Independent Statistics & Analysis
U.S. Energy Information Administration

Country Analysis Executive Summary: South Africa

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Overview

- South Africa is one of the most developed countries in sub-Saharan Africa and is the second-largest economy in the region, following Nigeria, in terms of gross domestic product (GDP), according to the latest estimates by the World Bank Group. However, South Africa was the largest petroleum and other liquids consumer in Africa, consuming about 623 barrels per day (b/d), surpassing Nigeria and Algeria, the 2nd and 3rd largest, respectively, by at least 25% in 2019. [1]
- The country has a large, energy-intensive coal mining industry and mostly uses coal to meet its energy needs, given the country's limited proved reserves of oil and natural gas. South Africa also has a sophisticated synthetic fuels industry, producing liquid fuels from its coal-to-liquids plant in Secunda and its natural gas-to-liquids plant in Mossel Bay.
- Although South Africa has a high level of access to electricity relative to other sub-Saharan African countries, its electric power sector experiences frequent power outages as a result of insufficient investment in the infrastructure. South Africa is seeking to diversify its power generation mix by attracting investment in renewable energy sources, but coal will likely remain the main fuel source to meet its energy needs for the near future.

Sector organization

- South Africa has several government agencies that oversee the coal, oil, and natural gas sectors. The Department of Minerals and Energy (DMRE) and the Petroleum Agency of South Africa regulate oil and natural gas exploration and production, and the DMRE and the Mine Health and Safety Inspectorate are responsible for overseeing mineral extraction regulations. The National Energy Regulator of South Africa (NERSA) regulates the midstream segment of the oil and natural gas sector as well as the electric power sector. The Department of Environment, Forestry, and Fisheries (DEFF) also provides regulatory oversight on environmental issues in the oil and natural gas sector. [2]
- The Mineral and Petroleum Resources Development Act, most recently amended in 2014, is the main legislation governing the upstream segment of the coal, oil, and natural gas sectors. In July 2021, the Upstream Petroleum Resources Development Bill was introduced in Parliament to separate the regulatory framework for the oil and natural gas sector and the mining sector, increase policy and regulatory certainty, and attract investment in the upstream oil and natural

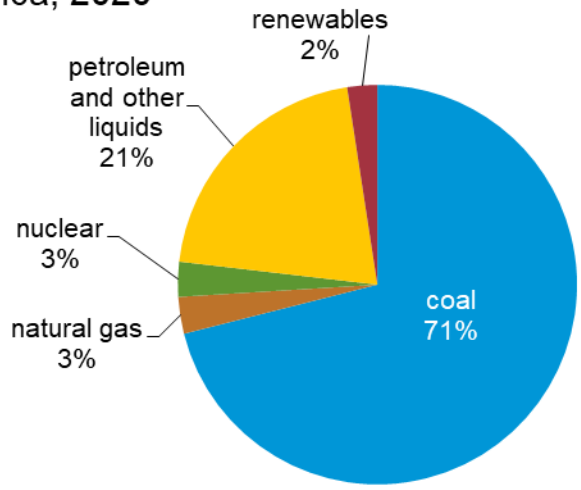
gas segment. Parliament must approve the bill for it to become law and enter into force, and as of June 2022, it was unclear when or if the Parliament might approve the bill.[3]

- The state-owned company Petroleum Oil and Gas Corporation of South Africa (PetroSA) operates all upstream oil- and natural gas-producing assets in South Africa, along with the natural gas-to-liquids (GTL) plant at Mossel Bay. The company also participates in oil and natural gas activities internationally.[4] The downstream oil sector is more diversified and includes companies from Europe, North America, and Asia. BP, Shell, Chevron, TotalEnergies, and Engen as the main participants.

Energy consumption

- According to the latest estimates in BP's *2021 Statistical Review of World Energy*, coal and petroleum and other liquids accounted for most of South Africa's total primary energy consumption in 2020, at estimated shares of 71% and 21%, respectively (Figure 1). According to Eskom, about 53% of the coal in South Africa was used in the electric power sector, followed by the petrochemical industries (33%), the metallurgical industries (12%), and for domestic heating and cooking (2%).[5]

Figure 1. Primary energy consumption in South Africa, 2020



eia Source: BP *2021 Statistical Review of World Energy*

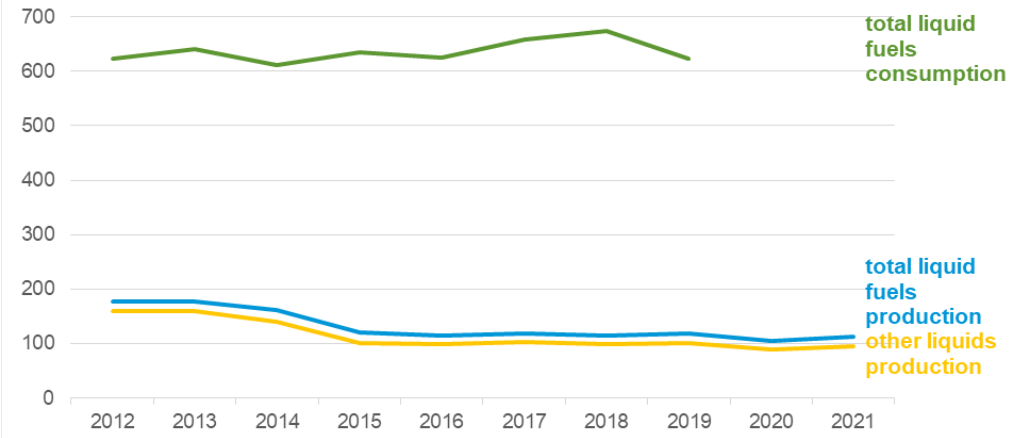
Petroleum and other liquids

Exploration and production

- According to the *Oil & Gas Journal* (OGJ), South Africa holds proved oil reserves of 15 million barrels as of January 2022.[6] All of the proved reserves are located offshore in the southern part of the country in the Bredasdorp Basin and off the western coast near the maritime border with Namibia.
- Total liquid fuels production in 2021 was about 112,000 b/d, of which only 1,000 b/d was crude oil and lease condensate.[7] (Figure 2) South Africa's synthetic fuels, which are derived from coal and natural gas, account for almost all of the country's total liquid fuels production.

Figure 2. Total annual liquid fuels production and consumption in South Africa, 2012–2021

thousand barrels per day



Source: U.S. Energy Information Administration

Transportation and storage

- South Africa has six oil terminals, located in Saldanha Bay, Port Elizabeth, East London, Richards Bay, and Durban. The Saldanha Bay storage terminal is a major regional storage hub and is strategically located along the shipping route around the Cape of Good Hope. As a result, it can serve demand centers in both Europe and Asia. It has a crude oil storage capacity of 55 million barrels.[8] Its most recent expansion was the commissioning of the Saldanha Bay II liquids storage terminal in October 2020, which provided an additional nine tanks for a total increase of about 10 million barrels of storage capacity. A further expansion of this facility is under consideration, which could add another 3.2 million barrels of storage capacity if the company moves forward with the expansion plan and completes construction.[9]

Refining and refined oil products

- South Africa has four existing refineries, but currently only the 107,000 b/d Natref refinery in Sasolburg, near Johannesburg, is operational[10] (Table 1). South Africa also has a natural gas-to-liquids (GTL) plant in Mossel Bay and a coal-to-liquids (CTL) plant in Secunda that process natural gas and coal to produce synthetic liquid fuels.
- BP and Shell, joint venture partners, own the 180,000 b/d Sapref refinery, and they halted operations indefinitely at the refinery at the end of March 2022. Future plans for the refinery are unclear.[11]
- In July 2020, the Astron Energy refinery at Cape Town was taken offline after a fire occurred as a result of an explosion at the facility. Astron Energy stated that it hopes to restart the refinery by the end of 2022, pending completion of repairs.[12]
- Engen, which is majority-owned by Petronas, closed its refinery in Durban after a fire and explosion occurred at a diesel hydrotreater at the facility in December 2020. According to Reuters, Engen stated that it intends to convert the refinery to an import and storage terminal by the end of 2023.[13]
- In September 2021, the government of South Africa published new regulations for fuel standards that aim to reduce fuel emissions. The regulations stipulate that, starting in September 2023, diesel fuel must meet lower sulfur content requirements. The new regulations will impose higher operating and capital costs on domestic refiners, which must upgrade their facilities to produce fuel that meets the new requirements. The South African Petroleum Industry Association (SAPIA) issued a statement stating that South Africa's refineries could become obsolete within two years without government aid for facility upgrades.[14]

Table 1. South Africa's refineries

Refinery name	Ownership	Location	Notes	Nameplate capacity (barrels per day)
Natref refinery	Sasol (64%) TotalEnergies (36%)	Sasolburg	Operational	107,000
Sapref refinery	BP (50%) Shell (50%)	Durban	Closed indefinitely; possible future restart	180,000
Astron refinery	Astron Energy	Cape Town	Shut down in July 2021; possible restart in 2022	110,000
Enref (Engen) refinery	Petronas (74%) Phembani (21%) Phembani-led consortium (5%)	Durban	Shut down in 2020; planned conversion to a storage and import terminal by 2023	125,000
Total				**522,000**

Data source: *Facts Global Energy, Oil & Gas Journal*, *Energy Intelligence Group,* South African Petroleum Industry Association website, and company websites

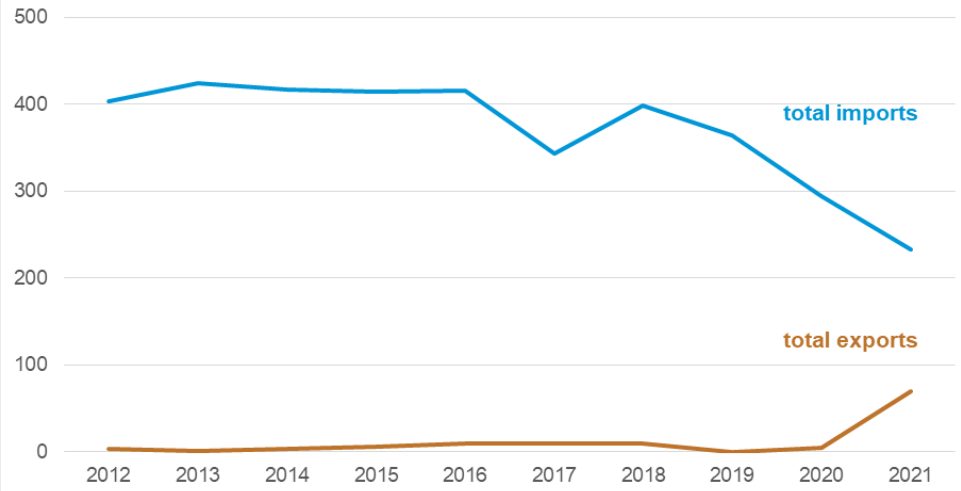
Petroleum and other liquids trade

- According to the latest estimates by Global Trade Tracker, South Africa imported about 232,000 b/d of crude oil and condensate and exported about 69,000 b/d in 2021 (Figure 3). South Africa imports mainly from countries in the Middle East and in Africa; Nigeria and Saudi Arabia

supplied the most imports in 2021, at 100,000 b/d and 89,000 b/d, respectively. South Africa also imported small volumes from Ghana and Angola, approximately 19,000 b/d and 13,000 b/d, respectively[15] (Figure 4).

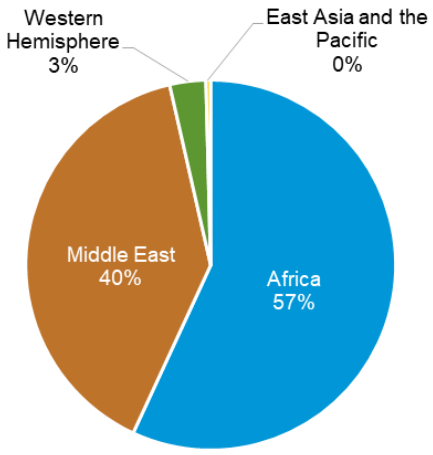
Figure 3. South Africa's total annual exports and imports of crude oil and condensate, 2012–2021

thousand barrels per day



Source: U.S. Energy Information Administration and Global Trade Tracker

Figure 4. South Africa's total crude oil and condensate imports, 2021



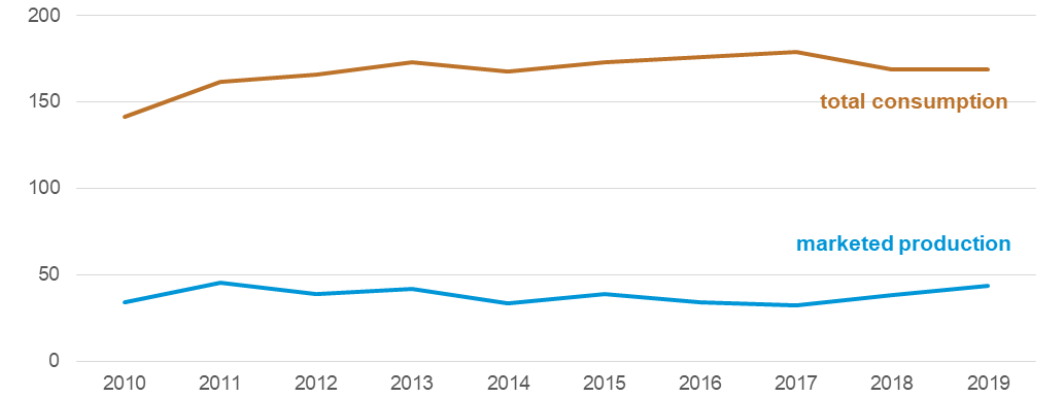
Source:Global Trade Tracker

Natural gas

Exploration and production

- Most of South Africa's natural gas originates from the maturing offshore F-A field and the South Coast Complex fields. From the fields natural gas is sent to the GTL facility in Mossel Bay via an offshore pipeline. South Africa produced about 43 billion cubic feet (Bcf) of dry natural gas in 2019 and consumed about 169 Bcf in that same year[16] (Figure 5).
- TotalEnergies announced two deepwater natural gas and condensate discoveries that could provide a substantial boost to the country's natural gas production as early as the mid-2020s. The two natural gas-condensate finds, the Brulpadda and Luiperd discoveries, are in Block 11B/12B, approximately 110 miles south of Mossel Bay.[17] Once brought online, the natural gas and condensate from these fields can provide additional feedstock for the Mossel Bay GTL plant, which has been running below capacity for several years, and reduce the country's natural gas imports. The Brulpadda and Luiperd discoveries also renewed interest in further exploration of South Africa's offshore blocks, which may potentially lead to new discoveries in the future.[18] According to recent field analysis by Rystad Energy, the Brulpadda and Luiperd discoveries are expected to produce approximately 340 and 300 million cubic feet, respectively, of natural gas and liquid fuels at their peaks.[19]
- South Africa has limited natural gas resources, and so it imports much of its natural gas from neighboring countries, such as Mozambique, to meet demand. Although South Africa reportedly has large shale gas resources in the Karoo Basin, it has significant challenges to commercially exploit the shale gas deposits. Some of those challenges include a lack of infrastructure to transport and process natural gas and Karoo Basin's complex geological characteristics that make exploration and appraisal efforts technically challenging and more expensive.[20]

Figure 5. Annual natural gas production and consumption in South Africa, 2010–2019



Natural gas to liquids

- The PetroSA GTL plant is in Mossel Bay and is wholly owned by the South African government through the Central Energy Fund. PetroSA operates the plant and the offshore gas fields that provide the fuel. The plant converts natural gas to synthetic liquid fuels, such as motor gasoline, kerosene, diesel, propane, and distillates.[21] The Mossel Bay GTL refinery has a nameplate capacity of 45,000 b/d, but it has operated well below capacity for several years because of insufficient natural gas supplies. In addition to encouraging exploration efforts offshore, the government and PetroSA have tried to address the declining utilization by installing a condensate splitter that can process condensates in addition to natural gas, increasing the facility's utilization rate.[22] The recent Brulpadda and Luiperd finds, once brought online, could provide additional feedstock for the plant by sending natural gas and condensate to the GTL plant, but commercial operations may not begin until mid-2020s at the earliest.[23]

Transportation and storage

Pipelines

- Imported natural gas comes from Mozambique's Pande and Temane fields and is transported to Sasol's Secunda GTL plant via a 535-mile pipeline. Sasol, the South African government, and the government of Mozambique own the pipeline through a joint venture: the Republic of Mozambique Pipeline Investments Company (ROMPCO). The Pande and Temane fields in Mozambique are aging and, according to a report by Norton Rose Fulbright, natural gas production from these fields will begin declining in the mid-2020s, which will limit Secunda GTL plant operations unless the plant can acquire alternative sources for feedstock.[24]
- Two midstream projects have been proposed that would expand South Africa's natural gas pipeline network, but the projects have not progressed beyond the proposal stage. In 2013, Gigajoule, a domestic power company, proposed to build a natural gas pipeline that would run from Maputo in northern Mozambique to South Africa and provide feedstock to natural gas-fired power plants positioned near the pipeline in both countries. In March 2016, a joint venture comprised of Mozambique's national hydrocarbon company and a private sector consortium (which includes South African oil and natural gas company SacOil, the China Petroleum Pipeline Bureau, and Profin Consulting Sociedada Anónima) proposed to build the Africa Renaissance pipeline, an $8 billion, 1,615-mile pipeline with a capacity of 635 Bcf per year that would ship natural gas from Mozambique's Rovuma Basin to South Africa's Gauteng province. The project is scheduled to be completed in 2026.[25]

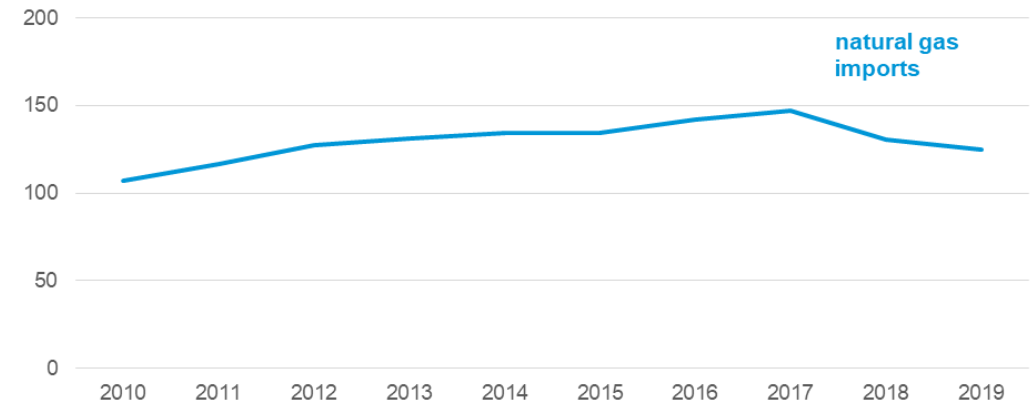
LNG

- South Africa currently does not have any liquefied natural gas (LNG) terminals, but the government is looking to develop LNG infrastructure as a way to diversify natural gas import supply. The state-owned Central Energy Fund is evaluating the potential to build a floating storage and regasification unit (FSRU) at the Ngqura deepwater port, located next to the Coega Special Economic Zone in the Eastern Cape Province. In November 2021, the Central Energy Fund issued a request for information (RFI) for constructing an FSRU that would have an LNG storage capacity of 6 million cubic feet and a regasification capacity of at least 185 Bcf per year. ExxonMobil and Royal Vopak also signed a memorandum of understanding in December 2020 to explore the feasibility of developing an LNG regasification terminal in South Africa.[26]

Natural gas trade

- As a result of limited domestic natural gas resources, South Africa does not export any natural gas; the country imports most of its natural gas by pipeline to meet domestic consumption[27] (Figure 6).

Figure 6. South Africa's annual natural gas imports, 2010–2019
billion cubic feet



eia Source: U.S. Energy Information Administration

Coal

Sector organization

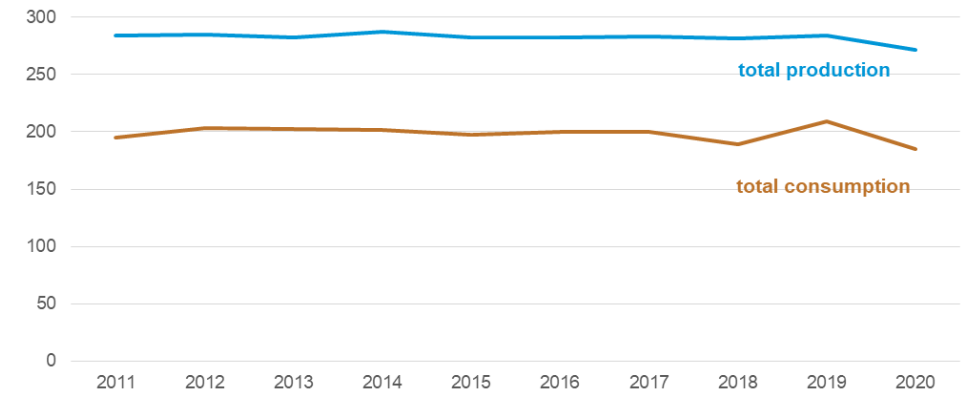
- Sasol is a key participant in South Africa's energy industry and in addition to the company's involvement in refining and marketing of oil products and natural gas, it also controls coal mining in South Africa. Sasol operates six coal mines and produces about 40 million metric tons of coal per year, which is mostly used for feedstock at the Secunda coal-to-liquids (CTL) plant and for power generation for its Sasolburg facilities. Sasol exports about 3.3 million metric tons of coal through the Richards Bay Coal Terminal (RBCT), which Sasol is one of the shareholders.[28] According to South Africa's DMRE, other major companies that participate in South Africa's coal sector include Anglo American, BHP Billiton, Eyesizwe, and Kumba Resources Limited. Coal production is mainly concentrated in large mines, and 11 mines account for about 70% of total domestic production.[29]

Production

- According to the BP's *2021 Statistical Review of World Energy,* South Africa has the largest proved coal reserves in Africa, estimated to be about 11 billion short tons at the end of 2020, or about 62% of the region's total proved coal reserves.[30] Most of the coal produced in South Africa comes from the Witbank, Highveld, Free State, and Ermelo fields in the eastern part of the country. South Africa has the potential to increase coal production, particularly from the resource-rich Waterberg Basin in the northeastern area of the country.[31]
- South Africa's coal production and consumption have remained relatively the same over the past decade. South Africa produced approximately 272 million short tons of coal (MMst) in

2020, making it the seventh-largest coal producer in the world. South Africa also consumed about 185 MMst in the same year (Figure 7).[32]

Figure 7. Annual coal production and consumption in South Africa, 2011–2020
million short tons



Source: U.S. Energy Information Administration

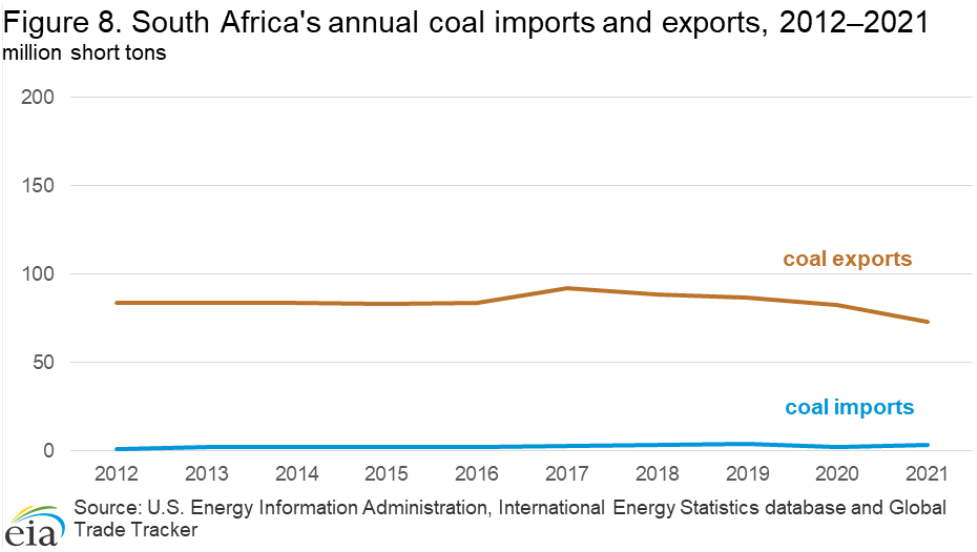
Coal to liquids

- The Secunda CTL refinery uses coal liquefaction and gasification to produce synthetic liquid fuel and synthetic gas. Secunda CTL is the world's only commercial coal-based synthetic fuels refinery and is wholly owned and operated by Sasol. The Secunda CTL refinery produces synthetic fuels and a range of chemical feedstock for producing solvents, polymers, and chemicals as well as synthetic fuel components and pipeline natural gas.[33] The plant houses two factories and has a total capacity of 160,000 b/d of oil equivalent.[34]

Coal exports

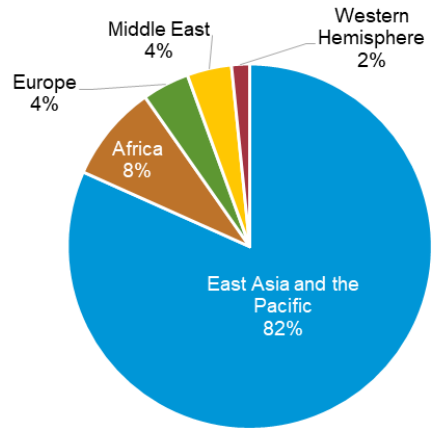
- The state-owned company Transnet controls the railways that transport coal from the mines to the ports where the coal is shipped abroad. Most of South Africa's coal is exported via the Richards Bay Coal Terminal (RBCT), and the remainder is shipped via the Maputo and Durban terminals.[35]
- RBCT is located on the eastern coast of South Africa and is one of the world's largest coal export terminals; it has a capacity of 100 million short tons per year (MMst/y).[36] Plans to expand RBCT's capacity to 121 MMst/y were suspended because the terminal still operates below its throughput capacity (Figure 8).[37] Recent RBCT data indicate that coal exports at the terminal are declining; in 2020, approximately 77.4 MMst of coal were exported via RBCT, down from a peak of 84.3 MMst in 2017. A majority of the coal exported from RBCT went to Asia (92%) in 2020, and exports to Europe (3%) and Africa (5%) accounted for the remaining shares.[38]
- According to the latest estimates by Global Trade Tracker, South Africa exported about 73 MMst of coal in 2021. The East Asia and Pacific region received about 82% of South Africa's coal shipments, and most of the exports went to India (38%) and Pakistan (18%) (Figure 9).[39]

Figure 8. South Africa's annual coal imports and exports, 2012–2021



Source: U.S. Energy Information Administration, International Energy Statistics database and Global Trade Tracker

Figure 9. Total coal exports from South Africa by region, 2021



Source: Global Trade Tracker

Electricity

Sector organization

- Under the National Energy Regulatory Act of 2004, the Electricity Regulation Act of 2006, and the National Energy Act of 2008, the National Energy Regulator of South Africa (NERSA) is responsible for oversight of the country's electric power sector, namely, the generation, transmission, and distribution segments as well as electricity sales and trade. NERSA has the authority to issue electricity distribution licenses, set electricity tariffs, and develop and enforce regulations for the electric power sector.[40]
- Eskom Holdings SOC Limited (Eskom) is a vertically integrated, state-owned power company, and it owns and operates the national electricity grid and supplies about 90% of the power

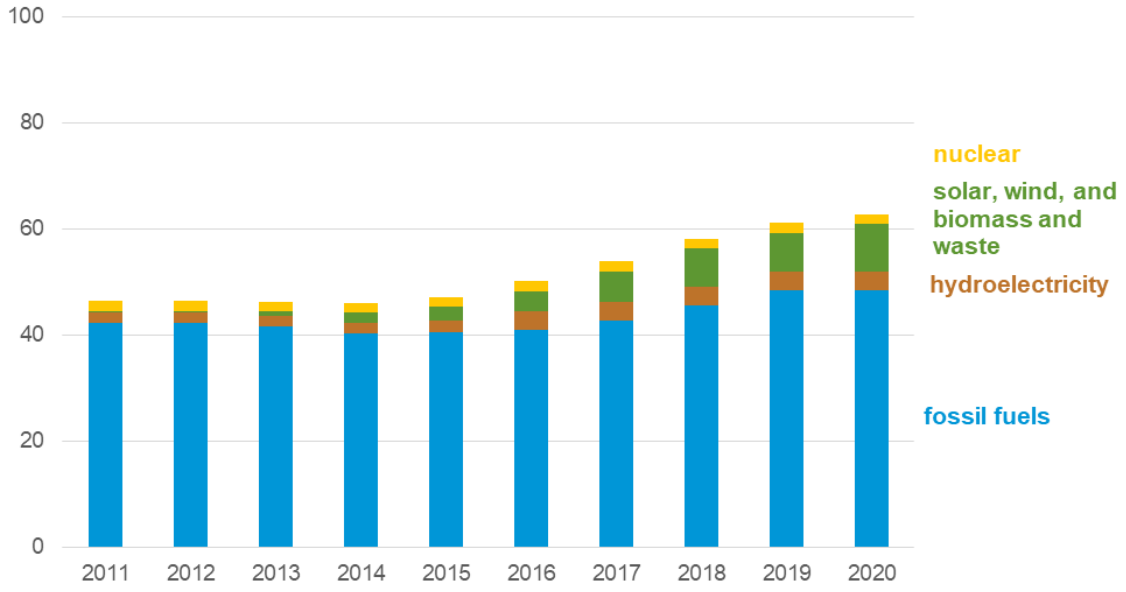
generation in South Africa. Despite Eskom's large presence in the power sector, the share of power supplied by independent power producers (IPPs) is growing. Eskom also exports electricity to neighboring countries Botswana, Eswatini, Lesotho, Mozambique, Namibia, Zambia, and Zimbabwe.[41] South Africa is a member of the Southern African Power Pool (SAPP), which started out in 1995 as the first formal international power pool in Africa. Its mission is to provide reliable and economical electricity supply to consumers in SAPP-member countries through an interconnected electricity grid.[42]

- According to the latest estimates by the World Bank, approximately 84% of the population had access to electricity in South Africa in 2020, which is significantly higher than the sub-Saharan Africa regional average of 48% for the same year.[43] However, South Africa's electric power sector has struggled to provide adequate and reliable power to its end users over the past decade because of aging coal-fired power plants, insufficient investment in power infrastructure, mismanagement of the sector, and frequent bouts of load shedding (scheduled power cuts). The lack of reliable power supply has affected the country's industries and economic growth.[44]
- In November 2021, the Just Energy Transition Partnership (a partnership involving the governments of South Africa, the United Kingdom, the United States, the European Union, France, and Germany) announced that it will provide an initial commitment of $8.5 billion toward financing South Africa's decarbonization efforts. The initial commitment aims to mobilize private-sector financing through various mechanisms such as grants, concessional loans, and other risk-sharing instruments. The partnership aims to support South Africa in reducing its use of coal and reducing its emissions by 1.0–1.5 gigatonnes over the next 20 years.[45]

Power generation and capacity

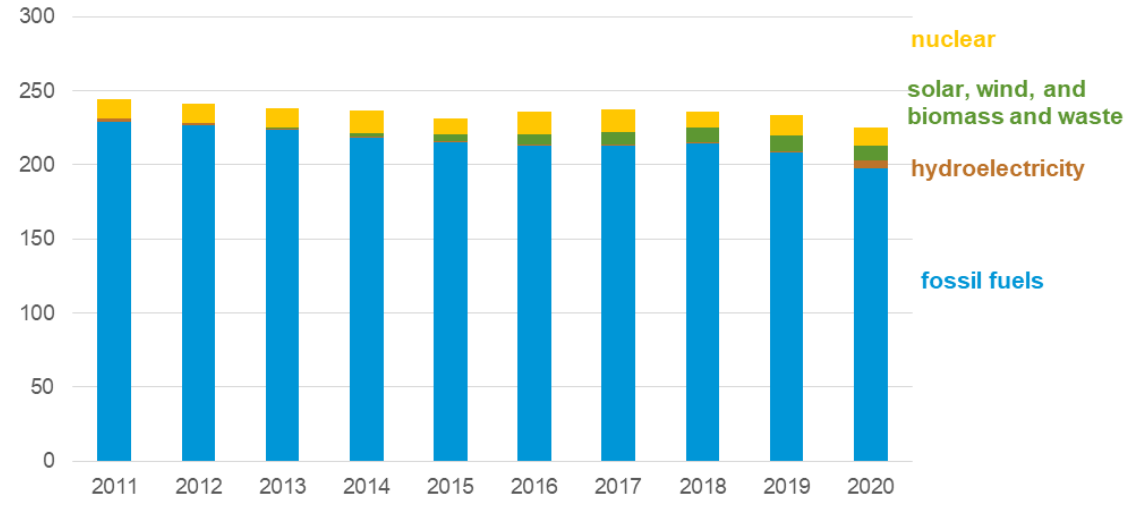
- South Africa had a total installed capacity of 62.7 gigawatts (GW) and generated about 223 gigawatthours (GWh) of electricity in 2020. Fossil fuel-derived generation accounted for approximately 79% of total capacity and approximately 89% of total power generation in South Africa in 2020 (Figures 10 and 11).[46]
- As a result of the country's abundant coal reserves and consistent domestic coal production, South Africa predominately uses coal-fired power generation to meet its electricity generation needs. Eskom has been expanding its coal-fired power capacity to meet growing demand. Eskom completed construction of the 4.8 GW Medupi power plant in 2021, but an explosion in August 2021 delayed the start of commercial operations. A new start date has not yet been announced.[47] The 4.8 GW Kusile power plant began full commercial operations in March 2021, after construction of its third unit was completed and synchronized with the national grid. Once both are fully online, the Medupi and Kusile coal-fired power plants will be two of the largest power plants in the world. These plants highlight the importance of coal in the country's power generation mix, in spite of small but growing competition from natural gas and renewable energy sources.[48]

Figure 10. South Africa's electricity capacity by fuel type, 2011–2020
gigawatts



Source: U.S. Energy Information Administration

Figure 11. South Africa's net electricity generation by fuel type, 2011–2020
gigawatthours



Source: U.S. Energy Information Administration

Nuclear

- South Africa has two nuclear reactors in operation, both located at the Koeberg plant near Cape Town. The Koeberg plant was commissioned in 1984 and is owned and operated by Eskom. The two reactors collectively provide about 1.9 GW of capacity. The government planned to install six new steam generators at the plant to expand its capacity by early 2022, but the expansion work has been delayed, and the project's completion date remains unclear.[49]

Renewable energy

- South Africa derives a marginal amount of its total power capacity and generation from hydropower resources. South Africa is a relatively dry country, but its rivers in the eastern part of the country are used for hydroelectric power generation. Most of South Africa's hydroelectric power generation comes from four plants that generate power by sending water to a dam that, when released, is then used to generate power. [50]
- According to the International Trade Administration, power generation derived from non-hydropower renewable sources has a lot of potential for growth in South Africa because of its renewable energy auction program, the Renewable Energy Independent Power Producer Procurement Program (REIPPPP), which has been successful in attracting private sector investment in renewable energy projects. As of September 2021, the REIPPPP has procured approximately 6.4 GW of renewable energy from 112 independent power producers over seven bidding auction windows. The REIPPPP is also attractive as an alternative source of power generation because South Africa's fossil fuel-fired power plants experience frequent periods of load shedding and so have difficulty providing reliable power supply to its end users. [51]

Notes

- Data presented in the text are the most recent available as of August 2, 2022.
- Data are EIA estimates unless otherwise noted.

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[1] Based on 2020 estimates for country and sub-Saharan Africa regional GDP figures. The World Bank Group, World Bank Open Data, accessed May 26, 2022. U.S. Energy Information Administration. International Energy Statistics database, accessed July 22, 2022.

[2] Lizel Oberholzer, "Oil and gas regulation in South Africa: an overview," *Thomson Reuters Practical Law*, September 1, 2020. Christina Pretorius, "Mining Laws and Regulations South Africa 2022," *International Comparative Legal Guides,* September 13, 2021.

[3] Donna Slater, "New Upstream Petroleum Resources Development Bill lauded for improvements," *Engineering News,* July 12, 2021. "Impact of the Upstream Petroleum Resources Development Bill on SA's oil and gas industry," *Norton Rose Fulbright*, January 2020.

[4] "South Africa Oil & Gas Report: Q1 2022," *Fitch Solutions Country Risk & Industry Research*, December 2021. "About PetroSA," Petro S.A. company website, accessed May 19, 2022. PetroSA Company Factsheet, *Rystad Energy*, May 11, 2022.

[5] BP 2021 Statistical Review of World Energy, accessed April 7, 2022. Eskom, Generation Communication CO 0007 Revision 16, Fact Sheet: Coal in South Africa, August 2021.

[6] *Oil & Gas Journal*, "Worldwide Look At Reserves and Production," [Table], December 2021.

[7] U.S. Energy Information Administration. International Energy Statistics database, accessed July 22, 2022.

[8] "Africa's hidden oil hub near Cape Town booms after making millions for traders," *News24*, May 29, 2018.

[9] "Oil tanking MOGS Saldanha terminal opens in Cape Town, South Africa," *Tank Storage Magazine*, April 20, 2020. "Saldanha Bay II Liquids Storage Terminal, South Africa," *Offshore Technology*, October 27, 2021. "Crude blending and storage terminal, Saldanha, South Africa," *Naue*, accessed May 20, 2022.

[10] Natref profile, *Energy Oil & Gas,* Issue 178, accessed March 4, 2022. Christina Katsouris, "Africa Struggles to Retain, Build Refining Capacity," *Energy Intelligence Group*, March 22, 2022.

[11] Robert Brelsford, "Shell, bp joint venture to idle South African refinery," *Oil & Gas Journal*, February 11, 2022. Christina Katsouris, "Africa Struggles to Retain, Build Refining Capacity," *Energy Intelligence Group*, March 22, 2022.

[12] Wendell Roelf, "South African refinery explosion kills two, injures seven," *Reuters*, July 2, 2020. "Astron Energy Targets 2022 Restart for Cape Town Refinery," *Ship & Bunker*, May 4, 2021. Lisa Steyn, "Glencore to open new and improved Cape Town refinery in 2022," *News24.com,* February 15, 2022. Christina Katsouris, "Africa Struggles to Retain, Build Refining Capacity," *Energy Intelligence Group*, March 22, 2022.
[13] "S. Africa's Engen refinery to be converted into a storage terminal," *Reuters*, April 23, 2021.
[14] "Warning over new petrol and diesel rules for South Africa," *BusinessTech*, September 27, 2021. Tunicia Phillips, "New clean fuel standards could be the end of refineries and lead to job losses," *Mail & Guardian,* September 21, 2021. Paul Burkhardt, "South Africa Sets Rule to Lower Sulfur in Diesel Fuel by 2023," *Extractives Baraza*, September 8, 2021.
[15] Analysis by U.S. Energy Information Administration based on US EIA's International Energy Statistics database and trade data provided by Global Trade Tracker, accessed May 27, 2022.
[16] U.S. Energy Information Administration, International Energy Statistics database, accessed January 27, 2022.
[17] "Brulpadda and Luiperd have potential to spark an energy transformation in South Africa," *Offshore Technology*, January 21, 2021. Megan Rodgers, Amore Carstens, et al., "The Brulpadda and Luiperd gas discoveries: A game changer for South Africa's petroleum offshore exploration," Cliffe Dekker Hofmeyr, February 10, 2021.
[18] "TotalEnergies' Luiperd plans set to fire South Africa's domestic supply," *Rystad Energy*, September 22, 2021. "Shell farm-in off South Africa's signals continued interest in emerging play," *Rystad Energy*, November 6, 2020. "Luiperd wildcat roars for Total in South Africa," *Rystad Energy*, October 29, 2020.
[19] "Asset Factsheet: Brulpadda," *Rystad Energy*, March 10, 2022. "Asset Factsheet: Luiperd (full field)," *Rystad Energy*, March 10, 2022.
[20] U.S. Energy Information Administration, "Technically Recoverable Shale Oil and Gas Resources: South Africa," September 2015. S. Clark, et al., "South African shale gas economics: Analysis of the breakeven shale gas price required to develop the industry," *Journal of Energy in Southern Africa*, Vol. 32, No. 1 February 2021.
[21] "Operations and Refinery," Petro S.A. company website, accessed March 4, 2022.
[22] South Africa Oil & Gas Report: Q1 2022, *Fitch Solutions Country Risk & Industry Research*, December 2021. "Shell and BP mothball South Africa's 180 kb/d Sapref refinery indefinitely," *Facts Global Energy* Flash Alert, February 16, 2022.
[23] Iain Esau, "Focused TotalEnergies pushes on with Luiperd early production project in South Africa," *Upstream Online*, November 10, 2021.
[24] "Overview," ROMPCO company website, accessed March 21, 2022. "Sasol Gas, Mozambique," *Offshore Technology*, October 4, 2021. "Mozambique-South Africa Gas Pipeline," *Global Energy Monitor*, accessed March 22, 2022. James Ross, "Hitting the gas in South Africa," Norton Rose Fulbright, September 2020.
[25] "South African Investors Compete over Mozambican Gas Pipelines," *Egypt Oil & Gas*, March 6, 2016. "Gasnosu North-South Gas Pipeline," *Global Energy Monitor,* accessed March 21, 2022. "Africa Renaissance Pipeline," *Global Energy Monitor*, accessed March 21, 2022. "A $7.98 billion ARP connects Mozambique to the wider region," *Seetao*, January 22, 2021. Charné Hundermark, "The African Renaissance Pipeline Project: Linking Mozambique with the Wider Region," *Energy Capital & Power,* accessed May 20, 2022. Keletso Moilwe, "Top 5 Pipeline Developments in Africa by Length," *Energy Capital & Power*, accessed May 20, 2022. S. Oirere, "African gas pipeline projects compete with coal and LNG power," *Gas Processing News*, accessed May 20, 2022.
[26] Elaine Mills, "South Africa issues RFI for LNG terminal," *Argus Media*, November 8, 2021. Bojan Lepic, "Vopak, ExxonMobil to conduct South Africa LNG feasibility study," *Offshore Energy*, December 17, 2020.
[27] U.S. Energy Information Administration. International Energy Statistics database, accessed March 10, 2022.
[28] "Sasol Mining," Sasol company website, accessed May 24, 2022.
[29] "Coal Resources: an overview," Republic of South Africa, Department of Mineral Resources and Energy website, accessed May 20, 2022.
[30] BP 2021 Statistical Review of World Energy, accessed April 7, 2022.
[31] Republic of South Africa, Department of Mineral Resources, South Africa's Coal Industry Overview 2014, Report R111/2014, pg. 1. L.S. Jeffrey, "Characterization of the coal resources of South Africa," *The Journal of The South African Institute of Mining and Metallurgy*, February 2005, pg. 95.
[32] U.S. Energy Information Administration. International Energy Statistics database, accessed April 7, 2022
[33] Secunda Synfuels Operations Overview," Sasol company website, accessed March 4, 2022. National Energy Technology Laboratory, Commercial Use of Fischer-Tropsch Synthesis, Sasol, accessed May 20, 2022.
[34] "Sasol," *Global Energy Monitor*, accessed June 23, 2022.

[35] South Africa's Coal Industry Overview 2014, Department of Mineral Resources, Republic of South Africa, Report R111/2014.
[36] "FAQ," Richards Bay Coal Terminal company website, accessed May 26, 2022.
[37] "Richards Coal Bay Terminal," *Global Energy Monitor,* accessed May 26, 2022. International Energy Agency, Medium-Term Coal Report 2016, page 113; Creamer Media's Mining Weekly, "Richards Bay Coal Terminal sets new 75.4Mt export record", January 19, 2016.
[38] "RBCT Media Briefing 2021," Richards Bay Coal Terminal company website, accessed May 26, 2022.
[39] Data provided by Global Trade Tracker trade database, accessed May 27, 2022.
[40] Eskom, Integrated Report 2021, pg. 6. Eric le Grange, "Electricity regulation in South Africa: an overview," *Thomson Reuters Practical Law*, January 1, 2019.
[41] Eskom, Integrated Report 2021, pg. 6. "Power Generation Mix," Eskom Fact Sheet, December 2021.
[42] International Trade Administration, "South Africa Commercial Guide – Energy," September 10, 2021. Eskom, Integrated Report 2021, pg. 6. About SAPP, South African Power Pool website, accessed May 13, 2022.
[43] The World Bank Group, World Development Indicators database, accessed May 13, 2022.
[44] "The shocking cost of load shedding to South Africa's Economy," *Business Tech*, November 11, 2021. "MEC Anton Bredell on ESKOM stage 4 load shedding," Republic of South Africa media statement, March 9, 2022. Council for Scientific and Industrial Research, "Load Shedding Statistics," December 1, 2021.
[45] Zachery Skidmore, "COP26: South Africa to receive $8.5bn to end coal use," *Mining Technology*, November 3, 2021. European Commission, "France, Germany, UK, US and EU launch ground-breaking International Just Energy Transition Partnership with South Africa," press release, November 2, 2021.
[46] U.S. Energy Information Administration, International Energy Statistics database, accessed January 27, 2022.
[47] "Medupi Power Project timeline and what you need to know," *Construction Review Online*, January 4, 2022. Nicolette Pombo-van Zyl, "Completion of Medupi coal power station announced by Eskom," *ESI-Africa*, August 2, 2021. "Power Generation Mix," Eskom Fact Sheet, December 2021.
[48] "The Kusile Power Station Project, South Africa," *Power Technology*, accessed May 16, 2022. "Power Generation Mix," "Medupi Power Station," *Global Energy* Monitor, accessed May 16, 2022. Eskom Fact Sheet, December 2021.
[49] World Nuclear Association, "Nuclear Power in South Africa," World Nuclear Association Country Profiles, updated August 2021, accessed on April 8, 2022. Chris Yelland, "Nuclear power station life-extension project running late, even before it starts," *Daily Maverick*, January 9, 2022.
[50] Wilhelm Karanitsch, "South Africa – Enlight the rainbow nation," *Andritz Hydro*, accessed May 5, 2022. "Pumped Storage Hydropower," U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, accessed May 5, 2022. "Region Profile: Africa," International Hydropower Association, accessed May 5, 2022. United Nations Environment Programme , Atlas of Africa Energy Resources, 2017, pg. 270.
[51] International Trade Administration, "South Africa Commercial Guide – Energy," September 10, 2021. "Renewable Independent Power Producer Programme," Republic of South Africa webpage, accessed May 11, 2022. "South Africa's Renewable Energy Independent Power Producer Programme," case study by NDC partnership, accessed May 11, 2022. "South Africa Power Report: Q1 2022," *Fitch Solutions Country Risk & Industry Research*, December 2021. António Ferreira Pinto, "REIPPP: One of the world's best renewable energy tenders, but there's room for improvement," *PV Magazine,* September 30, 2021.