2022

CAREER OPPORTUNITIES

in the energy and water sectors

EW SETA

ENERGY AND WATER SECTOR EDUCATION AND TRAINING AUTHORITY

INTRODUCTION

In a country with many social and environmental issues, choosing a career for the environment can present interesting opportunities. As South Africa transitions to a more inclusive green economy, making a green career choice can bring benefits for our country and ensure that a healthy environment supports our collective well-being.

There is no denying that our climate is getting hotter and every single one of us needs to take action because there is no planet B.

The Energy and Water Sector Education and Training Authority (EWSETA) is mandated to drive skills development in South Africa's Energy and Water Sectors. The very nature of the energy and water sectors means that many of the career opportunities within these sectors will be considered 'green jobs'.

This publication is an overview of green jobs that are in some way linked to these sectors, as well as energy and water career opportunities that exist where one can make a contribution to the green economy.

Here are a few compelling reasons to consider a 'green career'

- The environment is important
- Green careers promote public health
- If you are an environmental activist, a green career would give you the opportunity to 'live your passion'
- Several career paths are available
- You could help fight climate change
- Protection of ecosystems and endangered species
- You can make a real difference in the world

GREEN CAREERS

WHY ARE GREEN CAREERS IMPORTANT?

- Green jobs reduce the environmental impact of enterprises and economic sectors by improving the efficiency of energy, raw materials and water; de-carbonising the economy and bringing down emissions of greenhouse gases; minimising or avoiding all forms of waste and pollution; protecting or restoring ecosystems and biodiversity; and supporting adaptation to the effects of climate change.
- The transition to a green(er) economy requires new skills. Skills needed for the newly emerging jobs and skills needed for the adjusted existing jobs. Without a suitably trained workforce the transition will be impossible.
- Skills gaps and shortages are a challenge facing many sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing. The use of clean technology requires skills in technology application, adaptation and maintenance.
- The availability of workers and enterprises with the right skills for green jobs plays not only a critical role in initiating the transition to a green economy, but also in enabling a just energy transition (see info on page 22) that ensures social inclusion and decent work. Employers investing in new technologies need to be able to find workers with the right skills.

AIR POLLUTION ANALYST

Air pollution analysts collect, analyse and interpret air quality data and work to provide responses to address air pollution. They develop and coordinate the implementation of environmental management systems, to enable organisations to identify the impact of emissions on the environmental health of people. Air pollution analysts also support the formulation of reports and evaluation of draft and existing policies for managing air quality and remediation strategies.

Skills required for this career

- Strong research competence
- Ability to work with large data sets
- Analytical and logical problem-solving ability
- Good verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Atmospheric Science
- B.Sc., B.Sc. (Hons), M.Sc. in Chemistry
- Diploma and Advanced Diploma in Environmental Health

Employers

- National, provincial and local government
- NGOs, community-based and development organisations and private consultancies
- Research institutions
- Mining and manufacturing companies

AIR POLLUTION CONTROL ENGINEER

Air pollution control engineers research atmospheric emissions and develop responses to air pollution. They evaluate the impact of hazards and design regulations and procedures to prevent or reduce harmful emissions. They further provide technical support for civil, environmental and litigation projects and provide input into and develop air quality policies and strategies.

Skills required for this career

- Ability to apply engineering principles related to air pollution
- Logical analytical and problem-solving ability
- Strong project management skills
- Excellent verbal and written communication and presentation skills

Studies

- B.Sc.Eng. in Civil Engineering
- B.Eng. in Civil Engineering
- Diploma, Advanced Diploma, M.Tech in Civil Engineering

Employers

- National, provincial and local government
- NGOs and private consultancies
- Research institutions

ATMOSPHERIC SCIENTIST

Atmospheric scientists study atmospheric conditions and phenomena to better understand climate patterns and their effects and develop forecasts of where and when these events are expected to occur. They collect and compile data from the field and assist in the development of new data collection instruments. Some can advise stakeholders on risks or opportunities caused by weather events and climate change such as flash floods and droughts.

Skills required for this career

- Mathematical and statistical ability to develop forecast models
- Exceptional analytical ability
- Critical thinking and problem-solving skills
- Ability to communicate complex atmospheric concepts

Studies

- B.Sc., B.Sc. (Hons), M.Sc. in Meteorology
- B.Sc., B.Sc. (Hons), M.Sc. in Ocean and Atmosphere Science
- B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Atmospheric Science

Employers

- National, provincial and local government
- NGOs and private consultancies
- Research institutions

EARTH & SOIL SCIENTIST

Earth and soil scientists analyse the composition, structure and other physical and chemical attributes of soil. They plan and implement soil management programmes and conduct environmental impact assessments for urban parks, agricultural enterprises and industrial sites. They can also develop plans and strategies for the reclamation and preservation of soil in areas such as wetlands, for example.

Skills required for this career

- Meticulous attention to detail
- Logical analytical thinking skills
- Significant problem-solving skills

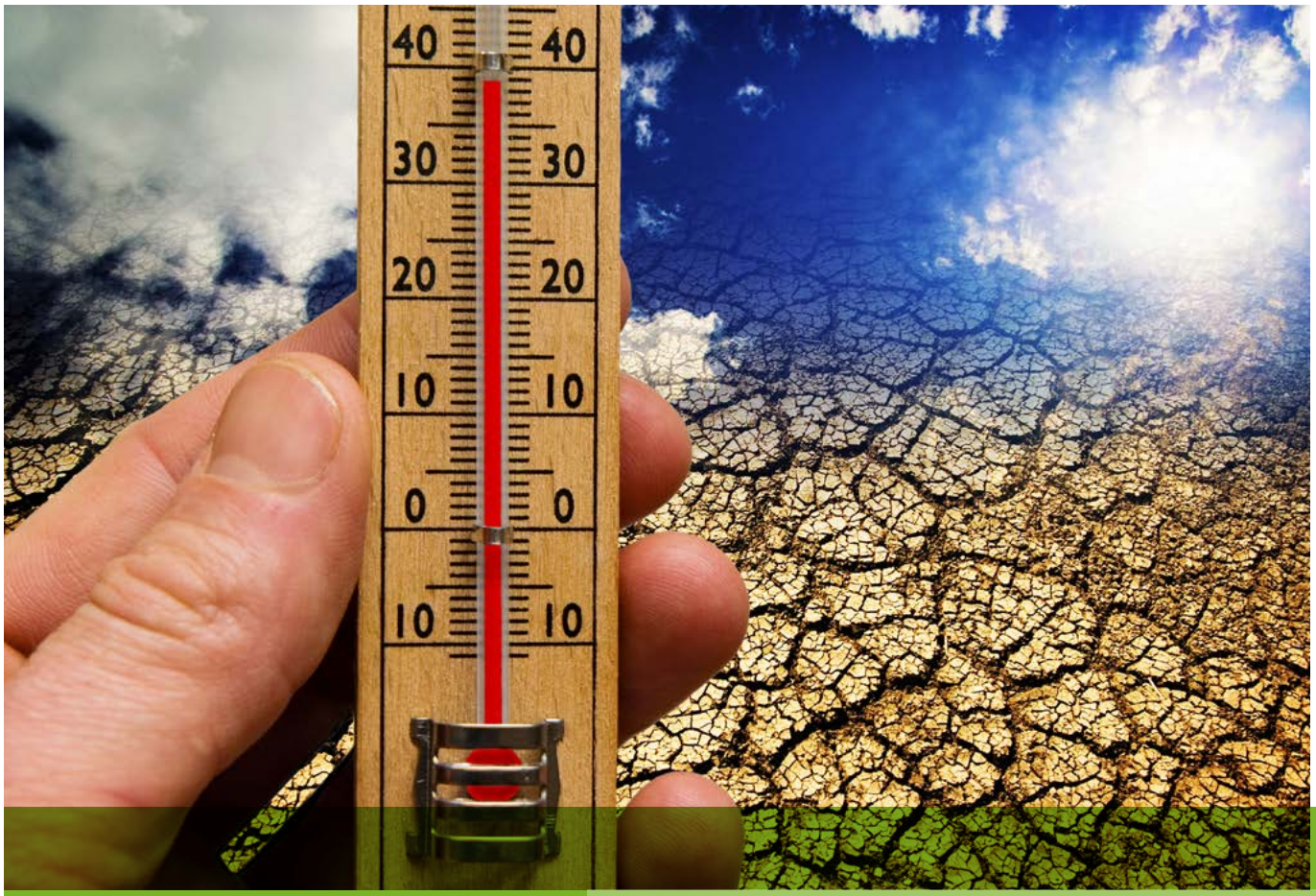
Studies

- B.Sc.Agric., B.Sc.Agric. (Hons), M.Sc.Agric. in Soil Science
- B.Sc., B.Sc. (Hons),M.Sc. in Geography specialising in Geomorphology

Employers

- National, provincial and local government
- Research institutions
- Private consultancies
- Agricultural production and fertilizer manufacturing companies

CLIMATE CHANGE SCIENTIST



Climate change scientists research, collect and evaluate climate data and develop models that predict changes to the environment, economy and society. They advise government on policy and legislation that can help to mitigate the impact of climate change and advise businesses and industry and civil society on mitigation and adaptation measures.

Skills required for this career

- Extensive problem-solving ability
- Excellent logical reasoning and analytical skills
- Ability to work with and manage large datasets
- Strong research competence

Studies

- B.Sc., B.Sc. (Hons), M.Sc. in Geography specialising in Climate Science
- B.Sc., B.Sc. (Hons), M.Sc. in Meteorology
- B.Sc., B.Sc. (Hons), M.Sc. in Ocean and Atmospheric Science
- B.Sc. (Hons), M.Sc. in Climate Change and Development

Employers

- National, provincial and local government
- NGOs, community-based and development organisations and private companies and consultancies
- Research institutions

WATER SECTOR CAREERS

South Africa is generally an arid country with variable rainfall and is prone to droughts. Its freshwater is supplied by 22 water source areas situated in the highest lying plains of our water catchments, where the most rainfall is received.

Access to good quality potable water and adequate sanitation, is a global human right. Efficient water access is critical for human wellbeing and supporting the economy and the jobs and livelihoods it supports. Using water efficiently is critical for both effective ecosystem functioning, as well as sustainably providing water for basic human needs.

The right skills are needed in the country's water sector to ensure future sustainability of fresh water supply.

Unsafe water and lack of basic sanitation cause 80% of all sickness and disease in the world."

AQUATIC BIOLOGIST

Aquatic biologists study the ecology and living organisms in freshwater. They monitor the health of water by examining biological indicators such as micro- and macroinvertebrates as well as the physical conditions of water such as salinity, temperature and oxygen content. Aquatic biologists also monitor and report on pollution levels and its impact on water quality.

Skills required for this career

- Ability to conduct extensive and complex fieldwork
- Strong research and analytical competence
- Excellent laboratory processing skills
- Good verbal and written communication and presentation skills

Studies

- B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences specialising in Botany or Zoology
- B.Sc., B.Sc. (Hons), M.Sc. in Biodiversity and Conservation Biology or Environmental Water Science

Employers

- National, provincial and local government
- NGOs, community-based and development organisations and private consultancies
- Research institutions

PLUMBER

Plumbers install and repair water provisioning, drainage and sewerage pipes and systems. They are not only involved with the construction of new houses and plumbing systems, but also with assessing and fixing problems in existing and older systems. Plumbers can specialise in the installation and maintenance of sustainable plumbing systems such as rainwater tanks, solar hot water and greywater plumbing systems that will assist users in efficient water use and reducing environmental impact.

Skills required for this career

- Good manual dexterity and coordination
- Ability to read and interpret blueprints
- Problem-solving competence
- Foundational measuring and mathematical ability

Studies

- Plumbers are trained through a National Certificate in Engineering Studies in Plumbing at National Qualifications Framework Level 1 to 3 offered at all Technical and Vocational Education and Training Colleges across the country.
- They can also qualify with a General Certificate in Plumbing

Employers

- National, provincial and local government
- Plumbing and pipe-fitting companies
- Construction companies
- Independent consultancies

WATER ALLOCATION OFFICER

Water allocation officers monitor the allocation and use of water from rivers, dams and reservoirs. They advise on and develop distribution and allocation policies, strategies and guidelines for water use. They also oversee water use registration and licensing and maintain oversight of water availability and demand. Some officers can also provide inputs for water user billing and water pricing.

Skills required for this career

- Ability to use geographical software to monitor and map data
- Strong problem-solving ability
- Analytical skills with excellent critical thinking capacity
- Good communication and negotiation skills

Studies

- B.Sc., B.Sc. (Hons), M.Sc. in Hydrology
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- B.Sc. in Hydrology and Water Resources Management
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Water utility companies

WASTEWATER PLANT OPERATOR

Wastewater plant operators manage activities in a plant that stores, distributes and treats water for safe disposal and domestic and commercial reuse, through the removal of pollutants and the treatment of wastewater. They collect, test and analyse water samples, as well as operate chemical-feeding devices for the treatment of wastewater. Some operators repair pumps and valves, reporting more serious defects if necessary.

Skills required for this career

- Critical thinking and problem-solving competence
- Strong organisational ability around plant activities
- Keen attention to detail and accuracy
- Skills to effectively manage plant operations

Studies

- Wastewater plant operators can benefit from a General Certificate in Water and Wastewater Reticulation Services at National Qualifications Framework Level 2 to 4
- They can also benefit from a National Certificate in Water and Wastewater Treatment Practice at National Qualifications Framework Level 1 to 4 offered at Technical and Vocational Education and Training Colleges.
- Training could also take place on the job with mentoring by an experienced operator.

Employers

Wastewater treatment plants

WATER TREATMENT PLANT OPERATOR

Water treatment plant operators operate plant equipment and processes to store, treat and distribute water including water purification for domestic use and removing waste and contaminants from sewage water. They collect and analyse samples throughout the treatment process to ensure adequate chemicals are added to purify the water. They also inspect equipment and monitor operating conditions to ensure they are functioning correctly and to detect potential malfunctioning within the treatment plant system.

Skills required for this career

- Critical problem-solving and analytical skills
- Meticulous attention to detail
- Ability to troubleshoot basic machinery issues
- Good physical stamina

Study Options

- Diploma, Advanced Diploma, M.Tech in Water Science and Technology
- Water treatment plant operators can benefit from a Further Education and Training Certificate or National Certificate in Water and Wastewater Treatment Practice at National Qualifications Framework Level 1 to 4 offered at Technical and Vocational Education and Training Colleges
- Training could also take place on the job with mentoring by an experienced operator

Employers

Wastewater treatment plants

WATER AND WASTEWATER ENGINEERS

Water and wastewater engineers design and oversee projects involving the management, distribution, disposal and treatment of water. They conduct water quality and feasibility studies for the location and development of facilities such as water supply systems or water treatment plants, for example. They also design and perform analyses on the most effective equipment and processes needed for functioning water systems. Some can provide interventions and risk management for the provision of flood-related damage or drought contingency systems.

Skills required for this career

- Critical problem-solving and analytical thinking ability
- Ability to design water and wastewater equipment and processes
- Independent project management competence
- Good verbal and written communication and presentation skills

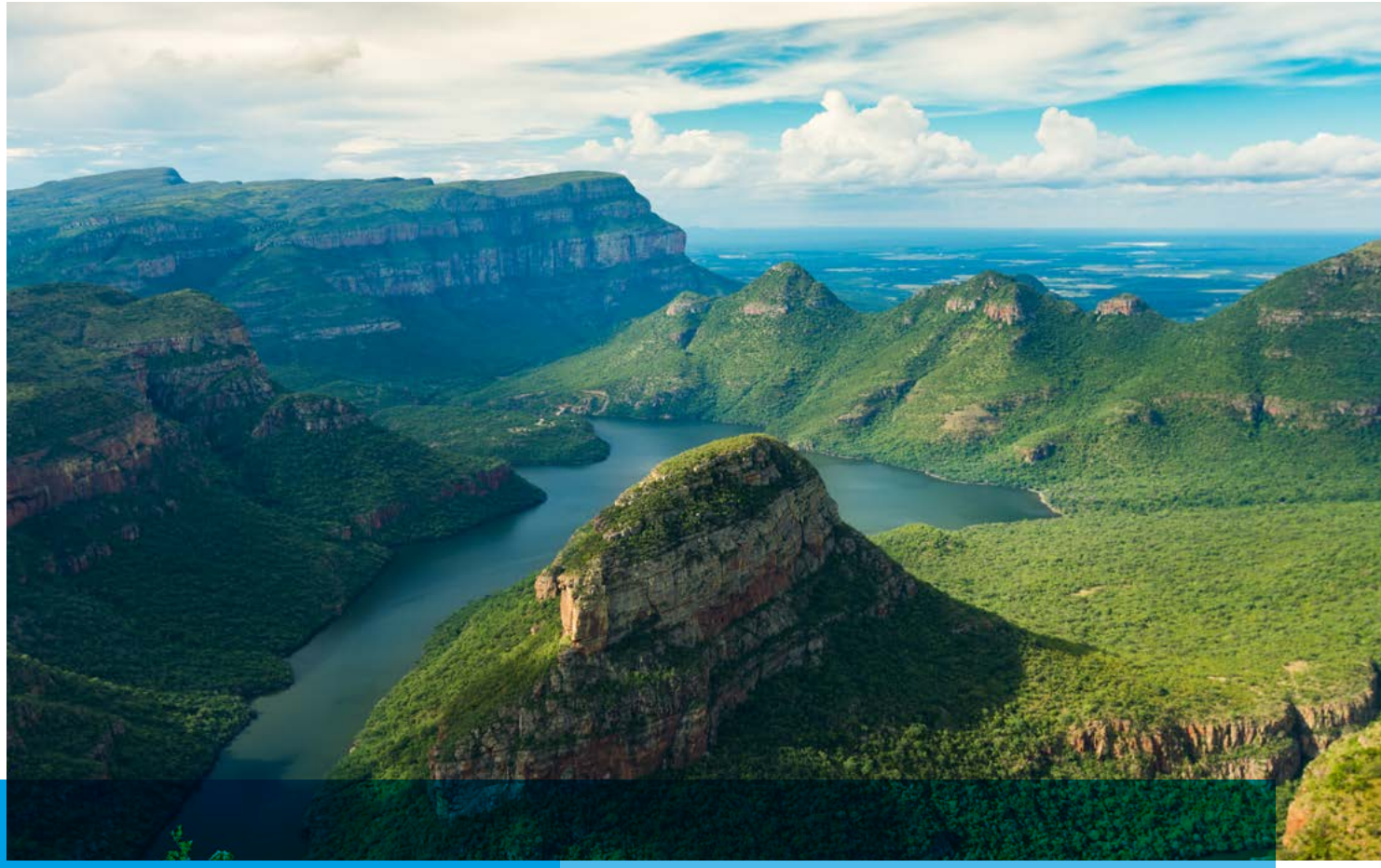
Study Options

- B.Sc.Eng. in Civil Engineering specialising in Water Engineering at UCT, UKZN and Wits B.Eng. in Civil Engineering specialising in Water Engineering at SU, UJ and UP Diploma, Advanced Diploma, M.Tech in Civil Engineering at CPUT, CUT, DUT, MUT, TUT, UNISA, VUT and WSU

Employers

- National, provincial and local government
- Water utility companies
- Water treatment plants
- Research institutions
- NGOs, community-based and development organisations and private consultancies

WATER CONTROL OFFICER



Water control officers monitor and control water abstraction in catchment areas. They undertake the inspection of dams in accordance with legislation and assist with water registration, validation and issuing of water licenses. They can also record water metre readings and alert designated authorities on the misuse of water resources.

Skills required for this career

- Understanding the principles of monitoring and evaluation
- Good analytical and problem-solving skills
- Strong organisational ability
- Good verbal and written communication skills

Study Options

- B.Sc., B.Sc.(Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- M.Sc. in Water Management
- B.Sc. in Hydrology and Water Resources Management
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Water utility companies

WATER INSPECTOR

Water inspectors evaluate and inspect the extraction, use and quality of water in domestic use, irrigation in agriculture and manufacturing purposes. They regulate and monitor water permits and licensing and facilitate investigations around water use complaints and infrastructure compliance. They also inspect water storage facilities such as instream and off-channel dams to ensure they comply with water regulations.

Skills required for this career

- Methodical approach to investigation
- Analytical and critical thinking ability
- Excellent problem-solving ability
- Safety awareness and consideration

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology
- Water inspectors can benefit from a Further Education and Training Certificate or National Certificate in Water Treatment Practice at National Qualifications Framework Level 1 to 3 offered at Technical and Vocational Education and Training Colleges

Employers

- National, provincial and local government
- Water utility companies

WATER LIAISON PRACTITIONER

Water liaison practitioners develop and implement communication strategies to relay appropriate water-related information to promote sustainable water resource management and use. They analyse water related legislation and policies and its application. They also establish, maintain and promote collaborative relationships and partnerships amongst water users. Some also organise events and workshops around specific water projects and coordinate the participation of stakeholders.

Skills required for this career

- Excellent interpersonal and networking skills
- Strong analytical and problem-solving ability
- Events coordination and management skills
- Good verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Catchment management agencies
- Water utility companies

WATER QUALITY ANALYST

Water quality analysts analyse freshwater and develop policies and plans for the control of factors which may produce water pollution. They collect water samples, conduct chemical, bacteriological, physical and biological analyses and compare the results to predefined water quality standards. They then provide recommendations and procedures to address challenges or maintain or improve water quality.

Skills required for this career

- Competence in laboratory processes and equipment
- A sound analytical approach to problem-solving
- Good attention to detail and organisational ability
- Ability to easily communicate complex concepts

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Biological Sciences
- B.Sc., B.Sc. (Hons), M.Sc. in Chemistry
- B.Sc. in Water and Sanitation
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Research institutions
- Water treatment plants
- Private consultancies and testing laboratories

WATER USE SPECIALIST

Water use specialists monitor, evaluate and audit water use programmes or initiatives. They conduct water use surveys and collect and analyse water samples to determine changes in water supply and quality. They also develop and operate data and information management systems to enable effective water resource monitoring. Some report and advise on strategies to address water use challenges and opportunities as well as water regulation processes.

Skills required for this career

- Strong analytical and problem-solving ability
- Ability to carry out fieldwork and laboratory processes
- Good project management competence
- Good verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Hydrology
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Catchment management and other local water management agencies
- Water utility companies
- Private consultancies

HYDROGEOLOGIST

Hydrogeologists investigate the occurrence and exploration opportunities and challenges of groundwater according to geographical formations, surface water flow and man-made influences. They study and collect data on the flow and quality of groundwater systems and model future behaviour and impacts on aquifer systems. They can also advise on the decision-making processes for aquifer subdivisions, rivers and irrigation strategies ensuring compliance with environmental legislation.

Skills required for this career

- Excellent research capabilities
- Analytical with excellent critical thinking skills
- Strong problem-solving ability
- Good verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Hydrogeology
- B.Sc., B.Sc. (Hons), M.Sc. in Hydrology

Employers

- National, provincial and local government
- Research institutions
- Mining and construction companies

HYDROLOGIST

Hydrologists study the quality, quantity, distribution, circulation and physical properties of surface and underground water. They study the impact of precipitation and identify water supply sources to evaluate the effect of human activities on the quantity and quality of water, as well as study interactions between components within the hydrological cycle. They also map and model future water levels by tracking usage and precipitation data and advise on effective water use programmes.

Skills required for this career

- Extensive research and fieldwork capability
- Ability to geographically map and model hydrological data
- Excellent analytical and problem-solving ability
- Good verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Hydrology
- B.Sc., B.Sc. (Hons), M.Sc. in Geology specialising in Hydrogeology

Employers

- National, provincial and local government
- Research institutions
- Water utility companies
- Private consultancies

WATER RESOURCE MANAGER

Water resource managers design and implement water resource programs and strategies, related for example, to ecological infrastructure and provision such as supply, quality and regulatory compliance. They conduct investigations around water storage, wastewater discharge, compliance and regulatory challenges and identify specific sources of water pollution. They also assess the implications of proposed water resource schemes and drought management measures. They develop strategies to address water supply, conservation and ecosystem management, and regulatory compliance according to water standards and laws.

Skills required for this career

- Critical problem-solving and analytical thinking ability
- Understanding of water compliance and regulatory legislation
- Experience in modelling and mapping hydrological data
- Excellent verbal and written communication and presentation skills

Study Options

- B.Sc., B.Sc. (Hons), M.Sc. in Hydrology
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental Science specialising in Water Science
- B.Sc., B.Sc. (Hons), M.Sc. in Environmental and Water Science
- B.Sc. in Hydrology and Water Resources Management
- M.Sc. in Water Resource Management
- Diploma, Advanced Diploma, M.Tech in Water Science and Technology

Employers

- National, provincial and local government
- Catchment management and other local water management agencies
- Water utility companies
- Private consultancies

IRRIGATIONIST

Irrigationists install and maintain irrigation systems to ensure optimum soil moisture levels for the production of crops. They lay pipes down with a predetermined number of sprinkler heads at specified points or adjust lateral-moving irrigation systems to maximise the watering of crop areas. They also perform maintenance of these systems by repairing or replacing valves, pumps and other equipment. They can further install timers and clocks as well as prepare equipment for use during winter periods.

Skills required for this career

- Physical fitness and stamina to walk large farm fields
- Ability to read blueprints and technical diagrams
- Capability to drive and operate farming machinery
- Good teamwork and communication competence

Study Options

- Irrigationists can benefit from a National Certificate in Landscape Irrigation at National Qualifications Framework Level 1 to 2, accredited by the Agriculture Sector Education Training Authority
- They can also benefit from a National Certificate in Primary Agriculture in Plant Production at National Qualifications Framework Levels 1 to 2 offered at agricultural colleges and most Technical and Vocational Education and Training Colleges
- Training could also take place on the job with mentoring by an experienced irrigation technician

Employers

- National and provincial government
- Commercial and small-scale farms
- Agricultural co-operatives
- Research institutions

ENERGY SECTOR CAREERS

Electricity powers the daily lives of people and is the foundation of all social and economic activity. All aspects of production and consumption across all value chains rely on electrical power, for production, manufacture, transport, storage, amongst other support services. More than 75% of South Africa's primary energy needs are provided through coal generated power, that contributes significantly to carbon emissions and greenhouse gasses.

As the threat and pressures of climate change increases, combined with the move to cleaner and sustainable energy provision to meet the country's domestic and economic needs, requires the exploration of innovative, alternative energy sources and renewable energy has in important role to play. South Africa is well placed to generate renewable energy with its abundance of natural resources, sun and wind.

These alternative energies will provide a diverse mix of cleaner energy to meet the country's needs while meeting its global emission reduction targets. The move to cleaner, renewable energy brings with it a need for new skills.

What is meant by a 'Just Energy Transition'?

77% of South Africa's greenhouse gas emissions are from energy – either electricity, heat or transport used by industry and households and 86% of SA's electricity comes from coal fired power stations. The move from fossil-based fuels sources to renewable energy sources is critical to South Africa's decarbonisation journey. A 'Just Energy Transition' seeks to ensure that the lives and communities that are tied to high-emitting energy industries (e.g., coal) are not left behind in the shift towards a low emissions economy. The energy transition must be fair and perceived to be fair. A well-managed "Just Energy Transition" can be a strong driver for new jobs, better jobs, social justice, and poverty eradication.

BIOFUELS ENGINEER

Biofuels engineers research, design and develop products, tools, procedures and processes that generate biofuels for electricity and powering vehicles and machinery. They consider all the complex factors that go into the production of alternatives to fossil fuels and work to redirect established scientific principles for producing energy into innovative technological solutions.

Skills required for this career

- Extensive analytical and logical reasoning ability
- Creative problem-solving
- Strong attention to detail
- Sound project management skills

Study Options

- B.Sc.Eng. in Bio-resources Engineering
- B.Sc.Eng. in Chemical Engineering
- B.Eng. in Chemical Engineering
- Diploma, Advanced Diploma, M.Tech in Chemical Engineering

Employers

- National, provincial and local government
- Biofuels, renewable and private energy companies
- Research institutions

BIOMASS PLANT TECHNICIAN

Biomass plant technicians provide technical support and services in the installation and operation of biomass power plant processes, systems, facilities and equipment. They control and adjust the production of biofuels and perform routine maintenance to the mechanical and electrical equipment used. They also calculate and load biomass feedstock, maintain records and report on the quality and quantity of daily production.

What is Biomass?

Biomass is plant-based material used as fuel to produce heat or electricity. Examples are wood and wood residues, energy crops, agricultural residues, and waste from industry, farms and households. Since biomass can be used as a fuel directly, some people use the words biomass and biofuel interchangeably.

Skills required for this career

- Machine and mechanical operating capability
- Good problem-solving and analytical thinking ability
- Strong organisational competence
- Written and verbal communication skills

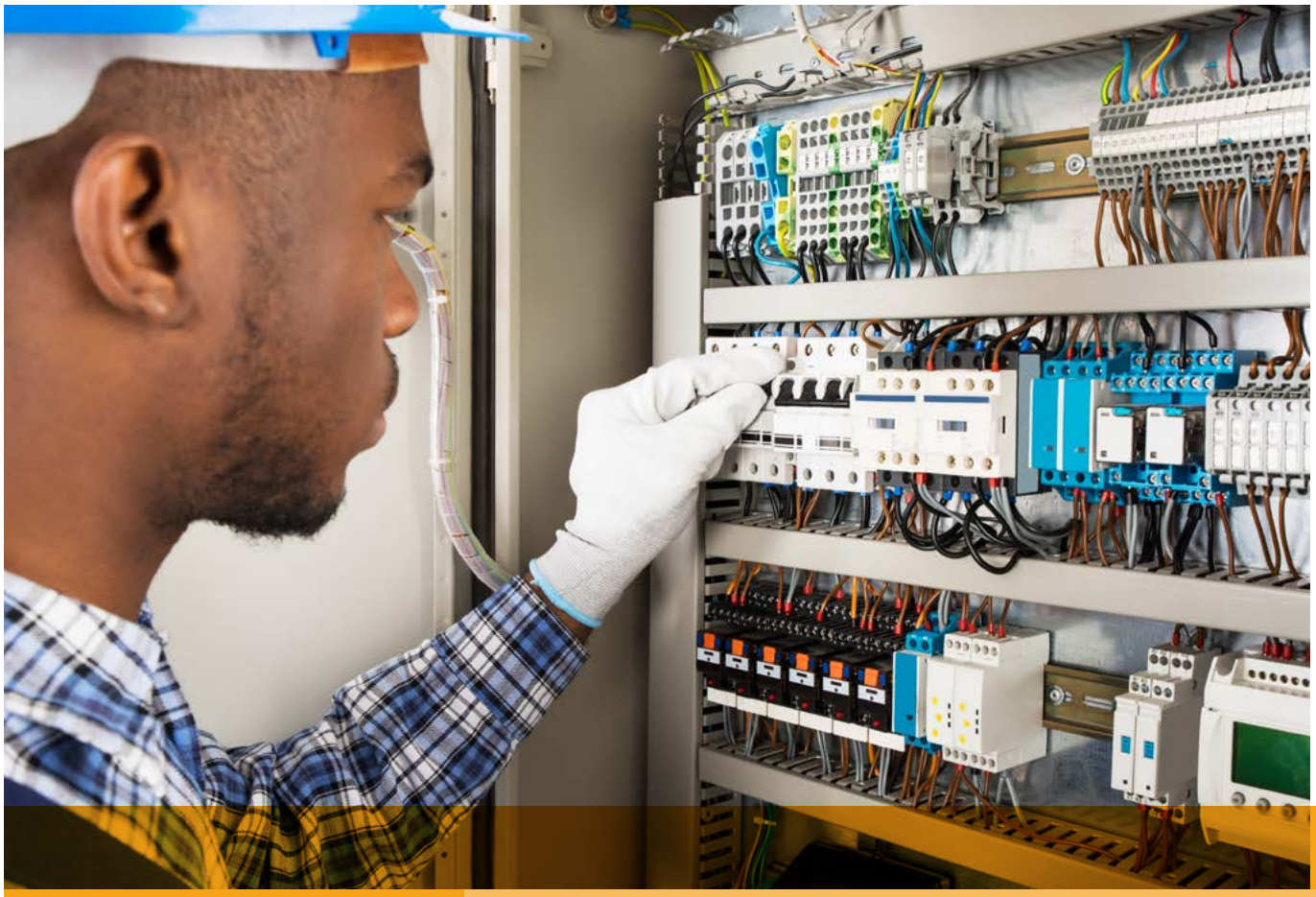
Study Options

- Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control
- Biomass plant technicians can also benefit from a National Certificate in Fossil Power Plant Operations at National Qualifications Framework Level 1 to 4
- Training could also take place on the job with mentoring by an experienced technician

Employers

Biomass power production plants

ELECTRICIAN



Electricians install, test, connect, commission, maintain and modify a multitude of electrical equipment, wiring and control systems. They detect and repair faulty light and other electrical power systems. Some also work with and advise on renewable technologies and energy efficient electrical systems such as wind turbines and solar panels, for example.

Skills required for this career

- Strong logical reasoning and problem-solving competence
- Ability to read and interpret technical electrical drawings
- Good physical stamina
- Good verbal and written communication ability

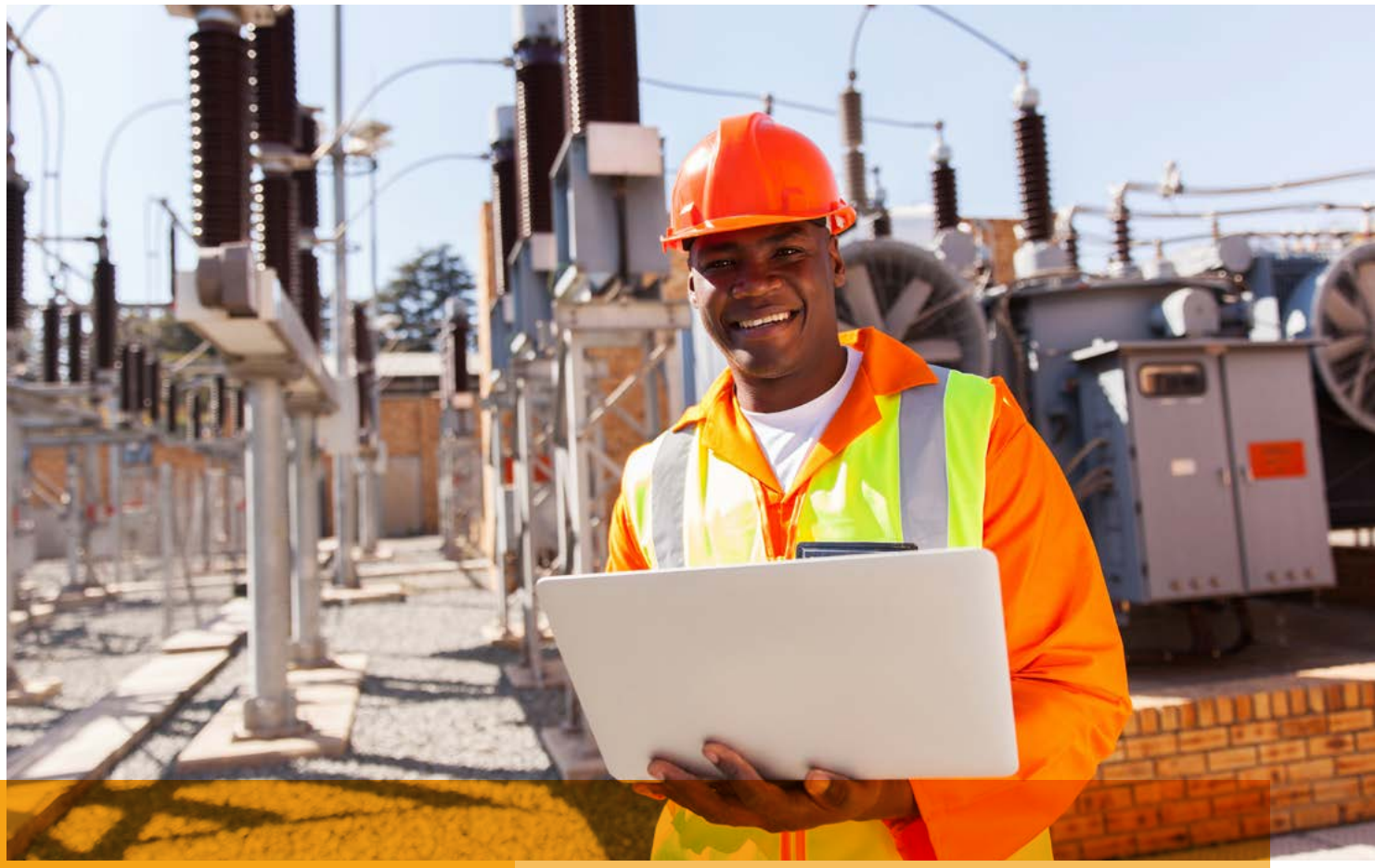
Study Options

- Diploma, Advanced Diploma, M.Tech in Electrical Engineering
- National Vocational Certificate in Electrical Engineering Studies at National Qualifications Framework Level 2, 3 and 4 offered at majority of Technical and Vocational Education and Training Colleges
- National Vocational Certificate in Electrical Infrastructure Construction at National Qualifications Framework Level 2, 3 and 4 offered at most Technical and Vocational Education and Training Colleges

Employers

- Local government
- Manufacturing and mining companies
- Private electrical service companies

ELECTRICAL ENGINEER



Electrical engineers design, develop and supervise the manufacture, installation, operation and maintenance of equipment, machines and systems for the generation, distribution, utilisation and control of electrical power. They test equipment, solve operating problems and estimate the time and cost of electrical engineering projects. Electricity generation in South Africa is heavily dependent on coal, with significant environmental impacts. There is a concerted drive to steer South Africa towards increasing renewable electricity generation.

Skills required for this career

- Very strong analytical and logical reasoning competence
- An extensive knowledge of electricity use contexts
- Creative problem-solving skills
- Competence in the use of popular engineering and design software

Study Options

- B.Eng. in Electrical Engineering
- B.Sc.Eng. in Electrical Engineering
- Diploma, Advanced Diploma, M.Tech in Electrical Engineering

Employers

- National, provincial and local government.
- Construction, production and manufacturing companies.
- Renewable and private energy organisations.
- Research institutions

ENERGY EFFICIENCY
TECHNICIAN

Energy efficiency technicians evaluate electrical installations, equipment and processes to determine the amount of energy used and lost to improve energy usage and recommend and install energy conserving measures. They audit the ventilation, heating and cooling, lighting and power systems during building construction and at manufacturing plants. Some can be consulted to provide energy usage goals for businesses and analyse costs and benefits of energy saving devices.

Skills required for this career

- Methodological problem-solving skills
- Ability to read and interpret building plans and schematics
- Ability to use design and energy modelling software
- Good verbal and written communication skills

Study Options

- B.Eng. in Electrical Engineering
- B.Sc.Eng in Electrical Engineering
- Diploma, Advanced Diploma, M.Tech in Electrical Engineering

Employers

- Provincial and local government
- Energy provision and service companies
- NPOs and private consultancies

POWER GENERATION
OPERATIONS MANAGER

Power generation operations managers plan, direct and coordinate the work activities and resources of power generation and ensure that targets are met. They carry out regular plant inspections to ensure plans are on schedule as well as inspect production equipment and machinery, making sure repairs and maintenance are carried out. They also set work schedules, evaluate employee performance and enforce safety protocols. Some are involved in the strategic planning and development for new power generating plants.

Skills required for this career

- Strong managerial and business experience
- Creative problem-solving and analytical thinking ability
- Understanding of labour legislation and safety regulations
- Good written and verbal communication skills

Study Options

- B.Sc.Eng. in Electrical Engineering
- B.Eng. in Electrical Engineering at
- Diploma, Advanced Diploma, M.Tech in Electrical Engineering

Employers

- National, provincial and local government
- Biofuel, renewable and private energy companies

GEOTHERMAL TECHNICIAN

Geothermal technicians perform technical activities for the generation of power from geothermal energy sources. They install, test and maintain commercial geothermal heat pumps and monitor and take readings of the equipment, making necessary adjustments to increase performance and energy outputs. They are also responsible for inspecting machinery, making basic repairs and calling in more specialised technicians to address serious challenges. They can also provide reports and suggestions based on current performance of geothermal machinery.

What is Geothermal Energy?

It is the heat that comes from the sub-surface of the earth contained in the rocks and fluids beneath the earth's crust and can be found as far down to the earth's hot molten rock, magma.

Skills required for this career

- Good problem-solving and analytical skills
- Strong organisational competence
- Machine and mechanical operating capability
- Written and verbal communication skills

Study Options

- B.Eng. in Electrical Engineering specialising in Energy systems
- B.Sc.Eng in Electrical Engineering specialising in Power systems
- Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control
- Geothermal technicians can also benefit from a National Certificate in Fossil Power Plant Operations at National Qualifications Framework Level 1 to 4
- Training could also take place on the job with mentoring by an experienced technician

Employers

Geothermal power production manufacturers

HYDRO POWER PLANT
CONTROLLER

Hydro power plant controllers provide technical support and services in the installation, operation and maintenance of hydropower plant processes, systems, facilities and equipment. They start up and power down electrical generation systems, monitor and adjust equipment to ensure optimal performance. They also keep records of ongoing power plant operations to identify processes that can be improved.

Hydropower, also known as water power, is the use of falling or fast-running water to produce electricity or to power machines.

Skills required for this career

- Ability to read and interpret electrical readings and meters
- Problem-solving and troubleshooting skills
- Safety conscious with a keen attention to detail
- Good written and verbal communication

Study Options

- Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control
- Hydro power plant controllers could benefit from a National Certificate in Hydro Power Plant Process Control Operations at National Qualifications Framework Level 2 to 4
- Training could also take place on the job with mentoring by an experienced mentor

Employers

Hydropower generation plants

NUCLEAR POWER PLANT
CONTROLLER

Coal fired power stations currently dominate electrical power generation in South Africa. There is however increasing domestic and global pressure, to explore alternative energy sources to meet needs for sustainable growth. Nuclear energy currently contributes 3% to the national power grid.

Expanding the scope of nuclear power generation requires the safe control of nuclear energy and its radioactive deposits to ensure minimal impact to the environment and human health and wellbeing.

Nuclear power plant controllers provide technical support and service in the installation, operation and maintenance of nuclear power plant processes, systems, facilities and equipment. They monitor performance indicators and record and review components, adjusting fission rates, pressure, water, temperature and flow rates, for example. They also run scheduled tests on all equipment to ensure safe and efficient nuclear operation.

Skills required for this career

- Excellent problem-solving ability
- Ability to keep accurate and consistent records
- Keen attention to detail and an awareness for safety
- Physical and mental endurance

Study Options

- Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control
- Nuclear power plant controllers will also benefit from a National Certificate in Nuclear Power Plant Process Control Operations at National Qualifications Framework Level 3 to 5
- Training could also take place on the job with mentoring by an experienced mentor

Employers

Nuclear power generation plants

RENEWABLE ENERGY
ENGINEER

Renewable energy engineers research and design renewable energy technologies, equipment and power generation plants. They plan and oversee the installation of renewable energy power plants, decide on the most ideal location and ensure that the sites operation meets engineering and environmental standards. They can also develop and improve existing procedures and assess and review energy production systems and technologies, advising on methods and techniques to reduce energy costs and improve energy efficiency.

Skills required for this career

- Strong mathematical competence
- Creative problem-solving and analytical thinking ability
- Ability to coordinate and manage complex projects
- Understanding of current energy policies and legislation

Study Options

- B.Sc.Eng. in Electrical Engineering
- B.Eng. in Electrical Engineering
- Diploma, Advanced Diploma, M.Tech in Electrical Engineering

Employers

- National, provincial and local government
- Construction, production and manufacturing companies
- Renewable and private energy organisations
- Private consultancies

SOLAR POWER PLANT
TECHNICIAN

Solar power plant technicians provide technical support and services in the installation, operation and maintenance of solar power plant processes, systems, facilities and equipment. They startup and operate power generating systems such as turbines and generators, making adjustments when needed and monitor electrical, mechanical and electronic equipment to ensure optimal performance. They also keep operational logs and reports and perform preventative maintenance and repairs in cases where deterioration or failure has occurred.

Skills required for this career

- Machine and mechanical operating capability
- Logical troubleshooting and problem-solving skills
- Strong organisational and analytical thinking competence
- Written and verbal communication skills

Study Options

- Diploma, Advanced Diploma, M.Tech in Electrical Engineering specialising in Process Control
- Solar power plant technicians can also benefit from a National Certificate in Electrical Engineering at National Qualifications Framework Level 2 to 4 offered at most Technical and Vocational Education and Training Colleges
- Training could also take place on the job with mentoring by an experienced technician

Employers

- Public power utilities
- Private solar power companies

WIND ENERGY ENGINEER

Wind energy engineers design, build and monitor wind turbines and wind farms. They analyse annual wind speed and direction data to determine the best location for a wind farm and design and develop the electrical systems, specifications and materials for wind technology components. They plan and oversee the installation of wind turbines and coordinate operations to meet engineering and environmental standards. They also analyse performance data and strategise to maximise operation costs and energy generation.

Skills required for this career

- Excellent analytical and logical reasoning competence
- Creative problem-solving skills
- Competence in popular engineering and design software
- Knowledge of current energy legislation and policies

Study Options

- B.Eng. in Electrical or Mechanical Engineering
- B.Sc.Eng. in Electrical or Mechanical Engineering
- B.Sc.Eng. in Aeronautical Engineering
- Diploma, Advanced Diploma, M.Tech in Electrical or Mechanical Engineering

Employers

- Wind energy providers
- Manufacturing companies
- Energy agencies, partnerships and consultancies

CAREER OPPORTUNITIES
IN HYDROGEN AND FUEL CELL TECHNOLOGIES

South Africa, in line with the global trend, sees the hydrogen economy as the way forward. This is mainly due to the diminishing stocks of the world's fossil fuels, such as oil, and the impact of their combustion on climate change. With over 75% of the world's platinum reserves (the key catalytic component of Polymer Electrolyte Membrane (PEM) fuel cells), South Africa is ideally positioned with both the raw materials and the scientific expertise to drive a developing hydrogen economy. The hydrogen and fuel cell industry in South Africa is growing and a number of opportunities for scientists and engineers are being created.

What is Hydrogen & Fuel Cell Technology (HFCT)?

Hydrogen and fuel cell technology is a technology which uses both hydrogen and fuel cells to generate electricity. Hydrogen is the simplest element and the most plentiful gas in the universe. It is used as an energy carrier that stores and delivers energy in a usable form. Using hydrogen as an energy carrier will reduce the country's dependence on importation of oil and also reduce greenhouse gas emissions that cause global warming, if the hydrogen is produced from clean sources of energy. Fuel cells directly convert the chemical energy in hydrogen to electricity, with water and heat being the by-products. A fuel cell operates like a battery but, unlike a battery, it does not run down or require recharging.

How Fuel Cells WorK

A fuel cell consists of an electrolyte and two catalyst-coated electrodes. Oxygen passes over one electrode (the cathode) and hydrogen over the other (the anode), resulting in the generation of electricity, water and heat. When the hydrogen gas is passed over the "anode" of the fuel cell, with the help of a platinum catalyst, the hydrogen atom splits into a proton and an electron, which take different paths to the cathode. The proton passes through the electrolyte. The electrons create an electrical current that can be utilised before they return to the

cathode, where they react with the oxygen and the hydrogen protons, forming a water molecule.

WHAT IS THE FUTURE OF HYDROGEN AND FUEL CELL RESEARCH?

For some time now there has been significant funding provided by the South African government through the Department of Science & Technology (DST) and other institutions, and backed up by the private sector, to fast-track hydrogen & fuel cell technology research and innovation and also to encourage learners at high schools to study maths and science subjects to enable them to enter this field.

South Africa has great potential to manufacture various components in the hydrogen and fuel cell technology value chain. This is partly because of the country's rich platinum-group metals reserves. Hence, the manufacturing of Membrane Electrode Assemblies (MEAs) and PEM fuel cells in South Africa has the potential to create jobs and add significant value to this huge mineral resource. In order to achieve this, there is also a pressing need to attract top level postgraduates to become part of the growing research programmes of Hydrogen South Africa (HySA) at universities and other institutions.

It must be stressed however that very high standards are set to gain entry to some of the faculties such as Engineering or Science. Because this research field requires such a broad spectrum of disciplines, one could choose any of the Science degrees or diplomas, including Physics and Chemistry, Applied Science or Material Science, Chemical or Mechanical Engineering, Electrical Engineering, Thermodynamics, Electronics or Metallurgy. These subjects could be useful for research in hydrogen and fuel cell technologies.

A four-year BSc Engineering degree or BSc Honours degree opens doors for postgraduate studies at various universities and other tertiary institutions in this research field. Excellent academic results are rewarded by attractive bursary support at many of the universities and other scientific institutions around the country. The criteria for these bursaries differ from institution to institution, however most require postgraduate academic records with an average of 75% and above.

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