERS IV). It was held on the 27th of October 2022, in partnership with the University of Johannesburg's Process, Energy & Environmental Technology Station (PEETS); Africa Centre for Evidence (ACE) and Centre of Environmental Education (CEE); and supported by various other organisations.

The Gauteng's Environment Research Symposium responds to the key strategic plans of the Gauteng Provincial Government (GPG) Priorities linked to the Provincial Growing Gauteng Together (GGT 2030) Plan. The Symposium has involved numerous researchers (over 600 in the past 4 years) in the environmental field to pave the way to meeting the country's commitment (in this case the achievement of Net Zero GHG emissions by 2050, entered in the Paris

agreement) by the sharing of best practices and key learnings in terms of actions proven to be working towards achieving the targets. It also reduces fragmentation and improves research outputs by promoting networking, collaboration and transformation to inform the way research and projects are conducted.

Collaborative research has become more prevalent globally over the past 50 years and researchers are increasingly required to work across disciplines, institutions and borders. To this end, the Department signed a Memorandum of Agreement (MOA) with University of Johannesburg (UJ) coordinated through the Africa Centre for Evidence (ACE), and the UJ Process Energy and Environmental Technology Station (UJ-PEETS). The aim of the MOA is to provide for cooperation on environmental research (share skills, collect and analyse data, etc.) to ensure that both parties benefit from the agreement and help decision makers to make informed decisions thus contributing to the sustainable development of the Gauteng province and supporting environmental research. As such, UJ has been a long-standing partner in the symposium from the beginning to date.



The selected theme of this financial year was ***“Strengthening actions to move towards Net Zero by 2050 in the Gauteng Province”***.

This year’s theme was selected with the aim of localizing the commitment that was signed in the Paris Agreement/United Nations Framework Convention on Climate Change (UNFCCC) 2015, discussing pathways for the Province and the country to move towards reaching the set target, as well as encourage and strengthen the actions that are taken to that end.

The slogan for this financial year’s symposium was ***“#RaceToZero”***.

The slogan was adopted from the Race To Zero global campaign that was launched in the United Nations Secretary-General’s Climate Ambition Summit 2019. It rallies leadership and support from businesses, cities, regions, and investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth.

This report doesn’t only present the discussions emanating from the GERS IV symposium, but it also highlights the identified research areas, together with their prioritisation by the participants of the symposium. The identified research priority areas and gaps will thereafter be presented to institutions such as universities and other government departments and get taken up in a form of sponsorship of postgraduates or bursaries to research the areas further. The research areas that were identified in the previous symposium are already being studied in this financial year. This proves that the annual research symposium has tangible impacts.

TABLE OF CONTENT

FOREWORD.....	3
EXECUTIVE SUMMARY	4
ABBREVIATIONS AND ACRONYMS	6
INTRODUCTION.....	7
OBJECTIVES.....	9
THEME.....	9
PLENARY	10
JUSTIFICATION OF THE NEED FOR A JUST TRANSITION	10
WAY FORWARD	11
SMART CITIES TOWARDS ACHIEVING NET ZERO BY 2050	12
BREAK AWAY SESSIONS.....	13
MAXIMISING THE WATER, ENERGY AND FOOD NEXUS IN GAUTENG.....	16
DEVELOPING NET ZERO PATHWAYS IN GAUTENG PROVINCE.....	19
PRIORITISATION.....	21
CONCLUSION.....	21
ANNEXURES.....	21



ABBREVIATIONS AND ACRONYMS

ACE	Africa Centre for Evidence
COJ	City of Johannesburg
COP	Community of Practice
CEE:	Centre of Environmental Education
DFFE	Department of Forestry, Fisheries and Environment
DWS	Department of Water and Sanitation
EAPs	Environmental Assessment Practitioners
EV	Electric Vehicles
EPPC	Environmental Policy, Planning and Coordination
GCRO	Gauteng City-Region Observatory
GDARDE	Gauteng Department of Agriculture, Rural Development and Environment
GERS	Gauteng Environmental Research Symposium
GHG	Greenhouse Gases
GP	Gauteng Province
GPG	Gauteng Provincial Government
GTAC	Government Technical Advisory Centre
HOD	Head of Department
NGO	Non-Governmental Organization
PEETS	Process, Energy & Environmental Technology Station
SDG	Sustainable Development Goals
TMR	Transforming, Modernizing and Re-Industrializing
UJ	University of Johannesburg
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSG	United Nations Secretary-General
WEF	Water Energy Food nexus
WWTPs	Wastewater Treatment Plants



INTRODUCTION

The purpose of this report is to present the outcomes of the 4th Annual Gauteng Environment Research Symposium hosted by the Gauteng Department of Agriculture and Rural Development and Environment (GDARDE) in partnership with two institutions of the University of Johannesburg: the Africa Centre for Evidence and the Process, Energy & Environmental Technology Station (PEETS); and supported by the National Business Initiative (NBI), the Water Research Commission (WRC), Local Governments for Sustainability (ICLEI), the Council for Scientific and Industrial Research (CSIR), the Centre of Environmental Education (CEE), the International Union for the Conservation of Nature (IUCN), the Department of e-Government, the Gauteng City Region Observatory (GCRO), the Green Building Council of South Africa (GBCSA), GIBS Business School, the South African National Energy Development Institute (SANEDI), the Department of Forestry, Fisheries and Environment (DFFE), and Vodacom, amongst other institutions.

The main aim of the Gauteng Environment Research Symposium (GERS) was to bring together officials from various levels (local, provincial and national) of government

departments, businesses, Non-Government Organisations (NGOs), academia, research institutions and other stakeholders, with the aim of providing a platform for networking, collaboration and sharing on research experience, particularly regarding operational and strategic environmental issues, and to enhance the networking in order to maximise research impacts and save costs by minimising duplication of research work. The symposium has, over the past years, identified research gaps and niche areas that different stakeholders have then elected as areas that they can incorporate into their existing outputs. By so doing, research work that is carried out is able to assist in informed decision making. The symposiums have a track record of shaping the discussions related to the provincial government's contribution to the South Africa's national environmental commitments, priorities, and monitoring, evaluation and reporting (MER); and providing a platform for feedback on existing actions, initiatives and programmes that are in line with the selected theme of the year as well as planned initiatives by various implementing and benefiting institutions, at the same time benefiting the general public.

This year's symposium had various stakeholders discussing actions that the Gauteng Province can concentrate on in order to strengthen the move towards "Net Zero by 2050". The Net Zero agreement was signed and committed to by South Africa together with 195 other parties / countries in the Paris Agreement on the 12th of December 2015 and came to effect on the 4th of November 2016 (UNFCCC 2015).

This year the symposium was held virtually to allow various stakeholders to participate. This enriched the outcome of the fourth environmental research symposium.

The following sections of the report will not only highlight the set objectives of the symposium, but they will also elaborate on the presentations and discussions that were held on the day, including the consensus that the participants reached in terms of research areas that can be prioritised in future to inform the policy decisions being made in the Gauteng Province.





OBJECTIVES

Just like the theme, which changes every year to address the key pressing issues that are affecting the Gauteng Province at that time, the objectives of the symposium are modified each year to represent the key milestones that the symposium aims to achieve. The primary objectives of this year's event were as follows:

- Discussed and determined the Gauteng Net Zero 2050 pathways.
- Shared best practice approaches in the environmental sector with regards to actions that can advance the province to contribute to the International Net Zero standards and environmental sustainability objectives.
- Provided a platform for networking and collaboration on current research programmes, which are particularly relevant for the provincial priorities in terms of the Growing Gauteng Together 2030 Plan.
- Strengthened the knowledge sharing amongst government officials, academia, researchers and other stakeholders.
- Identified gaps in available research.
- Identified areas for research collaboration.
- Developed action plans to take research forward.

All the above-mentioned objectives were achieved, hence the sections below will explain the detail and discussions held in meeting them.

THEME

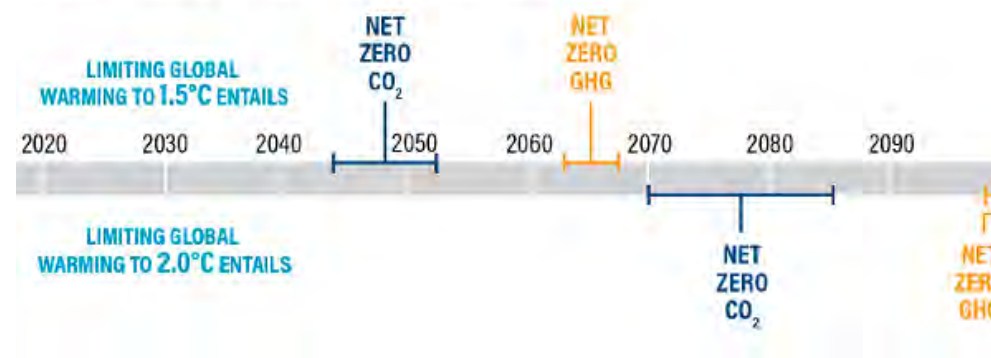
The selected theme of this financial year was ***"Strengthening actions to move towards Net Zero by 2050 in the Gauteng Province"***.

This year's theme was selected with the aim of localising the commitment that was signed in the Paris Agreement 2015, discussing pathways for the province, but that thus will help the country move towards reaching the set target, as well as encourage and strengthen the actions that are taken with that objective nationally and by other provinces. This was clearly manifested in the purpose of the symposium, for example, one of the ultimate goals of the symposium was to present a platform for various stakeholders to discuss operational and strategic environmental issues which will benefit the general public, which will undoubtedly help the country to achieve its commitment.

The slogan for this financial year's symposium was ***"#RaceToZero"***.

The slogan was adopted from the Race To Zero global campaign that was launched in the United Nations Secretary-General's Climate Ambition Summit 2019. It rallies leadership and support from businesses, cities, regions, and investors for a healthy, resilient, zero carbon recovery that prevents future threats, creates decent jobs, and unlocks inclusive, sustainable growth.

Global timeline to reach net-zero emissions



Source: IPCC Special Report on Global Warming of 1.5°C

WORLD RESOURCES INSTITUTE



PLENARY

The keynote address given in the plenary session was presented by the National Business Initiative (NBI). The presentation was entitled “Strengthening actions to move towards Net Zero by 2050 in the Gauteng Province” with the aim of setting the scene and get attendees to understand and localise actions and programmes that are linked to the Net Zero pathways.

The presentation focused on a high-level action plan that South Africa can implement to move towards Net Zero emissions by 2050. It also laid the foundation for the topics which the discussions of the day revolved around.

It was mentioned in the presentation that South Africa is a signatory to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement. As an energy and emissions intensive middle-income developing country, South Africa recognises the need to contribute its fair share to the global effort to move towards net-zero carbon emissions by 2050, without losing consideration of the principle of common but differentiated responsibilities and the need for recognition of its capabilities and national circumstances. South Africa is highly vulnerable to the impacts of climate change and will need significant international support to transition its economy and to decarbonise. Furthermore, given the country’s high rate of inequality, poverty and unemployment, and the extent of dependence on a fossil fuel- based energy system and economy, this transition must take place in a way that is just, that leaves no-one behind and that sets the country onto a new, more equitable and sustainable development path; one which builds new local industries and value chains.

JUSTIFICATION OF THE NEED FOR A JUST TRANSITION

With a Gini coefficient of 0.63, South Africa is one of the most unequal societies in the world today. A recent study by StatsSA, shows that the top 10% of South Africa’s population owns 86% of the country’s aggregate wealth and the top 0.1% close to one third. Since the onset of the COVID-19 pandemic, levels of poverty have further increased and have likely shifted beyond 55% of the population living in poverty. In July 2020, a record of 30.8% of the population was unemployed.

Exacerbating this are levels of youth unemployment that are amongst the highest in the world. As South Africa grapples with the economic recession accompanying the pandemic, and copes with the need to rebuild the capacity of the State and its institutions following a decade of state capture, it must start rebuilding and transforming its economy to make it resilient and relevant in a decarbonised world.

While a transition towards a net-zero economy will create new economic opportunities for South Africa, it is also a transition away from coal, which without careful planning and new investments, will put many jobs and value chains at risk in the short-term, exacerbating current socioeconomic challenges. Today, the coal mining sector provides almost 0.4 million jobs in the broader economy, with ~80 thousand direct jobs and ~200 to 300 thousand indirect and induced jobs in the broader coal value chain and economy. The impact is even broader when it is considered that, on average, each mine worker supports 5–10 dependents. This implies a total of ~2 to 4 million livelihoods.

The transition to low-carbon must do more than simply address what is directly at risk from decarbonisation. The transition must also



address the broader economic concern of stalled GDP growth of ~1% for the last five years, rising unemployment with ~3% increase over the last five years, deteriorating debt to GDP ratio, with growth of ~6% for the last 10 years, and the consistently negative balance of trade. StatsSA, 2017. Poverty Trends in South Africa. An examination of absolute poverty between 2006 and 2015. Chatterjee, A., et al, 2020. Estimating the Distribution of Household Wealth in South Africa. Minerals Council of South Africa, 2020. Department of Statistics, Republic of South Africa, 2021. South African Reserve Bank, 2021. These challenges are more severe given further deterioration during the COVID-19 pandemic.

It is therefore critical that South Africa's transition is designed and pursued in a way that is just; meaning that it reduces inequality, maintains and strengthens social cohesion, eradicates poverty, ensures participation in a new economy for all, and creates a socio-economic and environmental context which builds resilience against the physical impacts of climate change. This transition requires action, coordination, and collaboration at all levels. Within sectors, action will need to be taken on closures or the repurposing of single assets.

A national, coordinated effort to enable the Just Transition will also be crucial to address the education system and conduct national workforce planning. To implement its Just Transition, South Africa will need to leverage global support in the form of preferential green funding, capacity-building, technology- sharing, skills development, and trade cooperation.

To move towards this Net-Zero vision for the economy by 2050, South Africa must mitigate rather than exacerbate existing socio- economic challenges and seize emerging economic opportunities to support its socio-economic development agenda.



WAY FORWARD

To make progress along this line, a translation of policies and plans into concrete actions is required. The presenter emphasised that a clear distinction of what each sector would need to contribute at a minimum is a must for the transition to Net Zero. Having defined what South Africa's carbon budget should be relative to other countries, it was noted that there's a baseline of between 9 and 10 gigatonnes of carbon dioxide equivalents from 2015, with most of the emissions being from the power sector, specifically power generation. With such knowledge, it was clear that most of the opportunities, especially immediate opportunities, to reduce emissions are in this sector.

Thus, one element would be to focus on the power sector and the need for supporting infrastructure that the country has to put in place. Expanding the grid, but also being able to modernize the grid to handle a new type of power system that's based on renewables is something that is very critical. Given that the country is experiencing various stages of load shedding, the prompt introduction of renewable energy and alternative energy sources into the grid should be prioritised in the transition process.



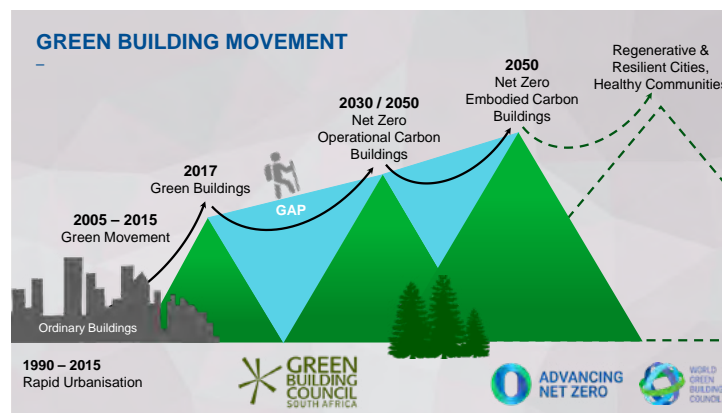
From the keynote presentation, some of the key pathways that Gauteng, as well as the country as a whole, would have to take are listed below:

1. **Decarbonise the power system.** This will require investing in renewables at a rate of 67 gigawatts per annum, which is an ambitious target but there is no lack of opportunity. Expansion of the grid itself is critical, but in addition to that, actions would have to be taken around modernization of the grid since the power system itself is changing - we get a sense of the capacity of the grid to take on more renewables, in particular by noting where new renewable energy generation projects are located. An example of the country that was able to roll out renewable energy seamlessly is China, with 20 gigawatts of energy being produced in one year in 2020. This should be used as a case to study and to draw key learnings from.
2. **Take advantage of the potential of the green hydrogen economy and derivatives from green hydrogen.** Some of the projects that are already in place in this regard are located in the Western and Northern Cape.
3. In addition, **efforts to reduce emissions** from some of the more contaminating processes around heavy manufacturing, steel and cement should also be prioritised.

4. **Transformation of vulnerable sectors.** An example of a sector that would have to be transformed is the Petro chemicals power sector. For this to happen, it would be necessary to engage with representatives from agriculture, forestry, chemicals as well as the financial sector and transport.
5. **Expand the rail infrastructure.** Contrary to most countries, South Africa has been shifting away from rail and more to road – the country would need to reverse that trend to reduce emissions. Making these systems efficient will ensure that there is a greater usage resulting in less cars on the road and hence less emissions. The presence of shipping and porting infrastructure was also acknowledged with the need to expand the investment in infrastructure that will reduce the emissions.
6. **Massive roll out of electric vehicles** for private passenger transport as well as public transport.

An innovative pathway to decarbonise the economy could be the establishment of a champions' platform that's draws champions from multiple sectors. For example, NBI has spent over two years analysing, and engaging very intensively on what the pathways could look like in various sectors, on what would be needed and attempting to reach an understanding of the various relevant aspects.

Engagements with the whole range of stakeholders, from government, from civil society, and from industry, were the basis of NBI's publishing 6 reports related to "Strengthening actions to move towards Net Zero by 2050 in the Gauteng Province".



**SMART CITIES
TOWARDS
ACHIEVING NET
ZERO BY 2050.**

Source: Green Building Council SA



BREAK AWAY SESSIONS

These sessions were made up of presentations and facilitated discussions with small groups of attendees. Participants with different expertise were able to share their knowledge in a more focused group discussion type of setting and participants were able to voluntarily choose topics they had more experience or interest in and were thus able to contribute to more.

This breakaway session responded directly to the theme of the day, looking at the important role cities can play to accelerate progress towards clean, low-carbon, resilient and inclusive energy systems through deploying solutions and technologies to reduce emissions, and also zooming into the detail of smart cities' contributions to the overall Net Zero targets that the country has committed to. New technologies and increased connectivity, as well as the sheer scale of the world's metropolises, open up important opportunities to optimise urban planning, improve services and extend access, while at the same time creating revenue streams, jobs and business ventures. Having the participants engage in discussions on these themes has proven to facilitate collaboration in projects of a related nature.

With the growing urbanisation trend, the central role of cities will only keep increasing. Cities

today account for more than 50% of the planet's population, 80% of its economic output, two-thirds of global energy consumption and more than 70% of annual global carbon emissions. By 2050, more than 70% of the world's population will live in cities, resulting in a massive demand growth for urban energy infrastructure.

As economies recover from the COVID-19 pandemic, CO₂ emissions are rebounding rapidly. The increase in energy-related CO₂ in 2021 could be the second largest in recorded history. Cities are the engines of economies, and the solutions they seek can transform the energy landscape by creating new synergies to reduce emissions, improve energy efficiency, enhance resilience and provide a cleaner prosperous future for us all. Strong international cooperation and collaboration can play a crucial role in this, notably through emerging knowledge-sharing networks that span cities and countries.

Aside from emissions, cities are also crucial role-players in terms of water. A huge amount of effort and investment has gone into conserving fresh water sources over recent decades. As a result, half of all freshwater ecosystems and inland waters are now not only protected but healthy and productive. This is important for achieving net zero because of the latent

mitigation and sequestration potential of water-based 'sinks', such as wetlands, peatlands, mangroves. The knock-on gains for biodiversity and water security make the policy very popular.

Water now finds itself at the heart of a decarbonised ecosystem that delivers multiple additional benefits for society and the environment. Critically, water and sanitation services are now affordable and available to all, even in areas experiencing water stress. The water industry also provides vast numbers of green jobs. Furthermore, today's institutional, legal and regulatory frameworks incentivise businesses and financiers to keep improving how our water is managed.

In 2019, the world generated 53.6 million metric tons (MMT) of e-waste, or about 7.3 kilograms (~16 pounds) per person; equivalent in weight to 350 cruise ships. Developed nations are the biggest offenders, and unfortunately recycling programs can't keep pace with the estimated 2.5 MMT of waste accumulated every year and expected to reach 74.7 MMT by 2030.

As technology advances, devices are more complex and built with proprietary designs making it expensive and nearly impossible to repair without engaging manufacturers or



authorized service providers. Unusable devices are replaced with yet another smart device, creating a throwaway culture burdened with a huge e-waste problem. This cycle of behaviour has prompted governments to push new right-to-repair rules to govern smart phone, tablet, and laptop manufacturers, to name a few, to help reduce e-waste.

In light of the above, the ultimate goal of a Smart City is transformational - to achieve enhanced quality of life for citizens and deliver tangible benefits at national, provincial and municipal levels while leveraging our natural resources judiciously. This is very much in line with the theme of the GERS IV, as the reduction of GHG and the move to net zero will ensure that the afore mentioned benefits are realized.

It was through the opening presentation of the session that the already existing certified Net Zero Carbon modelling projects were brought to the attention of participants of the session: The Vodafone Site Solution (Pilot) Level 2; The 78 Corlett Drive -Design (Pilot) Level 1; Vleihuis Development (Pilot); MDA Property Holdings (PTY) LTD (Pilot); and the Nieu Kanaan Net Positive Level 2 Modelled, Net Zero-Carbon.

In this session the topics covered were as follows:

- a. Towards applying a green infrastructure approach in the Gauteng City-Region (Status quo).
- b. Pathways to 2030 and beyond: Net Zero, Energy Efficiency & Certification.
- c. Enabling road freight transformation towards Net Zero 2050.
- d. How can Gauteng province stimulate Circular Economy with emphasis on E- Waste Management?

The following were some of the outcomes of the discussion:

1. The existing projects done in various institutions that focus on Implementing the principles of Smart cities towards achieving Net Zero by 2050 were identified to be:
 - a. GCRO Green Infrastructure Project (<https://www.gcro.ac.za/research/project/detail/green-assets-and-infrastructure/>).
 - b. Green Building Council (GBC).
 - c. Smart Mobility (SM).
 - d. Smart truck pilot project.
 - e. e-Waste project (Electronic waste).
2. Within the projects being implemented or in the pipeline, the below are ways in which the Net Zero guidelines and concepts were incorporated in their planning:
 - a. GBC – Highly energy efficient buildings using renewable resources.
 - b. SM – Electric trucks penetration in the RSA Market with a Battery Electric approach.
3. The following are the identified gaps in available research:
 - a. Finding buildings in which to implement the audits of buildings around South Africa, in response to the Green Building movement.
 - b. Skills development in Smart Mobility to be identified and Knowledge Gap to be closed through standard reporting in RSA.
 - c. Performance Based Standards and the Smart Truck Pilot Project, developing a talent pipeline of PhDs in Vehicle Dynamics. (We have lost many PhDs in this area to overseas countries)
 - d. One of the areas that require further research, and a great deal of effort is improving cooperation between different spheres of government and public-private stakeholders to



remove apparent fragmentations in policy planning, development and implementation.

Our response to infrastructure development (e.g. housing especially for the poor and or roads) is measured more on number of units completed but less on sustainability of grey structures when viewed within the broader aspect of their physical interaction with the natural ecosystems. We seem to be pulling in different directions in pursuit of our own mandates.

4. The identified projects or research focus areas that should be prioritised to maximise Implementing the principles of Smart cities towards achieving Net Zero by 2050 in Gauteng were agreed on as follows:
 - a. Working with C40 cities to work on their Green Building Policies, conducting case studies within the cities to build on the research and defining ways to implement the Green Building Movement.
 - b. Smart Mobility, including topics such as: Derivation and publication of Electric Vehicle CO₂ emissions factors for RSA. Diesel TCO (Total Cost of Ownership) vs. BET (Battery Electric Truck) TCO. Taxes, rebates and incentives – Global best practice vs. RSA. Non-financial incentives. BET technology evolution vs. use case. Impact on Electricity demand (MW Scale charging). Impact on local reticulation (Transport Node/MW Charging), Viability and Legislation for micro grid charging.
 - c. Research areas for decarbonisation (20% CO₂ emissions reduction target with existing diesel trucks).
 - d. Publication of official TTW (Tank-To-Wheel) and WTW (Well-to-Wheel) CO₂ emissions factors for RSA. (TTW means the direct combustion of energy for the respective mode of transport, whereas WTW includes the production, transportation and distribution of fuel, including the final combustion of energy.)
 - e. Performance Based Standards (PBS) and the Smart Truck Pilot Project.
 - f. Research areas for freight electrification.
 - g. Viability, incentives and legislation for micro grid charging.
 - h. Consider a Green Transport Technology Centre of Excellence at University of Pretoria focussing on vehicle dynamics (to enable PBS and smart truck research) – This would complement the Green Transport supply chain work being done at UJ.





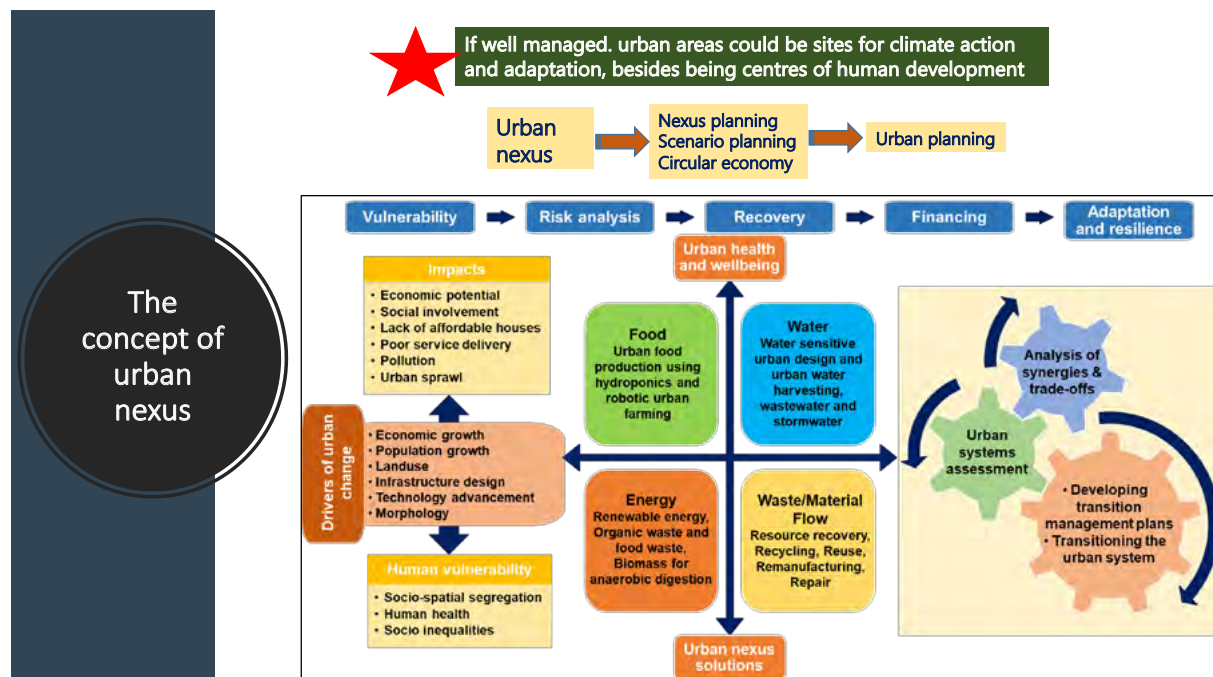
MAXIMISING THE WATER, ENERGY AND FOOD NEXUS IN GAUTENG.

This session also responded directly to the theme of the GERS IV as throughout history, water and energy have been determining factors in the development of humanity and it is through processes related to their generation, conservation and maintenance that emissions have increased, hence targeting their decarbonisation is envisaged to minimise and contribute positively to the shift toward net zero.

Water needs energy for the diverse stages that make up its cycle, and it can likewise be argued that, certainly since the invention of the steam engine in 1712, energy needs water. While water may be a source of energy (hydroelectric, geothermal, and oceanic), the water sector is undoubtedly energy intensive and it consumes 1723 TWh, which is the equivalent of 8% of world energy production. This energy consumption is forecast to double by the year 2040, particularly due to the projected

intensification of desalination processes in the Middle East and North Africa and wastewater treatment processes in emerging economies.

According to data from the International Energy Agency, 583 billion m³ of water are consumed in electricity production (approximately 15% of the water used globally), of which 66 billion will not be returned to their source. Depending on the type of fuel used for electricity production, the



Source: WRC (Samkelisiwe HG-GDARD Symposium 2022)

water consumption ranges from 0.7 m³/MWh (combined cycle) to 2.7 m³/MWh (nuclear power).

In the management of water and energy cycles, this water-energy nexus needs to be considered in terms of its contribution to global warming through the emission of greenhouse gases (GHGs). This is supported by the various conclusions of the Kyoto Protocol, the Climate Change Summit, as well as other different international bodies. In progress alongside this, the European Union's perspective is to reduce 30% GHG emissions by 2020 and around 80% by 2050, relative to the 1990 levels.

In Gauteng, water, energy and emissions are directly related due to the use of municipal energy in wastewater treatment plants (WWTPs). New investigations confirm the possibility of reducing and



even eliminating the emission of greenhouse gases in wastewater treatment plants through the implementation of different renewable energy technologies. In all simulations, the energy that is generated by the plant itself (anaerobic digestion and in-pipe microturbines) took priority. While several investigations had been carried out in recent years in this respect none of them integrated a complex mix of technologies into their analysis, nor did they prioritize (in the case of working with several technologies) the use of the intrinsic energy resources of the plant. Although greater energy potential is obtained with external renewables, they are characterized by permanent energy fluctuations as opposed to the internal technologies which provide a constant flow of energy and a greater degree of control. Likewise, the waste that is generated by the plant could be given a second use, thereby contributing to the circular economy of the environment. In this regard, there has been some analysis of different alternatives to recover the internal energy of the plant using sewage sludge. Among these alternatives, anaerobic digestion is one of the most profitable technologies. Due to the seasonality and variability of renewable resources, it can be noted from the afore

mentioned studies or rather investigations that an energy storage system would need to be installed for WWTPs to take advantage of renewables and maintain efficiency, whilst still being as environmentally friendly as possible throughout the entire process.

In light of the above, the Water-Energy-Food (WEF) nexus is broadly defined as an approach that considers the interactions, synergies and trade-offs of water, energy and food when undertaking the management of these resources. South Africa is likely to benefit greatly from the integrated resource management approach that the WEF nexus provides, particularly those experiencing significant trade-offs between water, energy and food. South Africa is a water-scarce country with approximately 13% arable land, much of which coincides with regions that have a high concentration of mineral resources such as coal. About 30% of South Africa's crops are produced on irrigated land, accounting for approximately 75% of the total national agricultural water use (Ololade et al., 2017). From 1985 to 2008, South Africa was a net food exporter. However, in recent years the situation has changed due to a reduction in agricultural yields and an increased population (Ololade et al., 2017).

The province is tasked to manage resources while faced with growing demands for water, energy, and food, which is further compounded by climate change. Effective adaptation to change requires the efficient use of, water, energy, land, and other vital resources, and coordinated efforts to minimize trade-offs and maximize synergies.

The following topics were covered in this session:

- a. GDARDE Environment Research Project – Research Study on the Water, Energy and Food (WEF) nexus (climate change adaptation projects).
- b. Urban nexus and transformative pathways towards a resilient Province of Gauteng.
- c. Energy Efficiency and Demand Side Management – the key to sustainable wastewater infrastructure and municipal energy savings.
- d. Resilient food systems and access in the urban nexus.

The following were some of the outcomes of the discussion:

1. The existing projects of various institutions that focus on Maximising the water, energy and food nexus in Gauteng were identified:
 - a. iZindaba Zokudla-an action research



program dedicated to creating a fertile ground for urban farmers to interact and network. Operating directly at the nexus of food, water and energy, the organization is, furthermore, promoting the principles of circular economy in their work.

- b. Water quality-costs of treatments, biogas, etc.
- c. Botshabelo Farmers-stakeholder relations and access to markets.
2. Whilst the projects being implemented or in the pipeline do incorporate the Net Zero guidelines and concepts in their planning, the detail of this was not covered in this session.
3. The identified gaps in available research were as follows:
 - a. Resulting sludge/digestate treatment from the anaerobic digestion of organic waste (majority human faeces) from WWTP's. Biochemical testing of human faeces to understand the best management practices and health effects.
 - b. Application of Artificial Intelligence especially the internet of things (IoT) systems in water quality monitoring.
 - c. Micro digester adoption rate in South Africa and/or Sub Saharan Africa and the significance of micro digester in the WEF nexus.

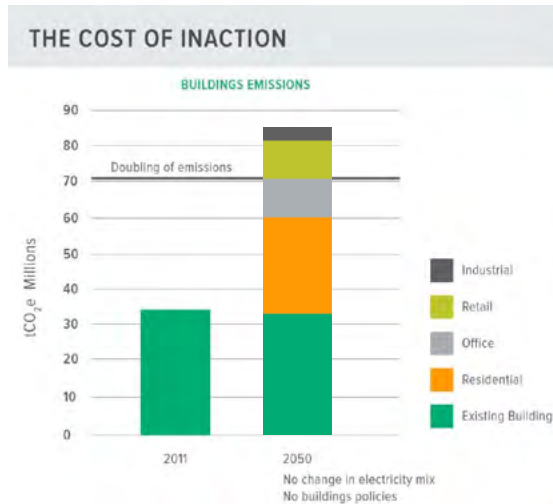
- d. Resource efficiency, industrial symbiosis and circular economy as a technique to achieve Net Zero 2050.
- e. Urban food garden designs (inc. rainwater harvesting systems).
- f. Alternative sources of energy, biogas, renewable, etc.
- g. Environmental costs associated with water contamination, aging infrastructure, etc.
- h. Climate resilience plan reviews – technology needs, assets assessments, circular economy.
- i. Climate change or environmental policy reviews and implementation plan - pilot projects
- j. Access to markets– small-scale farmers and township economy.
4. The below were identified as areas for research collaboration. It is important to note that this group focused on work that the institutions present in the parallel session felt they could collaborate on.
 - a) Wastewater infrastructure management and energy efficiency –
 1. Incorporation of biogas as a source of energy supply in the Wastewater Treatment Plants (WWTP's).
 2. Confirmation and modelling techniques

to deduce the life of plant for the infrastructure (WWTP's) currently in use by municipalities.

3. Strategies to upgrade and manage the current Wastewater Treatment Plants (WWTP's).
- b) Reducing the carbon footprints of WWTP's through using the climate resiliency approach where the design of the WWTP's is resilient to severe weather and climate conditions such as droughts, floods etc.
- c) Asset management in the context of WWTP's as an infrastructure, investments towards WWTP's (carbon financing?).
- d) Capacity building programs dedicated to creating transformative pathways to a resilient Gauteng in response to rapid urbanisation. These programs should be on Aquaponics, permaculture, circular economy, resource efficiency etc.
- e) Farmers' engagements at rural and urban settlements.



DEVELOPING NET ZERO PATHWAYS IN GAUTENG PROVINCE



This session responded to the theme of the GERS IV by focusing on customising actions that the Gauteng Province would have to take in achieving the national commitment. Some practical examples of actions came from the C40 2020 publication of an analysis of the contribution that C40 cities must make to delivering the Paris Agreement objective of limiting global temperature rise to 1.5°C above pre-industrial levels, entitled 'Deadline 2020: How cities will get the job done'. The analysis showed that, as a collective, C40 cities must reach their emissions peak by 2020 and achieve

zero net emissions by 2050 at the latest. The study divided cities into different categories based on their historical emissions, economic growth and development status.

Johannesburg was classified as an 'early peak city'. Johannesburg's proposed mitigation scenario includes room for some growth in emissions in the short term, but states that the City's GHG emissions should peak by 2030 at no more than 28.9 Mt CO₂, and then decline towards net-zero emissions by 2050. The City of Johannesburg has set targets for emission reductions that are consistent with this trajectory, with deadlines aligned with key strategic documents and commitments. This trajectory is also, in the short term, consistent with South Africa's national GHG emissions reduction target. The National Climate Change Response White Paper and the first Nationally Determined Contribution under the Paris Agreement both commit the country to a 'peak-plateau-decline' model, with emissions peaking between 2020 and 2025 and then plateauing for ten years before declining.

Carbon Neutral, Climate Neutral, Net Zero, Net Zero Carbon: These terms are often used interchangeably, but do they mean the

same thing? They do, mostly. Carbon neutral refers to a net carbon dioxide (CO₂) emissions balance of zero. This may be achieved either by eliminating all CO₂ emissions, or by balancing CO₂ emissions with removals (often through carbon offsetting or sequestration by vegetation). This is also termed 'net-zero carbon'. Sometimes confusion occurs when other gases are involved. Technically speaking, a city can be 'carbon neutral' whilst still emitting other greenhouse gases, such as nitrous oxide (N₂O) from waste disposal, biomass combustion or agriculture. These gases are also emitted alongside CO₂ in the combustion of fossil fuels. This is why sometimes the terms 'net zero' or 'climate neutral', which more explicitly cover all greenhouse gases, are used instead. Johannesburg interprets 'net-zero emissions' as including all greenhouse gases.

In this session the ways localisation of the actions that Gauteng Province can take to realise the 2050 goal were discussed. The following topics were covered:

- Tracking transition towards a lower-carbon and climate-resilient South Africa (with focus on Role of Province).
- Just energy transition: South Africa's pathway



to Climate Change Commitments, Policy and Planning (with focus on role of Province).

c. VSA Climate Change Response.

The outcomes of the session were as follows:

1. The existing projects done in various institutions that focus on Developing Net Zero Pathways in Gauteng were identified as follows:
 - a. ICLEI studies towards provincial, country and global GHG target planning.
 - b. Vodacom learner awareness/training and gender mainstreaming.
 - c. Vodacom Repair and recycling initiatives.
 - d. GDARDE/UJ study that waste pickers/ reclaimers' communication regarding where to operate and deliver etc.; to consider: how to support, how to prevent contravention of National Environmental Management: Waste Act (NEMWA), include legislative compliance required.
2. The Net Zero guidelines and concepts incorporated in the planning of these projects are as follows:
 - a) Energy and social understanding of impact.
 - b) Vodacom exploring 100% RE across network by 2025 through independent power producers (IPPs).

- c. Internet of Things (IoT) – understanding and integration in this space.
- d. Policy impact and application (existing and new).
- e. Net Zero guideline towards waste management: estate application (minimise need for disposal volumes).
- f. e-waste recycling needs more formalisation.

3. The identified gaps in available research are as follows:

- a. Holistic environmental impact considerations around food, water, energy security; Just Energy Transition (JET); Emissions
 - b. Practical Operational requirements in above.
 - c. Understanding of Recycling integration.
 - d. Waste picker/reclaimer impact in the province (consider socio-economic impact) should be quantified – UJ has some data.
 - e. Awareness-How do we communicate these ideas being discussed? Communicate waste recycling areas, coupons, potential to engage the youth.
4. Identify areas for research collaboration:
- a) Waste management (in a broad sense): circular economy towards addressing

Climate Change and GHG issues.

- b. Waste upcycling, management and diversion, for a Just Energy Transition (JET) in the waste sector there is a national requirement for an integrated approach (role player e.g. OEM collaboration).
- c. Potential for JET benefit among informal recycling value chain operations.
- d. Critical success factors for participation in circular economy, barriers to implementation.
- e. At what speed is this shift to net zero happening.



PRIORITISATION

Symposium participants voted live via Mentimeter on the prioritisation of the research areas/gaps identified in the parallel sessions. They were asked to indicate their top three priority research areas. The live results were displayed during the voting process; and the top 3 Identified priority projects that will be carried out in the next financial year are as follows:

1. Integration of formal and informal sectors towards net zero.
2. Sustainable wastewater infrastructure development and management.
3. Sustainable waste management (including upcycling).

CONCLUSION

From the discussions held at the symposium it was evident that for the country to achieve the Net Zero commitment, it cannot continue with business as usual. There would have to be radical changes that are put in place. These include but are not limited to add renewable energy options on the grid, explore electric vehicles (EV's) for the public transport fleet, shift policies from shelves to operations, reverse back to rail and limit passenger vehicles, reduction of waste, maintain and improve water saving measures, amongst other initiatives. Most importantly, it starts with everyone's change of mindset, keeping the target in mind when achieving our Key Performance Indicators at work, as well as in living our day to day lives.

ANNEXURES

Please click below to access the links.

[Attendance register](#)

[Meet your speakers Booklets](#)

[Programme](#)

[Invitation poster](#)

[Presentations](#)

