Careers in the Energy Sector

energy
Department: Energy
REPUBLIC OF SOUTH AFRICA
The Department of Energy is responsible for ensuring exploration, development, processing, utilization and management of South Africa's energy resources. As the country's economy continues to grow, the increasing demand for energy continues to become a focus for attention locally and internationally among ordinary citizens, businesses and, captains of industry.

The vision of South Africa's energy strategy, as championed by the Department of Energy, is to contribute towards affordable energy for all, and to minimize the negative effects of energy usage on human health and the environment. The energy strategy also envisages promotion of energy efficiency technologies across all sectors, and sets a national target for energy efficiency improvement of 12% by 2015.

1.1. Upstream

The upstream sector refers to the extracting of crude oil and natural gas and production of crude oil and natural gas. It is also known as the exploration and production (E&P) sector. The upstream sector includes the searching for potential underground or underwater oil and gas fields, drilling of exploratory wells, and subsequently opening the wells to recover and bring the crude oil and/or natural gas to the surface. The following are activities involved in the Upstream part of the Oil Industry:

- Exploration – Predicating where oil and gas may be found
- Drilling – Finding Oil and Gas
- Production – Extracting oil and gas
- Processing – Removing impurities

Midstream

The midstream sector involves the transportation (by pipeline, rail, barge, oil tanker or truck), storage, and wholesale marketing of crude or refined petroleum products. Pipelines and other transport systems can be used to move crude oil from production sites to refineries and deliver the various refined products to downstream distributors. Natural gas pipeline networks aggregate gas from natural gas purification plants and deliver it to downstream customers, such as local utilities.

The midstream operations are often taken to include some elements of the upstream and downstream sectors. For example, the midstream sector may include natural gas processing plants that purify the raw natural gas as well as removing and producing elemental sulphur and natural gas liquids (NGLs) as finished and products.

Downstream

The Downstream sector is a term commonly used to refer to the refining of crude and the selling and distribution of natural gas and products derived from crude oil. Such products include liquefied petroleum gas (LPG), petrol, jet fuel and diesel.

The downstream sector includes oil refineries, petrochemical plants, petroleum products distribution, retail outlets and natural gas distribution companies. South Africa has the second largest refining capacity in Africa, surpassed only by Egypt. Refining is an industrial process where crude oil is processed and refined into much more useful petroleum products such as petrol, diesel, heating oil, kerosene and liquefied petroleum gas. Oil refineries are typically large sprawling industrial complexes with extensive piping running through, carrying streams of fluids between large chemical processing units. Refined products are sold in the local and export markets. There are also synthetic fuels. Synthetic fuels are liquid fuels obtained from coal, natural gas or biomass. They may also be derived from other solids such as plastics or rubber wastes, or from the fermentation of biomass. The downstream industry touches consumers through thousands of products such as petrol, diesel, jet fuel, heating oil, asphalt, lubricants, synthetic rubber, plastics, fertilizers, aromatics, pesticides, pharmaceuticals, natural gas and propane.

1.2. Activities

- Refining – processing and removing impurities from crude oil
- Primary Distribution – tanker and pipeline transportation
- Terminal and Storage – Warehousing or Port Management as well as Secondary Distribution
- Sales and Marketing to commercial and retail customers

1.3. South African Industry Players

PetroSA and SANSOL are the local companies that play a role in both upstream and downstream. Multinational Oil Companies such as BP, SHELL, CALTEX, ENGEN and TOTAL are involved at different stages of the oil industry value chain.

1.4. Economic Contribution

South African petrochemical industry is of substantial economic significance to the country. It accounts for 7% of the country’s output and approximately 25% of its manufactured sales. It generates over R15bn in revenues and contributes R40bn in taxes. Thus far, synthetic fuels refineries save the country billions of rands in Foreign Exchange each year. The Petroleum Industry employs over 100,000 people.

1.5. Career Opportunities

Most engineering disciplines such as Electrical, Mechanical and Environmental engineering are relevant for this field. Other disciplines are:

- Sales and Marketing (Marketing and Selling Petroleum Products)
- Information Technology Specialists
- Human Resource Management and Legal Services
- Transport (for example Tracking and Logistics Management)
- The Department of Energy has study programmes to ensure opportunities for prospective students
- Maths and Science are a good foundation for aspirant learners

ELECTRICITY

 Eskom generates about 90% of electricity in South Africa and about 45% in Africa. About 90% of South Africa's electricity is generated from coal fired power stations. The other 10% comes from nuclear, hydroelectric and pumped storage schemes. The electricity value chain begins with generation at power stations. Electricity is then transmitted through transmission lines to Transmission B/Ls from the Transmission Substations power is routed to Distribution Substations. Power then goes through to recirculation line until it reaches the customer.

2.1. Primary Sources of electricity

Most of our electricity is generated from coal. However, electricity can be generated from other sources such as nuclear, gas, liquid fuels, hyro, wind, solar, waves and biomass

2.2 Fields of Study in the Electricity Sector

The following fields are the most relevant for somebody who would like to work in the electricity value chain:

- Engineering
- Economics
- Natural Sciences
- Environment

2.3.1 Engineering Fields

Engineering fields include the following:

- Electrical Engineering: Electrical engineers are involved in the planning, design and commissioning of generation, transmission and distribution of electricity systems.
- Mechanical Engineering: Mechanical engineers plan, design, manufacture and maintain plants and equipment.
- Civil Engineering: Civil engineers are involved in the construction of infrastructure of civil nature such as dams, power stations, and access roads.
- Metallurgy: Metallurgists deal with properties of various materials for application in the electricity industry.

- Production of Engineering: Production engineers ensure the production of electricity is cost-effective.

2.3.2 Environmental Studies

An environmental qualification can enable one to work with environmental impact assessment, resource exploitation and pollution management.

2.3.3 Legal and Governance Studies

Legal and governance qualifications can enable one to work in the electricity regulation environment. Making energy policy also requires those qualifications.
**RENEWABLE ENERGY**

Renewable energy harnesses naturally occurring non-depletable energy sources to produce electricity, gas and liquid fuels. South Africa is well endowed with renewable energy sources, however these sources remain largely unexploited.

### 3.1. Renewable Energy Sources:
- Solar
- Wind
- Hydro
- Biomass & biofuels

### 3.2. Renewable Energy Technologies (RET’s)
Renewable Energy Technologies are used to harness renewable energy sources. RET’s is a labour intensive and produce more jobs. RET’s include solar cookers and heaters, solar panels to generate electricity and wind turbines.

### 3.3. Career Opportunities in Renewables
- Installation and operation – The installation and operation of renewable technologies offers opportunity for work and business maintenance of the technology is also an opportunity in the field
- Research and Development – A lot of research is taking place in renewables
- Teaching – Opportunities also exist for those who are qualified to teach communities and individuals about renewable energy
- Energy Specialist – To audit and monitor clean energy programmes
- Independent Power Producers (IPP) Renewables offer an opportunity for IPP’s especially in the light of power shortages in the country
- Government (Policy Makers) – Government set out and enforces policy on a regular basis. This is an opportunity for people involved in renewables

### 3.4. Institutions offering Energy Studies
- University of the Western Cape
- Nelson Mandela Metropolitan University
- University of Fort Hare
- University of Johannesburg
- University of Cape Town
- Witwatersrand University
- Tshwane University of Technology
- Stellenbosch University

### 3.5. Organisations that offer employment opportunities in Renewables
- Government Departments such as the Department of Energy, Department of Science and Technology, Department of Water Affairs, Department of Environmental Affairs etc
- Municipalities such as Eskom, Council for
- Consulting companies (Renewable Technology, Micaaral)
- National Energy Fund (NEF)
- Eskom
- Industrial Development Corporation (IDC)
- Development Bank of Southern Africa (DBSA)
- National Energy Regulator of South Africa (NERSA)
- Council for Scientific and Industrial Research (CSIR)
- Independent Power Producers

**NUCLEAR ENERGY**

Nuclear Energy is the process of creating heat through the fission reaction. Fission processes take place when the nucleus of a heavy atom like Uranium is split into two while struck by a neutron. Nuclear energy can be used amongst other things in electricity generation and nuclear medicine.

### 4.1. Key Players in the Nuclear Sector
- Department of Energy
- ESKOM – Koeberg Nuclear Power Station
- Nuclear Radioactive Waste Disposal Institute (NRWDI)
- Thermos Lab, Cape Town

### 4.2. Careers in the Nuclear Sector
- Government/Public Sector
- Nuclear Physics
- Chemical Engineers
- Nuclear Regulatory Officers
- Nuclear Reactor Operators
- Nuclear Inspectors
- Nuclear Economists
- Nuclear Security

### 4.3. Qualifications Required

- Tertiary Qualifications required:
  - BSc in Physics, Mathematics, Chemistry
  - BSc Nuclear, Electrical, Mechanical and Electronics

- National Nuclear Regulatory (NNR)
- South African Nuclear Energy Corporation (NECSA)
- Institutions in Higher Learning

**BURSARIES**

The Department of Energy (DoE) offers bursaries in the fields of Chemical Engineering, Nuclear Engineering and Radiation. The minimum requirements are an A in Science, Technology, Engineering, Mathematics (STEM) Fields.

### 7.1. The Department does this by:

- Directing policy and regulation development for the energy sector
- Managing Hydrocarbons (coal, gas & petroleum), Electricity and Clean Energy Industries (on an operational level)
- Managing the South African Nuclear Energy Industry and ensuring overall control of sources and special nuclear matters in terms of nuclear legislation

To achieve this, the department employs and needs a variety of professionals including:

- Engineers (Electrical, Mechanical, Civil, Metallurgists, Production etc)
- Economists
- Nuclear Research/Scientists
- Nuclear Physicists
- Artisans and Technicians
- Environmental Officers
- Geologists
- Regulatory Officers (Energy Officers/Inspectors)

### 7.2. Other disciplines in the department are:

- Communications
- Human Resources
- Legal Services
- Risk Management
- Internal Audit
- Strategy Monitoring and Evaluation
- Administration
- Information Technology
- Supply Chain Management

### 7.3. Internship

The department also offers students from universities and colleges opportunities to obtain their qualifications by participating in the department’s experiential/internship programme.

Career opportunities at the department are advertised in all major South African newspapers. Learners can also visit the department’s website (www.energy.gov.za) for more information.

This is a programme which gives students from universities, technicons or colleges an opportunity to gain hands on experience in a work related environment.

### 7.4. Who is eligible?

Any student who is required by his/her study programme to undergo practical training to complete his/her studies and needs to enhance changes for future employment.

### 7.5. Internship/Experiential Training

- All students from the university, university of technology or college willing to participate in the programme in order to obtain their qualification after a certain period of training
- Any person who has completed his/her studies with the said institutions that need potential learning to enhance changes for future employment

### 7.6. Requirement for Admission

- Brief CV which also indicates field of study
- Period of Internship Programme
- Format of evaluation to be submitted to the tertiary institution after completion of training or guidelines from your institution
- Academic transcript from your institution or degree/diploma/copy for those who have already graduated.

### 7.7. Selection Criteria

- The criteria used in the selection shall largely depend upon the academic performance and interviews
- Interviews will be conducted by relevant branch / component

### 7.8. Benefits

- Experience that gives the students an opportunity to apply and extend theoretical knowledge acquired in the classroom in a practical way
- A vehicle to establish positive contact with a prospective employer

**LIST OF SOUTH AFRICAN UNIVERSITIES**

**EASTERN CAPE**

- Nelson Mandela Metropolitan University
  T: 041 504 1111 | F: 041 504 2574
  www.nmmu.ac.za
- Rhodes University
  T: (446) 653 8148 | F: 046 622 8444
  www.ru.ac.za
- University of Fort Hare
  T: 040 653 2312 | F: 040 653 1338
  www.ufh.ac.za
- Walter Sisulu University of Technology
  T: 047 502 2200 | F: 047 502 2970
  www.wsu.ac.za

**KWAZULU NATAL**

- Durban Institute of Technology
  T: 031 373 2411 | F: 031 373 2011
  www.dut.ac.za
- University of KwaZulu Natal
  T: 031 2602227 | F: 031 262 2192
  www.ukzn.ac.za
- Mangosuthu Technikon
  T: 031 907 7111 | F: 031 906 5470
  www.mantech.ac.za
- University of Zululand
  T: 035 902 8934 | F: 035 902 6601
  www.unizul.ac.za

**LIMPOPO**

- University of Limpopo
  T: 015 268 2140 | F: 015 267 0142
  www.ul.ac.za
- University of Venda
  T: 015 962 8000 | F: 015 962 4742
  www.univen.ac.za

**NORTHERN CAPE**

- University of Pretoria
  T: 012 420 4111 | F: 012 420 4530
  www.up.ac.za
- University of South Africa
  T: 012 429 3111 | F: 012 429 2565
  www.unisa.ac.za
- Tshwane University of Technology
  T: 012 382 5911 | F: 012 382 5422
  www.tut.ac.za
- University of the Witwatersrand
  T: 011 717 1102 | F: 011 339 8215
  www.wits.ac.za
- Vaal University of Technology
  T: 016 950 9214 | F: 016 950 9800
  www.vut.ac.za
- University of Johannesburg
  T: 011 489 9900 | F: 011 489 2260
  www.uj.ac.za

**NORTHERN CAPE**

- Sol Plaatjie University
  T: 053 807 4300 | www.spu.ac.za

**MPUMALANGA**

- University of Mpumalanga
  T: 013 022 0001 | www.ump.ac.za