

PRIS²⁰²⁴

POSTGRADUATE RESEARCH & INNOVATION SYMPOSIUM

Energy Sustainability



HIGHLIGHTS

The College of Agriculture, Engineering and Science hosted its fourteenth Postgraduate Research and Innovation Symposium (PRIS) on 29 and 30 October at the Coastlands Hotel, Musgrave – the second off-campus edition of this event. This year's theme centred on *Energy Sustainability*. Approximately 400 delegates attended, and 181 students from all five Schools presented their research in oral or flash presentation sessions, with prizes to the value of R207 000 awarded to the best-performing students.

Welcoming delegates, UKZN Dean of Research Professor Neil Koorbanally highlighted the opportunity for students to showcase their research and gain experience in presenting their work, which would be essential no matter what career path they choose.

Koorbanally highlighted the continual improvement of the PRIS event, particularly the sense of an international conference that hosting the event off-campus conferred, and the high standard of the student presentations and research at UKZN, exemplified by the triumph at the 2024 national Three-Minute Thesis competition of Mr Shimon Corcos, a PhD candidate in the School of Mathematics, Statistics and Computer Science who would also present at PRIS.

Koorbanally encouraged students to seize the opportunity to listen to presentations from different disciplines to their own, engage with industry representatives, and network with academic supervisors.

Deputy Vice-Chancellor of the CAES, Professor Fhatuwani Mudau, opened proceedings on behalf of Vice-Chancellor Professor Nana Poku.



Professor Fhatuwani Mudau

Welcoming external stakeholders, academic judges, and exhibitors, Mudau emphasised the importance of collaboration between academia and industry in shaping the future of research and innovation and showcasing the opportunities available for students as they transition from academia to professional work.

'This annual event serves as a hallmark of our commitment to fostering an environment of innovation and academic excellence at the University of KwaZulu-Natal,' said Mudau.

'We are particularly excited about the collaborative spirit embodied in our theme: energy sustainability,' said Mudau. 'The College of Agriculture, Engineering and Science is deeply committed to UKZN's vision of becoming the Premier University of African Scholarship; we strive to play a transformational role in the development of South Africa and the continent while contributing to meaningful global knowledge production through our research.'

Mudau emphasised the importance of recognising research that demonstrated applicability and societal impact.



Professor Neil Koorbanally

Keynote Address

The opening keynote was presented by the Chairman of the Board of Eskom, Dr Mteto Nyati, who focused on what made for a successful turnaround strategy at the embattled power utility.

An alumnus of the University's Discipline of Mechanical Engineering, Nyati emphasised that challenges like rolling blackouts and the provision of energy security are what scientists and engineers are there for. He encouraged students to consider the societal impact of their work since, in the example of load shedding, everyone was negatively impacted.

'Apply your mind to solutions,' advised Nyati.

While Nyati emphasised the key role of engineers in Eskom, he alluded to the diverse skills needed to tackle societal challenges.

In the Eskom turnaround, accurate problem definition was important in identifying solutions, as was a strategy that ensured the organisation's sustainability. Nyati emphasised that considering the human side of the equation was essential as this ensured that technical solutions worked, saying that Eskom employees enabled the organisation's turnaround under visionary leadership.

Tackling debt and a dysfunctional, overly complex organisational culture in the context of increased societal lawlessness that impacted Eskom were some of the hurdles that had to be overcome.

Nyati covered the Eskom Generation Recovery plan implemented since March 2023 to improve performance sustainably and aimed at conclusion in March 2025. Clean energy is part of the utility's strategisation going forward.

After the opening session, students from the College's five Schools (of Agricultural, Earth and Environmental Science, Chemistry and Physics, Engineering, Life Sciences, and Mathematics, Statistics and Computer Science) presented a range of diverse research in parallel sessions.

These presentations were assessed by internal academics and external stakeholders who brought a wide range of experience and expertise to their assessments. External judges had the opportunity to become acquainted with the work being carried out by UKZN's postgraduate students in the sciences, challenge students to produce and present research to industry standards and enhance collaboration between UKZN and the organisations they represented.



Nyati highlighted the essential role of leadership and turning dreams into tangible implementation to overhaul an institution.



Guest Lecture

Executive of Scientific Services for uMngeni-uThukela Water (UUW), Dr Ntsapokazi Deppa presented a guest lecture on 'Green Initiatives and Skills in the Water Sector', presenting UUW's perspective.

'This presentation will enrich our discussions and highlight the intersections between research and real-world applications,' said Mudau.

Deppa spoke about UUW's multiple approaches to gearing up to hydropower and restoring natural systems like wetlands to help achieve emission reduction and sustainability goals by reducing biodiversity loss and ecosystem stress. She noted that being intentional about energy efficiency will contribute to the financial performance of utilities like UUW and outlined how the organisation has developed the skills necessary to contribute to the development of an environmentally sustainable, climate-change resilient, low-carbon economy and just South African society.

'All this has to be done using certain skills that are aligned with these green initiatives that we are so hoping to achieve,' said Deppa.



'I want to pose a challenge to the University, to move degrees that students are getting towards the green skills that are required by industry; what is it that UKZN can do to produce graduates responding to the needs of industry?'

Gala Dinner

The gala dinner on the evening of 29 October, expertly emceed by Professor Alan Matthews, provided attendees with more chances to engage with one another, enjoy entertainment provided by Drumshack Experience, and hear more about UKZN's leadership in energy sustainability thanks to a presentation from Professor Andrew Swanson from the Centre for Power and Energy Systems. He focused on the complexities of moving energy in space and time, touching on integrating renewable energy and improving the efficiency of moving energy.

The evening was also enhanced with the presentation of several lucky draw prizes, and the acknowledgement of the vital support of sponsors and industry partners.

Swanson emphasised that researchers could contribute to larger societal challenges, no matter how small the contribution.



Industry Session

The industry session on the second day provided the platform for hosting the third UuW Chair in Water Resources Research and Innovation Research Symposium, chaired by incumbent Chair Professor Jeff Smithers.

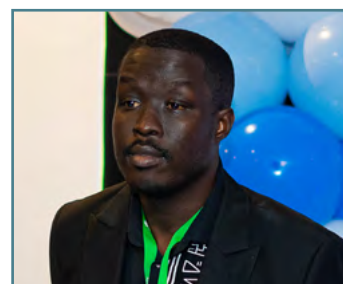
'[The co-hosting of this session] is a significant milestone for this year's Symposium; this partnership is a testament to the long-standing support that UuW has provided to our College,' said Mudau.

The session was designed around diverse research themes within the Chair's ambit, including flood studies and water supply, water governance and citizen science, and water, effluent, and sludge treatment. Dr Deppa presented the keynote address in this session.

A total of 16 presentations were made at the symposium by students and researchers in the Schools of Agricultural, Earth, and Environmental Sciences, Built Environment and Development Studies, Chemistry and Physics, and Engineering.

The research presented included work on enhancing flood risk assessment, detecting trends in rainfall and flood extremes, optimising water distribution schedules, flood forecasting using hydrologic and hydraulic modelling, assessing radon levels in aquifers, developing an indicator system for water equity assessment, citizen science for water quality monitoring, water governance, improved understanding of sedimentation processes using modelling, methods to analyse contaminants in wastewater, novel composites for removing antibiotics from water, and new devices and treatments for faecal sludge and urine management.

Smithers, who is also the Director of the Centre of Water Resources Research at UKZN said the partnership between UW and UKZN is key for national capacity development, from undergraduate-level teaching to postgraduate supervision, and to support research on water resources and related fields. The Chair promotes closer collaboration between UW and UKZN and encourages research at UKZN to focus on issues relevant to UW's research and development master plan.



Industry Partners and Exhibitors

19 external sponsors and exhibitors and 54 internal partners contributed to proceedings and student prizes and demonstrated what their organisations offer and what services they provide to the University and broader society.



Prize-Giving

The event concluded with a prize-giving session where the top two presentations from each School in both the oral and flash presentation categories were rewarded, with a special prize in each category, per School, based on voting from the audience for the research that demonstrated the most significant societal impact. Several lucky draw prizes were also awarded by sponsors including Eskom and UKZN's ICS division.

Professor Glen Bright closed the prize-giving session by encouraging attendees to make use of the PRIS forum to further collaboration.

Professor Alan Matthews' vote of thanks included overall organiser Ms Leena Rajpal, the Moodle coordinating committee, the technical committee, social media and website champions, the ICS technical support team, the CAES management, session chairs and co-hosts, internal and external judges, and the Public Relations committee.



Student Research Stories

In the lead-up to PRIS 2024, the stories of students conducting impressive research across the College were featured on the PRIS website and in a series of communiques.

READ THE STORIES

PRIS Winners

Prize-winners in the oral category received R15 000, R10 000 and R5 000 for first, second and third place respectively. Prize-winners in the flash category received R10 000, R5 000 and R3 000 for first, second and third place, respectively. For the biggest impact awards, oral presenters in each School received R5000, while flash presenters received R3000.

ORAL PRESENTATIONS

School of Agricultural, Earth & Environmental Sciences



First prize (sponsored by the College of Agriculture, Engineering and Science): **Sinikiwe Khumalo** (Evaluating Agronomic Value and Consumers' Acceptance of the Co-Compost Made from Human Excreta for Sustainable Agriculture)

Second prize (sponsored by the College of Agriculture, Engineering and Science): **Emmanuel Oyebamiji** (Incidence of Food Addiction in Diabetic Patients Living with Anxiety and Depression)

Third prize (sponsored by the South African Council for Natural Scientific Professions): **Gugu Buthelezi** (The Geothermal Energy Potential of the Shu-Shu Thermal Springs (Precursors of the Geothermal Energy Potential of South Africa) Investigated Using Isotopes, Geochemistry & UAVs)

Biggest Impact (sponsored by the Institute of Natural Resources): **Sinikiwe Khumalo** (Evaluating Agronomic Value and Consumers' Acceptance of the Co-Compost Made from Human Excreta for Sustainable Agriculture)

School of Chemistry and Physics

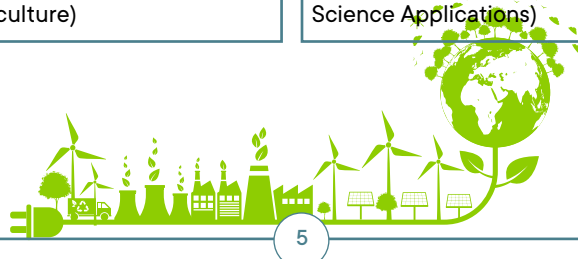


First prize (sponsored by the College of Agriculture, Engineering and Science): **Ian David** (Faster Quantum Simulation of Markovian Open Quantum Systems Via Randomisation)

Second prize (sponsored by SASOL): **Aaron Folkard** (Exploring carboxylic acids as novel green porogens in tailored $\gamma\text{Al}_2\text{O}_3$ supports enabling the next generation of supported catalytically active liquid metal solution catalysts)

Third prize (sponsored by Standard Bank): **Nondumiso Ngcobo** (Hemilabile $\text{N}^{\wedge}\text{P}$, $\text{N}^{\wedge}\text{O}$ -donor Pd(II) and Co(II) complexes: Synthesis, elucidation, and application as pre-catalysts in ethylene oligomerization)

Biggest Impact (sponsored by the South African Council for Natural Scientific Professions): **Ayo Ojo Oluwatumininu** (Behaviour of Polymeric Fluids at the Interface for Material Science Applications)



School of Engineering



First prize (sponsored by the College of Agriculture, Engineering and Science and the South African Research Chair in Sugarcane Biorefining): **Sishosonke Nsele** (Development and Evaluation of a Beverage Can Solar Air Heater for Winter Greenhouse Space Heating)

Second prize (sponsored by SASOL and the South African Research Chair in Sugarcane Biorefining): **Sémyn Rameshwarnath** (Smart Transport: A Stochastic Application of Artificial Neural Networks and Embedded Sensors)

Third prize (sponsored by Standard Bank and the South African Research Chair in Sugarcane Biorefining): **Koena Mothiba** (A Digital Twin for Monitoring the Change in Quality Attributes of Fresh Tomatoes in the South African Postharvest Supply Chain)

Biggest Impact (sponsored by the College of Agriculture, Engineering and Science): **Bokang Sithole** (The Run-of-River Hydropower Potential in the KwaZulu-Natal Tugela River)

School of Life Sciences



First prize (sponsored by the College of Agriculture, Engineering and Science): **Keelan Jagaran** (Therapeutic Potential of Ginkgo Biloba-Synthesized Solid Lipid Nanoparticles for siRNA Delivery Targeting the LRRK2 G2019S Mutation in Parkinson's Disease)

Second prize (sponsored by the College of Agriculture, Engineering and Science): **Mercy Alabi** (Preliminary Assessment of the Antibacterial and Anti-Quorum Sensing Potential of Endophytic Bacteria from *Kigelia Africana*)

Third prize (sponsored by Standard Bank): **S'thandiwe Magwaza** (Effects of Extraction Methods on Antioxidant and Anti-Hyperglycaemic Activity of Fucoidans from *Ecklonia Radiata*)

Biggest Impact (sponsored by the South African Council for Natural Scientific Professions): **Phila Mbambo** (Assessing the Microbial Burden of Leafy Green Fresh Produce Sourced from Local Farms, Street Vendors, and Retailers)

School of Mathematics, Statistics and Computer Science



First prize (sponsored by FNB): **Shivani Pillay** (A Multi-Class Quantum Kernel-Based Classifier)

Second prize (sponsored by SASOL): **Bester Saruchera** (Analysing Treatment Disengagement in Breast Cancer Patients in Zimbabwe Using Geo-Additive Discrete-Time Survival Models)

Third prize (sponsored by Standard Bank): **Slungile Tshibase** (λ Symmetries)

Biggest Impact (sponsored by the South African Council for Natural Scientific Professions): **Ntuthuko Zuma** (On the Perfectness of the Higson-Type and Other Compactifications)



FLASH PRESENTATIONS

School of Agricultural, Earth & Environmental Sciences



First prize (sponsored by the College of Agriculture, Engineering and Science): **Ameera Yacoob** (Assessing Unmanned Aerial Vehicle Data for Evapotranspiration Estimation: A Case Study in Swayimane, KwaZulu-Natal, South Africa)

Second prize (sponsored by the College of Agriculture, Engineering and Science): **Mutondi Tshikororo** (The Role of GW in Catchment Hydrology. Is it significant?)

Third prize (sponsored by the College of Agriculture, Engineering and Science): **Evania Chetty** (A comparative analysis of Multi-spectral and RGB-acquired UAV data for Land Cover Mapping of Smallholder Farms)

Biggest Impact (sponsored by SASOL): **Melusi Mthethwa** (Low-Cost Portable Near-Infrared Spectroscopy Screening for Clonal Varietal Purity Identification of Eucalyptus sp. during Nursery Clonal Propagation)

School of Chemistry and Physics



First prize (sponsored by the College of Agriculture, Engineering and Science): **Shruti Saroj** (Titania Nanotubes for Dye-Sensitised Solar Cells)

Second prize (sponsored by the College of Agriculture, Engineering and Science): **Adela Madaree** (Sulfate Removal from South African Acid Mine Drainage by Electrocoagulation)

Third prize (sponsored by the College of Agriculture, Engineering and Science): **Shamik Maharaj** (Utilising Continuous Measurement Models to Drive an Arbitrary, Two-Level Systems into a Known Target State)

Biggest Impact (sponsored by SASOL): **Sheyi Rotimi** (Applications of 1,3,5-Triazine as a Branching Unit for the Syntheses of Biological Active Branched Antimicrobial Peptides)

School of Engineering & School of Mathematics, Statistics and Computer Science



First prize (sponsored by the South African Research Chair in Sugarcane Biorefining): **Bongiwe Mtshali** (Evaluating the Potential of Woody and Non-Woody Invasive Alien Plant Species Grown in KwaZulu-Natal for Biogas and Bio-Oil Production)

Second prize (sponsored by Entelect): **Slungile Tshibase Onesipho Ntombela** (On Completeness and Paracompactness of Localic Groups)

Biggest Impact (sponsored by SASOL): **Onesipho Ntombela** (On Completeness and Paracompactness of Localic Groups)

First prize (sponsored by FNB): **Ipoteng Justice Mphahlele** (Extrusion-Injection Fabrication for the Development of Sawdust-Reinforced Polypropylene Composites)

Third prize (sponsored by the College of Agriculture, Engineering and Science): **Snothile Manyathi** (Lovelock Theories of Gravity)

School of Life Sciences



First prize (sponsored by the College of Agriculture, Engineering and Science): **Winnie Ramaloko** (Prevalence of mycoplasmas and antibiotic resistance in the Limpopo Province)

Second prize (sponsored by the College of Agriculture, Engineering and Science): **Valencia Ndlangamandla** (Genetic Diversity and Population Structure of *Cannabis Sativa* in Selected Provinces of South Africa)

Third prize (sponsored by the College of Agriculture, Engineering and Science): **Almahi Idris** (Coffee Improves the Antidiabetic and Ameliorates Effect of Metformin in Oxidative Hepatic Injury)

Biggest Impact (sponsored by the College of Agriculture, Engineering and Science): **Vunene Chabalala** (*Codium Extracatum* as a Potential Oxidative Stress Therapeutic Agent Towards Obesity and Type 2 Diabetes)

Category Impact Winners



Lucky Draw Winners



Sponsored by 2Cana:

- Nqobile Dlamini

Laptop sponsored by ICS:

- Samukelisiwe Ndlovu

Flash drives and headphones sponsored by ICS:

- Yolisa Magibile
- Abdalbasit Bala
- Masithembe Sigigaba
- Vishalan Pillay
- Caroline Ruvunga

Laptop sponsored by ICS:

- Tanita Permaul

Sponsored by 2Cana:

- Ngosa Russkyola
- Siyabonga Welcome Dlamini

Flash drives and headphones sponsored by ICS:

- Ndumiso Buthelezi
- Thobeka Mpanza
- Grace Kanonge
- Mukanda Gedeon Kadima
- Ncedo Jili



Partners

Many thanks to our internal and external partners for their support of PRIS 2024:



- UKZN College of Agriculture, Engineering and Science Finance Department
- UKZN Information and Communication Services Division
- UKZN Research Office
- Analytical Environmental Chemistry Research Group
- Astrophysics Research Centre
- Catalysis Research Group
- Centre for Functional Biodiversity and Oppenheimer Fellow in Functional Biodiversity
- Computer Vision and Machine Learning (CVML) Research Lab
- Energy Materials Research Group, Physics Cluster
- Nano-Chemistry Research Group
- Nano-Gene and Drug Delivery Group
- National Institute for Theoretical and Computational Sciences (NITheCS)
- Organic Synthesis and Medicinal Chemistry (OSAMC)
- Reactor Technology Research Group
- School of Engineering
- School of Mathematics, Statistics and Computer Science
- Structural Chemistry Research Group
- Thermodynamics Research Unit
- The Sugar Milling Research Institute/National Research Foundation South African Research Chair in Sugarcane Biorefining
- The National Research Foundation South African Research Chair in Land Use Planning and Management
- The uMngeni-uThukela Water Chair of Water Resources Research and Innovation
- Professor Glen Bright, School of Engineering (Dean and Head of School)
- Professor Naven Chetty, Biomedical Optics Research Group, School of Chemistry and Physics
- Professor Keshlan Govinder, Astrophysics Research Centre, School of Mathematics, Statistics and Computer Science
- Professor Sudan Hansraj, School of Mathematics, Statistics and Computer Science
- Professor Shahidul Islam, Biomedical Research Lab, School of Life Sciences
- Professor Gueguim Kana, Bioprocess Research Group, School of Life Sciences
- Professor David Lokhat, Reactor Technology Research Group, School of Engineering
- Professor Tafadzwanashe Mabhaudhi, Institute of National Resources
- Professor Aneshkumar Maharaj, School of Mathematics, Statistics and Computer Science
- Dr Abdul Mahomed, Catalysis Research Group, School of Chemistry and Physics
- Professor Genene Mola, Energy Materials Research Group, School of Chemistry and Physics
- Professor Brenda Moodley, Analytical Environmental Chemistry Research Group, School of Chemistry and Physics
- Professor Kavilan Moodley, School of Mathematics, Statistics and Computer Science
- Professor Kuveneshan Moodley, Thermodynamics Research Unit, School of Engineering
- Professor Mathew Moodley, Laser Material Research Group, School of Chemistry and Physics
- Dr Mervlyn Moodley, Quantum Research Group, School of Chemistry and Physics
- Professor Mohamed Mostafa, KZNDOT Chair in Sustainable Transportation- Sustainable Transportation Research group (STRg)
- Professor Samson Mukaratirwa, School of Life Sciences
- Professor Onesimo Mutanga, South African Research Chair in Land Use Planning and Management, School of Agricultural, Earth and Environmental Sciences
- Professor Vincent Nyamori, NanoChemistry Research Group, School of Chemistry and Physics
- Professor Ademola Olufolahan Olaniran, School of Life Sciences (Dean and Head of School)
- Professor Bernard Omondi Owaga, Structural Chemistry Research Group, School of Chemistry and Physics

- Professor Francesco Petruccione, National Institute for Theoretical and Computational Sciences (NITheCS), School of Chemistry and Physics
 - Professor Julia Sibiya, School of Agricultural, Earth & Environmental Sciences (Acting Dean and Head of School)
 - Professor Mogie Singh, Nano-Gene and Drug Delivery Group, School of Life Sciences
 - Professor Parvesh Singh, Organic Synthesis and Medicinal Chemistry, School of Chemistry and Physics
 - Professor Rob Slotow, Centre for Functional Biodiversity and Oppenheimer Fellow in Functional Biodiversity, School of Life Sciences
 - Professor Jeff Smithers, uMngeni-uThukela Water Chair of Water Resources, Research and Innovation, School of Engineering
 - Professor Viranjay Srivastava, School of Engineering
 - Professor Anne Stark, South African Research Chair in Sugarcane Biorefining, School of Engineering
 - Professor Andrew Swanson, Centre for Power and Energy Systems, School of Engineering
 - Professor Serestina Viriri, Computer Vision and Machine Learning Research Lab, School of Mathematics, Statistics and Computer Science (Dean and Head of School)
 - Professor Hongjun Xu, Centre of Excellence Radio Access and Rural Technologies, School of Engineering
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Website Addresses

Main Website:

<https://pris.ukzn.ac.za/>

Programme:

<https://pris.ukzn.ac.za/programme/>

Proceedings:

<https://pris.ukzn.ac.za/wp-content/uploads/2024/10/2024-Full-Programme-Version-6-28.10.24-with-cover.pdf>

Industry Session:

<https://pris.ukzn.ac.za/pris-2024-industry-session/>

Spotlight on PRIS 2024:

<https://www.youtube.com/watch?v=zdbO4UTiv9w>

Spotlight on PRIS 2024 - School of Agricultural, Earth and Environmental Sciences:

<https://www.youtube.com/watch?v=ek07xYmkQPc>

Spotlight on PRIS 2024 - School of Chemistry & Physics:

<https://www.youtube.com/watch?v=5ozf7FyM0to>

Spotlight on PRIS 2024 - School of Engineering:

<https://www.youtube.com/watch?v=EYirrR6cwKA>

Spotlight on PRIS 2024 - School of Life Sciences:

<https://www.youtube.com/watch?v=NerSNekiBMw>

Spotlight on PRIS 2024 - School of Mathematics, Statistics & Computer Science:

<https://www.youtube.com/watch?v=w5BNhq3eQAU>