



CSIR

our future through science

Our mandate

The CSIR is committed to contributing to national priorities in line with its mandate, which is stipulated in the Scientific Research Council Act, 1988 (Act 46 of 1988, as amended by Act 71 of 1990), section 3:

"The objects of the CSIR are, through directed and particularly multi-disciplinary research and technological innovation, to foster, in the national interest and in fields which in its opinion should receive preference, industrial and scientific development, either by itself or in co-operation with principals from the private or public sectors, and thereby to contribute to the improvement of the quality of life of the people of the Republic, and to perform any other functions that may be assigned to the CSIR by or under this Act."

OUR AREAS OF FOCUS

The CSIR plays a key role in supporting government's programmes through directed research that is aligned with the country's priorities, the organisation's mandate and its science, engineering and technology competences. Key issues that the CSIR seeks to address through various interventions include contributing to a vibrant economy and creating employment opportunities; building a capable state that is able to consistently deliver high-quality services for all South Africans; contributing to the development of economic and social infrastructure like transport, energy, water resources and ICT networks; transitioning to a low-carbon economy to improve our ability to understand the long-term effects of climate change and hence assisting government with the formulation of mitigation and adaptation strategies; transforming human settlements; improving health and building safer communities.

To address these issues, the organisation focuses its R&D in the areas of the built environment, defence and security, energy, health, industry and the natural environment.

In addition, the CSIR invests in and explores new research areas and enabling technologies to shape tomorrow's applications. Nanotechnology research at the CSIR focuses on the discovery of new materials and material properties at the nano-scale level. In materials science, the CSIR investigates and develops products

and technologies using natural materials, including base and precious metals, natural fibres and biomaterials, as well as man-made materials such as polymers and composites. Through synthetic biology, the CSIR applies engineering principles to biology in the construction of new biological systems and devices. The CSIR's photonics expertise is applied in a wide range of sectors ranging from novel health treatments to enabling the aerospace and automotive industries to remain competitive. The organisation also uses information and communications technology (ICT) to shape the country's digital future by devising ICT interventions for earth observation, health, broadband access and urbanisation. The CSIR applies its capabilities beyond the South African border, supporting sustainable development in a number of other African countries.

Many of the organisation's scientific discoveries and technological developments are made possible by its state-of-the-art research infrastructure. This includes laboratories, testing facilities, scientific instruments, equipment, machinery, clean rooms and pilot plants that enable the translation of CSIR research into scientific output such as publications, technology demonstrators and intellectual property.

BUILT ENVIRONMENT

Infrastructure is not only essential for faster economic growth, but for providing citizens with the means to improve their own lives.

The CSIR uses science, engineering and technology to contribute to the development and maintenance of the country's economic infrastructure and the transformation of human settlements. The main focus areas are the integration of data in decision-support systems for planning and maintaining settlements, improving the efficiency of buildings and developing new building materials and construction methodologies, developing design methods and maintenance procedures for road, port and railway infrastructure and developing models and methods for more efficient public and freight transport.

Infrastructure:

- The coastal and hydraulics laboratory allows researchers to accurately build scaled physical models of harbours, breakwaters, rivers and dams to test harbour and coastal engineering design.
- Damage caused by traffic over a period of 20 years can be simulated within three months using the heavy vehicle simulator, enabling road owners to improve their road design and construction practices.



DEFENCE AND SECURITY

There is an intricate link between safety and security and the country's continued socio-economic development. The CSIR contributes to keeping South Africa safe and secure by supporting the building of a capable state and developing technologies to ensure safer communities. The CSIR's main focus areas are information security, improved tactical and situation awareness as well as providing command, control and coordination solutions for multi-agency operations. It also ensures that government is a smart buyer and user of technology in this space.

Infrastructure:

- The CSIR's suite of wind tunnels has been used in support of the aerodynamic design efforts of the South African aeronautical industry for many years. Data collected at the facilities are used for airframe characterisation and to populate complex modelling and simulation environments for broader mission simulation predictions, doctrine development and training.

Our radar, electro-optical and electronic warfare infrastructure aids authorities in their efforts to protect South Africa's territories and people against organised crime, poaching and terrorism on land, at sea and in the air. This is made possible by providing wide-area, real-time, recognised situation pictures that enhance the situation awareness of commanders, and thereby the quality of their command decisions and the efficiency and effectiveness of the security operation.



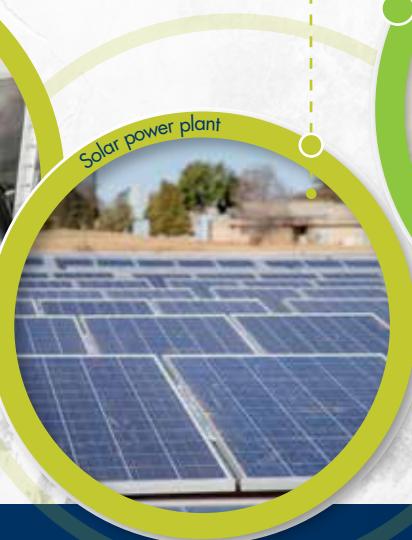
ENERGY

Increasing the diversity of the country's energy production mix is important to mitigate climate change while enhancing supply security. The CSIR aims to help the country achieve an energy-secure and low-carbon national economy. The organisation develops and implements renewable and alternative energy technologies with a specific focus on innovations in energy storage, system integration and renewable energy technologies, while also contributing to policy formulation and providing a coherent and organised response to the country's energy challenges.

Infrastructure:

- The CSIR co-hosts the Department of Science and Technology's HySA Infrastructure Centre of Competence where the synthesis, characterisation and performance testing of candidate hydrogen storage materials is undertaken to develop practical, affordable and safe hydrogen storage systems for use in selected portable, stationary and fuel cell vehicle applications.

As part of its plans to become energy-autonomous, the CSIR has constructed a 1 ha, 558 kW ground-mounted photovoltaic (PV) solar power plant in its Pretoria campus. The power generated by the plant's solar array feeds directly into the CSIR's campus grid, therefore, no energy storage is needed. The PV power plant is one of the first steps taken in the organisation's quest to become a leader in the area of distributed energy generation.



HEALTH

To provide accessible primary healthcare to all South Africans, appropriate technologies have to be developed and deployed. The CSIR puts its vast expertise to work to help improve the health of all South Africans. To combat the high burden of disease, researchers develop cost-effective bio-therapeutic technologies, biomedical technologies and health infrastructure. They design and adapt technologies to improve diagnosis and treatment in under-resourced areas. The CSIR also focuses on unlocking the value contained in South Africa's biodiversity and indigenous knowledge, improving food processing technologies and contributing to food security.

Infrastructure:

- The high-containment facility enables researchers to safely conduct experiments with live strains of pathogens for research and development of novel tools for the diagnosis of tuberculosis and methods of combating HIV/Aids.

The clinical and botanical supplies unit is a medicinal plant processing facility designed to add value to indigenous knowledge through scientific novelty by producing pharmaceutical grade herbal products, bridging the gap between laboratory research and clinical trials.



INDUSTRY

Research, development and innovation are essential to ensure that South Africa remains competitive. The CSIR develops and transfers manufacturing technologies that improve the competitiveness of existing South African industries and creates new manufacturing opportunities.

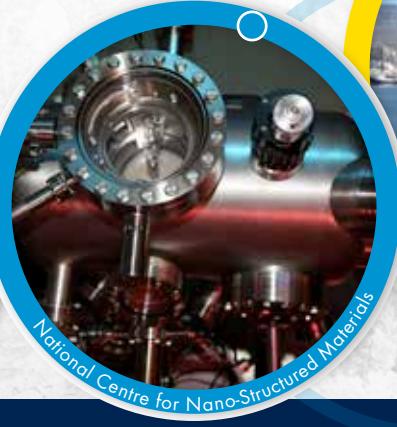
The organisation primarily focuses on beneficiating South African minerals across the value chain; supporting biotechnology-based businesses with new products and processes; developing additive manufacturing platforms for the aerospace and automotive industries; developing new advanced materials and composites; and using information and communications technologies to enhance industrial competitiveness.

The CSIR also manages industry support programmes for the aerospace, biomanufacturing and foundry sectors, as well as programmes that support technology localisation and technology-based small, medium and micro enterprises.

Infrastructure:

- The Biomanufacturing Industry Development Centre provides the equipment and capabilities that allow critical product and process development to support enterprises when launching new biotechnology based products into the market, as well as to assist established industry to implement advanced manufacturing technologies to enhance sector competitiveness.

The National Centre for Nano-structured Materials focuses on the modelling, synthesis, characterisation and fabrication of novel nano-structured materials with specific properties.



NATURAL ENVIRONMENT

Sustainable development is about being economically, socially and environmentally sustainable. All of these facets need to be equally heeded for the country to remain competitive.

The CSIR uses science and technology to improve our understanding of the scale and impact of climate change and to improve the country's ability to adapt to these changes; design and implement interventions that will facilitate the growth of the green economy; and help manage natural resources such as freshwater, as well as the marine and coastal environments.

Infrastructure:

- CSIR researchers use a variety of carbon dioxide (CO_2) measurement instrumentation such as wave gliders, sea gliders and flux towers to measure CO_2 exchange and related factors with the aim to more accurately predict and help mitigate the CO_2 build-up that could lead to high-risk and costly climate change.

The Biorefinery Centre, a first for South Africa, develops knowledge and technologies that will stimulate the growth of the forest products industry and create sustainable jobs in a new industry value chain. It provides industry with a facility for testing, evaluating or developing biorefinery technologies at a pilot scale level and provides specialised equipment, experimental facilities and expertise to service the sector to improve the competitiveness of existing forest product streams.



OUR PEOPLE

"The CSIR is the jewel in the crown regarding its enhancement of and contribution to science and technological development in South Africa",

Minister of Science and Technology, Naledi Pandor.

When you join team CSIR, you become part of a remarkable organisation distinguished for its excellence in research and commitment to making an impact in people's lives. Some of our leading minds in science, engineering and technology include:



Prof Bruce Sithole, a biorefinery expert who is also a C-rated NRF scientist. His research group focuses on biorefinery technologies which are meant to extract value from waste material.



Dr Patience Mthunzi-Kufa is conducting ground-breaking research on laser technology to improve HIV/Aids diagnostics.



Funeka Nkosi, a chemist who represented South Africa at the 67th Lindau Nobel Laureate meeting in Germany.



South Africa's youngest doctoral graduate at 23, Dr Previn Naicker, is a researcher in veterinary science and the development of protein particles at the CSIR.



Dr Janine Scholefield, a geneticist who is making a significant contribution to stem cell research, particularly on Africa's most threatening diseases and ways of finding preventions and cures.

The CSIR invests in a myriad of training interventions to foster young talent and further develop expertise by providing bursaries, studentships, internships, exchange and sabbatical programmes.

While more than 65% of the CSIR's workforce comprises scientists, engineers and technologists who are involved in research, development and innovation, they are supported by staff with skills in, among others, financial management, human resources management, commercialisation, administration, quality control, communication and the law; and each of these fields have specialisation areas of their own.

Our employees have access to comprehensive wellness programmes, as well as on-site child-care, sports and recreation facilities, which are all located on the campus, making the CSIR an employer of choice.

OUR PARTNERS

The CSIR collaborates closely with South African and international partners to effectively respond to developmental challenges. The quality of the collaborative work is greatly enhanced by complementary infrastructure, capabilities and a focus on research at different stages of the innovation value chain. Some examples of these partnerships include:

Industry

The National Cleaner Production Centre, South Africa - hosted at the CSIR on behalf of the Department of Trade and Industry has saved companies R1.54 billion through the implementation of the Industrial Energy Efficiency Project in partnership with the United Nations Industrial Development Organization.

The CSIR, through the Aerospace Industry Support Initiative, Denel Aerostructures and the University of Pretoria, are collaborating to establish a local expert capability in the analysis and design of aerospace fuel tanks. The collaborative research team investigates the dynamic loading of fuel and how to accurately predict these loads for design purposes.



Government

The CSIR has deployed the Health Patient Registration System to 650 government primary healthcare facilities across the country. The system is funded by the National Department of Health and it enables the electronic registration of patients on a national database.

The CSIR conducts real-time monitoring of the water quality in the uMhlathuze and eThekweni municipalities.



State-owned companies

Eskom and the CSIR work together to develop advanced technologies, processes and materials to address the rising energy demand, to counter the negative impact of fossil-based energy sources on the environment and to reduce costs.

The CSIR-Transnet collaboration focuses on infrastructure, rolling stock and operations management thus making logistics efficient and in turn lowers the cost of doing business in South Africa.



Research and technology organisations

The CSIR leads a project to undertake an independent scientific assessment which will feed into the Strategic Environmental Assessment for shale gas development in South Africa. On the project, the CSIR has teamed up with over 40 organisations from South Africa and the rest of the world, including the Commonwealth Scientific and Industrial Research Organisation who have worked on the scientific assessment phase as peer reviewers.

The CSIR collaboration with the National Health Laboratory Service for point-of-care diagnostics aims to solve the challenge of delayed diagnosis in remote locations.



Higher education institutions

The CSIR is collaborating with the Tshwane University of Technology in the field of laser materials processing. Through this partnership, students at the institution also get valuable work-place experience.

In an effort to improve the survival rate of cancer patients, the CSIR has teamed up with the University of Cape Town to form the Biomedical Translational Research Initiative. The aim is to understand the genetic mutations that characterise some cancers, and use this to identify chemotherapeutic agents that will provide the best clinical outcomes.



TURNING IDEAS INTO INNOVATIONS

Some of the high impact innovations and spin-off companies from our multidisciplinary research include the following:

The lithium-ion battery

The CSIR contributed to lithium-ion battery research through the discovery of lithium-metal-oxide electrode materials with a spinel-type structure. Today, lithium-ion batteries power our smart phones, laptop computers, electric vehicles, smart grids and even our homes.



Advanced Fire Information System (AFIS)

This CSIR-developed system uses satellite data to detect fires in real-time and automatically sends warnings directly to users via cell phones and tablets. AFIS has since been adopted by local and international conservation and fire prevention and management organisations in Argentina, Portugal and across Southern Africa.



CMore

This CSIR-developed tool is used to help combat rhino poaching through the provision of intelligence to decision-makers. It integrates and processes data from different sensors and communication devices. The tool is currently used by the South African National Parks in the Kruger National Park.



Corocam

UViRCO Technologies, the start-up company that resulted from research for Eskom to visualise corona discharges on power distribution networks, has captured some 50% of the world market with total sales of R180 million and exports of high-tech camera inspection systems to 40 countries.



Resyn™ Biosciences

This award winning company manufactures and sells microsphere-based research reagents to the international biosciences research and development market.



Persomics

Persomics markets technology for the miniaturisation of genomics experiments that make it possible to investigate cells faster than previously possible.



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