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COUNTRY REPORT OF THE REPUBLIC OF SOUTH AFRICA (RSA)

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REPORT OUTLINE

1. General information
   1.1 Country profile
   1.2 Economic indicators (GDP, population, No. of households, etc.)
2. Energy reserves
3. Current energy policy and measures
4. Past energy demand and supply (at least past 10 years)
   4.1 Energy demand by sector
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1. GENERAL INFORMATION

1.1 Country Profile

- The Republic of South Africa (RSA) is a country located in the southern extremity of the African continent.
- The country has borders with Zimbabwe, Lesotho, Mozambique, Botswana, Swaziland and Namibia. South Africa occupies approximately 1.22 million square kilometres (Km^2) of the African continent's total land area.

1.2 Economic Indicators

1.2.1 Gross Domestic Products (GDP)

- South Africa is regarded as the most developed country in the continent and has a comparative advantage in the production of agriculture, mining and manufacturing products.
- According to Statistics of South Africa (STATS SA) fundamental figures of the Gross Domestic Product (GDP), a fall in mining and manufacturing production in the final quarter of 2016 caused South African economic growth into negative state.

- Since the country became a full democracy, GDP Annual Growth Rate in South Africa averaged 2.89 % from 1994 until 2016.
- The long-term potential growth rate of South Africa under the current policy environment has been estimated at 3.5 %.

1.2.2 Employment vs. GDP

- The high levels of unemployment, at over 25 % is considered by the government as the most economic problems facing the country.
- According to STATS SA March 2017 Quarterly Employment Survey (QES), 32 000 jobs were lost across a number of sectors.
- Furthermore, STATS SA report indicates that employment decreased by 67 000 on a quarter-to-quarter basis.

1.2.3 Population

- The population of South Africa, according to STATS SA was about 55 million (people) in 2016 of diverse origins, cultures, languages and religions.
- The ethnic group encompasses black Africa (80.6 %), white (8.0 %), coloured (8.6 %) and Indian (2.6 %).

1.2.4 Number of House Holds

- There are about 14.5 million households in South Africa; more than 78.1 % of South African households live in formal dwellings, 6.9 % in traditional dwellings and 14.1 % live informal dwellings.

1.2.5 Education

- According to the results of the General Household Survey released by STATS SA in June 2016, 33.2 % of individuals aged five years and older attended an educational institution in 2015.
- Approximately 88 % of South Africans above the age of five years who attended educational institutions were in either primary or high school, whilst 4.4 % attended tertiary institutions.

2. ENERGY RESERVES

2.1 Coal Reserves

- South Africa's indigenous energy resources base is dominated by coal. According to the study released by Brand South Africa which is the official custodian of South Africa's Nation Brand, about 77 % of South Africa's primary energy needs are provided by coal and largely used to generate electricity/power.
- A significant amount is directed to the production of synthetic fuels and petrochemical operation, the remaining percentage of coal produced is exported regionally and globally.

2.2 Natural Gas Reserves

- Currently, South Africa does not have significant proven gas reserves. However, South Africa has significant potential for unconventional gas discovery in the form of Coal Bed Methane (CBM) and Shale Gas.
- With availability of natural gas in neighbouring countries, such as Mozambique and Namibia, and the discovery of offshore gas reserves, the gas industry in South Africa could undergo rapid expansion.
- The National Development Plan (NDP)-2030 states that South Africa needs to diversify its energy mix, liquefied natural gas (LNG) imports and the associated infrastructure could provide economic and environmentally positive options for power production, gas-to-liquids productions and other industrial energy uses.

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2.3 Petroleum Reserves

- South Africa has no crude oil reserves of its own and around 60 % of its crude oil requirements are met by imports from the Middle East and Africa.
- The other percentage (petroleum requirements) of the demand is fulfilled by synthetic fuels produced locally from coal and natural gas.
- Products refined locally from imported crude oil meet the remaining 64 % and the major petroleum products sold in South Africa comprise petrol and diesel.

2.4 Renewable Energy Sources

- The government is also looking to support sustainable green energy initiatives on a national scale through a diverse range of clean-energy options as indicated in the Integrated Resource Plan (the "IRP) 2010-2030.
- Renewable energy sources prioritized in the policy are biomass, wind, solar and small scale hydro power.

2.5 Nuclear Power

- South Africa is the only country in Africa with a commercial nuclear power plant.
- Currently, around 6.5 % of South Africa's electricity is provided through Eskom's Koeberg Nuclear Power Stations' two reactors located in the Western Cape Province, outside Cape Town.

3. CURRENT ENERGY POLICY AND MEASURES

3.1 The Constitution of the Republic of South Africa

- The Constitution states that government must establish a national energy policy to ensure that national energy resources are adequately delivered to cater for the requirements of the country.

3.2 The White Paper on Energy Policy for South Africa

- In order to meet the government's obligations, the White Paper on Energy Policy (1998) states that government will work towards the establishment and acceptance of broad targets for the reduction of energy related emissions that are harmful to the environment and human health.
- The White Paper on Energy (1998) identifies **5 overarching national energy policy objectives**:

i. Increased access to affordable energy services;

ii. Improved governance of the energy sector to achieve greater integration in energy policy development and energy services delivery;

iii. Stimulating economic development by encouraging fair competition within energy markets by means of targeted interventions through appropriate mechanisms;

iv. Management of energy related environmental impacts by promoting access to basic energy services for poor households to eliminate negative health impacts; and

v. Pursuing energy supply security through greater diversification, both in supply sources and primary energy carriers.

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3.3 National Energy Act (No.34 of 2008)

- The National Energy Act ensures that diverse energy resources are available in sustainable quantities and at affordable prices in South Africa.
- 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.

3.4 National Energy Regulator Act (No.40 of 2004)

- The National Energy Regulator is a regulatory authority established as a juristic person in terms of Section 3 of the National Energy Act, 2004.
- The National Energy Regulator's mandate is to regulate the electricity, piped-gas and petroleum pipelines industries in terms of the Electricity Regulation Act, 2006 (Act No.4 of 2006), Gas Act, 2001 (Act No.48 of 2001) and Petroleum Pipelines Act, 2003 (Act No.60 of 2003).

3.5 National Gas Act (No.48 of 2001)

- The gas industry in South Africa is regulated by the Gas Act 48 of 2001, which is currently being revised.
- The current Gas Act is primarily dedicated to the regulation of piped-gas and excludes other modes of transportation and gas sources such as landfill gas and unconventional natural gas (shale gas, coal bed methane, tight gas) and new technologies for transportation and storage of gas such as liquefied natural gas (LNG).
- The Gas Act is being amended so as to incorporate new gas technologies such LNG-to-Power.

3.6 Electricity Regulation Act (Act No.4 of 2006)

- To establish a national regulatory framework for the electricity supply industry;
- To make the National Energy Regulator the custodian and enforcer of the national electricity regulatory framework;
- To provide for licences and registration as the manner in which generation, transmission, distribution, reticulation, trading and the import and export of electricity are regulated; and
- To regulate the reticulation of electricity by municipalities.

3.7 Petroleum Pipelines Act (No.60 of 2003)

- To establish a national regulatory framework for petroleum pipelines; and
- To establish a Petroleum Pipelines Regulatory Authority as the custodian and enforcer of the national regulatory framework.

3.8 Petroleum Products Amendment Act (No.5 of 2005)

- Aims to promote an efficient manufacturing, wholesaling and retailing petroleum industry;
- To facilitate an environment conducive to efficient and commercially justifiable investment;
- To promote the advancement of historically disadvantaged individuals; and
- Creating employment opportunities and small businesses in the petroleum sector.

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3.9 Nuclear Energy Act (No.46 of 1999)

- The Act 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.
- It also regulates the acquisition and possession of nuclear fuel, nuclear and related material and equipment, and the import and export thereof.

3.10 Integrated Resource Plan (the "IRP")

- The IRP is the country plan which sets out the electricity supply and demand balance and requirements from 2020 to 2050.
- The IRP 2010-2030 incorporated a number of government objectives, including affordable electricity, carbon mitigation and reduced water consumption.

3.11 Integrated Energy Plan (IEP)

- The objective of the National IEP is to provide a roadmap of the future energy landscape for South Africa.
- The IEP directs future energy infrastructure investments and policy development and also analyses current energy consumption trends within different sectors of the economy.

4. PAST ENERGY DEMAND AND SUPPLY

According to the study undertaken by the University of Cape Town: Energy Research Centre, the South Africa's energy policy falls within three different periods: the first being the period of the apartheid regime (from 1948 up to 1994); the second the period following the first democratic elections of 1994 (up to 2000); and the third from 2000 onwards.

4.1 Energy Demand by Sector

4.1.1 Residential Sector

- According to the report on the "Potential Energy Efficiency Measures" issued by the Department of Energy of South Africa, as of 2012, the residential sector utilised approximately 192 PJ in the form of electricity and petroleum products, in addition to significant amounts of coal as well as biomass in the form of wood and crop residues.
- This represents an increase of approximately 32 % over the previous 10 years, indicating that the average energy consumption per household has declined slightly.

4.1.2 Commercial Sector

- The commercial sector in South Africa includes a very broad range of activities, including wholesale and retail trade, the motor trade, hospitality industry, and a range of business services.
- The commercial sector accounts around 4-5 % of total final energy consumption, primarily in the form of electricity.

4.1.3 Manufacturing Sector

- In 2012, the manufacturing sub-sector consumed 750 PJ annually, accounting for 28 % of the country's total final energy consumption.
- The largest energy consumer in manufacturing is the iron & steel industry, which accounts for almost one-quarter of the total energy consumption.
- Other significant consumers of energy are non-ferrous metals, non-metallic minerals and chemicals, which account for approximately 33 % of manufacturing industry energy consumption.

4.1.4 Mining Sector

- The mining and quarrying sub-sector consumed approximately 170 PJ in 2012, accounting for over 18 % of the total industrial sector consumption. Approximately two-thirds of this energy consumption was in the form of electricity.

4.1.5 Agricultural Sector

- The Agricultural sector, including forestry and fishing consumes approximately 60 PJ of energy annually, of which about two-thirds is in the form of petroleum products.
- The sector accounts for about 2 % of South Africa's total final energy consumption.

4.1.6 Transport Sector

- The transport sector in South Africa accounts for 27 % of total final energy consumption, 90% of which is assigned to road transport.
- Between 2004 and 2012, the energy intensity of the transport sector has been relatively consistent as compared to other sectors.

4.2 Demand and Supply by Energy

4.2.1 Fuel

- According to the South African Petroleum Industry Association (Sapia), the South Africa's oil industry is categorised into upstream (exploration and production) and downstream sector (refining, transportation and marketing).
- As stated previously, South Africa has no crude oil reserves and approximately 60 % of crude oil requirements are met by imports from Middle East countries and Africa.
- The demand for diesel has increased over time from around 7 billion litres in 2002 to around 13.4 billion litres in 2015.

4.2.2 Liquefied Petroleum Gas (LPG)

- LPG has been identified as an alternative energy carrier for the provision of quick and effective solutions to energy requirements.
- The demand for LPG in South Africa seems to be growing as more end-users diversify their energy mix in response to, amongst others; the power shortfalls and increasing electricity price.

4.2.3 Natural Gas

- Sasol has been selling coal gas since 1960s and has been importing natural gas from Mozambique officially from 26 March 2004.
- The use of natural gas in South Africa has been largely limited to applications in the industrial and residential markets.
- Only two types of gas are currently supplied to the South African market, namely: natural gas and synthetic gas (methane rich gas). Natural gas accounts for 3 % of energy consumption in the country.
- The IRP 2010-2030 expects the imported gas to meet 6 % of all new generation capacity and Open Cycle Gas Turbines (OCGTs) to meet 8 %.

4.2.4 Coal

- South Africa's indigenous energy resource base is dominated by coal as mentioned previously. Coal provides for about 77 % of South Africa's primary energy needs.
- About 28 % of South Africa's production is exported and over 90 % of electricity and 34 % of liquid fuels are generated using coal.

4.2.5 Electricity

- The electricity sector in South Africa is dominated by the national utility Eskom, which owns and operates most of the national electricity generation infrastructure and supplies 95 % of the country's electricity requirements and the remaining is supplied by municipalities, redistributors and Independent Power Producers (IPPs).
- The electricity sector is the leading consumer of coal in the country, accounting for 65.1 % of total coal consumption, followed by the synthetic fuel sector, which accounts for 21.4 % of total consumption for the production of liquid fuels.
- South Africa is dependent on coal for over 70 % of its primary energy needs, with in excess of 90 % of electricity being generated from coal and 34 % of liquid fuels produced from coal.

4.2.6 Nuclear

- Only one nuclear power station (Koeberg), a base-load station with installed capacity of 1,930 MW.
- Construction for the plant began in 1976 and full operation in 1985. Produced 12,806 GWh electricity in year ended 31 March 2010.
- Furthermore, it is expected that nuclear will comprise 17 % of South Africa's base load energy mix by 2030.

4.3 Energy Prices

- According to the "2016 South African Energy Price Report" issued by the Department of Energy in March 2017, the energy system costs are divided into cost components representing different parts of the energy value chain from primary energy supply (imports and extraction) to the production of the end product.
- The major energy system costs arise from imports of petroleum products. Imports of electricity from neighbouring countries contribute towards import costs but are comparatively small (less than 2 %).

4.3.1 Petroleum products prices

- Fuel prices in South Africa are adjusted on a monthly basis; such adjustments are informed by international and local factors.
- The main international factor is the crude oil price; whilst local factor is the exchange rate of the Rand against the US dollar. Fuel prices in South Africa are linked to the price of crude oil in international markets.
- Another local factor causing fuel price increases is fuel levy and the Road Accident Fund levy that are determined annually by the Minister of Finance which are effected in April annually.
- The Basic Fuel Price (BFP) for petrol 95 Octane Unleaded, Petrol 93 Unleaded, Petrol 95 LRP, Diesel 0.05 % Sulphur, Diesel 0.005 % Sulphur and Illuminating Paraffin is based on an import parity principle.
- This principle includes the cost of importing petrol from international refinery, transportation from the refinery and insurance.

Petrol Prices	➢ The petrol price over the last 10 years (2007-2017), South Africans were paying average of R6.55 per litre in 2007 and by 2013 petrol price increased to an average of R13.55 per litre. ➢ Over the past decade, petrol prices have seen some significant increases. Month-on-month price comparisons between 2014 and 2015 illustrate that petrol prices were lower in 2015 compared to 2014. ➢ The price of petrol ULP 95 inland was R12.89 per litre (2015) compared to R14.39 in April 2014. ➢ The price of petrol decreased by R4.02 since July 2014 until February 2015 and taking the current increase into account, a litre of petrol was R1.50 cheaper than it was in April 2015. ➢ Petrol prices in January 2015 commenced with a 10.9 % decline from R12.47 in December 2014 to R11.24 in inland. ➢ The petroleum products prices are all priced on an import parity basis, petrol is the most expensive of the fuels, over the period 2006 to 2013 it was 6 % above the price of diesel.
Diesel Prices	➢ Diesel prices have traditionally been lower than petrol prices. ➢ The lowest diesel prices occurred during the first quarter of the year 2016 with prices dropping to R9.26 per litre in February from R10.28 per litre in January in the inland.

	➢ In April 2016 diesel prices bounced back to a R10.00 streak in the inland, the main reason for the increase being the average increase in the price of crude oil by about 20 % and the depreciation of the Rand against the US Dollar. ➢ As a result of negative sentiment on emerging markets globally, the Rand lost around 40 cents against the US Dollar since the end of May 2016. ➢ This led to the increase in fuel prices with diesel prices experiencing a trivial increase of 4 cents per litre in July 2016.
Paraffin Prices	➢ The Department of Energy started to regulate the maximum retail price for illuminating paraffin, excluding the price of any form of packaging since January 2010. ➢ The total consumption of paraffin in South Africa was over half a million (556. 007, 302) litres in 2015. ➢ Paraffin prices remained cheaper than other petroleum products in comparison in 2015. ➢ International oil prices and the Rand/Dollar exchange rate are the contributing factors to the movements in the prices of paraffin. In 2014 paraffin prices were above the R8.00 threshold right through the year. ➢ Nonetheless, 2015 became a favourable year of paraffin customers where prices were the lowest. This was evidenced by R1.44 cents per litre decline in January to R7.46 per litre in the inland region.

	➢ Further decline of R1.50 c/litre took place in February due to a continual drop in crude oil prices. ➢ The apex prices for the paraffin occurred at the beginning of the third quarter in July 2016 due to the weakening of the Rand against the US dollar. ➢ The prices per litre at the coastal and inland were R7.33 and R7.86 respectively.
LPG Prices	➢ At the beginning of 2015 Liquefied Petroleum Gas (LPG) prices recovered by R2.1 per kilogram and a further decline in February by 1.5 cents to R18.61 per kilogram. ➢ The decreased in January was caused by the continued drop in the price of crude oil. ➢ Prices began to reflect a persistent and increasing trend from February to July 2015 to a peak of R22.73 per kilogram in the inland. ➢ Recuperating from peak prices in July, LPG prices dropped by 89 cents per kilogram in August to R21.84 cents per kilogram. ➢ This came as a result of plummeting oil prices and the weakening of the Rand. The weakening Rand reduced the over recovery on the Basic Fuel Price slightly.

4.3.2 Natural Gas Prices

- The National Energy Regulator of South Africa (NERSA) regulates piped-gas maximum prices in terms of the Gas Act 48 of 2001.
- Section 4(g) of the Gas Act requires the National Energy Regulator to regulate prices in terms of section 21(1)(p) in the prescribed manner.
- The National Energy Regulator only approves a price ceiling, implying that the actual prices charged to customers should not exceed the maximum price.
- NERSA also regulates tariffs in terms of section 4(h) of the Gas Act, which only provides for the regulation of transmission and storage tariffs in accordance with section 22.
- Gas prices are negotiated with customers individually and since April 2014, gas prices are subject to monthly adjustment in accordance with the applicable adjustment formula.
- The maximum Gas Energy Prices are determined in accordance with the methodology to approve maximum prices of piped-gas in South Africa promulgated by NERSA in October 2011.
- The maximum energy prices are referenced to price indicators of certain energy sources.
- The gas energy price is determined based on the wholesale prices of energy indicators and excludes transportation cost.
- The National Energy Regulator does not regulate the distribution tariff but regulates the other elements in the total price value chain.
- Tariffs are added to the gas energy price and trading margin to arrive at the total charge of the gas.
- Tariffs are a charge for services such as transportation, distribution and storage, whereas a price is the value/cost of the gas molecule.

4.3.3 Coal Prices

- The annual average price of coal anthracite depicts an increase to a four digit figure of R1028 per ton for local sales.
- The average export prices in 2015 for bituminous were almost double of local sales and plunged compared to the previous year.

4.3.4 Electricity Prices

- NERSA is the regulatory authority over the energy sector in South Africa and its mandate includes the regulation of the electricity supply industry.
- Its regulation amongst others includes regulation of electricity prices and tariffs.
- The electricity pricing scheme employed by NERSA is based on the multi-year pricing determination (MYPD).
- The electricity price is the Eskom average tariff approved by NERSA, per kWh converted into Rand per gigajoule.
- The average tariff approved by NERSA is an average of all Eskom's customer groupings.
- Bulk and industrial customers pay less than the average Eskom Tariff.
- Eskom's average price for electricity is based on the overall cost of supply but, in order to determine tariffs, the overall costs are broken down into relevant cost categories.
- The South African electricity industry has seen a dramatic increase in prices over the past few years. These increases have been blanketed across all sectors and are based on a number of factors such sector, usage and in the case of pricing according to the residential sector.

- The cost of electricity in South Africa, particularly to the industrial sector, has been among the lowest in the world.
- The overall price of electricity for Eskom is regulated and is based on approved costs plus a return on investments as determined by NERSA.
- As the energy regulator, NERSA exercises regulation over electricity pricing and tariffs by setting of tariff guidelines and structure, tariff methodologies, evaluates tariff applications from licensees and pricing frameworks.
- While Eskom's average price is based on cost, individual price levels per customer or per customer class might not be cost representative.
- This is due to cost averaging, historical cross-subsidies and social factors such as the customer's ability to pay the determined price.
- NERSA approved revenue requirement including the return for each Eskom division (Generation, Transmission and Distribution) is used as the total cost of the business to be recovered through the tariffs.
- Since the 2008 electricity crisis onwards, there is a clear and sharp inflection point for electricity tariffs in South Africa.
- The year 2009 had experienced a peak at 31.3 % compared to inflation of 6.16 %, this was the period of recession where the country experienced electricity shortfalls with increasing demand.

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5. OUTLOOK OF ENERGY DEMAND AND SUPPLY

The Department of Energy Integrated Resource Plan and the Integrated Energy Plan were used for the information outlined below:

- According to the Integrated Resource Plan (the "IRP) 2010-2030, the South African government has committed itself to an energy mix consisting coal, gas, nuclear and renewable sources.
- The IRP is the country plan which sets out the electricity supply and demand balance and requirements from 2020 to 2050.
- The **IRP 2010-2030** incorporated a number of government objectives, including affordable electricity, carbon mitigation and reduced water consumption.
- The objective of the **National Integrated Energy Plan (IEP)** is to provide a roadmap of the future energy landscape for South Africa.
- The IEP directs future energy infrastructure investments and policy development and also analyses current energy consumption trends within different sectors of the economy.
- The draft updated IRP envisages a base case with a total installed capacity in 2050 of 136 000 MW compared to the current total installed capacity of 51 000 MW.
- The draft updated IRP's base case envisaged a new build programme of power generating capacity over the period of 2021 to 2050, the base case for South Africa's generation portfolio will be as follows: Solar PV (17 600 MW); Wind (37 400 MW); Nuclear (20 375 MW); Coal (15 000 MW); Open Cycle Gas Turbine (13 332 MW); Combined Cycle Gas Turbine (15 000 MW); Landfill gas (250 MW); Hydro-electric Power (2 500 MW); and Demand response (500 MW).

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- According to the **National Development Plan (NDP)** of South Africa, natural gas and other renewable resources like wind, solar and hydro-electricity will be viable alternatives to coal and will supply at least 20 000 MW of the additional 29 000 MW of electricity needed by 2030.
- The NDP targets 6 925 MW of renewable energy to be operational by 2020 and through the Renewable Energy Independent Power Producers Procurement Programme (REIPPPP), the DoE is targeting the procurement of 13 225 MW from Independent Power Producers (IPPs) by 2025.
- According to the DoE report on energy demand (Draft 2012 Integrated Energy Planning Report), the transport sector will continue to make the highest demand on energy. Petrol and diesel vehicles will continue to be used in the foreseeable future, with electric vehicles only starting to make a significant contribution to passenger transportation after 2030. Electric vehicles do enter the market, however as this is not policy-driven they are assumed to have a maximum 20 % penetration rate by 2050.
- The report further indicates that outside of the transport sector, the most significant energy demand increase is expected to be in the industrial sector (manufacturing), followed by the commercial sector. The increase in energy demand within the commercial sector is associated with continued expansion of the tertiary sector as South Africa moves towards becoming a knowledge-based economy.
- Demand in the residential sector is largely driven by population growth, couples with increased urbanisation. According to DoE, South Africa needs over 40 000 MW new generation capacity by 2025.

5.1 Petroleum Products

- According to the draft IEP of the Department of Energy published in the Government Gazette No. 1430 in November 2016, demand for petroleum products increases the most significantly between 2015 and 2050 as this is primarily used within the transport sector.
- Furthermore, the draft IEP indicates that the demand for LPG is expected to increase steadily in the residential sector, whilst fairly minor, ranks as the third largest increase between 2010 and 2050.
- Diesel consumption continues to increase in the mining sector but only marginally when compared to electricity and natural gas.
- The use of illuminating paraffin is expected to decrease in future and to be negligible by 2025.
- The updated IRP stipulates that by the end of 2050 there will be 18 GW of PV, 37 GW of wind, 20 GW of nuclear, 34 GW of gas, 2.5 GW of import hydro, 15 GW of coal is required by the end of the study period.

5.2 Renewable Power Plants

- According to the Department of Energy, South Africa renewable industry is still small, but the growth potential is huge. The renewable energy will contribute a total of 18.2 GW by 2030, which is approximately 42 % of the new build (wind: 8.4 GW, solar PV: 8.4 GW, Concentrating Solar Plant (CSP): 1 GW and other 0.4: GW).
- Based on the report issued on the 31st December 2016, regarding "Independent Power Producers Procurement Programme (IPPPP)", the target of the IRP is to generate 17 800 MW capacity from the renewable energy sources, with 5 000 MW to be generated by 2019 and the remaining 2 000 MW by 2020.
- Furthermore, the report indicates that by end of December 2016, about 2.9 GW of the procured capacity was delivered. The delivered capacity represents 16 % of the 2030 target according to the NDP and the IRP.
- According to the updated IRP, the landfill gas planned capacity for 2017 and 2018 is 13 MW, whilst 28 MW is planned for 2019. The IRP further stipulates that there will be no generation capacity from biomass until 2018. However, in 2018 it is expected that biomass will generate a power output of 17 MW and increases to 142 MW in 2019.
- The updated Integrated Resource Plan of South Africa advocates the power generation capacity of about 37 GW from wind and about 18 GW of generation capacity from solar photovoltaic between 2020 and 2050.

5.3 Natural Gas Demand and Supply: OCGT and CCGT

- According to the Department of Energy data (draft IEP), South Africa has very limited natural gas resources and gas accounts for 3 % of energy consumption. With the availability of natural gas in neighbouring countries such as Mozambique and Namibia, and the discovery of offshore gas reserves in South Africa, the gas industry is undergoing rapid expansion.
- The draft IEP further indicates that at a national level, natural gas consumption currently exceeds production, with the majority of demand being met through imports from Mozambique. Demand for natural gas shows the next most significant increase after that of petroleum products.
- The country is currently expecting outcomes of the assessment of shale gas potential in the Karoo Basin, which is estimated at 391 Tcf.
- The IRP as per Ministerial Determinations does not indicate any planned generation capacity from natural gas (between 2016 and 2021). However, coal and nuclear technologies contribute the most to the energy share and can be referred to as base load options, with load factors above 85 % in general whilst gas Combined Cycle Gas Turbine (CCGT) is considered mid merit or Open Cycle Gas Turbine (OCGT) peaking with load factors above 30 %.

5.4 Coal Demand and Supply

- According to the IEP, South Africa ranks amongst the top 10 countries in terms of coal reserves and is currently the sixth largest coal producer in the world, with total production being equivalent to approximately 4 % of world production.
- The Department of Energy of South Africa is currently considering the employment of Clean Coal Technologies such as Carbon Capture and Storage (CCS) in order to reduce and eliminate CO_2 emissions. CCS roadmap indicates that by 2020 the country will construct a demonstration plant and in 2025 a commercial scale plant will be commissioned.
- Coal technologies will continue to play a role in the Base Case, however this will be reduced significantly by 2030 as the existing fleet of coal technologies starts to be retired. However, new coal technologies will continue to contribute to electricity supply of approximately 50 GW by 2050 (additional).

5.5 Nuclear Energy Demand and Supply

- Nuclear power accounts for about 5 % of South Africa's primary energy supply. Currently, the country has one nuclear power station (Koeberg), which is a base-load station with installed capacity of 1 8000 MW according to the IEP.
- Due to significant uranium resources in South Africa, nuclear power generation therefore has a potential to play a very important role in reducing carbon footprint. Nuclear power will comprise 17 % of South Africa's base load energy mix by 2030 (with added 9, 600 MW) and a construction of over 20 GW of nuclear power, however this would only come on line between 2037 and 2050.

6. ENERGY-RELATED INVESTMENT FOR DOMESTIC AND OVERSEAS

- The **National Development Plan (NDP)-2030** envisages that by 2030 South Africa will have energy sector that promotes economic growth and development through adequate investment in energy infrastructure.
- Other recommendations in the NDP include the deployment of clean coal technologies to increase the efficiency of coal conversion, and any new coal power investments should incorporate the latest technology.
- The country's goals by 2030 include the 21 500 MW of new renewable energy capacity. However, the NDP-2030 outlines that diversifying South Africa's power mix will also require enhanced investments in transmission infrastructure and control systems.

6.1 Investment Opportunities in the Development of the Gas-to-Power Industry

- South Africa is now considering the development of the gas industry, which initial period of the industry development would be anchored by the Gas-to-Power Programme.
- According to the Department of Energy IPP office, the intention of the Gas-to-Power Programme is that of not only supplying power but also that of supplying a limited amount of gas, marketed in the form of a Gas Supply Agreement (GSA), for use of industrial and other users.
- The Gas-to-Power will therefore help enable the development of South Africa's gas sector. The gas required for power generation will be from both imported and domestic gas resources whenever become available.

- It is believed that the development of the gas industry will attract industry players and investors to invest in the gas infrastructure/industry in South Africa.
- The country therefore through its policy framework encourages project developers/investors to provide potential solutions to deliver the intended project (gas-fired power generation).
- In this manner, the DoE commenced with a formal Request for Information (RFI) which is intended to solicit available data from participants in the Gas-to-Power industry.
- The Department anticipates engaging with project developers who submit responses to the RFI to discuss their projects with a view to seeking clarity in relation to information contained in such responses to the RFI.
- South Africa will build infrastructure for Gas-to-Power in Richards Bay and Coega. Richards Bay will generate 2 000 MW of electricity from liquefied natural gas (LNG) imports and 1 000 MW at Coega.
- The government therefore, will seek bidders to manage the projects, underpinned by a 20-year Power Purchase Agreements (PPA) with state utility Eskom.

6.2 Investment Opportunities in the development of the Domestic Shale Gas

- The development of the Karoo shale gas will present significant investment opportunities for the country ; however this will require significant investment for the development of upstream, mid-stream and downstream infrastructure. Therefore, the development of the domestic shale gas in the Karoo Basin will require the establishment of a strategic relationship between government and the private sector.

6.3 Investment Opportunities in the Renewable Energy Sector

- Since the establishment of the REIPPPP in 2011, it has procured over 6 300 MW in five bidding rounds through various generation technologies such as solar PV, onshore wind, biomass, small hydro, CSP and landfill gas according to the report on “Renewable Energy Sector: Market Intelligence 2016”.
- The report further indicates that South Africa’s utility scale RE sector is the most mature in the continent, therefore it offers a useful platform for investors seeking to venture into market, which is growing rapidly.
- Various regional, continental and international programmes are in place to support the development of the infrastructure including technical and financial capacity, and policy environments conducive to increased uptake of Renewable Energy Sector.

6.4 Investment Opportunities in the Petroleum Sector

- According to the Department of Energy updates, Bidvest Tank Terminals will invest R1 billion in a new LPG import and storage facility in Richards Bay (South Africa) for global LPG logistics company Petredee. This has been regarded as a significant investment in South Africa.
- Therefore, it is expected that Bidvest Tanks will build a 22 600 tonne storage facility adjacent to its existing tanks.

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7. MAJOR DIFFICULTIES AND BOTTLENECKS CURRENTLY FACED IN FORMULATING ENERGY POLICIES

7.1 Security of Energy Supply

- The biggest challenge for the policy developers in the energy industry particularly in South Africa, is securing energy (electricity) supply to address load shedding, considering affordability and clean energy technologies.

7.2 Skill and Capital Requirements

- Secondly, according to the draft IEP, South Africa has estimated unconventional gas resources of 485 Tcf (reduced to 391 Tcf) located in the Karoo Basin. Therefore, the discovery and availability of shale gas in the Karoo Basin could balance security supply of electricity/energy in the near future. Further exploration is required to determine the extent of this recoverable natural gas resource.
- One of the challenges of introducing natural gas into new markets is that large capital-intensive investment in infrastructure along the supply chain is required. Furthermore, South Africa has no experience and skills to support the development of the Karoo Shale Gas.

7.3 Policy Framework Designed for Investment Opportunities

- South African policy developers to consider fiscal policy design for optimal royalties and levies, considering policy framework that will attract investment in the gas industry, enhance security of supply and influence competition in the energy industry particularly gas.

7.4 Deployment of Clean Coal Technologies

- South Africa is one of the countries which signed Conference of the Parties to own up to its carbon pollution on the environment through generation of electricity using coal resources.
- Therefore, the country is committed to the efficient use of coal resources through employment of Clean Coal Technologies such Carbon Capture and Storage (CCS) facility. The country through the South African Centre for Carbon Capture and Storage (SACCCS) has developed a roadmap for CO_2.
- In essence, its is the responsibility of the policy developers to develop legislative framework on CCS, to ensure a safe; secure operation and implementation/deployment of CCS.

8. SUBJECTS YOU WOULD LIKE TO STUDY IN ORDER OF PRIORITY AND THE REASON

8.1 Energy Demand Forecasting in World and Asia; Energy Policy in Japan (Oil & Gas, Coal, Electricity, Energy Conservation, New and Renewable Energy) and Approach to Global Environmental Issues/Energy Balance Table/Observation

- In order to develop the gas industry, South Africa is considering gas import, however planning around security of energy supply particularly on gas industry could be challenging. Therefore, the subject on energy demand forecasting will assist overcoming these barriers.
- Secondly, more than 90 % of South Africa's energy consumption is derived from fossil fuels, leading to carbon dioxide in the environment. Therefore, the carbon capture and storage of carbon dioxide has been identified as one of the appropriate methods to reduce carbon intensity on the environment. However, there is a need to develop and implement policy/regulatory framework on carbon capture and storage. Therefore, as a policy maker, I would like to understand cross-national variations in coal industry regulation including carbon capture and storage facility.

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8.2 Survey Technique for Energy Statistics Data, Energy Data Base Constriction, Energy Balance Table, Energy Demand Forecasting Exercise and Scenario Analysis for Energy

- In 2008 and late 2015, load shedding hits South Africa economy and further reduced manufacturing and mining sectors output. In order to maintain the stability of power supply, it is important for policy makers to address the energy demand and supply through adequate policy framework.
- Secondly, the National Development Plan (NDP) indicates that by 2030 the Department of Energy should ensure that the energy supply is secured and demand is well monitored, and that there is an efficient and diverse energy mix for universal access within a transformed energy sector.
- Although, energy policies such as the integrated energy plan and the integrated resource plan were developed to guide and provide a roadmap of the future energy landscape in the country, there are challenges for optimal deployment.
- Therefore this subject will assist in understanding changes in the demand and supply of energy and readjusting policies to match supply and demand.

8.3 Draft Policy Plan

- Drafting Policy Plan during the training period would assist in determining cross-national legislative drafting procedures. Furthermore, to evaluate other countries' energy policies, standards, and processes followed during the development and implementation of their policy frameworks. The task would be part of the process that aims to align South African government's policies with current international standards.

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NDO LIVHUWA

ARIGATO GOZAIMASU

THANK YOU

NGIYABONGA

DANKIE

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JE VOUS REMERCIE

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