



ENERGY TRANSITION IN SOUTH AFRICA

AN FTI CONSULTING REPORT

EXPERTS WITH IMPACT™

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1. THE GLOBAL SHIFT TOWARDS DECARBONISATION

The world is on a path of an energy transition which is changing the 'what' and 'how' of the way we produce, consume and conserve energy.

Rising energy demand, decarbonisation and electrification is changing our relationship with energy. This, together with understanding the potential impacts of climate change and how this could transform the energy industry is top of mind for industry executives, policy makers, investors and society.

Whilst the future global energy mix is debated by scenario planners, there will be no one single response to the decarbonisation challenge.

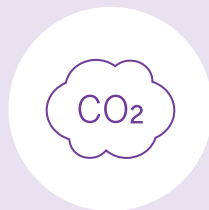
Each country will respond taking into account their individual developmental requirements, CO2 emissions, GDP and energy consumption on a per capita basis.

Predictions about the future global energy mix do however coalesce around there being continued global growth in energy demand; oil and gas continuing to be the dominant energy sources for the next few decades; gas playing a larger role in power generation; and the very rapid growth of renewables and biofuels.

THE DECARBONISATION CHALLENGE



DEVELOPMENT REQUIREMENTS



EMISSIONS



GDP



ENERGY ACCESS & CONSUMPTION

FUTURE GLOBAL ENERGY



ENERGY DEMAND



Continued global growth in energy demand



OIL & GAS



Oil & Gas dominant energy sources for next few decades



GAS



Gas plays larger role in power generation



RENEWABLES & BIOFUELS



Rapid growth of renewables & biofuels



What is apparent is a structural shift with the increasing electrification of energy, along with the macro trends of decentralisation, digitalisation and decarbonisation.

The impact of these changes will affect all players in the industry, as well as the way that societies produce and use energy.

The lines that traditionally separated energy value chains and industries continue to blur. Oil and gas players are increasingly active in power generation and retail. Large utilities and Independent Power Producers are moving from a small number of large grid scale projects to a more virtual approach of a large portfolio of small-scale distributed generation assets. Car manufacturers are vertically integrating with grid charging stations to control the network and ultimately the customer relationship. Energy users are increasingly prosumers, with the ability to produce their own energy and monetise the surplus, whilst trading with third parties. The common denominator in this is an increasing focus on electrons, rather than calorific content, in the overall energy system.

These structural shifts in electrification and decarbonisation will have important implications for South Africa's energy transition.

Like many countries across the globe, the challenge for South Africa is how to simultaneously provide for higher energy demand, expand energy access while lowering greenhouse gas emissions to protect the planet.

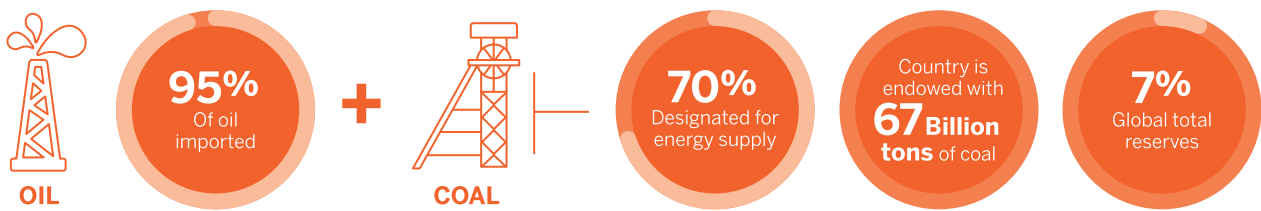
As the global energy transition gains pace, how will South Africa's transition to a low carbon economy impact the country's power; liquid fuels and mining sectors?

2. THE SHAPE AND PACE OF SOUTH AFRICA'S ENERGY TRANSITION

Transitioning South Africa's economy to a lower carbon economy system will require a staggering amount of capital to repurpose its infrastructure, such as upgrading power grids, refineries, gas terminals and pipelines.

A complex interplay between policy, technological innovation and market forces will determine whether a transition towards decarbonisation will have a positive influence on the country's future growth and development.

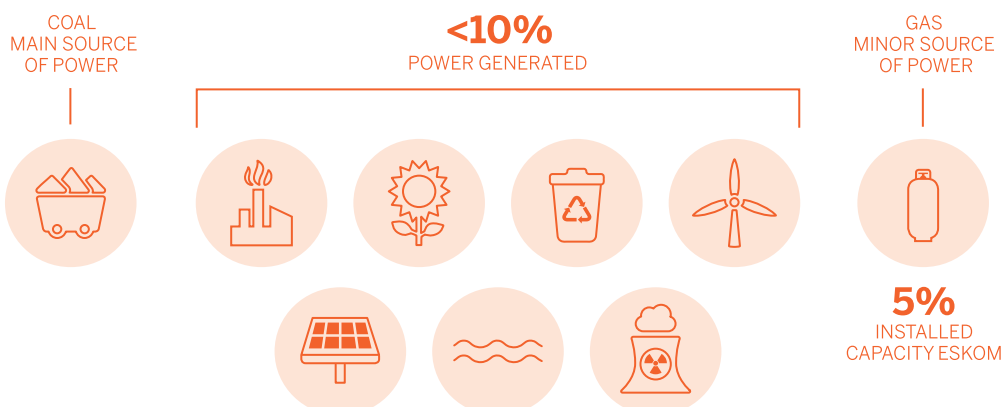
South Africa's energy supply is currently highly concentrated around **imported oil** and **domestic coal**. Over 70% of South Africa's energy supply has been and continues to be dominated by coal. The country is endowed with significant (an estimated 67 billion tonnes of coal, approximately 7% of global total reserves) and historically cheap coal resources. Coal is primarily used for power generation for industrial and residential use and is also converted to liquid fuels for transportation.



The second main source of energy supply is from **crude oil**. This is largely imported, then refined across four crude oil refineries to produce liquid fuels for transportation consumers. Natural gas is also converted from gas to liquids.

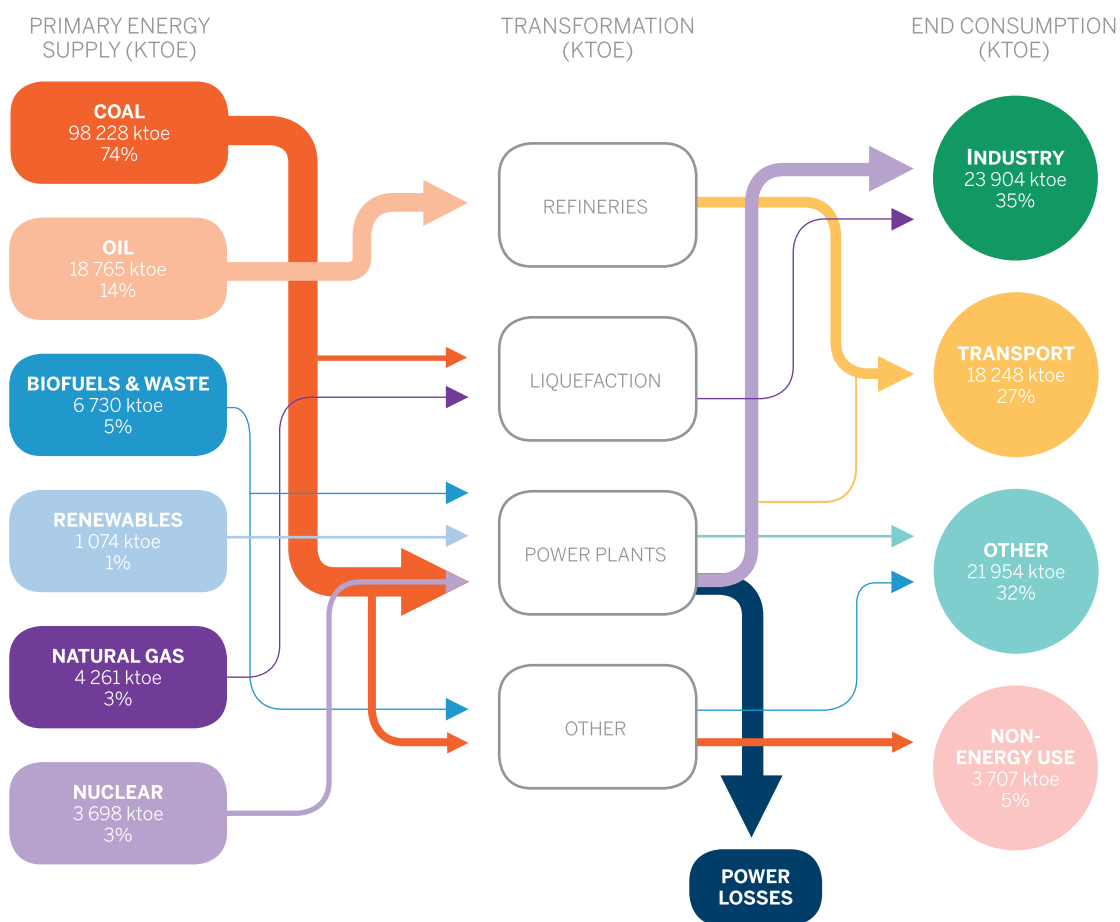
“INTERPLAY BETWEEN POLICY, TECHNOLOGICAL INNOVATION AND MARKET FORCES WILL DETERMINE WHETHER A TRANSITION TOWARDS DECARBONISATION WILL HAVE A **POSITIVE INFLUENCE ON SOUTH AFRICA'S FUTURE GROWTH AND DEVELOPMENT.**”

The predominant feedstock used for power plants remains coal. Less than 10% of power is generated via natural gas, biofuels, waste, wind, solar, hydro and nuclear. Currently, gas plays a minor role in electricity generation with about 5% of the installed capacity of Eskom. Electricity is then mainly consumed by industry and households.



With its high levels of solar radiation, favourable wind potential and large land mass for large-scale renewable energy projects, the country is well positioned to develop its renewable energy sector.

FIGURE 1: Provides an overview of South Africa's primary energy supply, processing infrastructure (e.g. refineries, power plants) and end consumption patterns:



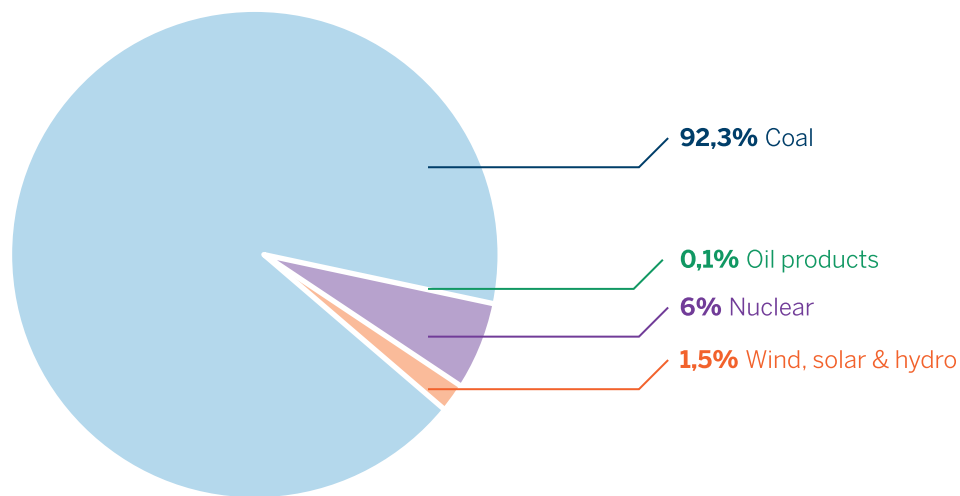
* Renewables = wind, solar and hydro

Source : International Energy Agency (simplified Sankey diagram) 2017, World Energy Balances, FTI Consulting

“THE SHAPE AND PACE OF SOUTH AFRICA'S ENERGY TRANSITION IS LIKELY TO BE **GRADUAL AND NON-LINEAR**”.

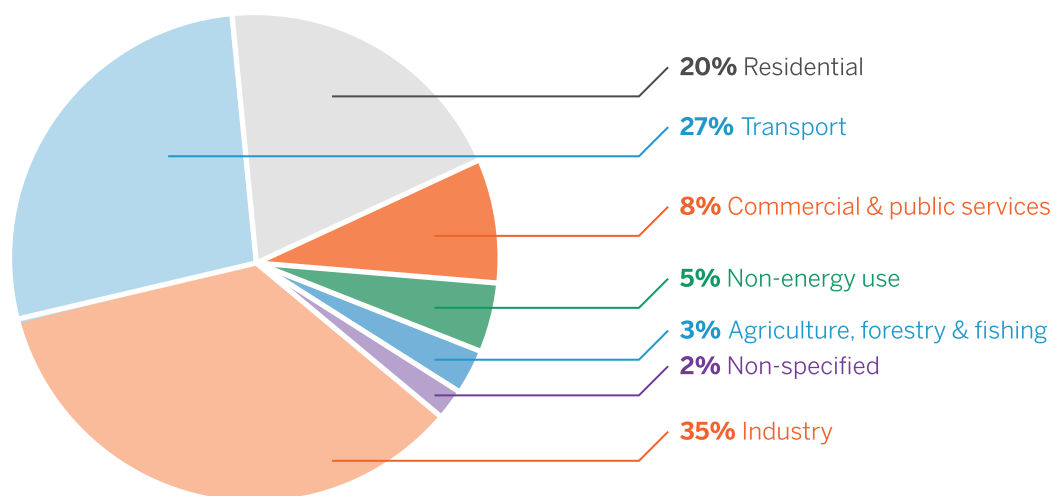
2. THE SHAPE AND PACE OF SOUTH AFRICA'S ENERGY TRANSITION

FIGURE 2 : Sources of energy supply for power generation in South Africa



Source : International Energy Agency 2017, World Energy Balances, FTI Consulting

FIGURE 3 : Final energy consumption in South Africa



Source : International Energy Agency 2017, World Energy Balances, FTI Consulting

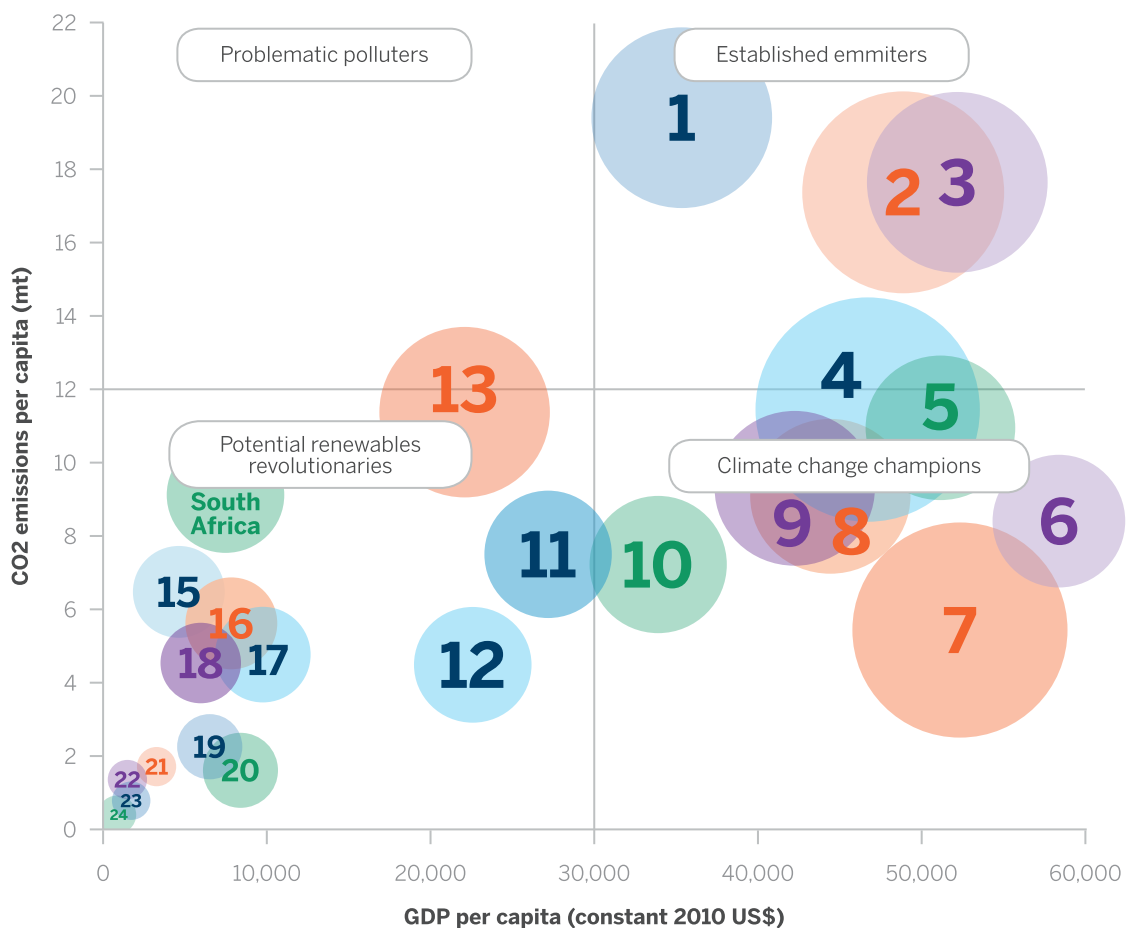
In FTI Consulting's Energising Africa report, we explore **how countries compare in terms of CO2 emissions, GDP and energy consumption on a per capita basis.**

This showed that globally:

- There are well established emitters (countries with high GDP and CO2 emissions per capita such as the US and the United Arab Emirates)
- Climate change champions (countries with high GDP and low CO2 emissions per capita such as Sweden, Japan and Germany).

South Africa has relatively low GDP compared to its CO2 emissions as a result of its abundance of coal as a primary energy source. However, it also has a competitive advantage for the development of renewable energy due to climatic and geographic factors. At this inflection point, the country has the opportunity to decide whether it grows into an established CO2 emitter or is able to evolve into a climate change champion.

FIGURE 4 : FTI consulting growth-emissions matrix ,global relationships between GDP, CO2 emissions and electricity consumption



- | | | | |
|-----------------------------|--------------------|-------------------------|------------------------|
| 1. United Arab Emirates | 7. Sweden | 13. Korea, Rep. | 19. Botswana |
| 2. United States of America | 8. Japan | 14. South Africa | 20. Costa Rica |
| 3. Australia | 9. Germany | 15. China | 21. Indonesia |
| 4. Finland | 10. European Union | 16. East Asia & Pacific | 22. India |
| 5. Netherlands | 11. Greece | 17. World | 23. Sub-Saharan Africa |
| 6. Denmark | 12. Portugal | 18. Arab world | 24. Zimbabwe |

* The size of the circles indicates electricity consumption per capita

Source : IEA and FTI Consulting

POWER

Government policy adopts a gradual approach to transition away from coal, but lower cost alternatives and consumer activism will likely disrupt the current centralised supply model.

State utility, Eskom is the monopoly power provider in the country and its failure to provide a reliable source of power to drive South Africa's economic activity continues to present the single biggest threat to Africa's most developed economy.

High levels of debt, falling revenue, rising costs and ageing power plants and infrastructure, makes it unlikely that Eskom will become a reliable provider in the near future. The ability of businesses and household consumers to address this risk has been constrained not only by the monopolistic nature of the power provider, but through regulatory limitations on the ability to self-generate.

Several stakeholder groups are joining the discussion on the future of coal in the country. Investors are becoming more reticent to provide funding for coal projects. Several banks in South Africa have announced they will no longer fund coal projects, and this is mirrored by international development banks. The carbon footprint of energy sources such as coal has become part of the criteria of accessing capital. Stakeholders from the coal community and those from the renewables community are increasingly moving in opposition to one another as if the future South African energy systems will be a binary choice between coal or renewables.

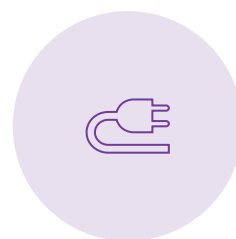
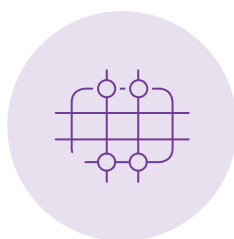
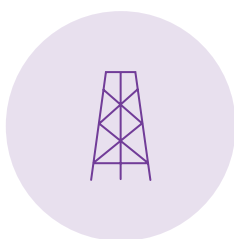
As the country works towards a future energy system combining coal, natural gas, oil, nuclear, renewables and hydro as the country diversifies its energy sources, stakeholder activism will also influence the pace of energy transition.

“FROM A POLICY PERSPECTIVE, A GRADUAL TRANSITION IS EXPECTED IN SOUTH AFRICA'S POWER SECTOR, ALTHOUGH INCREASED COST EFFECTIVENESS AND COMPETITION FROM ALTERNATIVE POWER SOURCES AS WELL AS CONSUMER ACTIVISM ARE LIKELY TO DISRUPT THE CURRENT CENTRALISED SUPPLY MODEL.”

It is therefore likely that in addition to pressure from potential investors for cleaner energy, market forces and technological innovation will play an important role in increasing the pace of South Africa's energy transition.

Set against a backdrop of falling renewable prices globally and significant growth in electricity output from solar PV and wind technologies over the last decade, it is widely cited that wind and solar have now become the cheapest forms of new power generation in South Africa. Renewables are now estimated to be about 40% cheaper than new build coal generation, and in some cases are cheaper than older existing coal plants (due to escalating maintenance costs as plants age) in terms of their Levelized Cost of Electricity (LCOE).

In addition, utility scale battery storage prices are falling which helps manage renewables intermittency. There has been an escalation of consumer requests for the expediting of Independent Power Producer (IPP) contracts to increase generation capacity - both renewable and non-renewable - and requests from municipalities to be allowed to buy power directly from IPPs, not just from Eskom.



The most realistic and rapid change to unfold in the next five years, therefore, is the increasing defection of consumers from Eskom's power grid. The Minister of Mineral Resources and Energy recently made a shift in policy direction by announcing that companies, such as those in the mining industry, can now generate their own electricity for internal use and would face no restrictions and could produce as much as they like.

Future possible implications include:

- **Consumers reducing their reliance on Eskom** through the adoption of behind-the-meter solar PV and battery storage technologies, escalating as costs continue to reduce and solar grid parity economics improve even further.
- **The emergence of companies with “virtual utility” business models** that enable and control the proliferation of distributed generation and participation of prosumers in the energy system, with greater convenience and lower cost for customers.
- **A move towards decentralised supply, with smaller, lower carbon installations** replacing large fossil fuel power plants.
- **More self-supply via Small Scale Embedded Generation (SSEGs)** – typically solar systems - for commercial and residential use.
- **More banking and wheeling agreements between private sector power producers and municipal grids** to distribute energy across cities and provinces to high demand users.

However, as a result of its historic reliance on coal and the large amount of state finance that has been invested in long-life coal power plants, South Africa has little option but to adopt a more gradual energy transition path. The Medupi and Kusile coal-fired power stations, for example, are anticipated to end up costing taxpayers over R300 billion and could be operational until at least 2065.

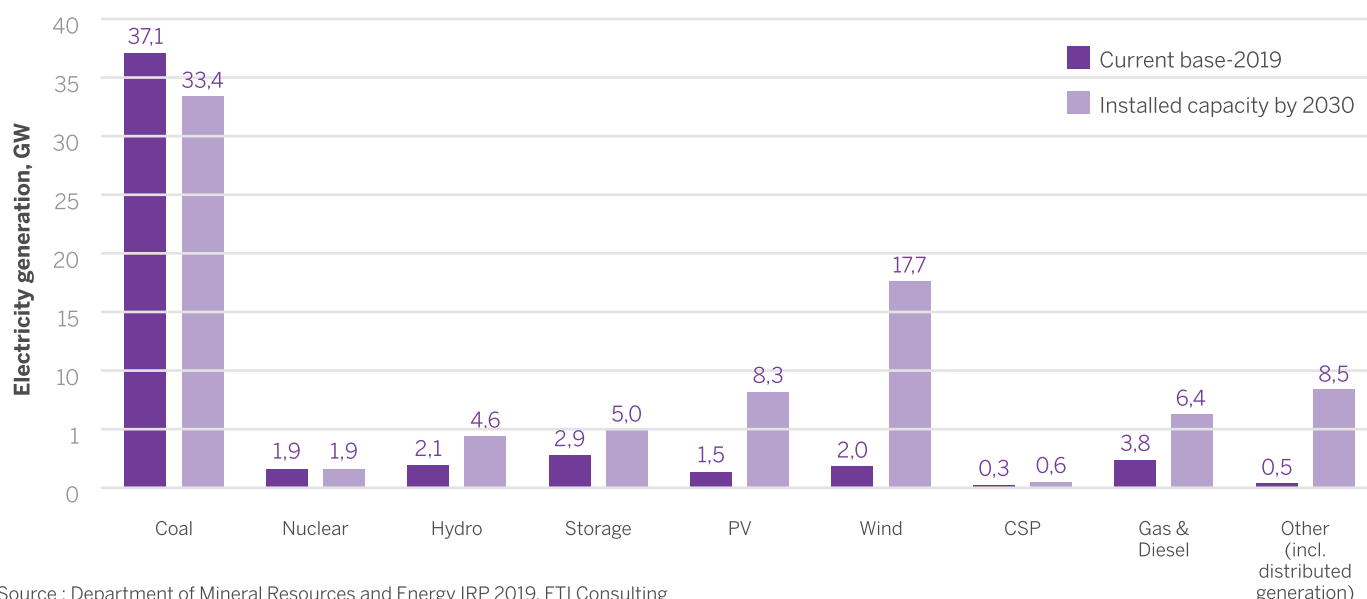
Despite this, we believe the fundamentals are in place to enable the country to transition to lower carbon economy, particularly given the increasing need for additional generation capacity and the decreasing costs of renewable power generation in the country.

A gradual policy approach

Policy for energy transition in the power sector is limited to a time frame of the next **10 years** and takes a gradualist approach to changing the energy supply mix for power generation. The 2019 Integrated Resource Plan (IRP) is an electricity infrastructure development and generation capacity procurement plan to 2030 and is based on the least-cost electricity supply and demand balance and considers security of supply and the environment through greenhouse emission and water use minimisation.

The IRP sets out a transition plan of adding 18,000 MW total installed capacity over the next decade and whilst coal is to remain the dominant source of generation, the notable changes are less of a reliance on coal and the increased the share of renewables and gas.

FIGURE 5 : Changes in South African energy supply planned by the IRP 2019



Source : Department of Mineral Resources and Energy IRP 2019, FTI Consulting



“IF THESE PLANTS CANNOT GENERATE SUFFICIENT REVENUES WHILE THEIR CAPACITY IS STILL REQUIRED, THEN THE BUSINESS CASE FOR THEM IS ERODED AND PUBLIC FUNDING WILL BE REQUIRED TO KEEP THESE PLANTS OPERATIONAL, AT A COST TO SOUTH AFRICAN TAXPAYERS.”

The highlights of the IRP 2019 for the energy supply mix in 2030 are:

- To **increase the total installed capacity by 18,000 MW**, in order to meet future electricity demand levels
- Despite an absolute and relative decline, **coal remains the dominant source of generation and decommissioning of older coal plants is planned** (although new units at Medupi and Kusile will come online)
- **Increasing hydro power** via the Grand Inga hydroelectric project in the Democratic Republic of Congo
- **Increasing storage capacity for variable power generation** (Eskom battery storage project now underway)
- **Major increases in solar PV and wind power**
- **Increasing the share of gas** in the overall national energy contribution and **preparation for the renewal of gas infrastructure** to enable this additional capacity
- **Increasing distributed and embedded generation**, including solar home, micro-grid and other 'behind the meter' options
- **The role of nuclear continues unchanged**. However, South Africa is likely to struggle to justify the financial cost of building new nuclear power stations due to cost escalation of traditional nuclear fission technology and construction complexity

Factoring in the impact of renewables on grid stability

Historically, power grids globally and within South Africa have been fairly centralised and homogenous, taking power generated at a constant rate from large fossil fuelled power plants and feeding this in a linear model through transmission and distribution systems to meet consumer demand. As the power all comes from similar sources and is produced at a predictable rate, the current is reasonably constant in terms of frequency and voltage. As the energy mix transitions towards renewables and distributed generation, the grid will instead increasingly resemble a non-linear nexus of interconnected nodes of demand and supply, with trading between these nodes rather than dependence on centralised “command and control” power planning.

“ROBUST INTEGRATION METHODS MUST MAXIMISE THE COST-EFFECTIVENESS OF INCORPORATING VARIABLE RENEWABLE ENERGY INTO THE POWER SYSTEM WHILE INCREASING OR AT LEAST MAINTAINING SYSTEM STABILITY AND RELIABILITY.”

These installations will move the grid to a more decentralised model with larger fluctuations in grid frequency. This is because the power generated by solar and wind power tends to be more uncertain than that from conventional sources, a fact which needs to be carefully considered during integration to maintain grid performance in three dimensions:

1. **Stability** - the quality of power and the grid's ability to respond quickly to load variation over seconds and even microseconds
2. **Flexibility** - the ability to compensate for variability in supply and demand and maintain its balance from seconds to months
3. **Adequacy** - the ability to supply the aggregate electrical demand and energy requirements of end-use customers at all

A major grid stability issue experienced in countries with higher renewable penetration is that of grid inertia, measured by the ability of the grid to quickly react to events (such as the loss of a nuclear or coal unit).

With higher levels of renewables there are less synchronous machines generating on the grid, which lowers the ability of the grid to stabilise itself. The result is curtailment of renewable generation, or reluctance of grid operators to accept additional renewables, despite the generation cost of renewables (especially solar PV) typically being more competitive than fossil fuels.

South Africa has a major challenge in this regard, as the aging coal fleet means that it already has low grid inertia before factoring in the impact of renewables.

The implication is that South Africa will likely need to replace its fleet of synchronous machines before pursuing higher renewable penetration. Should South Africa put in place the policies to import liquified natural gas and encourage exploration and production of domestic gas, it will be well placed to emulate the displacement of coal stations by gas-fired power as seen in the United States and China. **Combined Cycle Gas Turbines are modular in design and can be built rapidly**, with a wide range of grid stability advantages (ranging from small peaker plants to most efficient size in the range of 600MW for baseload or midmerit).

The ability of gas-fired generation to “follow load” means that can work in tandem with the intermittency of renewables, thus allowing for greater renewable integration and a net reduction in both cost and emissions.

Maintaining grid performance in all three dimensions will require changes to power system planning and operations, including grid upgrades and expansion to incorporate installations in remote locations (such as wind farms in the Karoo) to the supply network. Robust integration methods must maximise the cost-effectiveness of incorporating variable renewable energy into the power system while increasing or at least **maintaining system stability and reliability**.

This investment in network improvements is particularly critical in South Africa, where the distance that transmission and distribution networks must cover are vast compared to more compact grid networks, such as those in many European countries. At the same time, grid infrastructure is also suffering from years of under-investment, poor maintenance and increased stress on the system caused by repeated load-shedding, which must be considered before significant amounts of variable renewable power can be fed into the system without impacting grid stability.

Given that South Africa's transition away from fossil fuels is likely to be a **gradual transition** over a number of decades, it is also important to consider how existing coal fired power plants will continue to generate sufficient revenues to cover ongoing maintenance investments, without falling into disrepair while their generation capacity is still required to meet consumer demand at peak or sporadic hours.

If these plants cannot generate sufficient revenues while their capacity is still required, then the business case for them is eroded and public funding will be required to keep these plants operational, at a cost of South African taxpayers. As a result, it will be important for continuing planning to take this risk into account and ensure that the conventional generation still required for peak demand still provides attractive returns for investors, regardless of whether this investment is privately or publicly funded.

LIQUID FUELS

Environmentally orientated policies have been introduced, but a lack of compelling economic evidence and existing infrastructure will likely slow efforts to transition

Globally the impact of an energy transition on the hydrocarbon and liquid fuels industry will be influenced to the extent that industrial and consumer demand shifts to a “net zero” approach to carbon. Major global corporations and energy players are urgently investigating ways to reduce the net carbon footprint of their operations and supply chains, with traceability to the source of origin.

A wholesale demand shift to accounting for the true carbon and polluting impact will lead to winners and losers in the fuels sector, with an acute impact on coal-to-liquid and gas-to-liquid players, or less efficient petrochemical operations.

Technical challenges in the aviation and shipping sectors means that the technology to power planes and boats over air and water will remain hydrocarbon-based for the next five years. In the aviation sector, fuel demand will therefore still be proportional to growth of the aviation industry and jet engine deployment, although there may be a sub-shift from fossil fuel to biofuel solutions.

Similarly, shipping engines will gradually shift from Heavy Fuel Oil (HFO) to Liquefied Natural Gas based solutions to reduce emissions and promote cost competitiveness, albeit at a slow pace given the scale of the global industry and vessel lifespans. In response to these trends and the pursuit of lower carbon, fossil fuel companies are adapting their business portfolios to prepare for long term (>50 years) sustainability. Some companies are transforming from oil and gas companies into energy companies. Shell has become an electricity provider in the UK, which now provides renewable energy to all its residential customers. BP is becoming the world’s largest solar developer. Some companies have chosen to reposition completely by divesting their oil and gas assets, exit from fossil fuels and focus on renewables.

“A WHOLESAL DEMAND SHIFT TO ACCOUNTING FOR THE TRUE CARBON AND POLLUTING IMPACT WILL LEAD TO WINNERS AND LOSERS IN THE FUELS SECTOR, WITH AN ACUTE IMPACT ON COAL-TO-LIQUID AND GAS-TO-LIQUID PLAYERS, OR LESS EFFICIENT PETROCHEMICAL OPERATIONS.”

Our research in South Africa shows, however, that market forces and technology innovation are not yet compelling enough in South Africa to drive significant change in the liquid fuels sector in the next five years.

Like most other countries, the main driver of energy demand in South Africa is transportation, meaning that demand for fuels is highly correlated to the engine technology of a given country’s vehicle fleet. Major investment is underway at a global level in giant battery factories, which will radically reduce costs, whilst most major automobile manufacturers are shifting to Electric Vehicle (EV) production. However, more developed countries are still likely five years away from achieving a step change in EV adoption.



South Africa’s electric vehicle adoption is thus likely to remain limited given the low to middle income characteristics of its consumer base. There are over **11 million vehicles in South Africa, including cars, trucks, minibuses and motorcycles, and the volumes of full electric or plug in hybrid vehicles can be counted in the thousands.**

The adoption of EV's requires compelling economics, ease of use and reliable energy supply. The price competitiveness of mass market EV's are not yet at parity with internal combustion engine models. A significant reduction in battery costs would be required for EV's to become more competitive. South Africa has a fledging EV charging infrastructure network installed and EV's require access to chargers with locational charging time matched to user requirements. The lack of reliable power supply in the country is another barrier to uptake, where EV's security of supply of power is critical at system and local network level.

In terms of competing technologies, South Africa's relative lack of domestic gas and weak gas infrastructure network, together with its limited biofuels support policies, implies that the **vehicle fleet is unlikely to shift to compressed natural gas (CNG) or ethanol-fuelled engines** as has been seen in other middle income countries like Iran or Brazil respectively.

Liquid fuel demand is more likely to be affected in marginal cases where the benefit of shifting to gas or hybrid systems outweighs the cost of shifting technology. This is likely to occur in the thermal power generation sector, where smaller scale mid-merit or peaking power plants running on diesel will be more competitive if they are retrofitted to run on imported Liquefied Natural Gas. Similarly, demand destruction for liquid fuels is underway in energy intensive users that are in remote areas or that are experiencing acute grid reliability issues. This is the case of small to medium scale mining and manufacturing operations that are actively exploring how to shift from thermal (heavy fuel oil, diesel, paraffin) to hybrid systems (where existing applications are displacing more than 75% of liquid fuels with solar PV), or a wholesale shift to imported LNG (as some customers are actively exploring in the Western Cape).

This is underpinned by changes in the Original Equipment Manufacturer (OEM) market where **engine providers are shifting to hybrid offers of fuel, solar PV and battery storage.** Indeed, South Africa is now behind many African countries in this regard, where Commercial and Industrial energy users are at an advanced stage of shifting to hybrid systems that are both economic and reliable.

When it comes to policy for the oil and liquid fuels sector, there is no equivalent 10-year look ahead such as the Integrated Resource Plan (IRP). However, there have been a **series of environment orientated policy steps taken aimed at reducing emissions and improving air quality.**

For example, in June 2019, the Carbon Tax was introduced which aims to reduce greenhouse emissions and is based on the polluter pays principle. Discussions are underway between the liquid fuels industry and the government, as the latter aims to tighten fuel specifications and standards in order to meet emission regulation and align with advancing vehicle technology. Changing fuel standard specifications, known as Clean Fuels II, is targeted at vehicle emissions by reducing levels of benzene and sulphur in petrol and diesel as well as a reduction in particulates in exhaust gases.

To implement this would require a substantial investment in upgrading the refinery infrastructure to enable the production of cleaner fuels. This cost is prohibitive, especially in a price regulated environment. In addition, there continues to be a lack of clarity and alignment on who would pay the billions of rand capital requirement to upgrade refinery infrastructure and this has resulted in both a nuanced and postponement of change.



MINING

The energy transition will require mining to reposition itself over time to balance export and domestic markets and get ready for changing demand patterns in a cleaner, greener world.

The energy and mining sectors are closely interconnected in South Africa and a transition in energy will lead to a transition in mining. The mining sector will need to reposition itself to changing demand patterns driven by the energy transition and get ready for a cleaner and greener future. South Africa is endowed with an estimated \$2.5 trillion mineral reserves base, with world class reserves in platinum group metals, gold, diamonds and coal for example, and attracts domestic and international investment.

While anticipating changing demand patterns for different commodities is complex - a single trend can simultaneously increase demand for one group of commodities and reduce demand for another - **a diversified asset portfolio is a key consideration when allocating capital** with a long-term view to balancing domestic and export markets.

The energy transition to lower emissions systems towards alternative and cleaner sources, for example, is likely to reduce the demand for coal power generation in industrialised nations, but at the same time is likely to increase demand for platinum for catalytic converters for internal combustion engine vehicles and for battery components in electric ones. Platinum-based fuel cells will also become more significant as the hydrogen economy evolves.

“A DIVERSIFIED ASSET PORTFOLIO IS A KEY CONSIDERATION WHEN ALLOCATING CAPITAL WITH A LONG-TERM VIEW TO BALANCING DOMESTIC AND EXPORT MARKETS.”

Coal is the dominant source for South Africa's energy system and the main feedstock for power generation and to a lesser extent, liquid fuels. Coal for the domestic market is likely to remain secure for the next decade as the power generation plan continues to be reliant on coal but the role of coal will decline in relative and absolute terms.



Furthermore, it is the export of coal to global markets, especially China, which generates the lion's share of coal sales. Coal demand is expected to be stable over the next decade, but global markets are shifting away from coal to cleaner energy sources for power generation. China's energy system is transitioning, and its future growth is relying less on industrialisation-led growth. The long-term horizon for South African coal exports is will therefore likely be impacted.

3. CONCLUSION

Around the world, countries are announcing ambitious plans to cut their emissions and decarbonise their economies.

Since each country's development priorities, energy policies and domestic energy resources differ, there will be no one homogenous approach to the decarbonisation challenge.

South Africa's transition to a lower carbon energy system in is likely to take place over a number of decades, follow a nonlinear path which will be influenced and disrupted by the interplay between policy, market forces and technical innovation. This will necessitate stakeholder dialogue at a national level.

For investments to be made to take South Africa's energy transition forward, the economics need to be compelling, the alternative technologies proven, and confidence attained in this being a 'just transition' from an employment and economic perspective.



“FOR INVESTMENTS TO BE MADE TO TAKE SOUTH AFRICA'S ENERGY TRANSITION FORWARD, THE ECONOMICS NEED TO BE COMPELLING, THE ALTERNATIVE TECHNOLOGIES PROVEN, AND CONFIDENCE ATTAINED.”

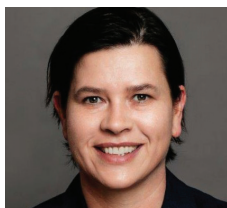
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EXPERTS WITH IMPACT

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