THE SOUTH AFRICAN ENERGY SECTOR REPORT 2019

energy

Department:
Energy
REPUBLIC OF SOUTH AFRICA

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Foreword

It is with the greatest appreciation and honour to introduce the 2019 South African Energy Sector Report. This report presents us with an opportunity to inform and update all the relevant stakeholders about the latest energy demand and supply trends in South Africa as prescribed in the National Energy Act no.8 of 2008. The report is based on the 2016 Energy Balance compiled by the Department of Energy (DoE) and mainly focusses on analysing energy supply and the subsequent consumption broken down into various sectors of the economy.

This report is published annually with data and analysis based on the latest published South African Energy Balances. We have made remarkable progress in improving the overall quality of our energy data in order to ensure that accurate, timely and reliable data is provided in all our publications and hope that this report will become a source of reference among energy analysts in South Africa and abroad. We will continuously collaborate with all our data providers to ensure that our energy data is of highest possible quality.

I extend my most sincere thanks and appreciation to the Energy Data Collection, Management and Analysis Directorate for the hard work that went into the compilation of this publication. I would also like to extend my appreciation to all the energy data providers and stakeholders for their concerted efforts and support during the process of compiling this report. Comments and inputs are welcome and could be addressed to Publications@energy.gov.za.

Mr. T. Zulu

Director General
Department of Energy

Introduction

Energy is at the heart of development (World Bank, 2019). Energy is also the vital force that powers businesses, manufacturing, the transportation of goods and the delivery of services to the nation. It is the lifeblood of modern living, as it has an impact on everything we do and affects our very existence. Energy is therefore an enabler for economic growth and stability.

The energy sector in South Africa has been, and continues to be, at the center of the economic and social development. The industry directly affects the economy by using labour and capital to produce energy. This role is particularly important when economic growth and job creation are such high priorities in the country. In addition to the energy sector's economic contributions in general, relatively lower and stable energy prices are very instrumental in stimulating the country`s economy.

As the country`s economy continues to grow, the Department of Energy is mandated to ensure that energy resources are available, and that there`s access to energy services in an affordable, reliable and sustainable manner, while minimizing the associated adverse environmental impacts.

The National Development Plan (NDP) envisages that by 2030 South Africa will have an energy sector that promotes economic growth and development through adequate investment in energy infrastructure. The plan also envisages that by 2030 South Africa will have an adequate supply of electricity and liquid fuels to ensure that economic activities and welfare are not disrupted, and that at least 95% of the population will have access to grid or off-grid electricity.

The South African energy sector is dominated by coal, which is plentiful and cheap, and is ranked among the lowest energy costs in the world. Apart from coal, which contributed around 69% to the total primary energy supply in 2016, South Africa gets energy locally from biomass, such as wood and dung, natural gas, hydro-power, nuclear power, solar power and wind.

In this report, the 2016 South African Energy Balance is analysed by breaking it down per sub-sectors, that is, the total primary energy supply which includes domestic production as well as imports and exports and total final consumption which includes the economic sectors, industry, transport, agriculture, commercial and public as well as residential sectors. There is also a further breakdown into the various industry subsectors in terms of energy consumption. The purpose of this report is therefore to show how and in what proportions the country's available energy is supplied and consumed by different sectors.

List of Abbreviations

bbl/d	Barrels per Day
CAIA	Chemical and Allied Industries' Association
CEF	Central Energy Fund
CTL	Coal-To-Liquid
DMR	Department of Mineral Resources
DOE	Department of Energy
GDP	Gross Domestic Product
GTL	Gas-To-Liquid
IEP	Integrated Energy Plan
INEP	Integrated National Electrification Programme
IRP	Integrated Resource Plan
JPoI	Johannesburg Plan of Implementation
LPG	Liquified Petroleum Gas
Mt	Megaton
MW	Megawatts
MYPD	Multi-Year Pricing Determination
NERSA	National Energy Regulator of South Africa
PetroSA	Petroleum Oil and Gas Corporation of South Africa
TJ	Tera Joules
R/t	Rand per Ton
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
ROM	Run-of-Mine
SAPIA	South African Petroleum Industry Association
StatsSA	Statistics South Africa
SWH	Solar Water Heaters
WSSD	World Summit on Sustainable Development

Key Energy Policies and Legislations

1. White Paper on the Energy Policy, December 1998

The White Paper on the Energy Policy was developed so as to clarify government policy regarding the supply and consumption of energy for the next decade. It was intended to address all elements of the energy sector as practically as it could. This White Paper gives an overview of the South African energy sector's contribution to GDP, employment, taxes and the balance of payments. It concludes that the sector can greatly contribute to a successful and sustainable national growth and development strategy.

The main objectives of the White Paper are the following:

- Increasing access to affordable energy services
- Improving energy governance
- Stimulating economic development
- Managing energy-related environmental impacts
- Securing supply through diversity

2. White Paper on Renewable Energy, November 2003

The White Paper on Renewable Energy supplements the Government's overarching policy on energy as set out in its White Paper on the Energy Policy (as stated above), which pledges 'Government support for the development, demonstration and implementation of renewable energy sources for both small and large-scale applications'.

This White Paper sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. Additionally, it has the following two goals:

- to inform the public and the international community of the Government's goals, and how the Government intends to achieve them, and;
- to inform Government agencies and Organs of State of these goals, and their roles in achieving them.

3. Nuclear Energy Policy, October 2008

The nuclear sector in South Africa is mainly governed by the Nuclear Energy Act 1999, Act 46 of 1999 and National Radioactive Waste Disposal Institute Act, Act 53 of 2008. National Nuclear Regulator (NNR) Act 1999, Act 47 of 1999. The Cabinet approved the Nuclear Energy Policy for South Africa in October 2008. The Nuclear Energy Policy outlines the South African government's vision for the development of an extensive nuclear energy programme by ensuring that Government's objective on the prospecting and mining of uranium ore and the use of uranium (or other relevant nuclear materials) as a primary resource of energy must be regulated and managed in a manner that will be for peaceful purposes.

Through the Nuclear Energy Policy, Government aims to achieve the following objectives:

- Promotion of nuclear energy as an important electricity supply option through the establishment of a national industrial capability for the design, manufacture and construction of nuclear energy systems;
- Establishment of the necessary governance structures for an extended nuclear energy programme;
- Creation of a framework for safe and secure utilisation of nuclear energy with minimal environmental impact;
- Contribution to the country's national programme of social and economic transformation, growth and development;
- To guide in the actions to develop, promote, support, enhance, sustain and monitor the nuclear energy sector in South Africa;
- Attainment of global leadership and self-sufficiency in the nuclear energy sector in the long-term;
- Exercise control over unprocessed uranium ore for export purposes for the benefit of the South African economy;
- Establishing of mechanisms to ensure the availability of land (nuclear sites) for future nuclear power generation;
- Allow for the participation of public entities in the uranium value chain;
- Promoting energy security for South Africa;
- Improvement of the quality of human life and to support the advancement of science and technology;
- Reduction of greenhouse gas emissions; and
- Skills development related to nuclear energy.

4. Integrated Resource Plan (IRP) 2010-30

The IRP is an electricity infrastructure development plan based on least cost supply and demand balance taking into account security of supply and the environment (minimize negative emissions and water usage).

When the IRP 2010-2030 was promulgated in March 2011, it was envisaged that it would be revised frequently due to the increasing demand of electricity in South Africa. The IRP, together with Ministerial Determinations issued in terms of Section 34 of the Electricity Regulation Act No. 4 of 2006, help investors to plan their investments in the country's energy sector and are used as a roadmap to meet the country`s electricity demand. In order to update and address gaps in the assumptions that were made in the IRP 2010-2030, the Department reviewed and updated the IRP and also extended the review period to 2050. The update process was mainly aimed at ensuring security of electricity supply, minimizing cost of electricity, minimizing negative environmental impact (emissions) and minimizing water usage. The updated 2018 IRP was published for public comments in November 2018 and interested stakeholders were given 60 days to submit their written comments to the Department. Following the consolidation of public inputs, the updated IRP has been presented to National Economic Development and Labour Council (Nedlac).

5. National Energy Act, 2008

The National Energy Act, 2008 (Act 34 of 2008) ensures that diverse energy resources are available in sustainable quantities and at affordable prices in South Africa. In addition, the Act provides for the increased use of renewable energies, contingency energy supplies, the holding of strategic energy feedstock and carriers, and adequate investment in energy infrastructure.

6. Petroleum Products Act, 1977

The aim of Petroleum Products Act, 120 of 1977, is to:

- Provide measures in the saving of petroleum products and an economy in the cost of the distribution thereof, the maintenance and control of a price, for the furnishing of certain information regarding petroleum products, and for the rendering of services of a particular standard, in connection with petroleum products;

- Provide for the licensing of persons involved in the manufacturing and sale of certain petroleum products;
- Promote transformation of the South African petroleum and liquid fuels industry;
- Provide for the promulgation of regulations relating to such licenses; and
- Provide for matters incidental.

7. Nuclear Energy Act, 1999

The aims of the Nuclear Energy Act, 1999 (Act 46 of 1999) are:

- To provides for the establishment of the National Energy Corporation of South Africa (Necsa) and defines its functions, powers, financial and operational accountability, governance and management;
- To provide for responsibilities for the implementation and application of the Safeguards Agreement and any additional protocols entered into by the Republic of South Africa and the International Atomic Energy Agency in support of the Nuclear Non-Proliferation Treaty acceded to by the Republic;
- To regulate the acquisition and possession of nuclear fuel, certain nuclear and related material and certain related equipment, as well as the importation and exportation of, and certain other acts and activities relating to, that fuel, material and equipment in order to comply with the international obligations of the Republic;
- To prescribe measures regarding the discarding of radioactive waste and the storage of irradiated nuclear fuel; and to provide for incidental matters.

8. The Gas Act, 2001

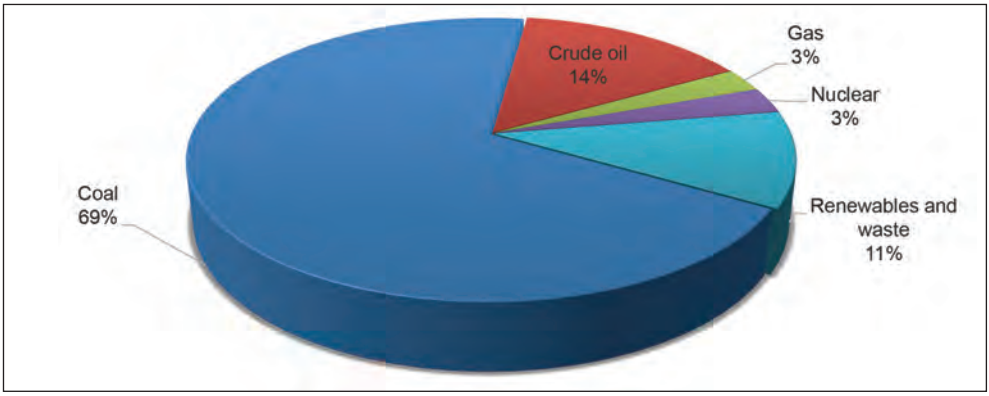
The aims of the Gas Act are as follows:

- To promote the orderly development of the piped gas industry;
- To establish a national regulatory framework;
- To establish a National Gas Regulator as the custodian and enforcer of the national regulatory framework; and
- To provide for matters connected therewith.

1. ENERGY SUPPLY

The South African energy supply is dominated by coal which constituted 69% of the primary energy supply in 2016, followed by crude oil with 14% and renewables with 11%. Nuclear contributed 3% while natural gas contributed 3% to the total primary supply during the same period. The primary energy supply in this case includes indigenous production and imported sources less exported quantities.

Figure 1-1: Total primary energy supply, 2016



Source: DoE Energy Balances, 2016

1.1 Crude oil and Petroleum Products

Overview

Owing to the lack of reserves, the country imports over 90% of its crude oil from Saudi Arabia, Nigeria and Angola. During the transformation stage, the country produced approximately 6.6% of its fuel requirements from gas (GTL), 46.8% from coal (CTL), and 46.6% from crude oil (DOE, Energy Balance 2016). Majority of petroleum products are refined in the country, however, some petroleum products were imported to supplement the production shortfall.

South Africa has, following Egypt, the second largest refining capacity in Africa amounting to 718 000 barrels per day. There are six refineries in the country; four of the refineries are on the coast and two are inland. Two of the refineries are synthetic fuels production facilities that produce liquid fuels from coal and gas, which are owned by Sasol and PetroSA respectively.

Sasol uses both the Coal-To-Liquids (CTL) and Gas-To-Liquids (GTL) technologies. The Petroleum Oil and Gas Corporation of South Africa (PetroSA) produce synthetic products using GTL technology. Major refineries include Sapref and Enref in Durban, Chevron in Cape Town, and Natref at Sasolburg. The capacity and location of the six refineries is shown in Table 1-1 below.

Table 1-1: Refinery production capacity

Refinery	Area and Province	Type	Capacity*
Chevref	Cape Town, Western Cape	Crude	100 000
Enref	Durban South, KwaZulu Natal	Crude	135 000
Natref (Sasol Oil owns 64% and Total SA 36%)	Sasolburg, Free State	Crude	108 000
PetroSA	Mossel Bay, Western Cape	Synthetic (GTL)	45 000
Sasol Synfuels	Secunda, Mpumalanga	Synthetic (CTL)	150 000
Sapref (BP owns 50% and Shell 50%)	Durban South, KwaZulu Natal	Crude	180 000
Total			**718 000**

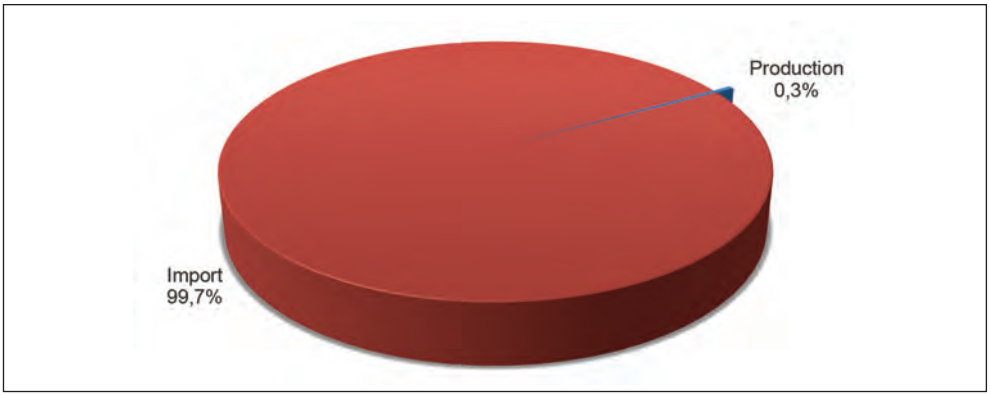
Source: SAPIA Annual Report 2017

**Crude equivalent (bbl/day)*

Crude Oil

In 2016, South Africa imported almost 100% of its crude oil requirements. The total primary crude oil supply was used by refineries during transformation process for liquid fuels production. This reflects the country's vulnerability and dependence on imports for its petroleum requirements. Almost all the imported crude oil is used for the production of liquid fuels, with a small percentage used towards lubricants, bitumen, solvents and other petrochemicals.

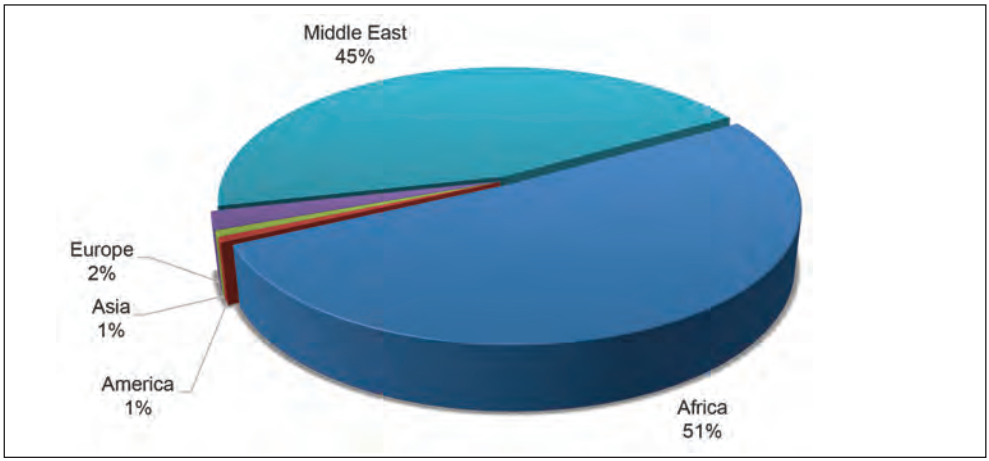
Figure 1-2: Crude oil primary supply, 2016



Source: DoE Energy Balances, 2016

As depicted in the table 1-2 and figure 1-3, the majority of crude oil volumes (51%) was imported from Africa, particularly Nigeria with total import volumes of 6.1 million tons in 2016. This was followed by Angola with import volumes of 4 million tons.

Figure 1-3: Crude oil imports by region, 2016



Source: South African Revenue Service (SARS), 2016

Crude oil imports by South Africa from the Middle East countries accounted for 45% of total crude oil imports in 2016. The greater portion of imports was sourced from Saudi Arabia with import volumes amounting to 7.9 million tons.

Table 1-2: Crude Oil imports volumes by country of origin, 2016

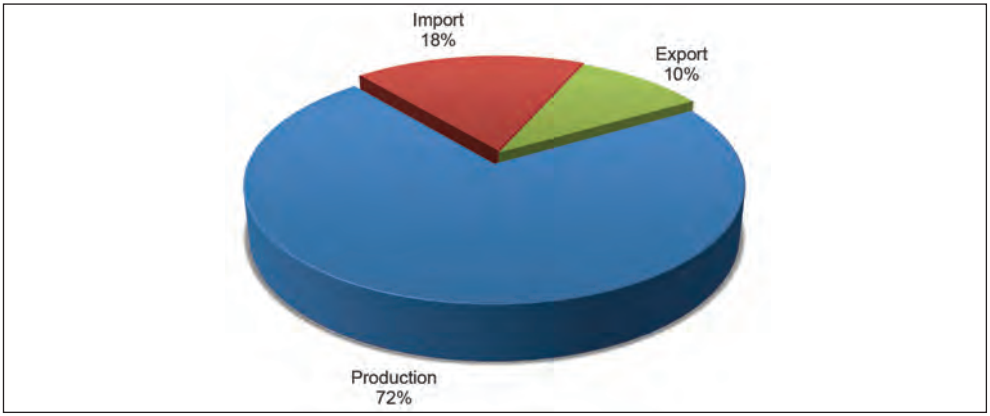
Country of Origin	Import Volumes	
	Ton	%
United Arab Emirates	672 729	3,2
Angola	4 000 306	19,2
Nigeria	6 130 723	29,4
Norway	269 784	1,3
Qatar	682 215	3,3
Saudi Arabia	7 939 250	38,1
Togo	289 904	1,4
Others	833 331	4,0
Grand Total	**20 818 242**	**100**

Source: South African Revenue Service (SARS), 2016

Petroleum products

According to the 2016 Energy Balances, 72% of the total petroleum products supply was produced locally. Imports amounted to 18% to make up for the local production shortfall while exports amounted to 10%.

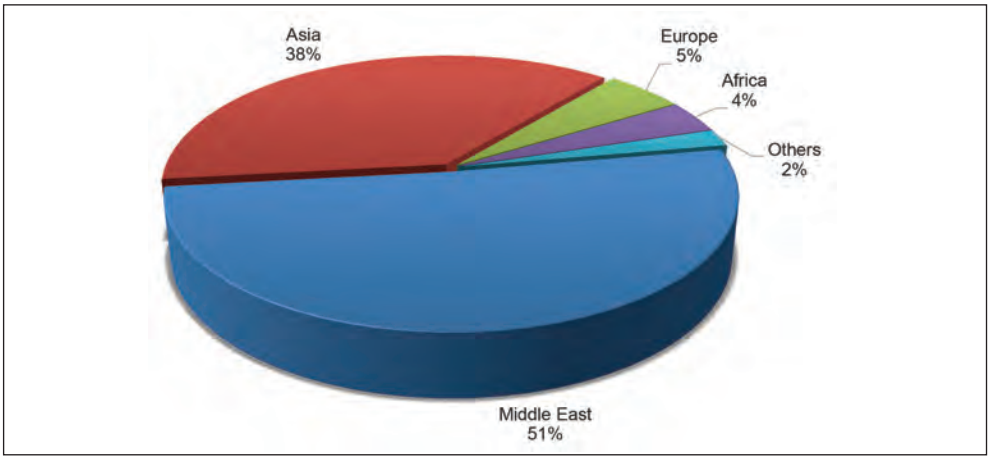
Figure 1-4: Petroleum products supply, 2016



Source: DoE Energy Balances, 2016

The majority of the petroleum products imported into South Africa was from the Middle East as depicted in figure 1-5 below. This was followed by the Asian region which was dominated by India, followed by Singapore. Europe accounted for 5% of the imported products, followed by Africa (4%) and others (2%), respectively.

Figure 1-5: Petroleum products imports by region, 2016

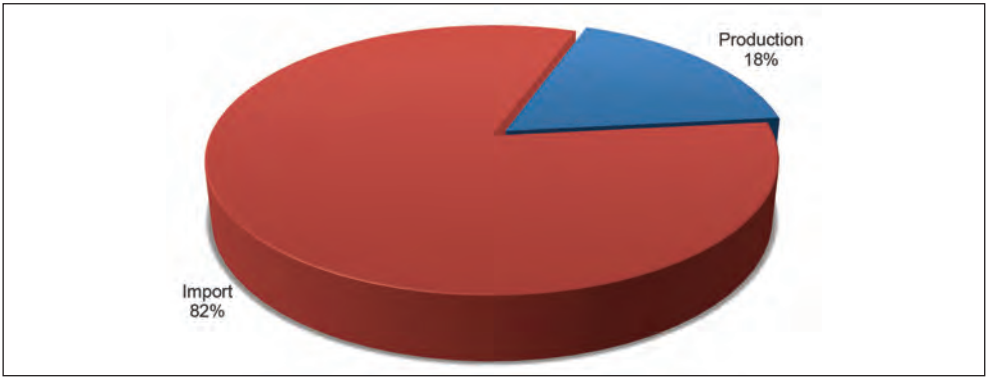


Source: South African Revenue Service (SARS), 2016

1.2 Natural gas

Currently natural gas is imported into South Africa by Sasol Gas via an 865 km pipeline from the Temane and Pande gas fields in Mozambique. Reserves in the Temane and Pande are estimated around 2.6 trillion cubic feet (TCF). The pipeline has a capacity of 240 million gigajoules (GJ) per annum. Approximately 120 million GJ is used annually by Sasol in the GTL and chemicals plant in Secunda, while the balance is distributed to commercial and industrial customers via a pipeline network covering more than 2 000km in the Free State, Gauteng, Mpumalanga and KwaZulu-Natal. In 2016, natural gas made up 3% of the total primary energy supply in South Africa. Natural gas domestic production amounted to 18% in 2016 whilst imports amounted to 82% during the same period.

Figure 1-6: Natural gas primary supply, 2016



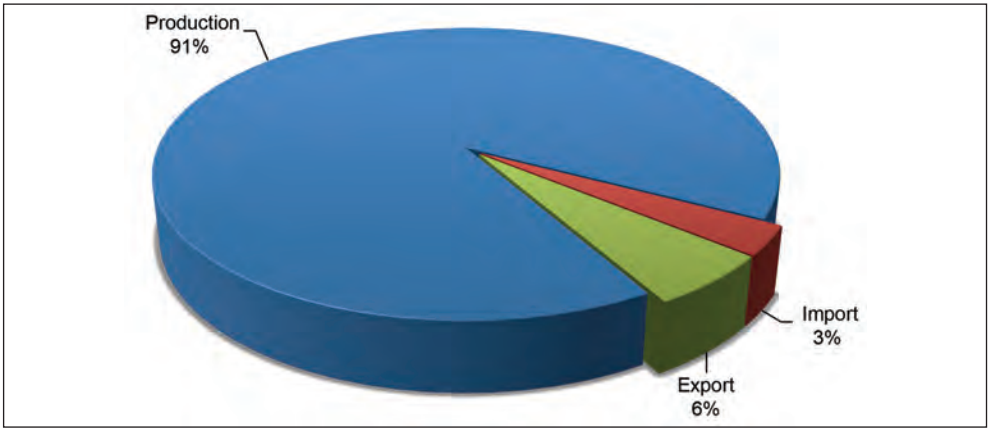
Source: DoE Energy Balances, 2016

1.3 Electricity

South Africa supplies approximately 40% of Africa's electricity (Eskom, 2019). The electricity sector in South Africa is dominated by the national utility Eskom, a primary electricity supplier and generates approximately 90% of the electricity used in the country. The balance is supplied by municipalities and redistributors as well as private generators.

The utility sells power directly to some 2 703 industrial, 51 848 commercial, 81 638 agricultural and 6 million residential customers. It owns and operates a number of coal-fired, gas-fired, hydro and pumped storage power stations, as well as one nuclear power station. Total production amounted to 91% in 2016, while the country's net exports amounted to 3%.

Figure 1-7: Electricity supply, 2016

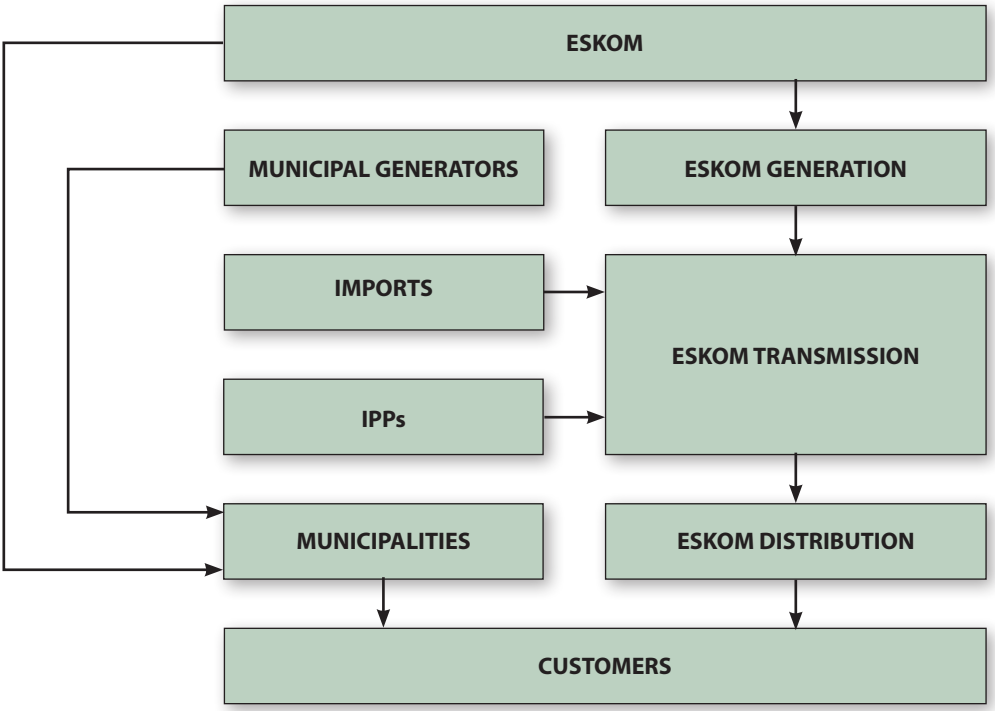


Source: DoE Energy Balances, 2016

Generation, Transmission and Distribution

Electricity infrastructure comprises of three sub-sectors, namely: - generation, transmission and distribution. In terms of generation, Eskom dominates the production of electricity. Eskom generates, transmits and distributes electricity to industrial, mining, commercial, agricultural and residential customers in South Africa, and to municipalities, who in turn redistributes electricity to businesses and households within their areas. The utility also purchases electricity from Independent Power Producers (IPPs) in terms of various agreement schemes as well as electricity generating facilities beyond the country's borders. Most power stations are located in Mpumalanga, except for Lethabo and Matimba which are located in the Free State and Limpopo provinces respectively.

Figure 1-8: Electricity Generation, Transmission and Distribution

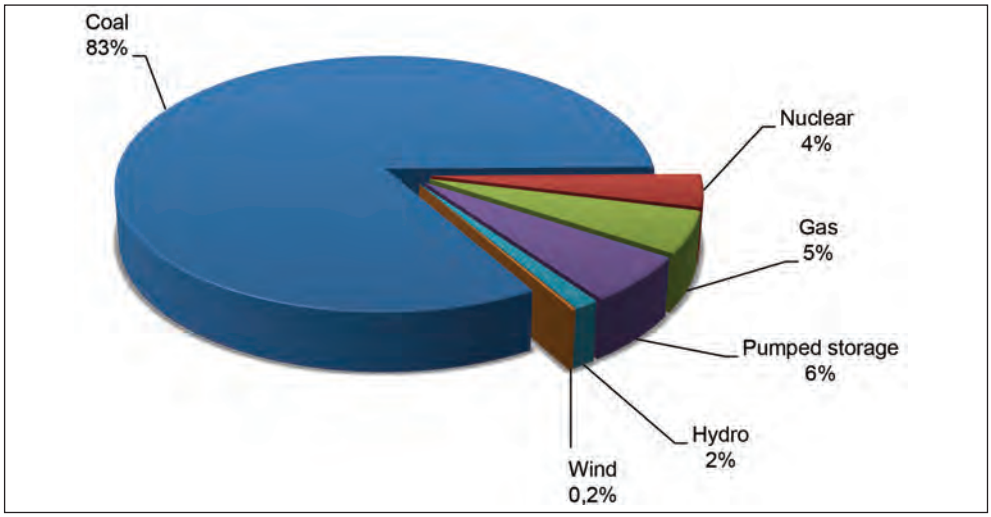


Source: Eskom

Eskom Generating Capacity

According to the Eskom's Integrated Results 2018, the net maximum generating capacity as at March 2018 amounted to 48GW.

Figure 1-9: Power Station Maximum Generating Capacity Mix



Source: Eskom Integrated Results, 2018

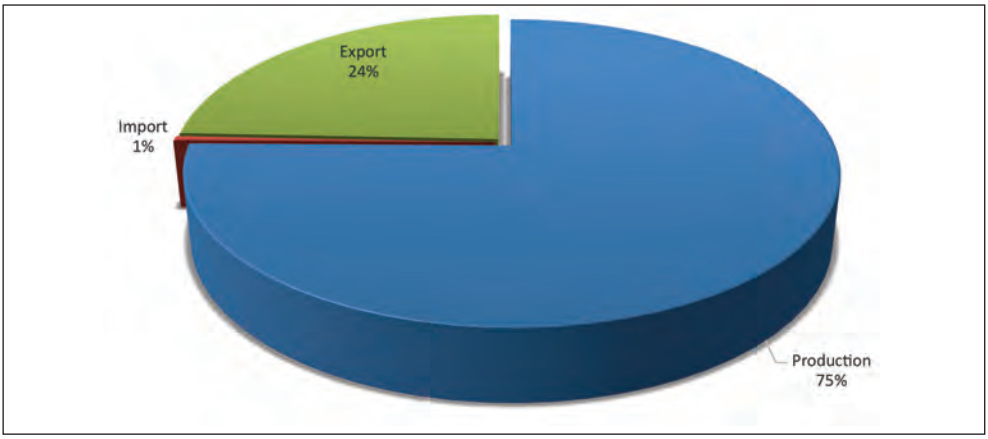
Coal fired power stations are still dominant in terms of power generating capacity until such a time other means of power generation like nuclear and renewables are ascertained. A significant contribution of the coal fired power stations makes up 83% to the maximum generating capacity mix in 2018 as depicted above. The combined contribution of maximum generation capacity by other power stations constituted 17% in total with gas turbines accounting for 5%, nuclear power stations 4% and pumped storage scheme 6%. Generation at the Sere wind farm at 100MW capacity was quiet insignificant compared to the others.

1.4 Coal

South Africa has the 5th largest recoverable coal reserves in the world, estimated at 66.7 billion tons (DMR, 2016). Consequently, South Africa's indigenous energy-resource base is dominated by coal. By international standards, South Africa's coal deposits are relatively shallow with thick seams, which make them easier and cheaper to mine. At the present production rate, it is estimated that there is more than 50 years of coal supply left.

South Africa's dependency on coal-based energy is unlikely to change significantly in the next two decades, owing to the relative lack of suitable alternatives to coal. In addition to the extensive use of coal in the domestic economy, 24% of South Africa's coal was exported in 2016 and only 1% imported, as shown in Figure 1-10 below.

Figure 1-10: Coal primary supply, 2016



Source: DoE Energy Balances, 2016

1.5 Renewables

South Africa is regarded as a prime candidate for increased use of renewable energy with its abundant natural resources of sun and wind. The country is highly dependent on coal burning for power generation, but does have a number of small-scale hydroelectric plants and only one nuclear power station. At the same time South Africa has an abundance of sunshine which lends itself very well for solar water heating and electricity generation.

Given the ever rising cost of traditional fossil fuels based energy, renewable energy is becoming a viable option. South Africa is presently rated as the 12th most attractive investment for renewable energy (IPPPP An Overview, 2019). The Renewable Energy Independent Power Producers Procurement Programme (REIPPPP) has to date, attracted investment (equity and debt) to the value of R209.7 billion, of which R41.8 billion (20%) is foreign investment (IPPPP An Overview, 2019). This augurs well for South Africa, as the programme has received international acclaim for fairness, transparency and the certainty of this programme.

Due to the success of the renewable programmes, there has been a rapid increase in SMEs focusing on renewable energy in the country. An influx of large scale energy project developers from many parts of the world, followed by a range of local and overseas investors are keen to shape a new investment frontier; not to mention the construction of the country's first large scale commercially driven renewable energy projects.

The South African government has identified the green economy as one of 12 job drivers that could help contribute to creating 5 million additional jobs by 2020. In fact, the New Growth Path, in which the sectoral jobs targets are disaggregated, envisages that as many as 300 000 new direct jobs could be created in the areas of natural resource management and renewable energy construction.

Renewable Energy Independent Power Producer Procurement Programme (REIPPPP)

In 2003, Cabinet approved private-sector participation in the electricity industry and decided that future power generation capacity will be divided between Eskom (70%) and Independent Power Producers, or IPPs (30%).

The NDP required the development of 10 000MW additional electricity capacity to be established by 2019 against the 2010 baseline of 44 000MW. The Integrated Resource Plan (IRP) 2010 developed

the preferred energy mix with which to meet the electricity needs over a 20 year planning horizon to 2030.

In line with the national commitment to transition to a low carbon economy, 17 800MW of the 2030 IRP target are expected to be from renewable energy sources, with 5 000MW to be operational by 2019 and a further 2 000MW (i.e. combined 7 000MW) operational by 2020.

The REIPPPP is aimed at bringing additional power into the electricity system through private sector investment in wind, solar, photovoltaic, concentrated solar power (CSP), biomass and small hydro technologies. The REIPPP programme constitutes one of the energy mixes as outlined in the National Development Plan and the Integrated Resource Plan 2010.

In May 2011, the DoE gazetted the Electricity Regulations on New Generation Capacity (New Generation Regulations) under the Electricity Regulation Act (ERA) which enable the Minister of Energy (in consultation with NERSA) to determine what new capacity is required. Ministerial determinations give effect to components of the planning framework of the IRP, as they become relevant. The current new capacity determinations include 14 725MW of renewable energy, comprising of solar PV (6 225MW), wind (6 360MW), CSP (1 200MW), small hydro (195MW), landfill gas (25MW), biomass (210MW), biogas (110MW) and the small scale renewable energy programme (400MW);

The determinations have been implemented in rolling bid windows with seven (1, 2, 3, 3.5, 4, 1S2 and 2S2) bid windows successfully completed in the first five years. All projects in Bid Window 1 (BW1) and Bid Window 2 (BW2), and 10 projects in Bid Window 3 (BW3) are now operational. By the end of June 2017, the REIPPPP had made the following significant impacts:

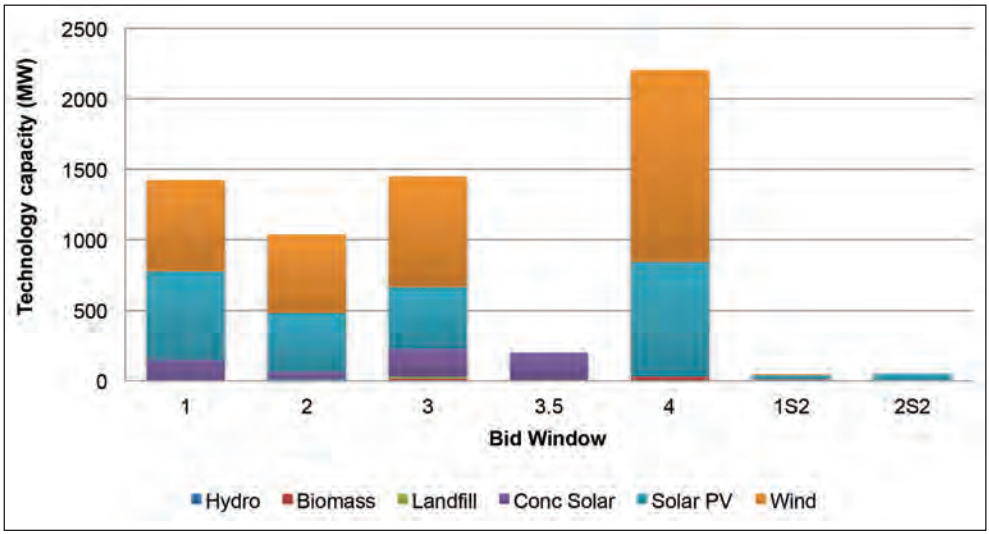
Energy supply capacity impact:

- 6 422MW of electricity had been procured from 112 RE Independent Power Producers (IPPs) in seven bid rounds, that is, Bid windows 1, 2, 3, 3.5, 4 and smalls BW1 (1S2) & smalls BW2 (2S2)
- 3 976 MW of electricity generation capacity from 64 IPP projects has been connected to the national grid;
- 35 669 GWh of energy has been generated by renewable energy sources procured under the REIPPPP since the first project became operational. Renewable energy IPPs have proved to be very reliable. Of the 64 projects that have reached COD, 62 projects have been operational for longer than a year. The energy generated over the past 12 month period for these 62

projects is 10 648 GWh, which is 96% of their annual energy contribution projections (P50) of 11 146 GWh over a 12 month delivery period. Twenty eight (28) of the 62 projects (45%) have individually exceeded their P50 projections.

In terms of national targets for renewable energy capacity, as defined by the IRP and National Development Plan, this represents 22% towards the 2030 target and 57% towards the 2020 target.

Figure 1-11: Allocated capacity in windows 1, 2, 3 and 4, 2017



Source: Department of Energy (DoE), 2017

1.6 Nuclear

South Africa is among the top countries in the world with uranium reserves, and accounted for a significant reserve base of an estimated 279 100 t of uranium, or around 5.2% of global proven reserves in 2012 (Chamber of Mines, 2012).

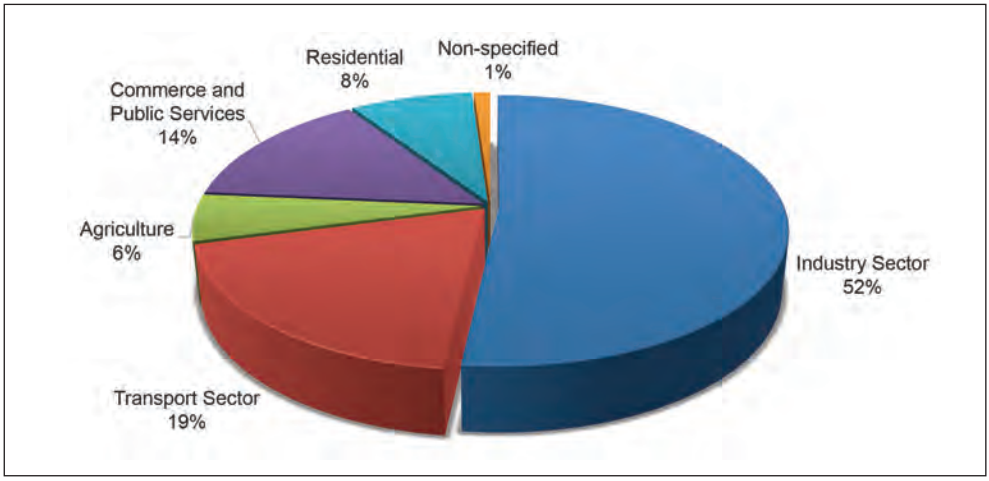
Uranium is used in a nuclear power station to produce energy, which contributes about 3% to total energy supply. All the uranium used at the Koeberg Power Station is produced locally. Koeberg nuclear power station is the only nuclear power station in South Africa and contains two 900MW uranium pressurized water reactors. The station located 30 km north of Cape Town. The plant is owned and operated by the country's national electricity supplier, Eskom.

2. ENERGY DEMAND

Energy is the lifeblood of the South African economy and is an important sector of the economy that creates jobs and value by extracting, transforming and distributing energy goods and services throughout the economy. South Africa's steady economic growth, coupled with an increasing focus on industrialisation and a mass electrification programme to take power into deep rural areas, has seen a steep increase in the demand for energy in recent years.

The share percentage of energy consumed by various sectors in the economy is depicted in figure 2-1 below. The five sectors identified in this report are industrial, transport, agriculture, residential, commerce and public services. The sector "non-specified (other)" refers to unaccounted energy (energy that has not been classified into a specific sector).

Figure 2-1: Energy demand by sector, 2016

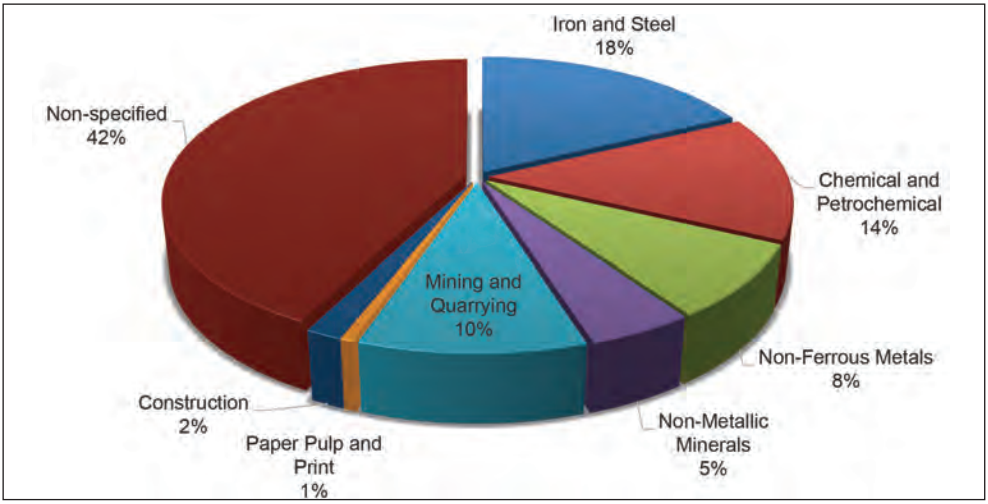


Source: DoE Energy Balances, 2016

2.1 Industrial sector

Iron and steel (18%) as well as Chemical and petrochemical (14%) are the largest consumers of energy in the industrial sector as depicted in Figure 2.2 below. Mining and quarrying accounted for 10% of the industrial consumption while non-ferrous metals and non-metallic both accounted for 8% and 5%, respectively. The remaining sub-sectors had minor energy consumption of 2% or less. The industrial sector consumed 52% of the final energy supplied in 2016.

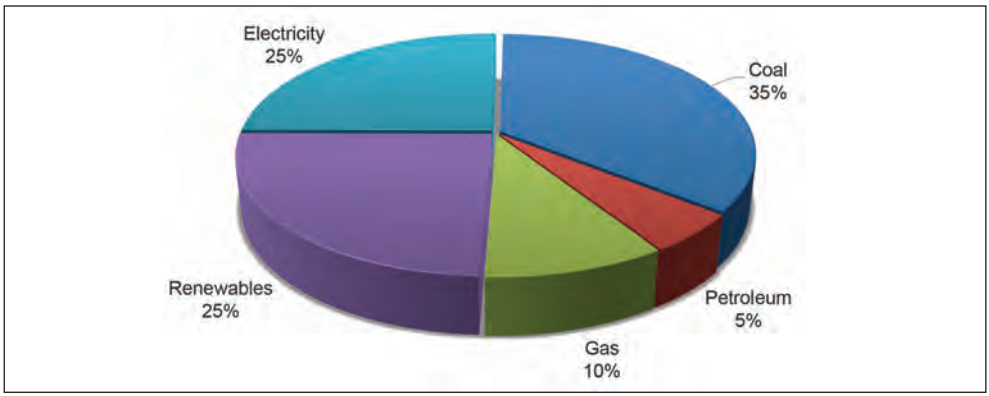
Figure 2-2: Energy demand by industrial sub-sectors, 2016



Source: DoE Energy Balances, 2016

As depicted in figure 2-3, coal was the most consumed source of energy in the industrial sector at 35%. This was followed by electricity and renewables both at 25%. Gas and petroleum products accounted for 10% and 5%, respectively, to the total energy consumption in the sector.

Figure 2-3: Energy demand in the industrial sector, 2016

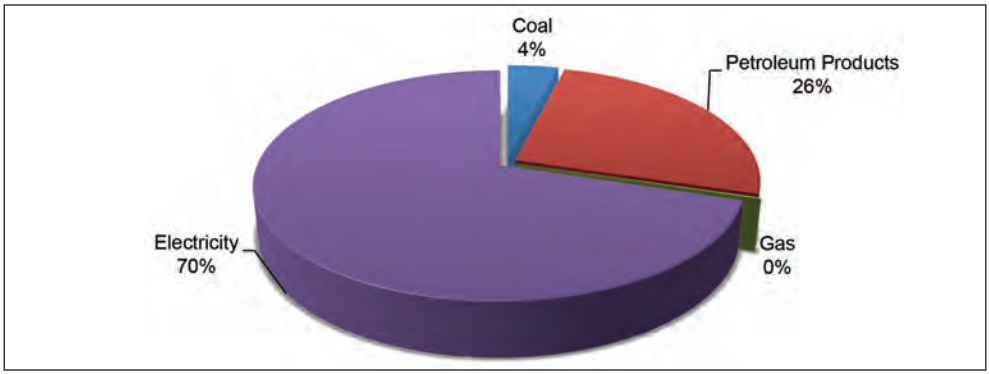


Source: DoE Energy Balances, 2016

2.1.1 Mining

The mining sector is one of the main consumers of energy in the country, particularly electricity. Of all the energy supplied in 2016, the industry used 70% of electricity, 26% of the petroleum products, 4% of coal and an insignificant amount of gas as depicted in figure 2-4 below. The total energy used by the sector is approximately 156 951TJ with electricity consumption of 110 072TJ.

Figure 2-4: Energy demand in mining, 2016

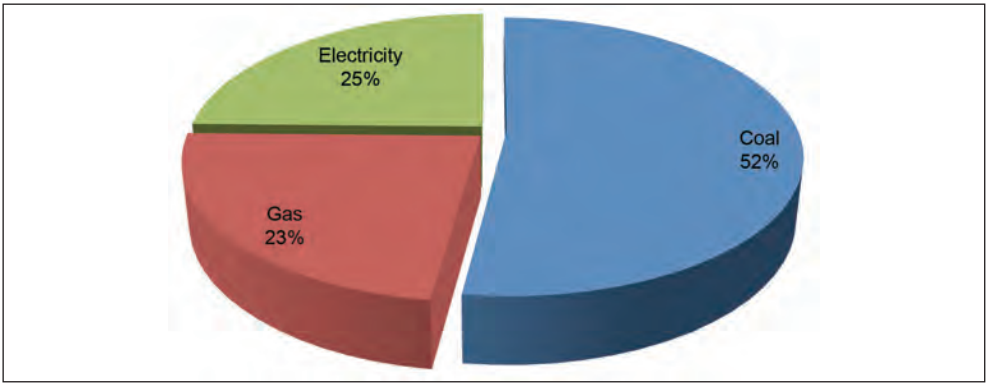


Source: DoE Energy Balances, 2016

2.1.2 Iron and steel

South Africa is a major producer and supplier of primary ferrous minerals and their alloys. The main energy carriers for iron and steel industry are electricity, coal and gas. In 2016, electricity contributed 25% towards the final energy demand of the sector whereas coal contributed 52% as depicted in figure 2-5. The remainder of its energy requirements was derived from gas contributing 23%. The total amount of energy used by the sector was 273 408TJ.

Figure 2-5: Energy demand in Iron and Steel industry, 2016

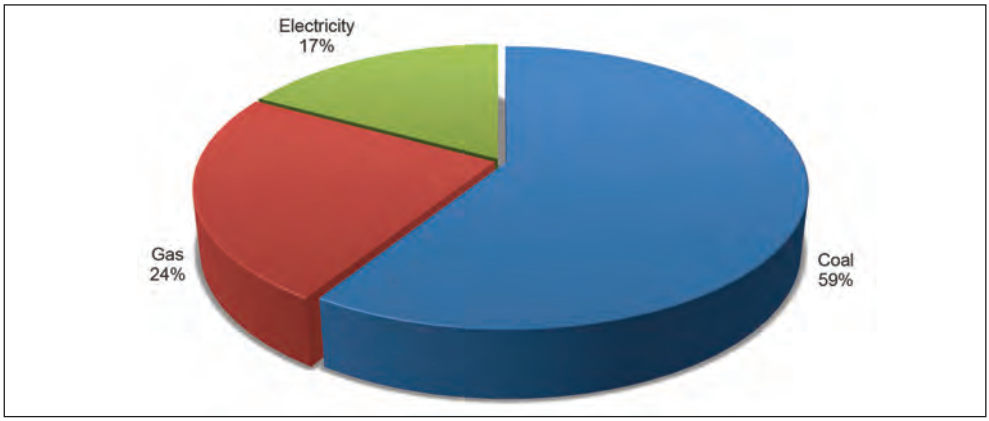


Source: DoE Energy Balances, 2016

2.1.3 Chemicals

South Africa chemical industry is coal and gas intensive thereby becoming the second most consumer of coal and gas, at 128 154TJ and 52 079TJ respectively, following the iron and steel industry. Electricity consumption by the sector accounted for 9.5% of the total energy supplied to the sector. Figure 2-6 depicts the energy demand in the chemical and petrochemical industry.

Figure 2-6: Energy demand in Chemical and Petrochemical industry, 2016

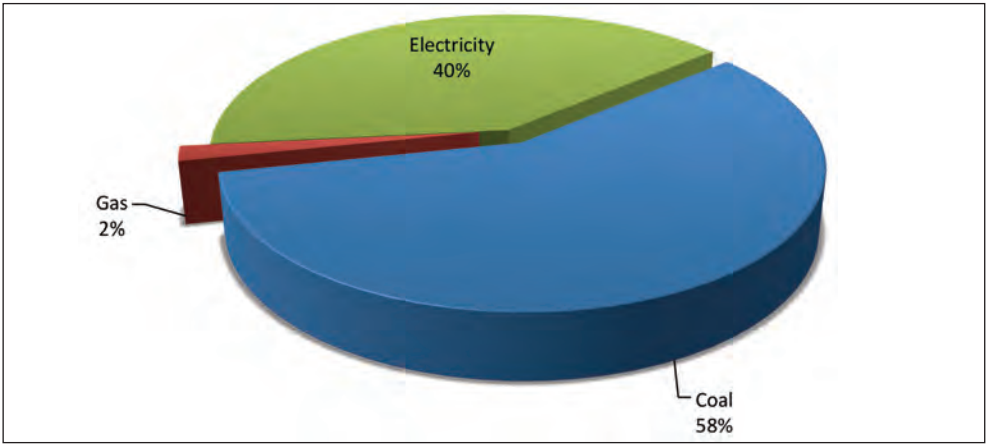


Source: DoE Energy Balances, 2016

2.1.4 Non-Ferrous Metals

The non-ferrous metal sector consumed roughly 126 883TJ of energy supplied in 2016. The non-ferrous metals electricity consumption amounted to 51 342TJ, which makes up 40% as depicted below. Coal and gas contributed 58% and 2% respectively.

Figure 2-7: Energy demand in non-ferrous metals, 2016

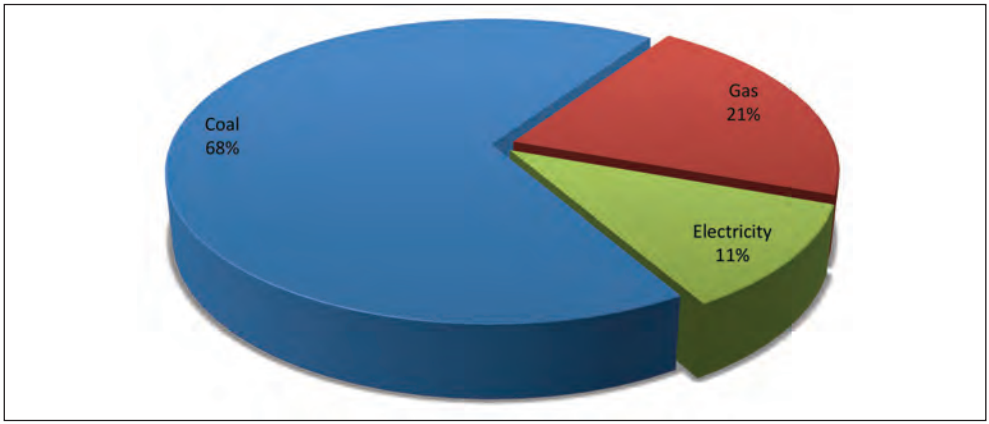


Source: DoE Energy Balances, 2016

2.1.5 Non-Metallic Minerals

Coal was the dominant energy carrier for the non-metallic minerals sector at 68%, followed by gas contributing 21% while electricity contributed 11%. The total energy consumed by the sector is 72 995TJ.

Figure 2-8: Energy demand in non-metallic minerals, 2016

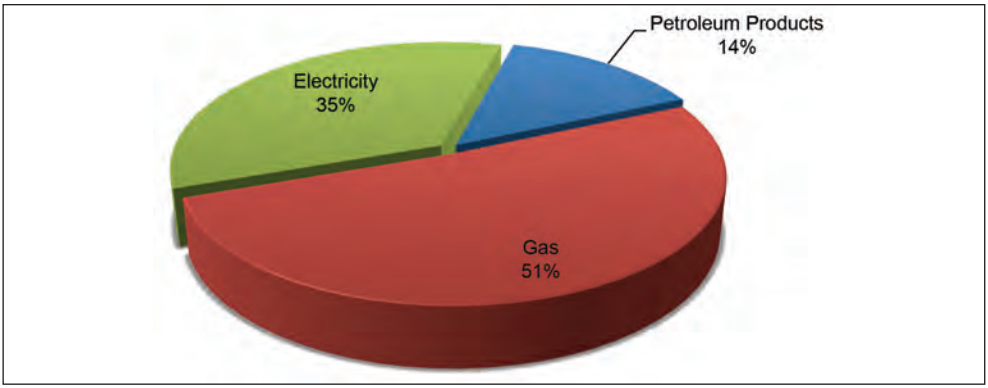


Source: DoE Energy Balances, 2016

2.1.6 Food and Tobacco

The total energy consumption by the food and tobacco sector in 2016 was 7 842TJ with electricity and gas contributing 35% and 51%, respectively. Petroleum products contributed 11% to the total energy consumed in the sector as depicted in the figure below.

Figure 2-9: Energy demand in food and tobacco, 2016

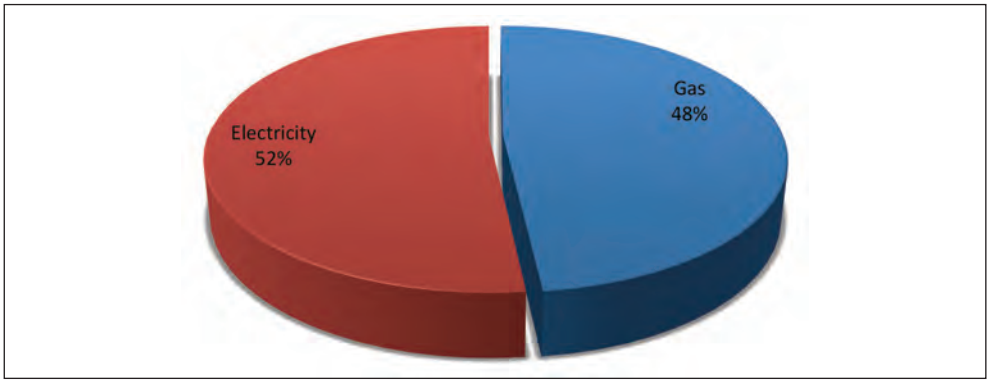


Source: DoE Energy Balances, 2016

2.1.7 Pulp and Paper

The pulp and paper industry used 52% of electricity as its energy source and 48% of gas, consuming 9 343TJ in total. Energy demand in this sector excludes own generation from biomass, which is currently not reported.

Figure 2-10: Energy demand in pulp and paper industry, 2016

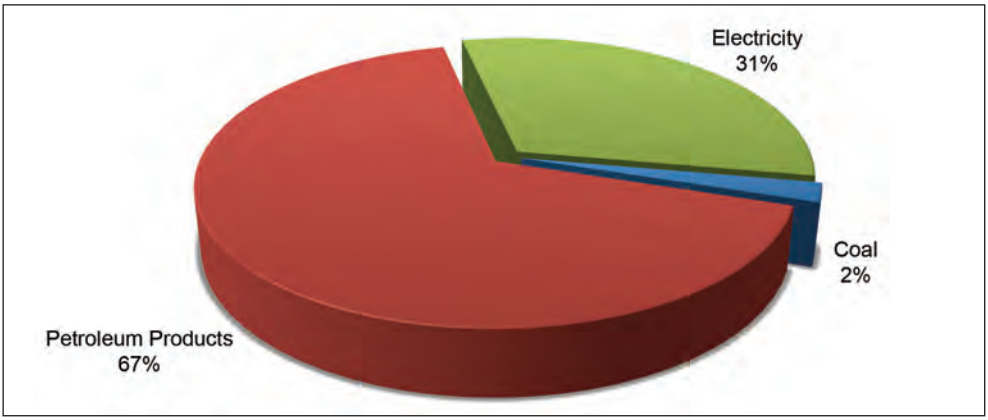


Source: DoE Energy Balances, 2016

2.2 Commerce and Public Services Sector

The commercial sector comprises of financial services, information technology, retail, tourism and services industry. Public services sector comprises of government and quasi government institutions which provides goods and services to the public, mainly for free. The total energy used by this sector is approximately 428 061TJ. The sector consumed petroleum products at 67% of the total energy consumed in the sector while electricity accounted for 31% and coal's contribution accounted 2% as depicted below.

Figure 2-11: Energy demand in the commerce and public services sector, 2016

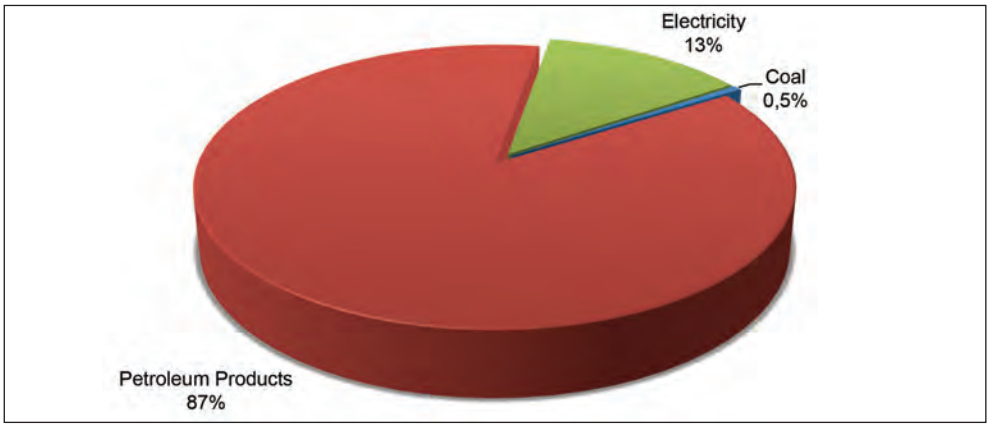


Source: DoE Energy Balances, 2016

2.3 Agricultural Sector

As shown in figure 2-11, the agricultural sector demanded liquid fuels the most at 87% in 2016 amounting to 144 909TJ consumed. This is as a result of transportation of agricultural raw materials, feeds, intermediary and finished products from farms to various market areas. Electricity accounted for 13% of energy demanded by the sector in 2016 amounting to 21 484TJ in consumption.

Figure 2-12: Energy demand in the agriculture sector, 2016

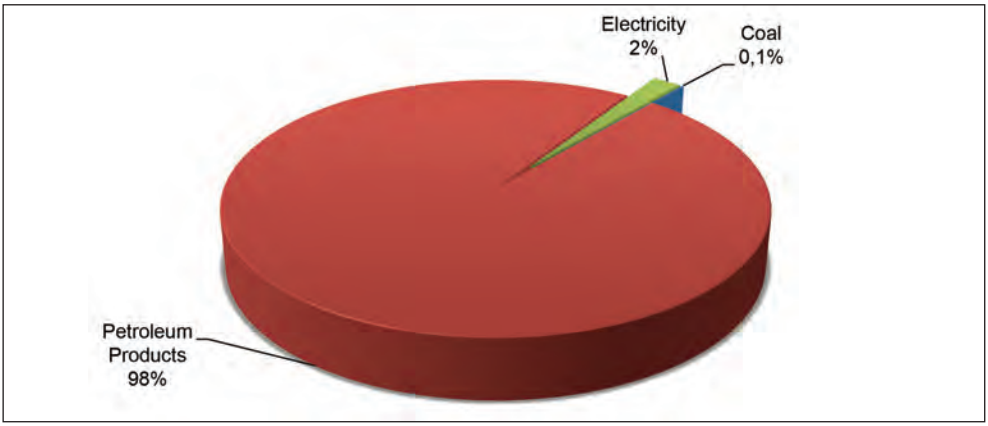


Source: DoE Energy Balances, 2016

2.4 Transport Sector

As the largest user of liquid fuels, the transport sector consumed 556 623TJ in 2016. The majority of this was used on the road at 79% followed by international civil aviation at 13%. The transport sector accounted for just over 50% of the total petroleum products consumed in the country.

Figure 2-13: Energy demand in the transport sector, 2016

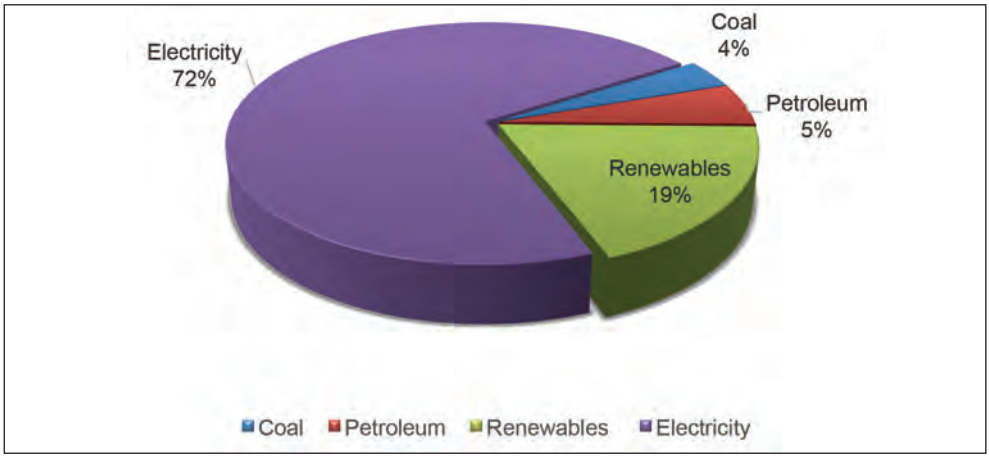


Source: DoE Energy Balances, 2016

2.5 Residential Sector

The residential sector accounted for 8% of the total energy consumption in 2016. The sector's consumption of electricity amounted to 72% of the total energy consumed in the sector. Petroleum products and coal accounted for 5% and 4%, respectively. In total the sector consumed 244 130TJ of energy.

Figure 2-14: Energy demand in the residential sector, 2016



Source: DoE Energy Balances, 2016

NB: Due to misaligned mappings of the raw data on consumption to the ISIC codes, the Department of Energy estimated the residential consumption of coal as one third of sales to merchants and domestic markets. This estimate kept on increasing over the years, which is contrary to the increasing number of residential electricity connections.

It was subsequently found necessary to estimate the actual consumption in this sector using methodologies that take into account the actual residential coal end-use data (from the General Household Survey) carried out by Statistics South Africa (StatsSA). The methodology was based on the average (in Rands) spent each month by sampled household. This average was used to calculate tons of coal consumed by dividing the total expenditure by the average coal price. Inferring these to the total population resulted in the massive drop in coal consumption in residential sector.

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Notes

Notes

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