

COAL IN THE AFRICAN ENERGY LANDSCAPE

**A SPECIAL POLICY
REPORT
ON ENERGY**

July
2022

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AFREC is a specialised energy agency of the African Union mandated to develop the African energy sector by coordinating, harmonising, protecting, conserving, developing and promoting rational exploitation, commercialization and integration of energy resources in Africa. Working with African Union member states with a broad network of experts and partners in all the 55 African countries, we ensure all energy initiatives responds to the future development of the African energy sector, in our pursuit to build 'the Africa We Want'.

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Executive Director's Statement

On 17 March 2022 the African Energy Commission (AFREC) hosted a virtual ministerial high-level meeting with the Ministers of Energy from the African Union member states, to present the status of the African Energy Information System (AEIS), planned activities and challenges facing governments in relation to data collection, validation and processing at national and continental level.

In attendance were Ministers from Algeria, Central Africa Republic, Senegal, Burundi, Republic of Congo, Equatorial Guinea, Namibia, Gabon, Cote d'Ivoire, Eswatini and Kenya who all emphasised that member states need to improve and modernise their National Energy information Systems in support of the continental AEIS. To assist achieve this, AFREC is supporting countries in several ways (as set out in the introduction).

The need for all AU member states to develop comprehensive energy data covering all aspects of supply and use of energy is vital if they are going to find the best policy options to meet goals of universal energy access and to play their role in the global energy transition.

One aspect of the transition is to assess the best way to achieve the Glasgow Climate Pact, agreed at CoP26 which called upon nations to phase down unabated coal power.

To assist the development of ideas on this topic, this policy brief, the first of three to be produced in 2022, explores coal resources, production and use in Africa. It draws on data from AFREC's energy data system and shows the role that coal plays in the African energy system.

It identifies the need for policies and programmes to be informed by cross-cutting evidence-based information and stresses the importance of further analysis, collaboration and good practices aimed at addressing challenges facing the development and integration of the natural gas sector in our continent. Similarly, the report aims to enhance understanding on specific fuels, their production processes, trade and use while serving as a framework instrument to policy makers across all African countries.

Mr Rashid Ali Abdallah
Executive Director
African Energy Commission (AFREC)

Acknowledgement

The analysis presented in this report is only possible through the work of energy statisticians in AU Member States and the support given to them to produce comprehensive energy statistics. Robust and comprehensive data are essential to understand any situation and help develop the best policies. Whilst supply data are generally widely available, all countries need to develop more comprehensive data on energy demand.

The report has been produced to help Member States understand coal in the African energy landscape, which may assist them in taking relevant actions. It is a summary report and more detailed analysis will be needed at individual country level, to help this the report uses freely available data and sources to assist country level analysis.

The report uses AFREC's Africa Energy Database as the main source of information for Africa. This reflects the work underway across African countries to enhance their energy data. This work needs to continue under AFREC's African Energy Information System (AEIS) programme and be supported by governments to ensure that all African countries have the data they need to plan and respond to national and international events.

This report has been produced for AFREC by Mr. Duncan Millard, International energy adviser. Contributions were made by Mr. Yagouba Traore, Head of Policy Strategy and Support at AFREC and Mr Abdoulaye Oueddo, Senior Policy Officer at AFREC. Additional reviews were undertaken by Ms Ndahafa Nakwafila, Communication and Information Specialist at AFREC, Ms. Anne Kenamile Leipego, Principal Energy Officer (Statistics), Department of Energy, Ministry of Mineral Resource, Green Technology and Energy Security Botswana and Ms. Salomé Maússe,

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We share our sincere thanks to the statisticians who are working with AFREC in all AU Member States, to produce the energy data relevant for this report, and colleagues across African institutions for their comments.

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Executive Summary

Africa plays a quite a small role in the world of global coal, accounting for around 5% of production and trade. However, in Africa coal is relatively more important: it represents around 10% of total energy supply and close to a third of electricity generated is produced from coal.

The higher use of coal for power generation is important given the commitment made at CoP 26 to phase down unabated coal.

Coal is used to some extent by just over a third (20) African countries, but its use in South Africa that dominates the picture. South Africa accounts for close to 90% of production, exports and final consumption of coal in Africa and around 90% of its electricity generation is from coal. As such, as and

when African countries take action in response to CoP 26, South Africa has a role to lead the way for Africa.

As shown in this report, coal use across Africa has been broadly stable this century. Indeed, countries who use coal have all embarked on programmes to produce electricity via solar PV while close to half is from wind. In both cases, Morocco and South Africa are leading the way in output terms.

Africa faces different challenges compared to other continents and virtually, all nations are working on programmes to provide universal electricity access and improved cooking facilities and fuels. These are vital initiatives as their success will improve the lives and health of millions of people. Developments in producing power from coal

are leading to more electricity being available, as the case study on Zambia shows. The task ahead for policy makers in Africa is therefore complex, as they strive to balance the need for power with adherence to global commitments and the challenge of encouraging investment to further develop the universal fuel in Africa, renewables.

This report aims to kick start that process by setting out how coal is produced and used, some of the developments happening in countries and some ideas for the future.

The type of analysis presented in this report is only possible through the work of energy statisticians in AU member states and the support given to them to produce comprehensive energy statistics. Robust and comprehensive

data are essential to understand the situation and help develop the best policies. Whilst supply data are generally widely available, all countries need to develop more comprehensive data on energy demand.

Introduction

This report is the first in a series of three reports that will be produced in 2022 to shed light on energy situation of Africa, using data collected by AFREC from AU Member States. The reports aim to enhance understanding on specific fuels, their production processes, trade and use while serving as a framework instrument to policy makers across all African countries.

The report focuses on coal, and is written in the context of agreements made at CoP26 on phasing down unabated coal use for power generation. It starts with an overview of African coal in the global context, before exploring in Sections 2 and 3 the development and change in coal production, trade, transformation and consumption across African countries. Section 4 explores coal reserves and a case study on Zambia is presented

AFREC'S ENERGY STATISTICS

In line with its mandate, AFREC has established and maintained the African Energy Information System (AEIS) since 2012, which allows collection and validation of African country energy statistics through the use of questionnaires. AFREC disseminates these statistics data through publications and datasets, which are available on AFREC website & visualization Dashboard at www.au-afrec.org.

In 2019, AFREC assessed the current AEIS and came up with a holistic improvement plan which attempted to address all the identified challenges. These include: the information technology infrastructure requirements, procedural mechanisms,

in Section 5. The final section sets out some policy considerations, all based on evidence produced.

The report is largely based on AFREC's data provided by AU member states countries, and is made available to all for free in the AEIS, which currently covers the period from 2000 to 2018, along with data for 13 countries for 2019. Additional data are drawn from various sources to provide a global perspective.

Though there are some inconsistencies and gaps in the data, Africa's energy data is still developing, and with the support of AFREC, improvement in quality and reliability can be observed. Therefore, it is only through positive, productive use of data and support provided to statisticians that energy statistics can help improve to create effective policies.

information flow processing, human capacity, technology architecture, programming and equipment, required funding, enhancement and expansion of the energy data collection into more sectors and indicators, thus making the AEIS a more integrated and comprehensive system.

In 2020 with support from the African Development Bank (AfDB), the AEIS was revamped to be fully aligned with international standards and best practices in order to guide the African energy sector transformation, investment and decision making. The work included:

- Improving existing questionnaires and developing new ones with a focus on

energy efficiency for all sectors, energy prices and taxes, CO2 emission, SDG7 tracking, Power Plants installed capacity amongst others.

- Improving data collection submission mechanism by adopting online data collection system.
- Developing a data visualization tool for data dissemination and reporting system.
- Capacity building for Member States through regional and national workshops, including training of 40 selected NFPs as trainers of other NFP's in the countries and the region.

In 2021, the new AEIS came into operation, enabling data submission through online data collection system and operating the visualization tool.

The new AEIS will enhance the quality of the energy data collected by AFREC and increase the coverage scope of AEIS, to include more energy indicators (CO2

emission, SDG tracking, data visualisation tools etc.), ensuring AFREC becomes the main source and central hub for quality, credible and reliable energy statistics for Africa.

However, these developments will take time to result in comprehensive data being available within all African countries. As such and also as a result of challenges presented by the impact of COVID-19, to process data collection, validation and dissemination at National level, in 2021 AFREC validated Energy Balance from only 13 African countries. Therefore, the data used in this report, whilst providing a very comprehensive overview of coal in Africa often only goes up to 2018. As and when all countries are able to provide complete and timely data, the information available to inform policy and understand energy use in Africa will increase.

AFRICA IN THE GLOBAL COAL WORLD

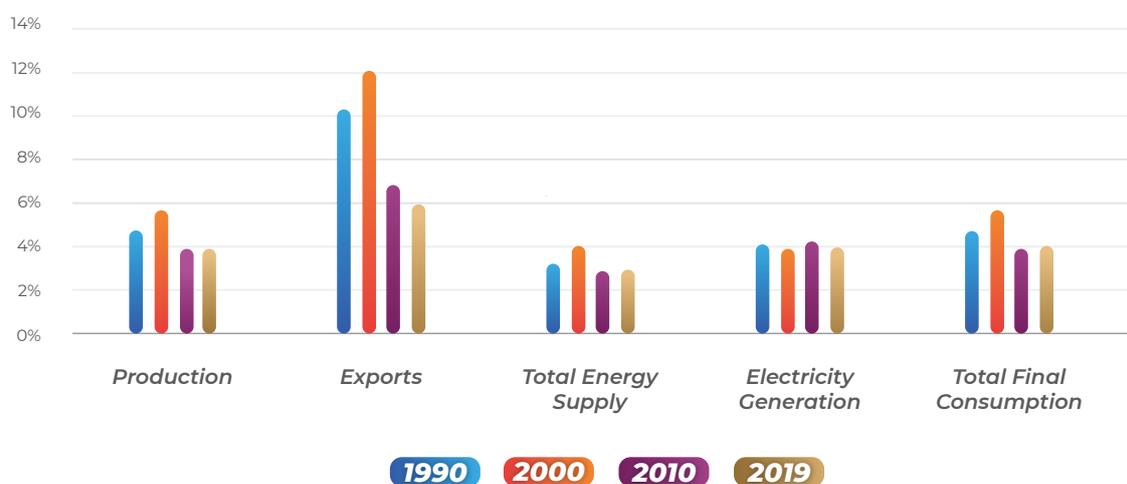
1

SECTION

Africa plays a relatively small role in the global production and consumption of coal, as shown by chart 1.1 below. Africa produces about 4% of global coal and its share of the world total of total energy supply and final consumption are

of a similar size. However, the continent has a slightly bigger share of the global picture with exports accounting for 6% of global exports in 2019, around half the share seen in 2000.

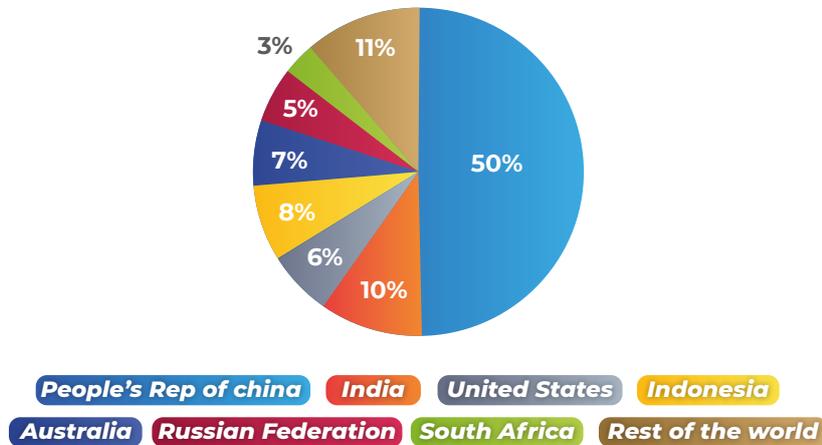
CHART 1.1 AFRICA'S PERCENTAGE SHARE OF WORLD COAL



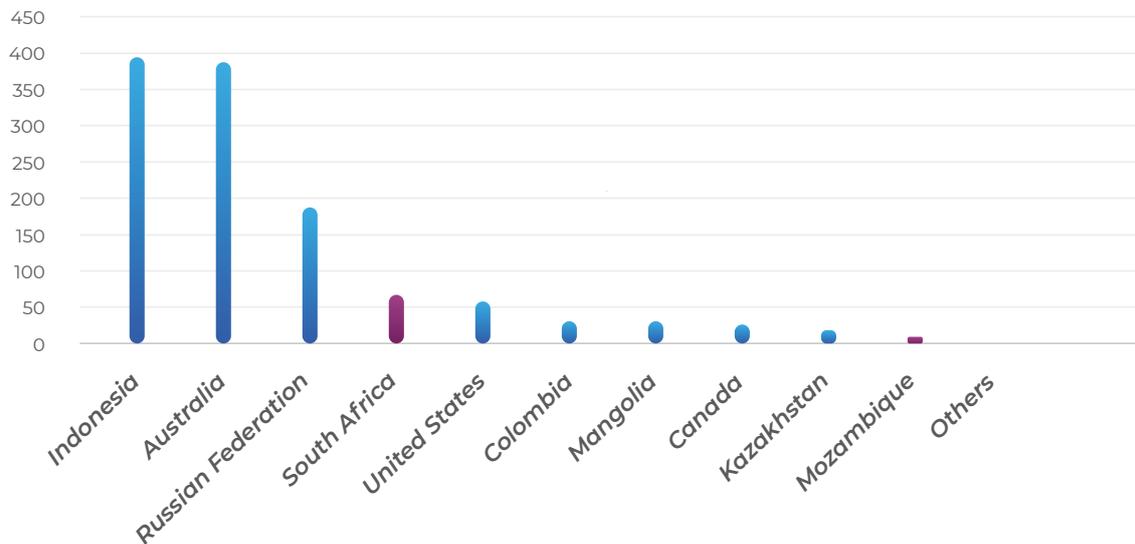
Source: IEA World energy balances, <https://www.iea.org/data-and-statistics/data-tables/>

Globally, coal production and trade are dominated by a relatively small number of countries. In 2020 China produced half the world's coal (chart 1.2) and was also the largest coal importer at around

a quarter of all coal imports. Exports are also quite concentrated with Indonesia and Australia combined accounting for nearly two-thirds of global coal exports in 2020 (chart 1.3).

CHART 1.2 SHARE OF GLOBAL COAL PRODUCTION 2020

Source: IEA, KWES 2021

CHART 1.3 COAL NET EXPORTERS, 2020, MILLION TONNES

Source: IEA, KWES 2021

Charts 1.2 and 1.3 also highlight a specific feature of coal in Africa, which is the significance of South Africa. South Africa is the only African country within the top ten coal producers (the tenth largest) and

was until very recently the only significant exporter of coal from Africa, however, that changed recently with growing exports from Mozambique (around 0.5% of global exports).

COAL IN AFRICA

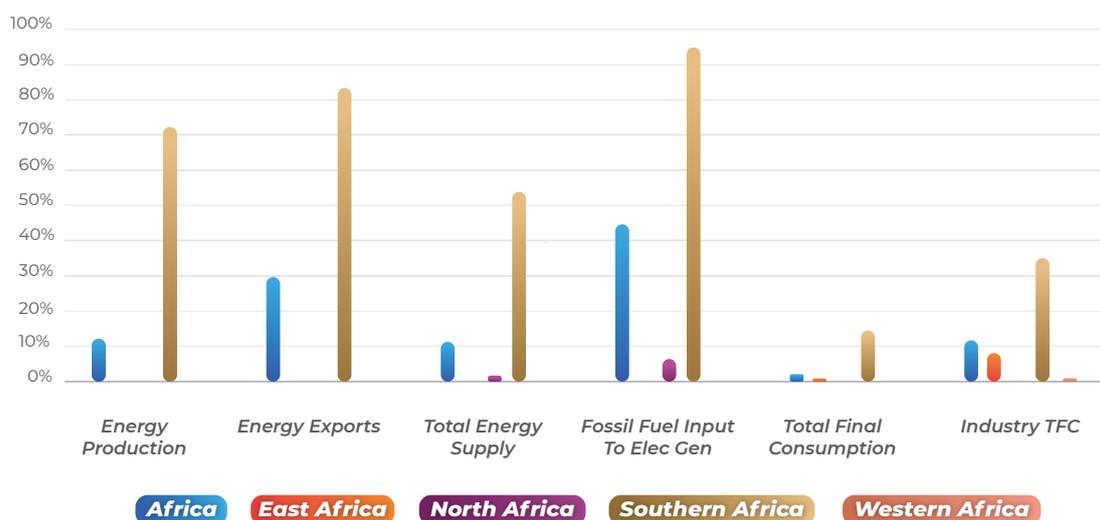
Across Africa coal accounted for just over 10% of energy production, exports, total energy supply (the fuel that is available for use) and final energy use by industry (chart 1.4). Coal's share of final consumption is much lower, just over 2%, which reflects the significant use of biomass, but coal has a much higher share of fossil fuels used to generate electricity, 44%. This is mainly due to the significant share of all Africa electricity that is produced by South Africa (around 30% of the total) and its use of coal for power generation.

Across the regions of Africa coal production and use is significant in Southern Africa, again this reflects the impact of South Africa, but coal is also produced and used

in many other countries across the region. In Southern Africa, coal accounts for 70% of energy production, 83% of exports, 53% of energy supply and 94% of the fossil fuels used to generate electricity. It is only final consumption that Southern Africa is closer to the rest of Africa with coal accounting for just over 20% of final consumption in the South compared to, as noted, just over 10% across Africa.

The role and significance of South Africa in Africa's coal production trade and use of coal is explored more in the next two sections.

CHART 1.4 COAL'S PERCENTAGE SHARE OF KEY ENERGY FLOWS IN AFRICA



Source: AFREC, African energy balance 2017

COAL PRODUCTION AND TRADE IN AFRICA

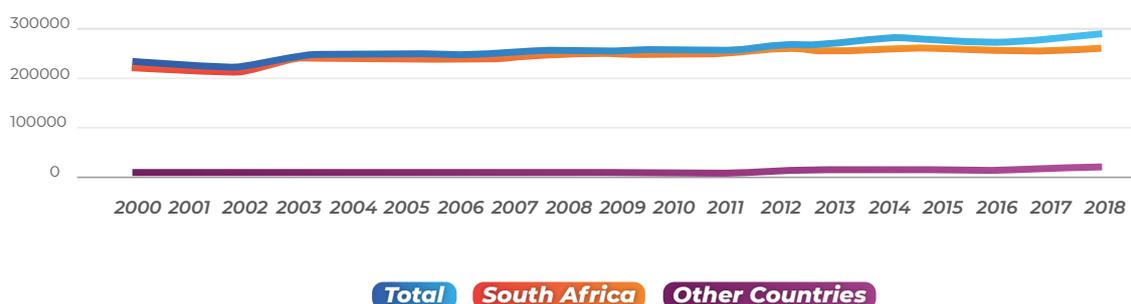
2

SECTION

AFRICAN COAL PRODUCTION

Between 2003 and 2011 coal production in Africa was quite stable at around 250 million tonnes per year, and almost all that coal, 98%, was produced by South Africa with 1% by Zimbabwe (chart 2.1).

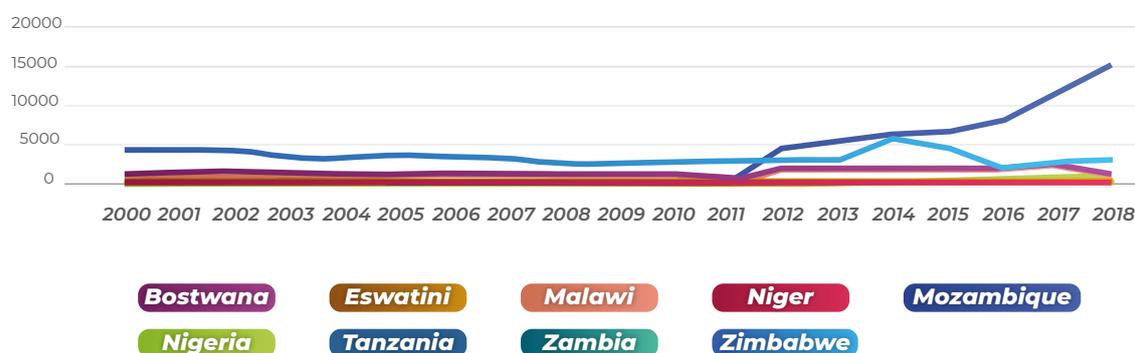
CHART 2.1 AFRICAN COAL PRODUCTION, THOUSAND TONNES



Source : AFREC

Since 2011 the situation has changed to a small extent with the emergence of other coal producers, notably Mozambique. Its production has increased from 0.6 million tonnes in 2011, overtook Zimbabwe in 2012 and has since increased to 15 million tonnes in 2018 (chart 2.2).

CHART 2.2 AFRICAN COAL PRODUCTION OUTSIDE SOUTH AFRICA, THOUSAND TONNES



Source : AFREC

Zimbabwe's production reached a peak of 5.8 million tonnes in 2014, before falling to around 3 million tonnes in 2018. Botswana saw some small growth to a high point of 2.2 million tonnes in 2017 before

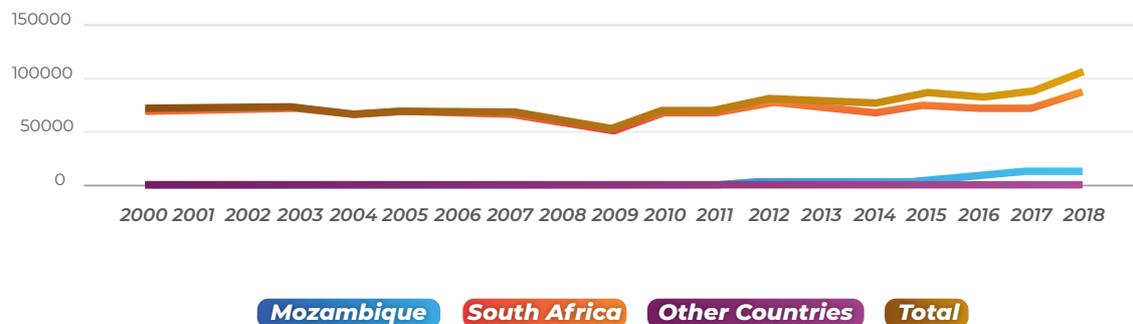
falling to 1.4 million tonnes in 2018. Coal production in Zambia has risen recently, surpassing 1 million tonnes for the first time in 2018.

AFRICAN COAL EXPORTS

Between 2000 and 2007 Africa exported around 70 million tonnes of coal a year. In 2008 and 2009 exports fell sharply to under 60 million tonnes before rising again to just under 70 million tonnes in 2011. Essentially, all these exports were from South Africa (chart 2.3). In 2012 Mozambique entered the export market, exporting 3.6 million tonnes and as exports from South Africa also grew it took total African coal exports to a new high at the time of just under 80 million tonnes. Sub-

sequently, continued export growth from Mozambique kept exports between 75 and 80 million tonnes per year. 2017 saw significant export growth from Mozambique from 7.9 million tonnes in 2016 to 12.7 million tonnes in 2017 which took total exports to 84 million tonnes. An increase from South Africa from 70 million tonnes in 2017 to 87 million tonnes in 2018 saw total African coal exports in that year exceed 100 million tonnes for the first time.

CHART 2.3 AFRICAN COAL EXPORTS, THOUSAND TONNES



Source : AFREC

Chart 2.4 shows the growing importance of Mozambique as a coal exporter in Africa. Exports from Mozambique accounted for 0.2% of total African exports in 2011, but rose steadily to 15% in 2017 and 13%

in 2018. In 2018, the other six African coal exporters accounted for a total of 0.6% of exports, amounting to 600,000 tonnes, between them.

CHART 2.4 PERCENTAGE SHARE OF AFRICAN COAL EXPORTS

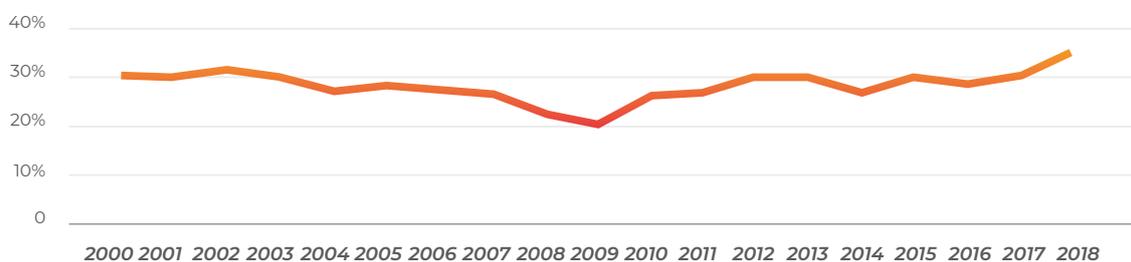


Source : AFREC

In general, Africa exports around 30% of the coal it produces (chart 2.5) but with variation year on year. From 30% of production in 2000, exports fell reaching 20% of production in 2009, before grow-

ing again, as the global economy grew back to 30% by 2012. Exports remained constant at this level before rising to 35% of production in 2018 on the back of record exports from South Africa.

CHART 2.5 AFRICAN COAL EXPORTS AS A PERCENTAGE OF PRODUCTION



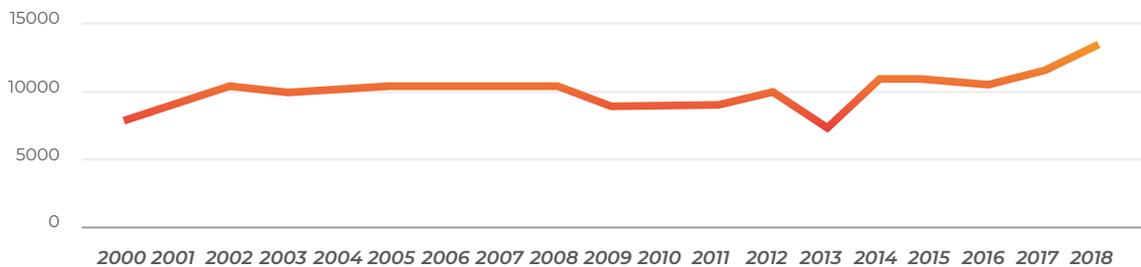
Source : AFREC

AFRICAN COAL IMPORTS

As indicated above, the majority (around 70%) of coal produced in Africa is used in Africa. In addition, a relatively small amount of coal is imported¹. Africa's coal imports reached 10 million tonnes in 2002 and stayed around that level until 2008, when they fell as South Africa reduced

its coal imports to just under 8 million tonnes in 2013. Since 2013 imports have risen again, largely due to increased imports by Morocco and Mauritius, where coal is used for electricity generation as set out in Section 3.

CHART 2.6 AFRICA'S COAL IMPORTS, THOUSAND TONNES



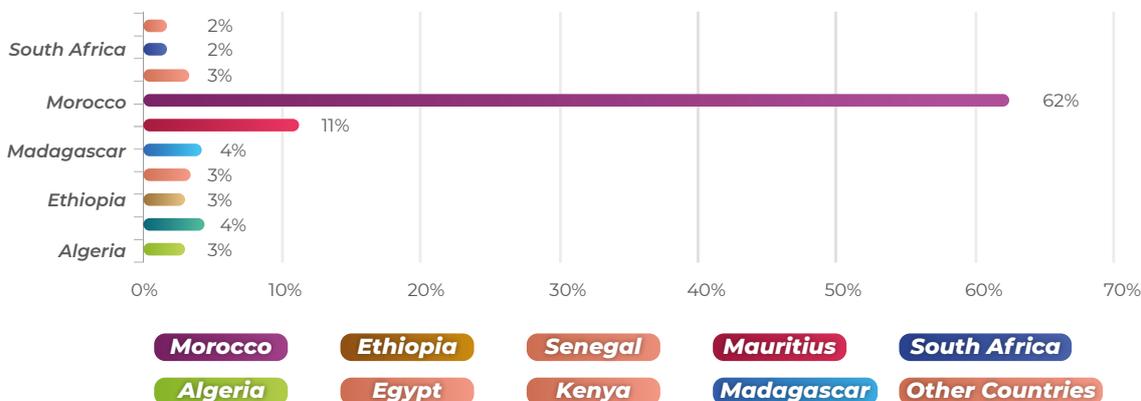
Source : AFREC

In 2018 Morocco imported 62% of Africa's total coal imports (8.5 million tonnes) followed by Mauritius (1.5 million tonnes) at 11% (chart 2.7). In total 15 African

countries import coal, but in all 13 countries other than Morocco and Mauritius, individual country's imports are lower than 0.6 million tonnes per year.

¹ Some of the imported coal is produced in Africa, but detailed data on imports by source is still being developed in many countries.

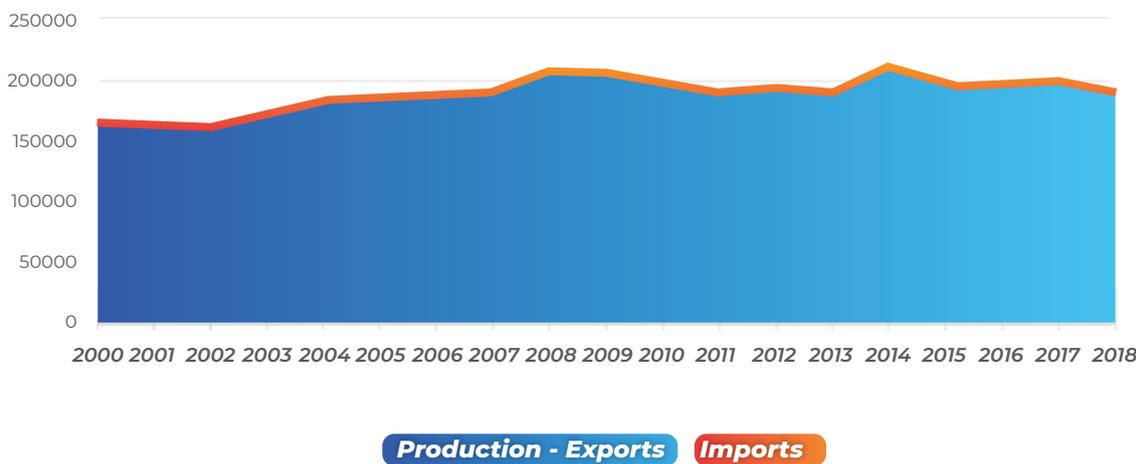
CHART 2.7 PERCENTAGE SHARE OF AFRICA'S COAL IMPORTS



Source : AFREC

Overall, as chart 2.8 illustrates, imports accounted for around 7% of the total supply of coal used in Africa in 2018, up from 5% for most of the preceding period. However, the majority of coal used in Africa is coal produced in Africa.

CHART 2.8 AFRICA COAL SUPPLY, THOUSAND TONNES



Source : AFREC

AFRICA'S USE OF COAL

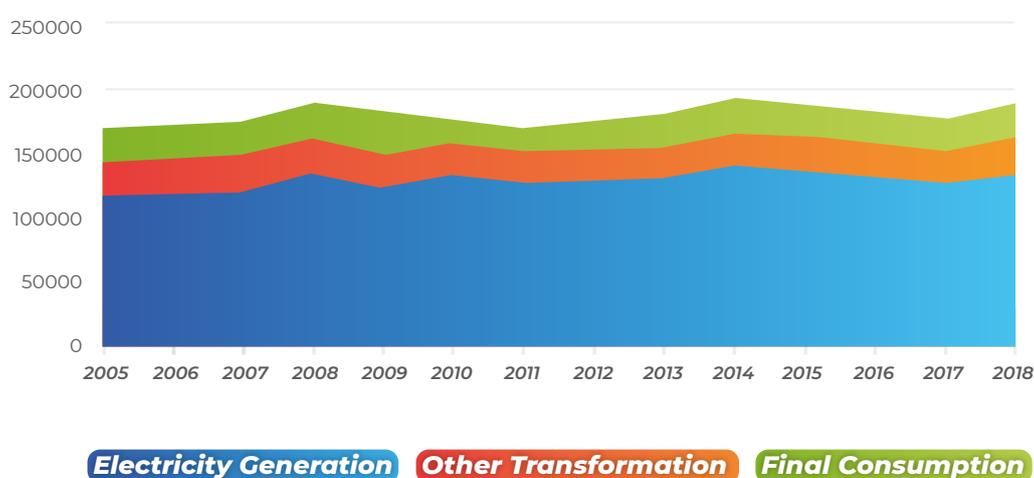
3

SECTION

Across Africa coal is used in three main ways: to generate electricity; for other transformation purposes (such as liquid-fraction and in blast furnaces); and by final consumers who burn the coal to extract heat for a variety of purposes.

Of the three, it is coal use to generate electricity is the most dominant of the three (chart 3.1), it accounts for around 70% of the use of coal compared to around 15% each for the two other use categories.

CHART 3.1 USE OF COAL IN AFRICA, THOUSAND TONNES

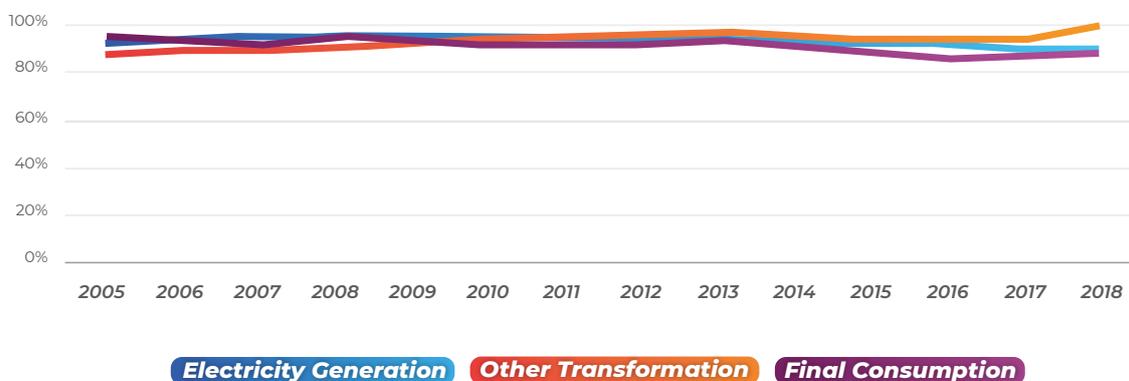


Source : AFREC

As with the supply side, South Africa dominates the use of coal in Africa. It is

responsible for close to 90% of the use of coal in all three categories (chart 3.2).

CHART 3.2 SOUTH AFRICA'S SHARE OF THE USE OF COAL IN AFRICA

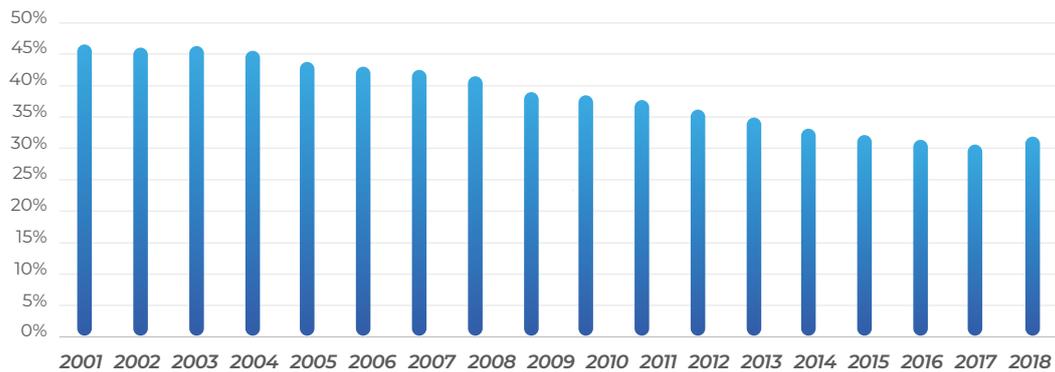


Source : AFREC

COAL AS A FUEL FOR ELECTRICITY GENERATION

Across the whole of Africa coal fired generation accounts for just over 30% (around 270TWh) of all generation. This amount has fallen steadily this century as shown by chart 3.3.

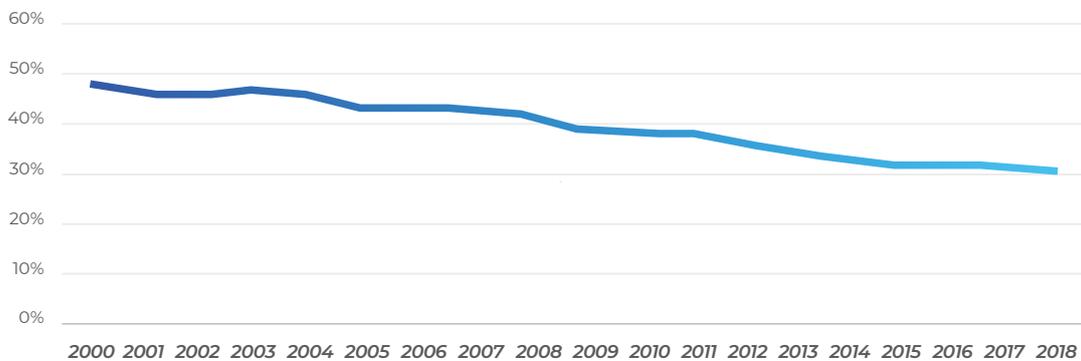
CHART 3.3 COAL'S SHARE OF ELECTRICITY GENERATION IN AFRICA



Source : AFREC

As with all other dimensions of coal in Africa, the importance of South Africa is crucial in understanding the situation. Chart 3.4 below shows South Africa's proportion of all electricity generated in Africa. Due to the increase in electricity generation across Africa and the stable situation in South Africa, its share has fallen from close to 50% in 2000, however, South Africa still accounts for around 30% of all electricity generated in Africa.

CHART 3.4 SOUTH AFRICA'S SHARE OF TOTAL ELECTRICITY GENERATION IN AFRICA

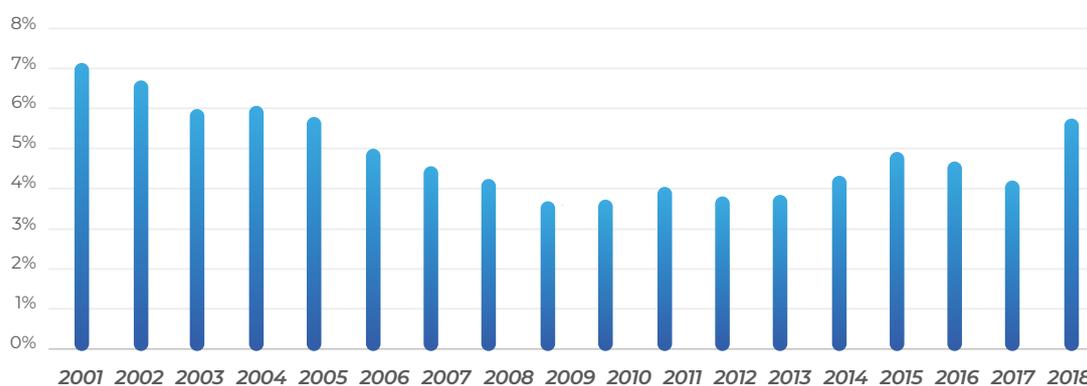


Source : AFREC

Coal accounts for nearly 90% of all electricity produced in South Africa. As such, looking at African countries excluding South Africa produces a very different picture of the importance of coal in power

generation. This is shown in chart 3.5 and indicates that without South Africa coal accounts for between 5 – 7% of power generation.

CHART 3.5 COAL'S SHARE OF ELECTRICITY GENERATION IN AFRICA EXCLUDING SOUTH AFRICA

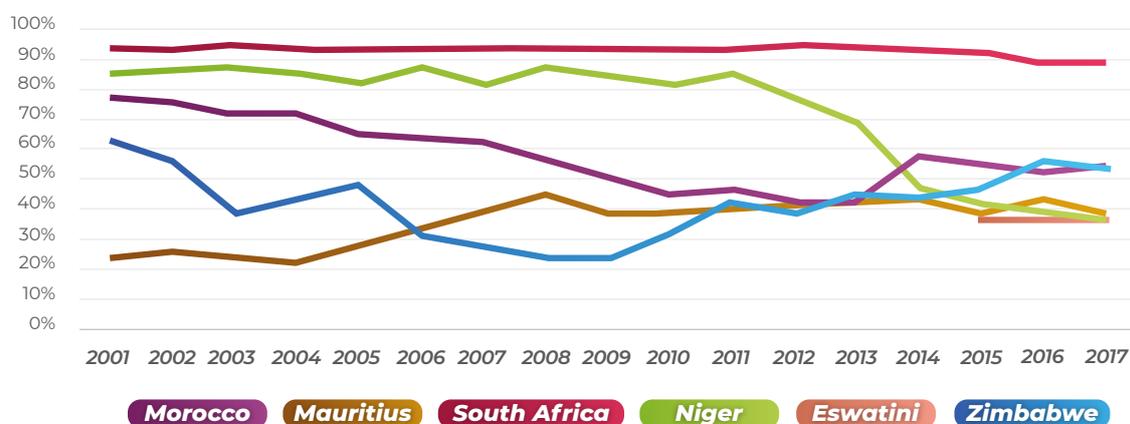


Source : AFREC

South Africa is not alone in having a high proportion of electricity generated from coal, as chart 3.6 shows. But it has the highest rate and one that has stayed fairly constant at around 90% of generation for

the past two decades. Elsewhere, there has been a fall in coal's share of electricity generation in Morocco and Niger, a fall and then an increase in Zimbabwe and a general increase in Mauritius.

CHART 3.6 COAL'S SHARE OF ELECTRICITY GENERATION IN SELECTED AFRICA COUNTRIES

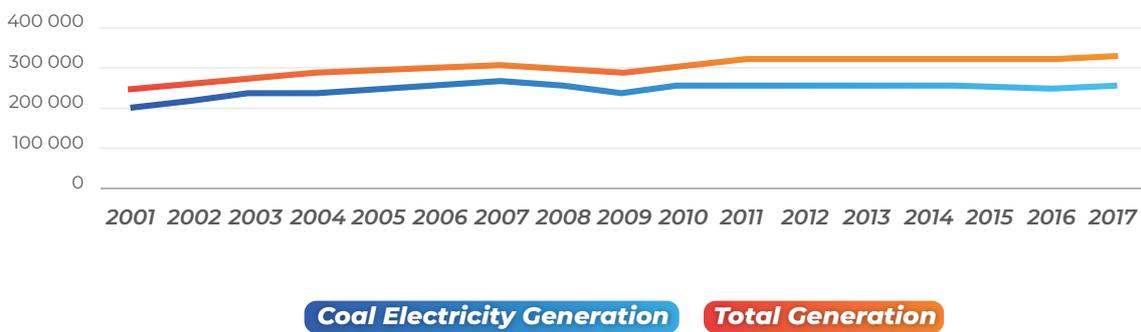


Source : AFREC

As a result of the changes shown above and in other countries, in countries that use coal to generate electricity, there has been a greater increase in the use of other sources for electricity generation than coal. Generation from other sources

has grown at a faster rate (10% between 2009 and 2017), than coal generation (4% between 2009 and 2017) (chart 3.7), largely through the stability of generation from coal in South Africa.

CHART 3.7 TOTAL ELECTRICITY GENERATION AND ELECTRICITY GENERATED FROM COAL IN AFRICAN COUNTRIES USING COAL GENERATION, GWH

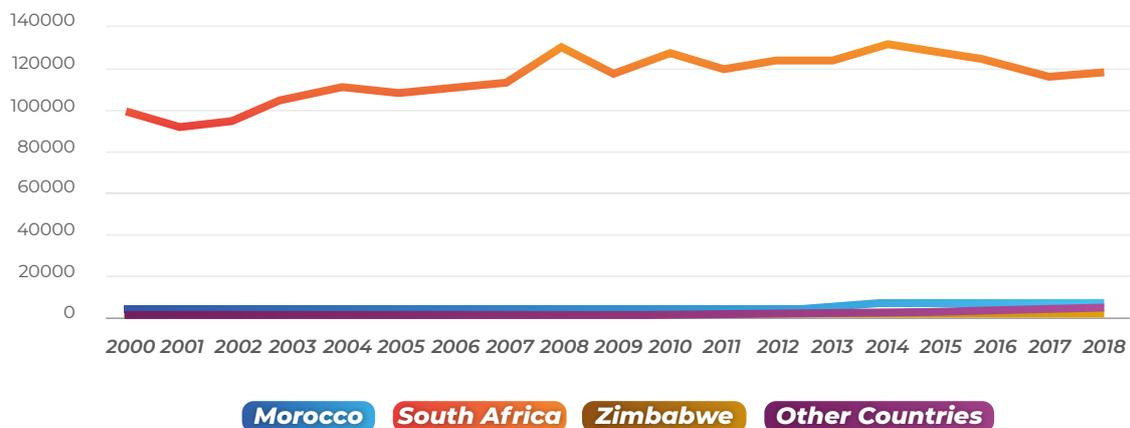


Source : AFREC

Around 130 million tonnes a year of coal are used to generate electricity in Africa. As would be expected, the majority of which is consumed by South Africa amounting to roughly 120 million tonnes

(around 90% of the total). The next two largest consumers are Morocco (around 7million tonnes, 5%) and Zimbabwe (2.5 million tonnes, 2%).

CHART 3.8 COAL CONSUMED FOR ELECTRICITY GENERATION, THOUSAND TONNES

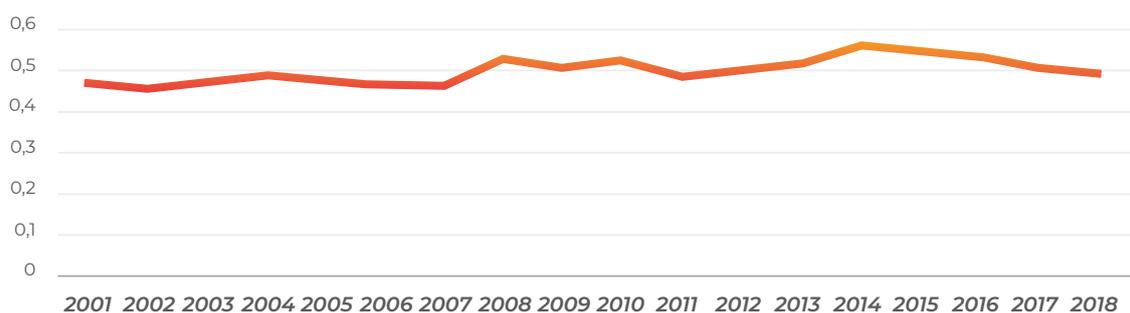


Source : AFREC

Conversion efficiency, the amount of coal needed to produce a GWh of electricity has generally been around 500 tonnes/GWh over the past 20 years (chart 3.9). However, as the chart indicates, there is

some evidence of a small decrease in the efficiency, with in most recent years, slightly more coal has been used to generate each GWh.

CHART 3.9 COAL CONSUMPTION PER GWH OF ELECTRICITY GENERATED IN AFRICA, KT/GWH

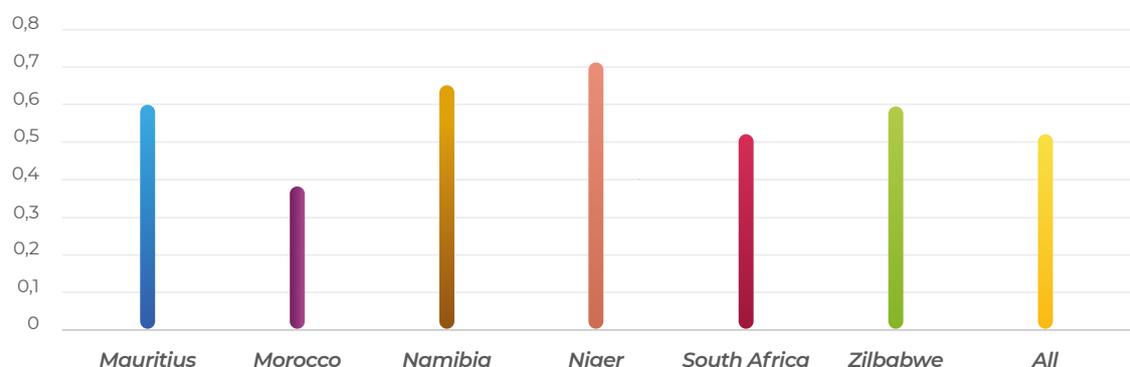


Source : AFREC

Conversion rates by country can vary for a number of reasons, as such it is perhaps better to look at average rates. Chart 3.10 shows the average amount of coal used to generate each GWh of electricity by the largest electricity producers in Africa.

Naturally the figure for South Africa is very much in line with the overall values shown in chart 3.9. But the range goes from just under 400 tonnes per GWh in Morocco to over 600 in Namibia and Niger.

CHART 3.10 COAL CONSUMPTION PER GWH OF ELECTRICITY GENERATED IN SELECTED COUNTRIES, KT/GWH



Source : AFREC

COAL USE IN OTHER TRANSFORMATION

Coal can be used for a number of other processes considered transformation in the context of an energy balance, for example liquid fraction where liquid fuels are made from it to its use in blast furnaces. Historically, data on other transformation uses of coal has not been routinely provided, and hopefully will be improved with time. Therefore, for now information on the precise use, the outputs and

their efficiencies cannot be properly determined.

As chart 3.1 showed, around 25–30 million tonnes of coal are used for transformation, other than for power production, the majority (95%) of which is by South Africa, with limited use in Zimbabwe, Algeria and Egypt.

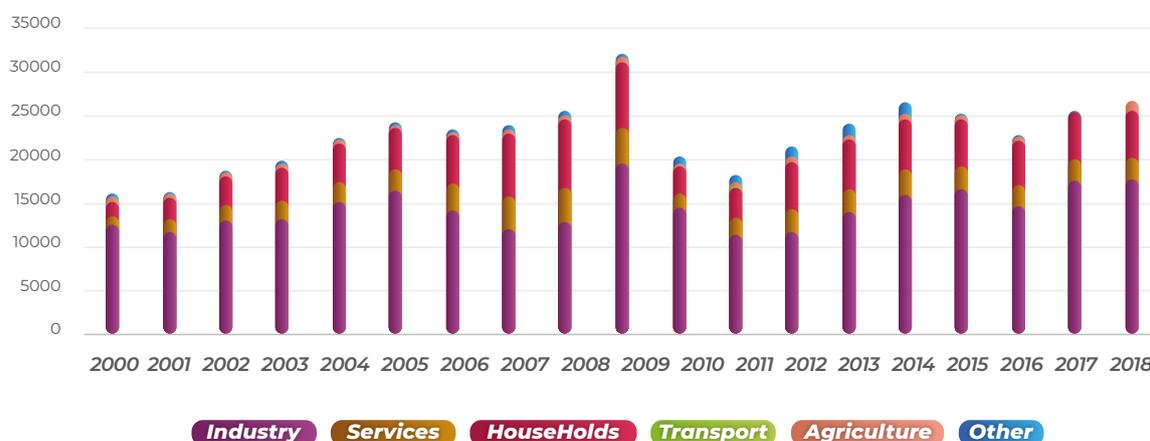
FINAL CONSUMPTION OF COAL

Coal is used in all sectors across Africa, but as illustrated by the charts below, it is the industrial sector that is the main user of coal. In 2000 the industry sector consumed 12.6 million tonnes of coal, representing 79% of all final consumption of coal. The next five years saw a steady rise in coal use by industry to reach 16.4 million tonnes in 2005, but with increased use in other sectors, notably the household sector, industry's share fell to 68% with households share growing from 10% to 20% (4.9 million tonnes consumed). The next three years saw a decline in industrial coal use and a continued growth in household use, in

2009 (with lower exports) industrial use rose to a new high of 19.8 million tonnes and households 7.5 million tonnes.

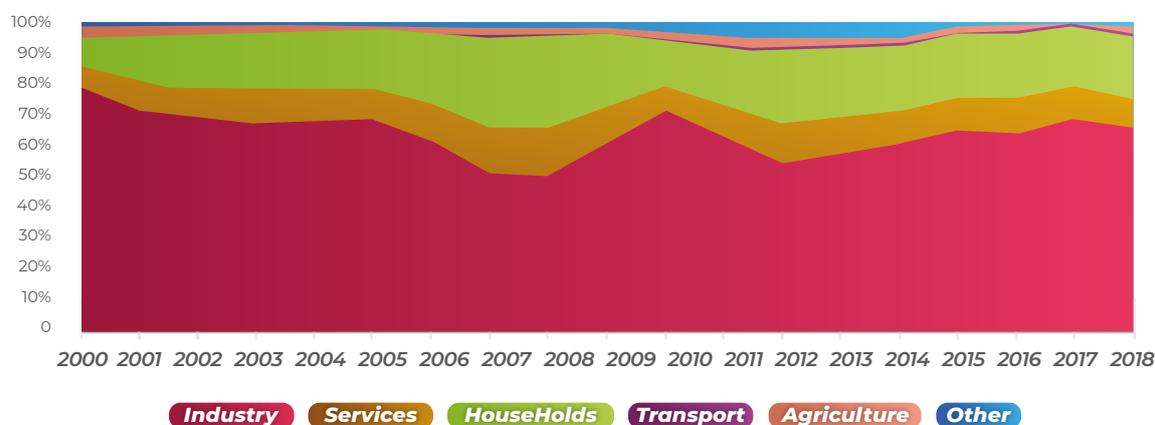
After a sharp decline in 2010 a more stable position has emerged in recent years with the industrial sector consuming between 16 and 17 million tonnes a year, households consuming around 5 million tonnes and the services sector consuming 2.5 million tonnes, around two-thirds, a fifth and a tenth of total consumption respectively.

CHART 3.11 FINAL CONSUMPTION OF COAL BY SECTOR IN AFRICA, THOUSAND TONNES



Source : AFREC

CHART 3.12 PERCENTAGE SHARE OF FINAL CONSUMPTION OF COAL BY SECTOR IN AFRICA

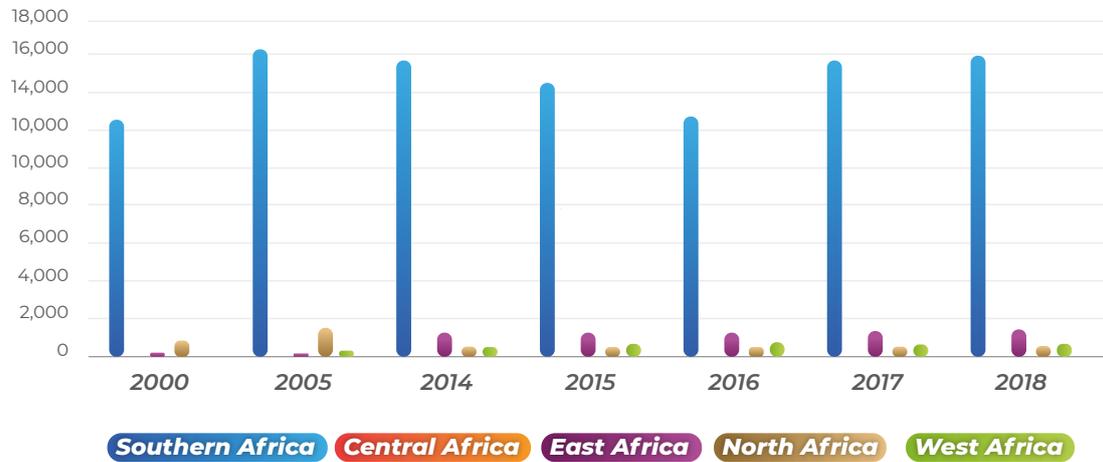


Source : AFREC

Southern Africa is the primary coal user across Africa, mainly because of high coal use in South Africa. The region consumes 90 per cent of coal used by industry in Africa in 2018, and 83 per cent of that is

used by South Africa (14.7 million tonnes of the 16 million consumed in the region), as such coal use in South Africa reflects the position shown in chart 3.13 for Southern Africa.

CHART 3.13 INDUSTRIAL COAL USE BY AFRICAN REGION, THOUSAND TONNES

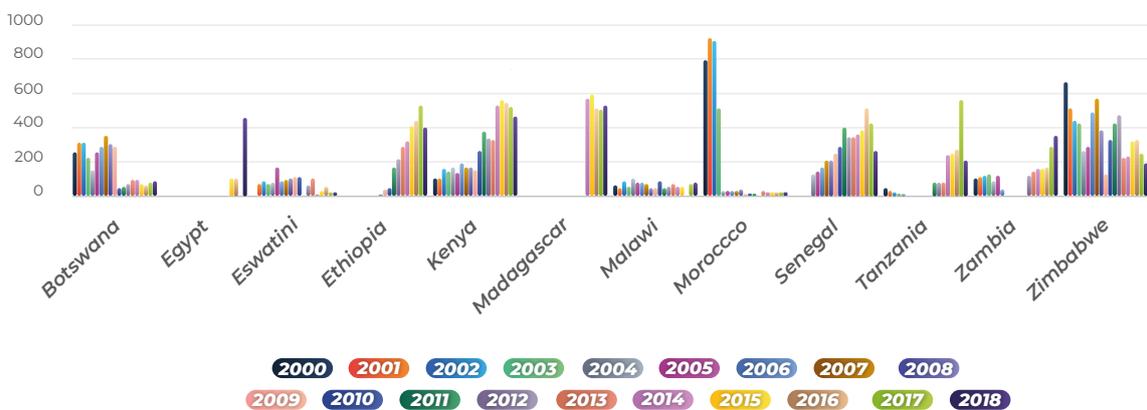


Source : AFREC

Beyond South Africa, industrial use of coal mainly occurs in 16 countries with 12 countries who have or do consume more than 50,000 tonnes a year as shown in chart 3.14. Consumption in these countries has taken different trends since 2000. Morocco and Botswana have seen sharp declines, whilst consumption has

also fallen in Zimbabwe in a more gradual way. Industrial coal use has increased in Kenya, Ethiopia, Tanzania and Zambia and these countries, along with Madagascar, report use of around 400 to 500 thousand tonnes a year, where 500 tonnes represent around 3% of industry use of coal.

CHART 3.14 INDUSTRIAL SECTOR COAL USE IN AFRICA, OUTSIDE SOUTH AFRICA, THOUSAND TONNES



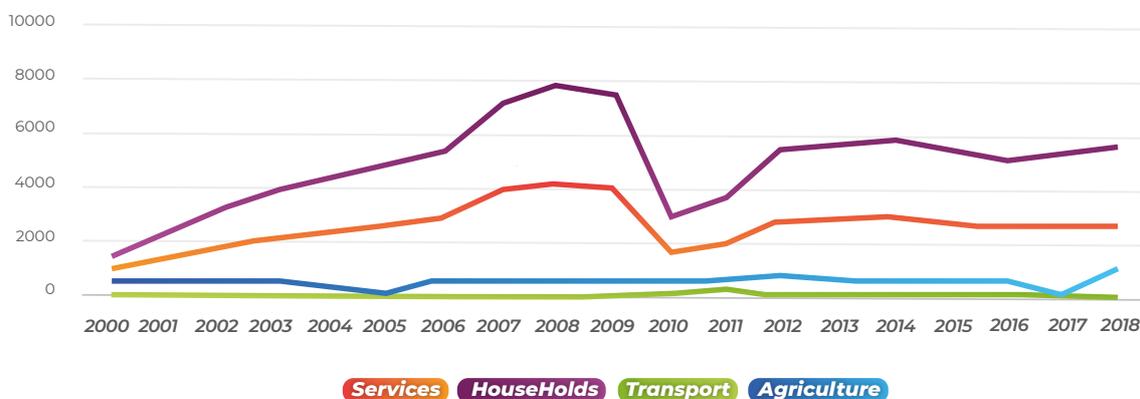
Source : AFREC

Note : Coal use has been reported in Algeria and Benin, but for specific years only. Industrial coal use is reported for Mozambique and Nigeria, but less than 50,000.

Outside the industrial sector it is essentially only South Africa that is reporting use in the Services and Household sectors. In both sectors, the reported trend is one of growth in the first decade of this century, then a large fall before much smaller growth in the second decade.

Botswana and Zimbabwe record small use, less than 8,000 tonnes each a year in agriculture, around 5% of the South Africa value, whilst it is Zimbabwe who now alone reports coal use for transport amounting to 7,000 tonnes in 2018.

CHART 3.15 COAL CONSUMPTION IN OTHER SECTORS, THOUSAND TONNES



Source : AFREC

COAL RESERVES

4 SECTION

Global coal reserves are estimated to be 1,074 thousand million tonnes, sufficient to last nearly 140 years at the current rate of production. Of the total reserves, 1.4% are held in Africa, with the largest producer, South Africa, having the lowest reserve to production (R/P) ratio of 39.8 (chart 4.1).

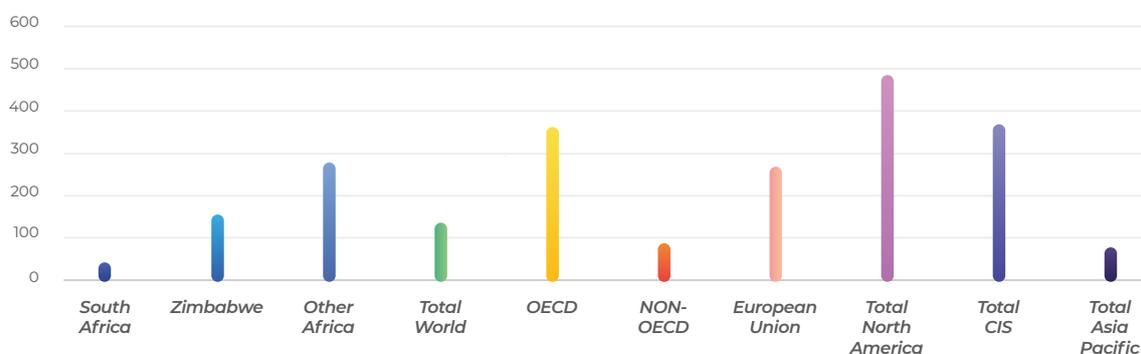
The extent to which coal reserves are developed will depend on the actions that of individual countries take and global demand. From an African perspective, the lower R/P ratio of South Africa may create an additional driver to hasten fuel switching away from coal.

TABLE 4.1 GLOBAL COAL RESERVES AT END 2020, MILLION TONNES

	Anthracite and bituminous	Sub-bituminous and lignite	Total	Share of world total	R/P ratio
South Africa	9893	0	9893	0,9%	39,8
Zimbabwe	502	0	502	0,0%	153,0
Other Africa	4376	66	4442	0,4%	280,4
Total Africa	14771	66	14837	1,4%	
Total World	753639	320469	1074108		139,2
of which: OECD	331303	177130	508433	47,3%	362,6
Non-OECD	422336	143339	565675	52,7%	89,6
European Union	25539	53051	78590	7,3%	265,8
Total North America	224444	32290	256734	23,9%	483,7
Total CIS	100208	90447	190655	17,8%	366,6
Total Asia Pacific	345313	114437	459750	42,8%	78,2

Source: BP statistical review of Energy 2021.

CHART 4.1 R/P RATIO OF COAL RESERVES



Source: BP statistical review of Energy 2021.

CASE STUDY ZAMBIA

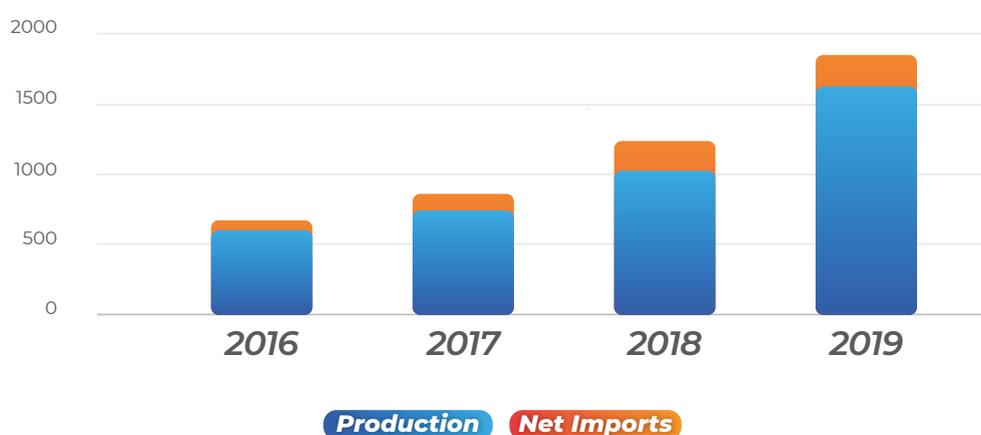
5

SECTION

The sections above have highlighted the importance of South Africa in all considerations of coal production and use in Africa. However, to get a wider understanding of coal use, it is useful to also consider smaller coal users. One such example is Zambia.

Coal production in Zambia increased significantly between 2016 and 2019 to a level of just over 1 600 000 tonnes (chart 5.1), nearly three times the level of production in 2016. In addition, net imports (imports minus exports) also grew by around three times over the same period increasing from 75,000 tonnes to 225,000 tonnes.

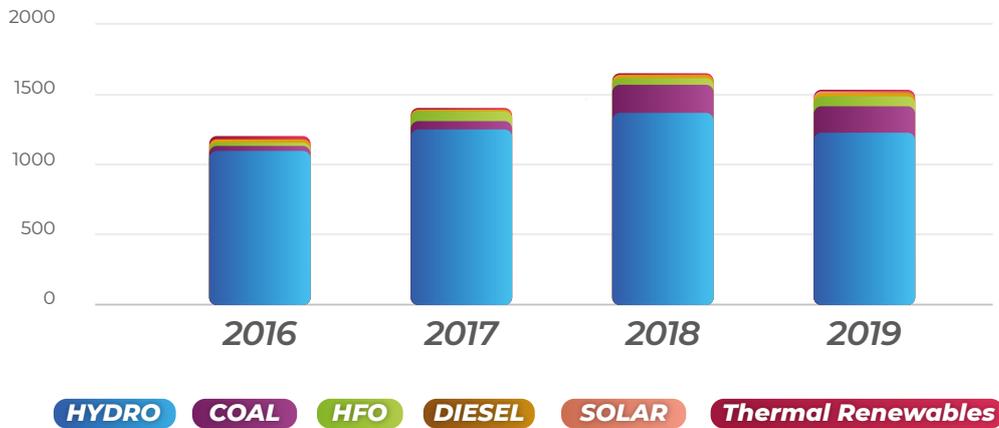
CHART 5.1 ZAMBIA COAL SUPPLY, THOUSAND TONNES



Source: MoE, Zambia

This increased supply reflects the use of coal as a source of fuel for electricity generation. The addition of new coal fired generation is perhaps the most significant change seen in the Zambian energy landscape in the past few years. It occurred due to the commissioning of the Maamba coalmine power plant, which is now the main user of the coal mined. This plant

started operation in 2016 and by 2019, coal accounted for 12% of all the electricity generated in the country (chart 5.2). With the addition of coal fired electricity generation (and smaller increases in solar PV), Zambia's total supply of electricity grew from 11.9TWh in 2016 to 15.3TWh in 2019.

CHART 5.2 ZAMBIA ELECTRICITY GENERATION (GWH)

Note: Generation from diesel includes an estimate of the amount generated for by CEC

Source: ERB, Zambia

Hydro electricity generation remains the most significant source of electricity in Zambia, accounting for just over 80% of production in 2019. However, this share is lower than the 92% level seen in 2016. The lower share may be in part due to variations in rainfall, but is also a result of increased coal generation. Solar generation also saw some growth in 2019 and now accounts for 1% of the total electricity produced and 3% of generation capacity.

Just over half of all electricity consumed is by industry – largely in mining – with around a quarter used by households. This distribution remained largely unchanged over the period (see table 5.1) although the share used by the residential sector has increased from 26% in 2016 to 27.5% in 2019.

TABLE 5.1 FINAL CONSUMPTION OF ELECTRICITY BY SECTOR, ZAMBIA (GWH)

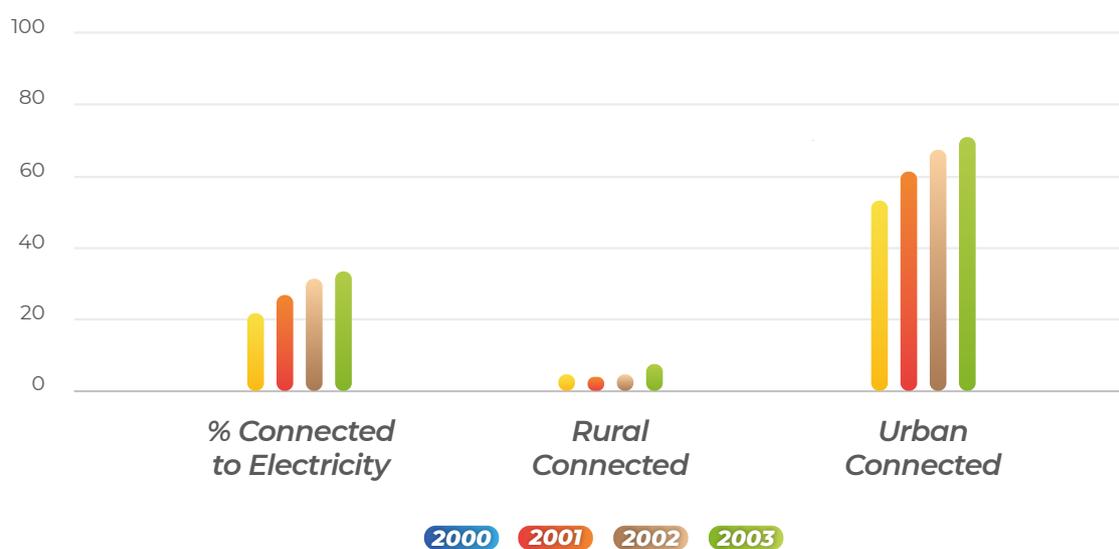
	2016	2017	2018	2019
Industry	6 773,6	7 166,5	7 765,7	7 501,1
Residential	3 387,5	4 146,9	4 336,9	4 022,5
Commercial and public services	597,2	750,2	827,8	824,9
Agriculture/forestry	228,0	261,5	297,0	312,6
Transport	32,6	32,0	32,5	31,2
Total	13 034,9	14 374,1	15 277,9	14 711,3

Source: ERB, Zambia

Zambia is making steady progress in its electrification programme with overall the number of connected households growing by 10 percentage points between 2010 and 2018, from 21.9% to 32.9%. The increase of coal fired generation has

increased electricity supply in Zambia and is contributing to more people across Zambia having access to electricity and experiencing the benefits that arise from it.

CHART 5.3 ZAMBIA ELECTRICITY CONNECTION RATE, % CONNECTED

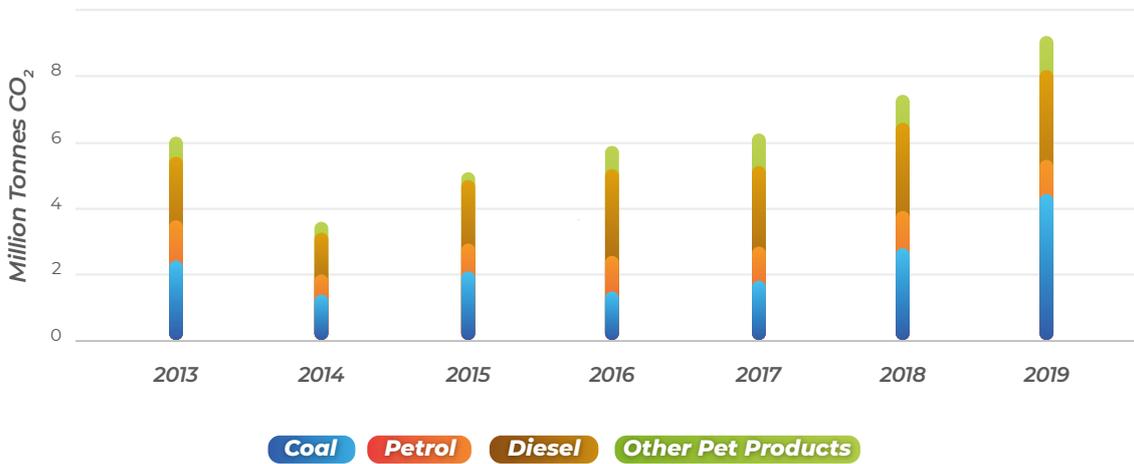


Source: 2010, 2015 Living conditions monitoring report, Zambia Statistics Agency, 2014, 2018 Sustainable Development Goals of Zambia, 2021

From a global perspective, Zambia's CO₂ emissions from fossil fuels are very low, accounting for around 0.02% of global CO₂ emissions from fossil fuel combustion. However, as chart 5.4 below shows that CO₂ emissions are increasing, growing from 5.9 MT CO₂ in 2016 to 9.2 in

2019 MT CO₂, an increase of over 50% (it is important to note that changes on small numbers can lead to large percentage changes). This is mainly driven by increased coal production and the subsequent use for power generation.

CHART 5.4: ZAMBIA CO₂ EMISSIONS FROM FOSSIL FUEL ENERGY USE, REFERENCE APPROACH

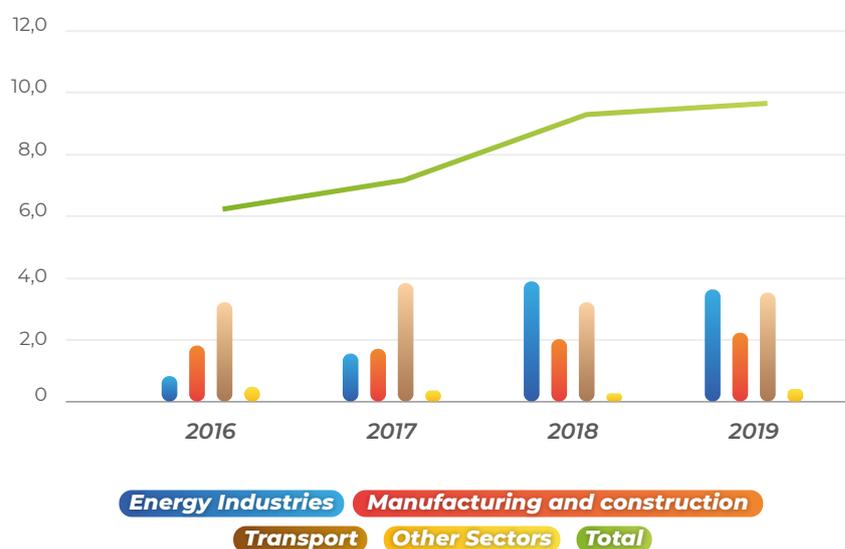


Note: No refinery production data was available for 2014 and 2015

Source: Calculation from Energy balance of Zambia.

Before 2018, the transport sector was the main source of these emissions producing 3.8 MT (53%), followed by manufacturing with 23% of the total. This changed

in 2018 and 2019 with the energy industry sector (which includes power generation) becoming the largest sector/source of fossil fuel emissions at 37%.

CHART 5.5 ZAMBIA CO2 EMISSIONS BY SECTOR, MT CO2

Source: Calculation from Energy balance of Zambia.

The case study for Zambia aims to highlight some of the challenges coal-consuming countries across Africa face. Many countries need additional power to achieve universal electricity access and coal is a means of providing it (along with renewable fuels). Similarly, many of these countries have very low CO2 emissions from fossil fuel use and whilst increas-

ing with additional use of coal for power generation, emissions are still low on a global per capita basis. Therefore, as African countries ponder/address the agreed global position to phase down the use of coal, it has to be balanced with the need to provide more electricity to their people and businesses. These challenges are explored in the next section.

POLICY CONSIDERATIONS

6

SECTION

RENEWABLE FUEL FOR POWER GENERATION

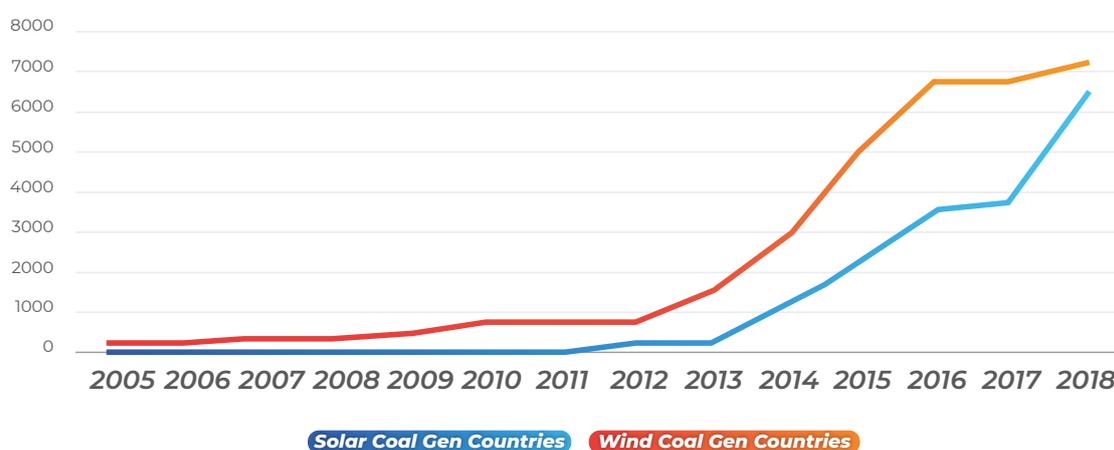
Africa needs more electricity to achieve universal electricity access, which is still at or below 10 per cent in some countries. Utilising the most abundant resource of a country is a natural way to achieve this and it is logical that most coal producing countries generate electricity from coal.

But whilst fossil fuels are not evenly distributed across Africa, renewable resources are available in all countries. Generating more electricity from renewable sources will be a very effective way of «reducing» electricity generation from coal. The evidence is that this is happening. Of the 12

countries that generate electricity from coal, two were using solar PV in 2005 and by 2018 the number had risen to all 12. Wind generation can be more complex with additional constriction and different wind resources but again the coal generating countries have moved from two using wind in 2005 to five in 2018.

Chart 6.1 shows the impact of these developments with solar electricity growing from less than 1000 GWh in 2012 to over 7,000 GWh in 2018 whilst wind grew from under 100 GWh in 2012 to nearly 6,500 GWh in 2018.

CHART 6.1 WIND AND SOLAR PV ELECTRICITY GENERATION IN COUNTRIES USING COAL GENERATION, GWH



Source des données : AFREC

In both cases, it has been Morocco and South Africa that have led the way in output terms, which reflects their more significant electricity production. It is also worth noting that electricity produced via solar and wind from countries that use coal as a source of power generation have seen greater increases than Africa as a whole. Overall solar and wind generation in Africa grew by 250% and 83% respectively between 2014 and 2018, but in countries using coal these growth rates were higher still at 440% and 140% respectively.

For Morocco, the case to develop more renewables goes beyond the need to work globally to help reduce CO2 emissions. As the largest coal importer in Africa, the level of coal generation exposes the country to wider financial risks should prices rise. These issues and others are likely to be behind the policy of Morocco to achieve 52% of the installed electrical power from renewable sources, of which 20% from solar energy, 20% from wind energy and 12% from hydraulic energy by 2030.

GAS AS A TRANSITION FUEL FOR POWER GENERATION

Natural gas, due to its lower carbon content, can be considered a transition fuel that can help remove and/or reduce use of fuels which produce the highest emissions, before gas use itself is reduced to meet long-term climate goals. One possibility for this in Africa might be to explore if any change could happen for countries with a very high degree of coal use for power generation.

As set out above, countries using coal for power generation are often coal pro-

ducers or are situated close to large coal producing countries and so coal is available and often competitively priced. Many of these countries (Botswana is the exception) also border countries who are significant gas producers (table 6.1). As such it may be sensible to explore what options exist for extending the gas network across Africa to help use gas as a transition fuel replacing, where it viable, the use of coal.

TABLE 6.1 BORDERING COUNTRIES OF HIGH COAL GENERATION COUNTRIES

Border	Countries with high coal consumption for power generation			
Mozambique	Zambia	Zimbabwe	South Africa	Eswatini
Algeria	Morocco	Niger		
Nigeria	Niger			
Angola	Namibia	Zambia		

However, as was noted in the accompanying AFREC policy Brief: Natural Gas in the African Energy, one of the challenges to this is the current lack of gas infrastructure.

However, for electricity there are more developed international interconnectors and a number of regional power pools or markets. One is the Southern Africa

Power Pool which covers all southern Africa countries and also reaches out to Tanzania and Angola. This could be used to provide the network so that it is not gas being exported, but the electricity generated from gas in the producer countries and thus help provide power to countries that could be used to reduce reliance on coal as a medium-term solution.

ENERGY EFFICIENCY

The cheapest way of providing more power to all is to minimise its wastage. Working towards reducing transmission and distribution losses is crucial to achieve, but of equal importance and probably more important is to improve energy efficiency. Ensuring that each kWh of electricity is used in the most efficient way through lower use appliances, energy efficiency labels and standards, effective monitoring of use and cost-efficient investment in business processes can reduce electricity consumption.

However, currently many African countries are still developing their data on how energy is used and most countries face

significant challenges in collecting these data.

To properly/better understand business energy use means running a survey of businesses and collecting data on the use of all fuels and any electricity they generate.

Running complete business surveys will always provide the best data, it is however not easy. It takes time, resources, knowledge of businesses (e.g., sample registers), etc. However, there are some alternatives to information on business energy use.

The second-best source of data is from energy suppliers. Energy suppliers will know some information about their customers, especially the largest ones. At a minimum, this will be the address, but it could extend to knowing its business sector. Energy suppliers also have (or should have) a greater understanding of the need for comprehensive energy data to help improve government policy and thus their operating framework. When a country has no information on business energy use, engaging and talking to energy suppliers is vital. The discussion can focus on what information is held, if and how it can be used, and what information (statistics) would be used for the supplier.

It may not be possible (and would be very unlikely) for a supplier to fully break down energy use by the business sector. However, they may be able to help with the largest consumers. For example, address matching between supplier data and any

form of the business register is complex. But if there are relatively few large consumers, matching is a viable possibility.

Collecting data on business energy use is more complex than energy supply data. Complete business surveys cost money but understanding how and why energy is used and how policies can be shaped to improve use efficiency, reinforce supply, and plan a country's energy transition make the expenditure very worthwhile. Where direct surveys cannot be run, or at least in the short term, energy statisticians should reach out to suppliers and any trade associations to explore what data might exist and how it can be used. Most importantly, energy statisticians need to work with their NSI (National Statistics Institution) to explore the use of existing data and to identify options for the future. The goal should be to gradually reduce the amount of energy not allocated to a sector.

REFERENCES

- AFREC, 2021. Designing the African Energy Transition. Retrieved from: <https://au-afrec.org/publications/afrec-energy-transition-en.pdf>
- AFREC. 2022. AFREC Policy Brief: Natural Gas in the African Energy. <https://au-afrec.org/en/resources/other-publications/policy-brief-natural-gas-african-energy-landscape>
- AFREC. 2022. AFREC data used in this report were extracted from the Energy browser. <https://au-afrec.org/en/energy-browser>
- BP Statistics Review of World Energy 2021. <https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html>
- IEA World Energy Balance and highlights <https://www.iea.org/subscribe-to-data-services/world-energy-balances-and-statistics>
- IEA Key World Energy Statistics (KWES) <https://www.iea.org/reports/key-world-energy-statistics-2021>
- UNFCCC Glasgow Climate Pact <https://unfccc.int/process-and-meetings/the-paris-agreement/the-glasgow-climate-pact-key-outcomes-from-cop26>
- Zambia Energy Regulation Board Statistical Bulletin <https://www.erb.org.zm/content.php?viewpage=stbn>
- Zambia Statistics Agency Living Conditions Monitoring Survey Report, 2010, 2015 <https://www.zamstats.gov.zm/index.php/publications/category/9-living-conditions>

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