AFRICAN ENERGY COMMISSION

اللجنة الإفريقية للطاقة

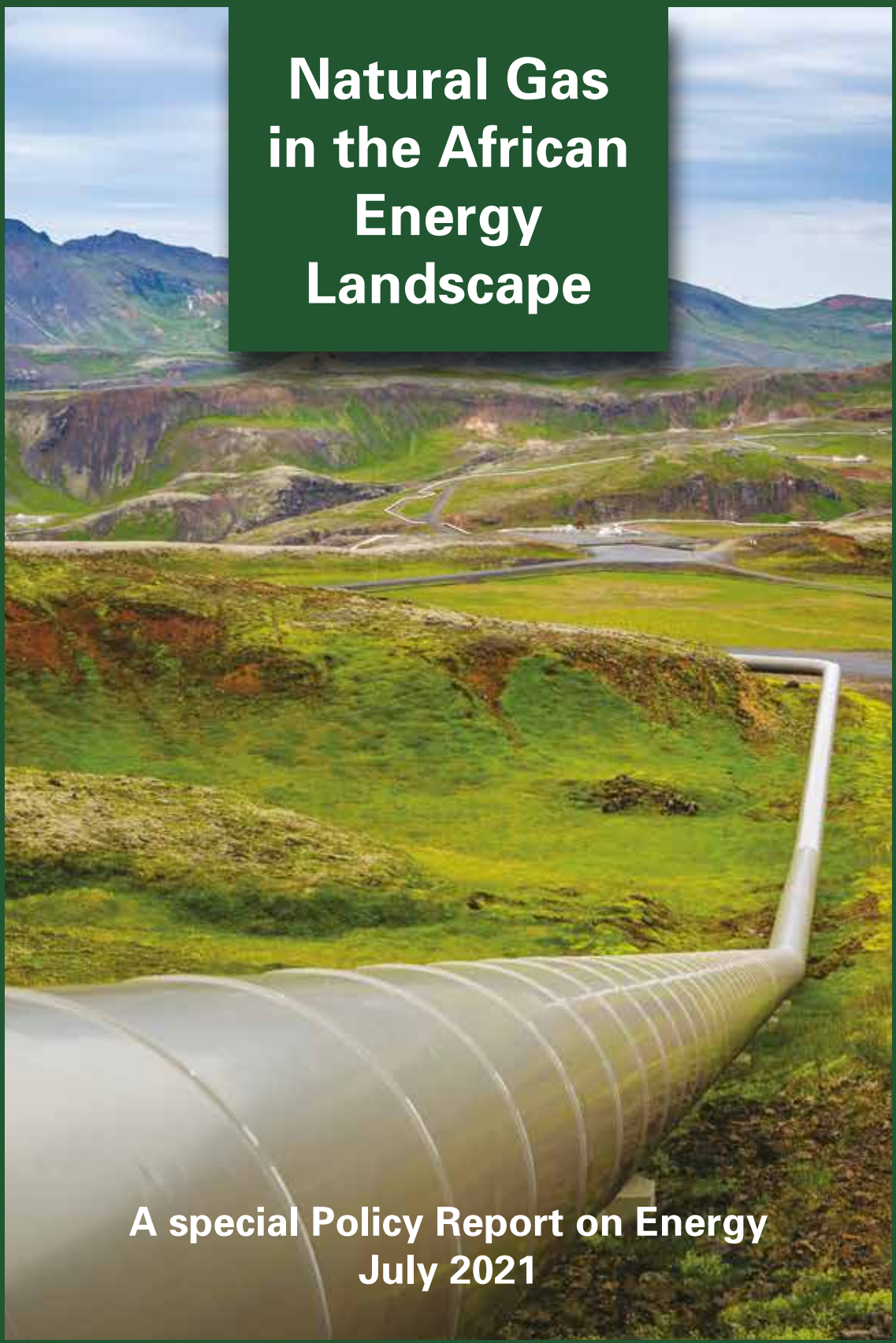
AFRICAN UNION

AFREC ENERGY

COMMISSION AFRICAINE DE L'ENERGIE

COMISSÃO AFRICANA D' ENERGIA

Natural Gas in the African Energy Landscape



A special Policy Report on Energy
July 2021

African Energy Commission (AFREC)

AFREC Policy Brief 2

AFREC is a specialised energy agency of the African Union mandated to develop the African energy sector by coordinating, harmonising, protect, conserve, develop and promote rational exploitation, commercialization and integration of energy resources in Africa. Working with our AU member states with a broad network of experts and partners in all the 55 African Union member states, we ensure all energy initiatives responds to the future development of the African energy sector, in our pursuit to build 'the Africa We Want'.
Learn more or follow @African Energy Commission (AFREC). Comments on the report are welcome and can be sent to:

African Energy Commission (AFREC)
02 Rue Chenoua, BP791, Hydra,16035, Algiers, Algeria
Tel: +213 23 45 9198
Fax: 213 23 45 9200
Email: Afrec@africa-union.org
www.au-afrec.org
Follow us on Social media@ African Energy Commission

Contents

- **List of Abbreviations** **4**
- **Foreword** **6**
- **Executive Director's Statement** **7**
- **Executive Summary** **8**
- **Introduction** **9**
- **Section 1: Africa in the global gas world** **10**
- **Section 2: Gas production and exports in Africa** **12**
  - **2.1** Production 12
  - **2.2** Exports 15
  - **2.3** Production and exports in 2020 17
- **Section 3: Africa's Use of gas** **20**
  - **3.1** Gas use for electricity generation 21
  - **3.2** Final consumption of gas 24
- **Section 4: Gas reserves** **28**
- **Section 5: Policy considerations** **30**
  - **5.1** Natural gas in the energy transitions 30
  - **5.2** Future demand for gas 30
  - **5.3** Increase demand in Africa 31
  - **5.4** Gas as a transition fuel for power generation 33
  - **5.5** Enhancing gas supply 33
  - **5.6** Infrastructure 34
- **Acknowledgements** **35**
- **References** **36**

list of abbreviations

AEIS	African Energy Information System
AfDB	African Development Bank
AFREC	African Energy Commission
AU	African Union
AUDA NEPAD	African Union Development Agency
EIA	Energy Information Administration
IEA	International Energy Agency
INP	Intituto Nacional de Petroleos
IPPs	Independent Power Producers
JODI	Joint Organisation Data Initiative
LNG	Liquefied National Gas
OPEC	Organization Of Petroleum Exporting Countries
RECs	Regional Economic Communities (RECs)
Snam	Societa Nazionale Metanodotti
TFC	Total final consumption
TJ	Terajoule

Jean van der Meulen - Cape Town, South Africa

Foreword

Africa is endowed with abundant energy resources ranging from renewable energies to fossil fuels. These resources, such as natural gas, can transform lives and economic opportunities for the continent. They can bring prosperity to countries, strengthen bonds between African countries through trade and dramatically advance social development, whilst allowing Africa to move away from its reliance on charcoal and firewood. If effectively developed and utilised, the natural gas can also bring about health and economic benefits to all, especially women and children.

Resources such as natural gas can also be used to advance long-term welfare in relation to the quest of addressing the global threat of climate change and energy transition. Hence, there is need for our continent to balance all branches of development, ensuring fair share in the global action response.

Balancing these development gains requires astute policy decisions. However, these decisions can only be made if there is adequate evidence-based data to inform the policy. It is for that reason that AFREC's work to enhance quality and reliable energy statistics across all African countries is so vital. A comprehensive energy statistic database on the supply and demand of fuels from our African Union Member states will enable us as a collective, to effectively plan for any energy development programme geared towards the transformation of Africa's energy sector.

African Union's fundamental principle of Africa's Agenda 2063 is to transform Africa into a powerhouse for the future, steering all our efforts towards attaining inclusive and sustainable economic growth and development in all our African countries or social justice.

Therefore, this report, the first of four series to be released this year, which shows how energy statistics can be used to know what is happening, why it is and what it means for the future of the energy sector in Africa. Using the data collected from all African countries, has enable a full understanding of the production, consumption and forecast of natural gas, how it is changing and what that means for the future. It shows how countries have chosen different options, some seeing greater exports, other using more gas at home to increase access to clean energy by providing energy for clean cooking and increase access to electricity.

Through this report, our member states, experts and development partners can reflect on how countries can leverage natural gas as a source for power generation and electricity supply among others.

H.E Dr Amani Abou-Zeid
Commissioner for Infrastructure and Energy
African Union Commission

Executive director's statement

Africa's natural gas can be harnessed to power the continent at a wider scale. For the past years, and precedent by the pandemic, Africa's concentration of gas resource has increased. However, the development of this sector vis-à-vis its benefit to its people have not yielded exclusive advantages to the continent.

Virtual absence of gas transportation infrastructure creates economic challenges to the wider adoption of gas as a power generation fuel and clean cooking, particularly in countries that cannot achieve economies of scale in gas production and transportation.
In-spite of these challenges, creating a better functioning markets is key to enhance integration of gas resources at national, regional and inter-continental to enable gas connectivity, in support of the renewed free continental trade opportunities within our continent.

Hence, this policy brief explores initial insights learnt from Africa's natural gas landscape perspective of efforts to emancipate Africa's energy system transformation, through the work of AFREC to bolster quality and reliable energy data across the continent, in which we support our member states to strengthen their capacity enabling them to cultivate sustainable and carbon efficient ways towards their response in developing energy potentials for Africa.

It draws on recent data and preliminary insights from AFREC's energy data streams on the performance and sectoral look, to measure potentials and boost accessibility to energy for all Africans as part of the energy mix. 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 on 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)

Executive Summary

Natural Gas has brought significant change to Africa. For some African countries, it has brought export revenue from supply gas to a world where gas demand has risen significantly and is projected to continue to rise in the years ahead, reflecting increasingly global markets, the commitment for lower carbon emissions fuels and its multi-purpose uses. Other countries, notably smaller producers have used their gas, coupled with imported gas, as a fuel to increase electricity generation and provide fuel, to allow economic growth.

Countries using gas as a source for power generation have seen their electricity supply grow about three times faster in the past 10 years than those not able to use gas. Countries using gas for final consumption have seen significant increases in demand for gas. But the benefits of gas are not being experienced across all African countries. More than half of African countries lack access to natural gas.

In the North of Africa, mainly Algeria, Tunisia and Egypt have relatively more developed economies where gas provides about half of all primary energy. Whilst others including Nigeria, Mozambique and Angola have historically looked to maximise the export value of gas through revenue.

However, the situation is changing. Nigeria is working on reducing flaring to maximise its supply of gas. Mozambique is expanding the use of gas, specifically to provide fuel for electricity generation. Likewise, Africa has seen its global share exports fall, especially for Liquefied National Gas (LNG) as the large suppliers of Qatar, Australia and the US increase their market shares.

Looking to the future, policy makers face a number of questions.

- Gas producing countries need to balance the value that gas can bring from export, but perhaps in an every increasingly supplied market, against the benefit of using that gas to fuel their economy.

- Active work is needed to access how African gas can be provided to more countries in Africa. How can countries work together to build the infrastructure needed to expand the gas network and electricity interconnectors to create the means of exporting electricity generated from gas to provide an opportunity for countries to switch away from a high dependence on coal and oil and help reduce CO2 emissions and to meet the goals of energy access for all.

- All countries need to look to minimise the wastage of gas, at production and in use. Increased efficiency of use, will mean more can be done with the same amount of gas, whilst reducing flaring benefits the environment and the economy.

The type of analysis presented in this report is only possible through the work of energy statisticians in countries 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 and whilst supply data are generally widely available, all countries need to develop more comprehensive data on energy demand.

Introduction

The best energy policies are based on a comprehensive understanding of the current situation upon which an assessment of possible actions and their impact can be made and evaluated. That assessment needs comprehensive energy data. indeed, reliable energy data can be seen as the foundation for energy policies.

The African Energy Commission (AFREC) is a specialized agency of African Union with a core mandate to coordinate, harmonise, develop and integrate energy resources on the African continent. In particular, AFREC is responsible to design, create and set up an energy continental data base and facilitate rapid dissemination of information among Member States, Africa's Regional Economic Communities (RECs), investors, academia and other stakeholders. Since 2012, AFREC has put in place and maintained the African Energy Information System (AEIS), which allows to collect African country energy statistics disseminate these data through publications and datasets available online on the AFREC's website, (https://au-afrec.org).

AFREC have been working with all African countries to assist them to produce a compressive energy database to inform policy making at national, regional and continental level. This work includes:

- The development of a new data collection system from African nations, which AFREC have developed in collaboration with Member States over the past 18 months.
- Training statisticians and through the "Training of Trainers" programme to build the capability, knowledge and skills dissemination for country to country and to regional training.
- Demonstrating the value of energy data to policy makers and African governments among others.

This report is therefore first in a series of four reports that will be produced in 2021 to shed light on energy situation of Africa, using data collected by AFREC from its 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.

This report focuses on Natural gas, starting with an overview of African gas in the global context, before exploring in Sections 2 and 3 the development and change in gas production, trade, transformation and, consumption across African countries. Section 4 explores gas reserves before a concluding section setting out key policy questions, all based on evidence produced.

The report is largely based on the AFREC's data provided by countries, made available to all for free in the AEIS. All charts and tables currently cover the period from 2000 to 2018. Additional data are drawn from various sources to provide a global perspective. The data mainly.

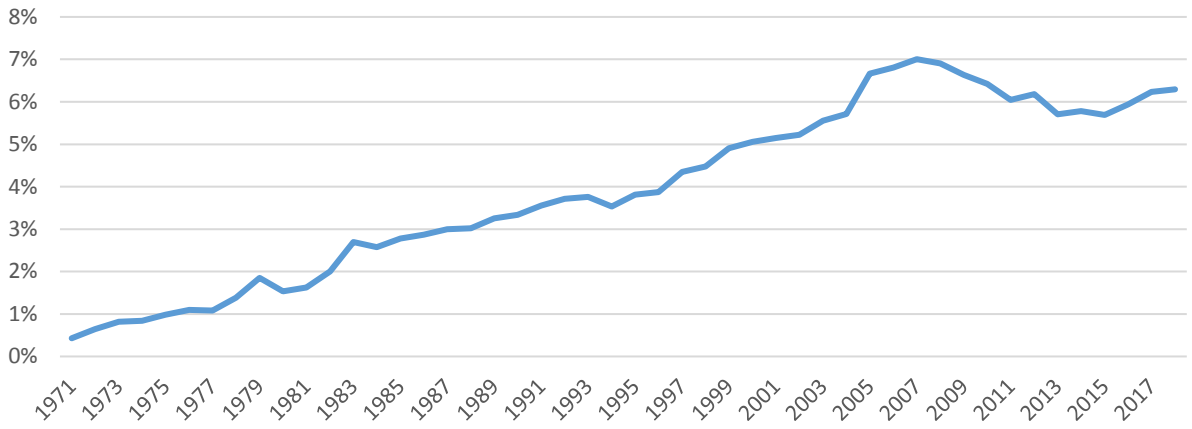
Though there are some inconsistencies and gaps in data, Africa's energy data is still developing, and with the support of AFREC, improvement in quality and reliability can be observed. Therefore, it is only through positive, productive use of data and support provided to statisticians that energy statistics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

Section 1: Africa in the global gas world

Africa plays an important part in the global exploration, export and supply of natural gas (referred to as gas) with production in 2019 of around 8.7 million TJ[1] of a global total of 142 million TJ, just over 6%.

Africa's share increased steadily over the past 50 years, peaking at nearly 7% in 2007, before receding to 6% as production fell in North Africa.

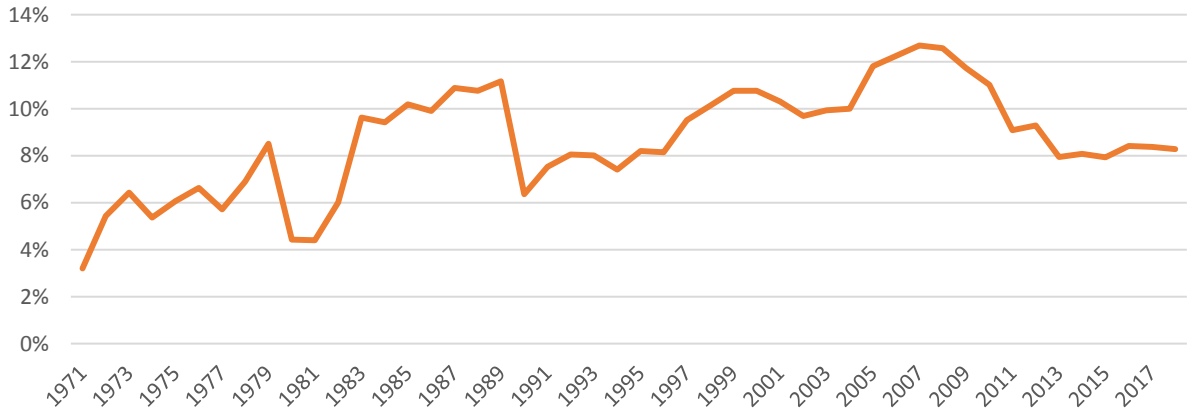
Chart 1.1 Africa's share of total global gas production



Data source: IEA World Energy Balance highlights

Africa's role as a supplier of gas is at the increase with global export accounting over 8% of global exports. Over the same period, Africa's gas exports reached a peak of 12% in 2007 (chart 1.2), before the reduction in African output and the growth of exports from other countries such as the US, Australia and Qatar.

Chart 1.2 Africa's share of global gas exports

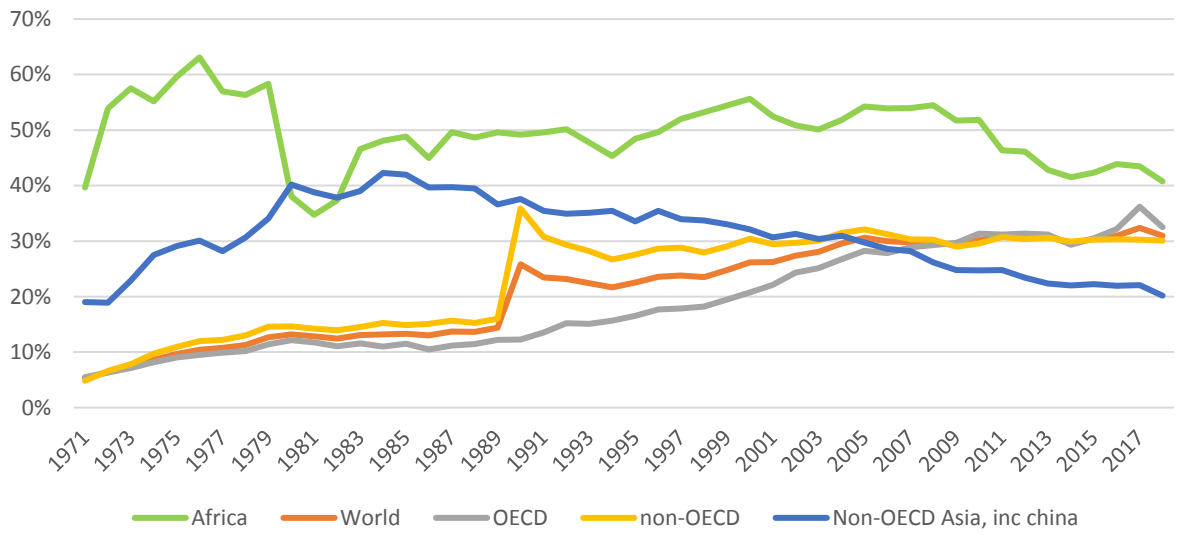


Data source: IEA World Energy Balance highlights

1. IEA World Energy Balance highlights

Currently around 40% of gas produced in Africa is exported (chart 1.3). However in many of the years of the past half century, more African gas was exported than used by the producing countries. This puts Africa apart from other regions of the world, where generally around 30% of gas produced is exported and specifically across Asia where the ratio of exports to own use has been steadily falling over the past 40 years and now just 20% of gas produced is exported.

Chart 1.3 Gas exports as a percentage of production

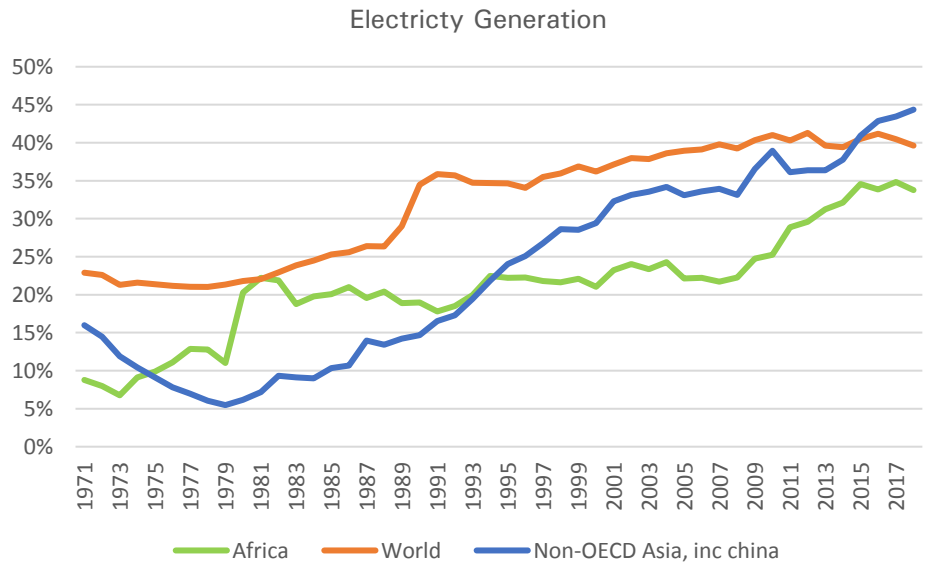


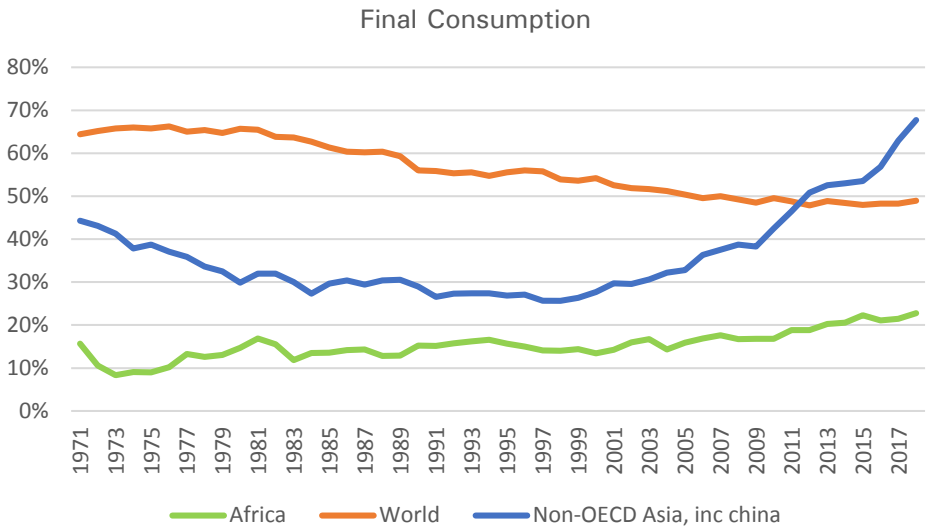
Data source: IEA World Energy Balance highlights

The impact of this is shown in chart 1.4, which shows the proportion of gas produced that is used for electricity generation and total final consumption. In Africa a third of gas produced is used for electricity generation, compared to nearly 40% globally and 45% in Asia.

For final consumption in businesses and homes, the distinction is wider still with just under a quarter of gas produced in Africa used as final energy in Africa, compared to nearly a half globally and two-thirds in Asia.

Chart 1.4 Gas use for electricity generation and final consumption as a share of gas produced





Note Non-OECD Asia including China became a net imprted of gas from 2012, so use now exceeds total production.

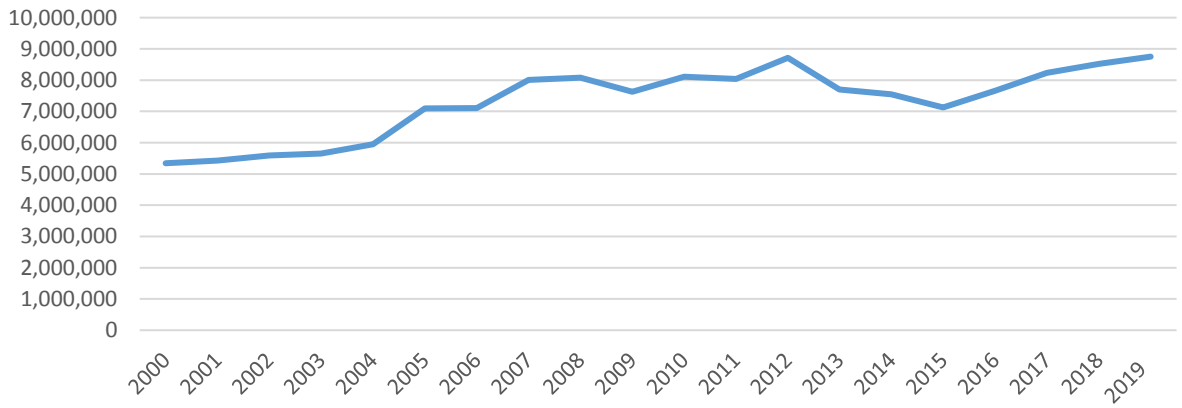
Data source: IEA World Energy Balance highlights

Section 2: Gas production and exports in Africa

2.1 Production

AFREC data show a general steady rise in African gas production from around 5,300,000 TJ in 2000 to a peak of 8,700,000 in 2012. Then during the period of the "Arab spring" output fell in North Africa such that, in 2015 total African production was 7,100, 000 before increasing and projected to be at close 2012 levels in 2019.

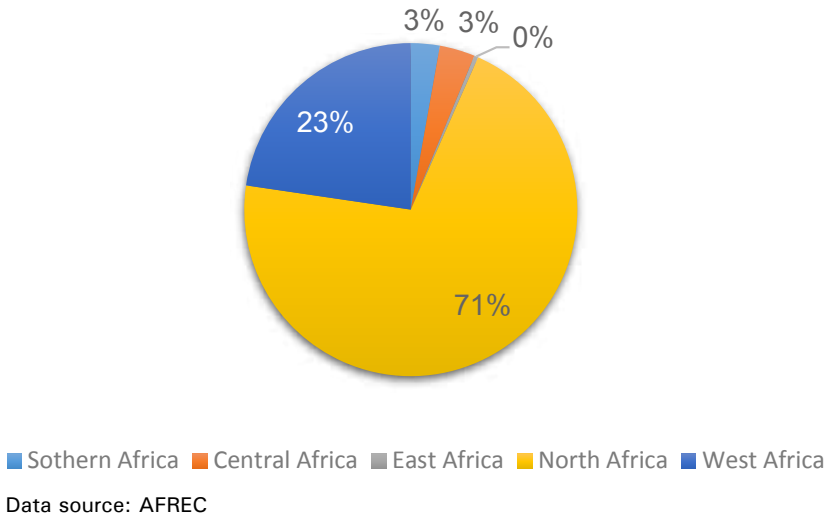
Chart 2.1 Gas production in Africa, TJ



Data source: AFREC

Gas is currently produced in 18 African countries, but it is very concentrated in North Africa, where just over 70% of all African gas is produced, followed by 23% in West Africa with the remaining production coming from the other African regions.

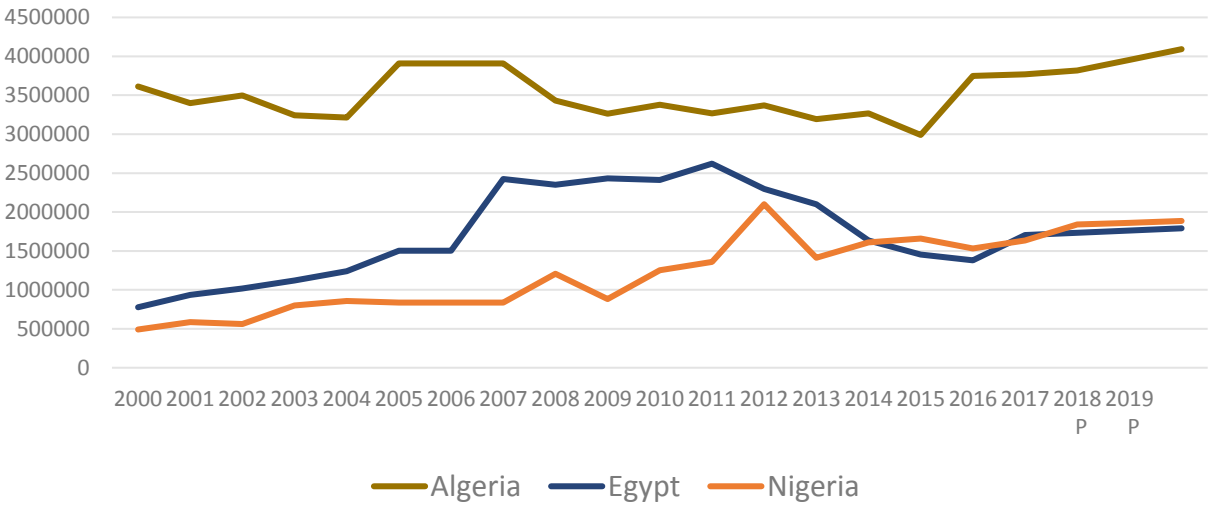
Chart 2.2 Gas production by African region, 2019



Data source: AFREC

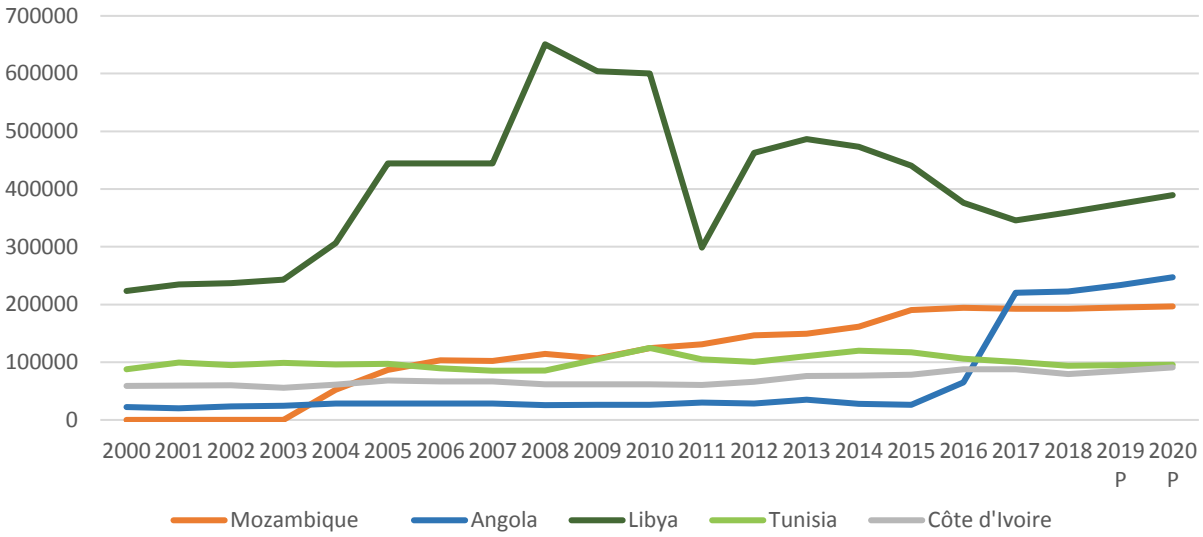
The top three producers, Algeria, Egypt and Nigeria account for 87% of all gas produced. With production from next 5 largest producers (chart 2.4), these eight countries make up 98% of all gas produced.

Chart 2.3 Gas production in Africa's largest gas producers, TJ



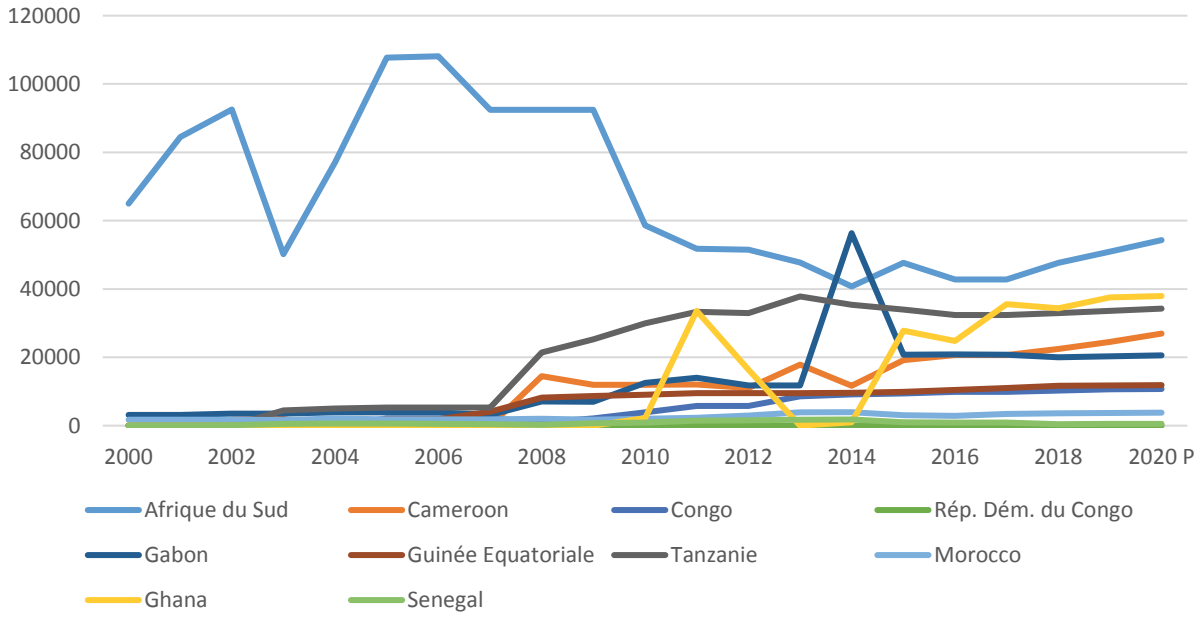
Data source: AFREC

Chart 2.4a Gas production in Africa's Medium gas producers, TJ



Data source: AFREC

Chart 2.4b Gas production in Africa's small gas producers, TJ



Data source: AFREC

Of the top eight gas producers, Angola saw a substantial increase from 2017 onwards, along with Mozambique and Nigeria which have seen the greatest increases in gas production since 2010 – all above 50%.

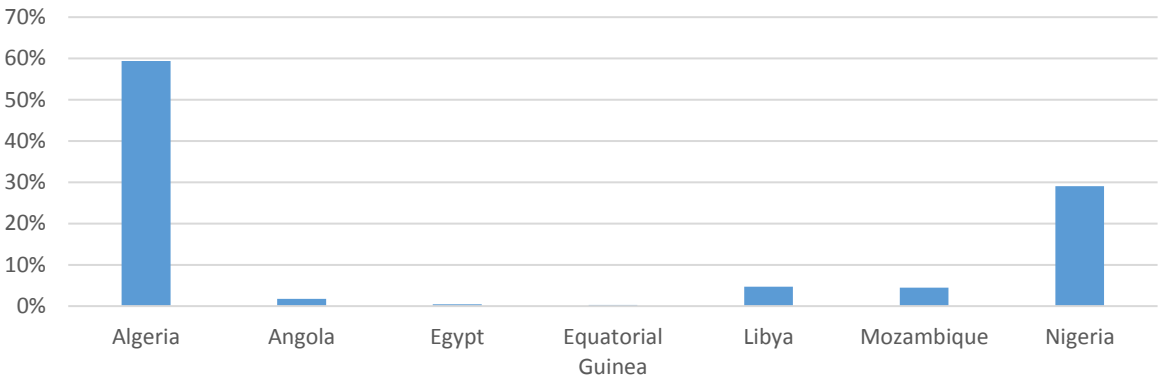
In contrast political instability in Libya has seen a fall in production of 38%. Whilst in Egypt production was affected by the Arab spring but also impacted by plummeting investments and aging infrastructure, leading to a production fall of 27% between 2010 and 2017.

Since 2017, with West Nile Delta and Zohr fields coming on stream, Egypt has significantly increased its output. The changes between 2014 and 2017 resulted in Nigeria overtaking Egypt as the second largest gas producer at this time, but still some 2,000, 000 TJ per year behind Algeria.

2.2 Exports

Naturally, it the largest producers of gas that typically have the greatest share of gas exports (chart 2.5), although this differs by country as is explored in the next section. In the early 1970s it was only Algeria and Libya who were exporting gas, but that has changed recently, partly due to the developments in LNG, so that now seven countries export gas. In 2017, Algeria accounted for nearly 60% of all Africa's gas exports, followed by Nigeria at just under 30%, although these figures reflect the production issues experienced by Egypt as described above, which significantly reduced its exports.

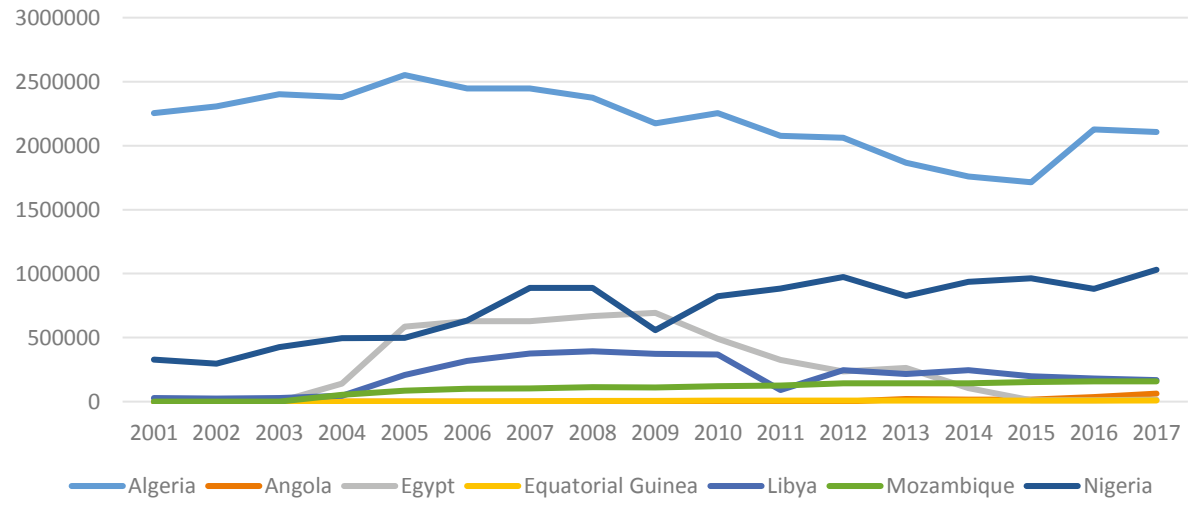
Chart 2.5 Share of African gas exports, 2017



Data source: AFREC

Nigeria's growing significance as a gas exporter is highlighted in chart 2.6, which shows a steady growth of exports each year over that past 20 years. In contrast exports from North African countries have all fallen since their respective peaks in the period 2005 to 2010. In part this is due to lower production, as is the case for Egypt and Libya, but for Algeria it also reflects a change in gas use as is explored more in Section 3.

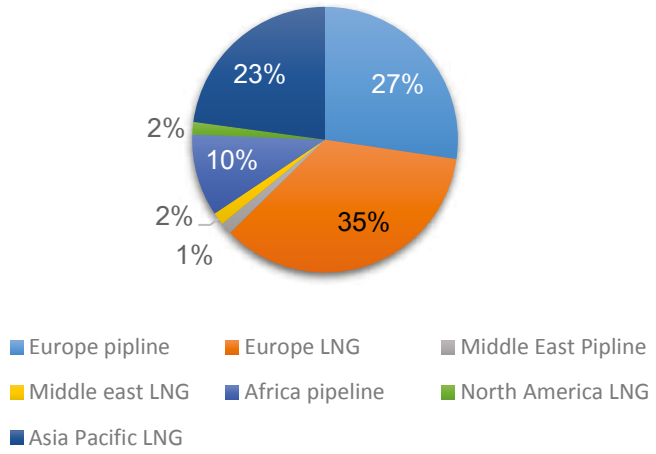
Chart 2.6 African gas exports, TJ



Data source: AFREC

The development of LNG facilities has allowed more countries to export gas and LNG exports are growing in importance for Africa. Initially, exports out of Africa were via pipeline from Algeria and Libya into Europe and then later into the Middle East from Egypt. But the development of LNG changed such practice, allowing countries like Nigeria, Angola to start to export gas, whilst for countries like Algeria and Egypt, LNG allowed to reach new markets.

Chart 2.7 Destination of African gas exports, 2019

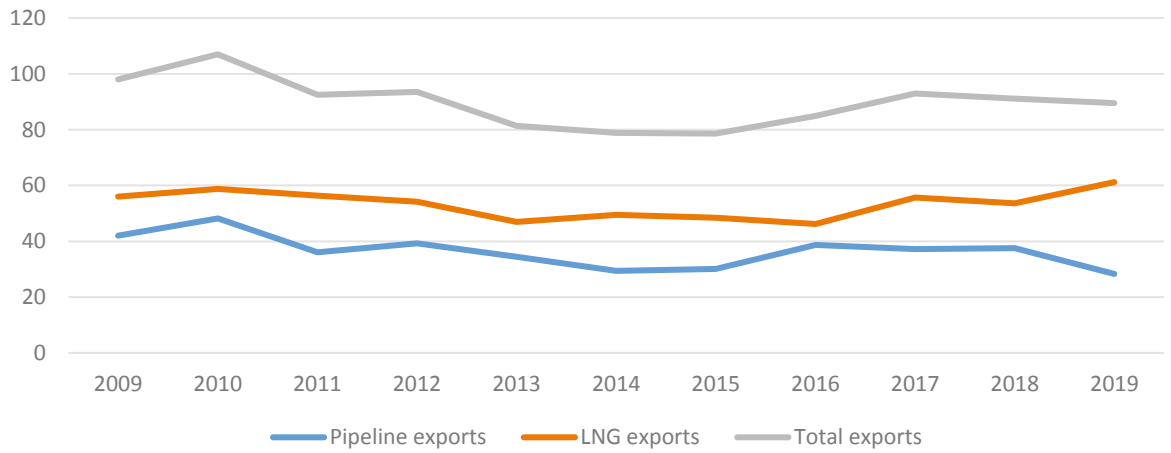


Data source: BP Statistical Review

Europe was the initial route for African gas exports via pipeline and Europe remains very important to African gas exports still accounting for over 60% of exports. But by 2019, more than half of these exports are delivered as LNG (chart 2.7). Whilst LNG exports to the Asia Pacific region account for 23% of exports, just below pipeline exports to Europe.

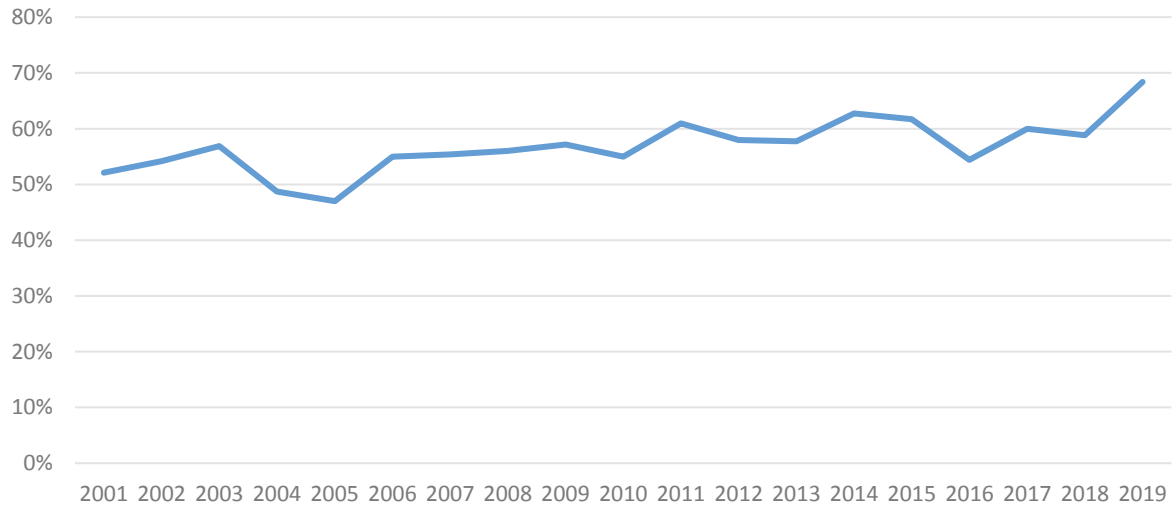
Through the development of LNG facilities, LNG exports have slowly become the main export route for African gas and are growing with LNG exports starting from Cameroon in 2018. In 2001 LNG exports accounted for just over 50% of gas exports but has increased to around two-thirds in 2019 (chart 2.9).

Chart 2.8 Africa's gas exports by type, billion cubic meters



Data source: BP Statistical Review

Chart 2.9 African LNG exports as share total African gas exports

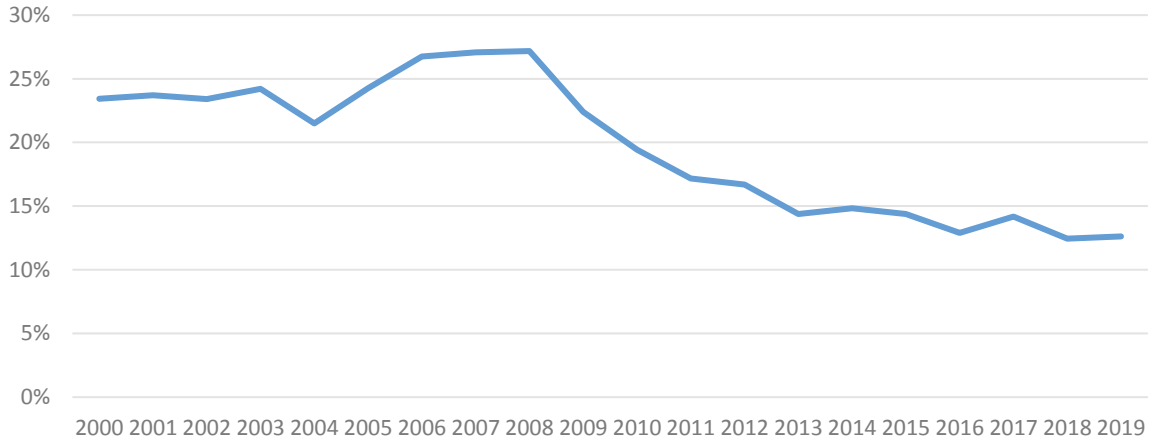


Data source: BP Statistical Review, AFREC

However, whilst LNG exports are growing in importance to African gas exporting countries, Africa's share of the global LNG export market is declining. Developments in Qatar, from 2010, the US since 2017 and Australia since 2016 means that these three countries now account for just over 50% of global LNG exports.

As a result, whilst Africa has generally been exporting just under 5 million TJ of LNG a year, for the past 10 years, apart from during the Arab spring, its share of global LNG exports has fallen from just over 25% in 2008 to around 12% currently (chart 2.10).

Chart 2.10 Africa share of total global LNG exports



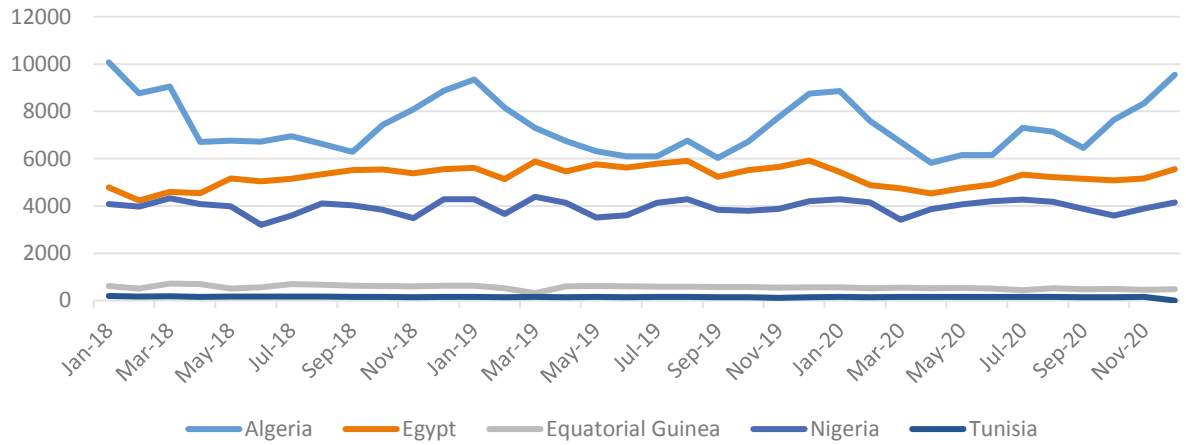
Data source: BP Statistical Review

2.3 Production and exports in 2020

Understanding the full impact of Covid-19 on African gas production and trade will need comprehensive data for 2020 which will only be available for all countries later this year, and into 2022. However, a few countries do provide data to JODI (the Joint Organisation Data Initiative, which is a global response by countries and international partners to bring greater transparency to oil and gas markets).

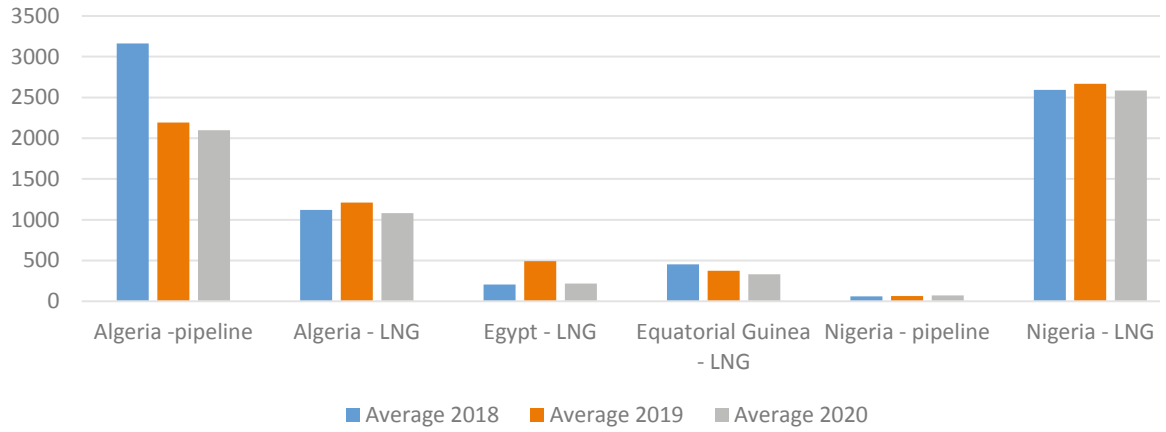
Production and export data are shown below in charts 2.11 and 2.12 and generally gas production and exports stayed relatively stable during 2020 across the 5 countries which provided data to JODI. Exports were generally on the lower side, but the scale of change is in the order of magnitude of 5 to10% lower than the fall seen in Algerian exports between 2018 and 2019.

Chart 2.11 Natural gas production 2018 to 2020, million cubic meters



Data source: JODI

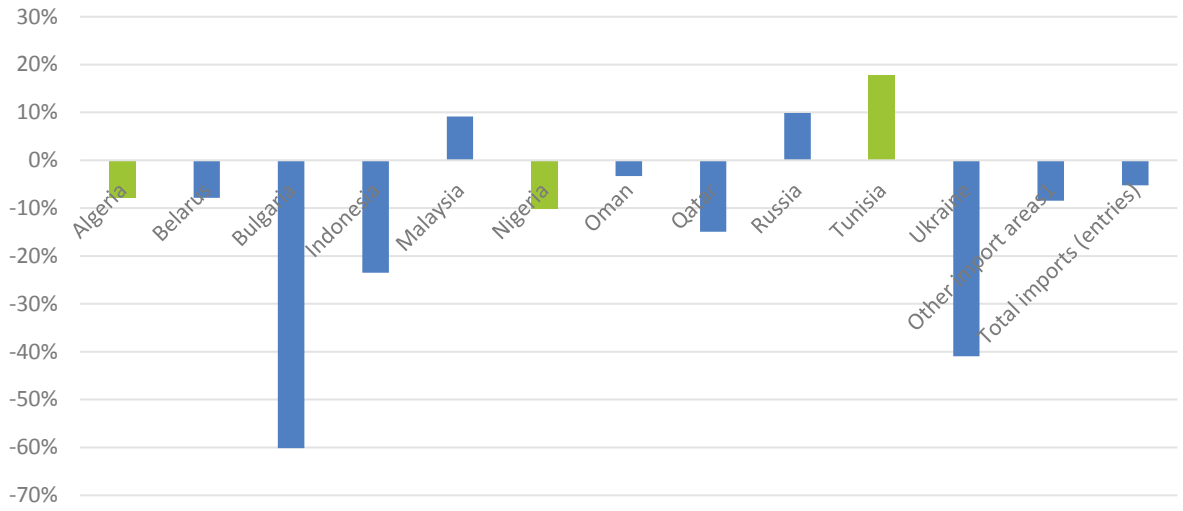
Chart 2.12 Average annual exports 2018 to 2020, million cubic meters



Data source: JODI

Data from the IEA allows African gas exports to be viewed from the perspective of the importing OECD countries. Again this shows falls of 10% or lower for African exporting countries and even a small increase in exports from Tunisia. Overall, it appears that Covid-19 had some impact on African gas exports, (though it also needs to be recalled that the winter period 2019/2020 in Europe was warmer which will have reduced gas demand), but perhaps not a very significant one.

Chart 2.13 Percentage change in OECD gas imports from non-OECD sources 2019 to 2020



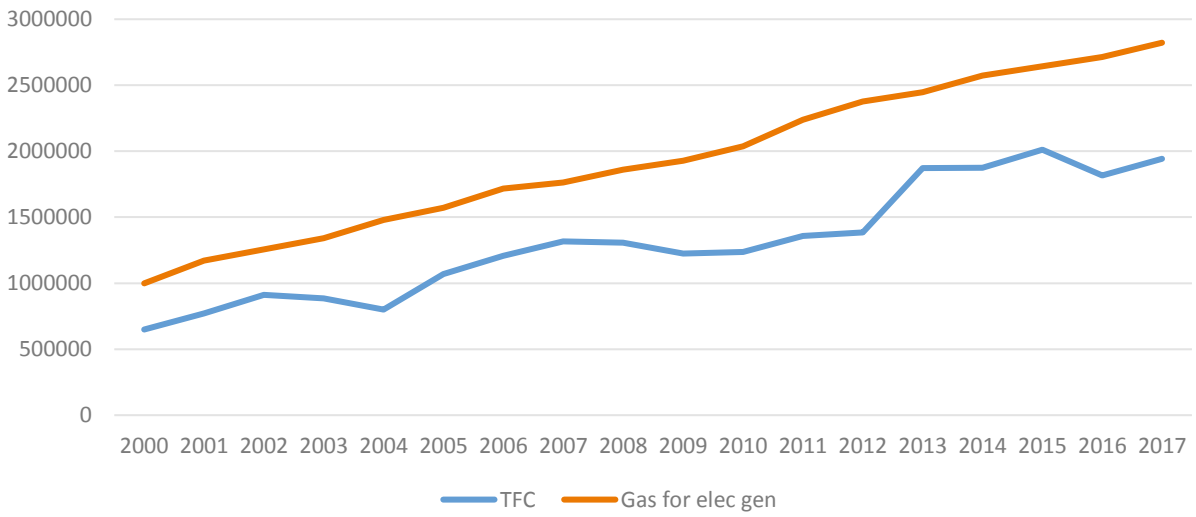
Data source: IEA Monthly Gas Statistics

Imports ship tanker gas carrier on the sea

Section 3: Africa's Use of gas

In addition to differences in the scale of gas production there are also differences in how gas is used across African nations. Gas in Africa is used for two general purposes, to produce electricity and for final consumption, in business and homes. In 2017 just over 2,820,000 TJ of gas was used to produce electricity and 1,940,000 used as final consumption (TFC). As chart 3.1 shows, the use of gas has grown over the past 20 years, but this ratio of 60% for electricity generation, 40% for final consumption has stayed quite stable.

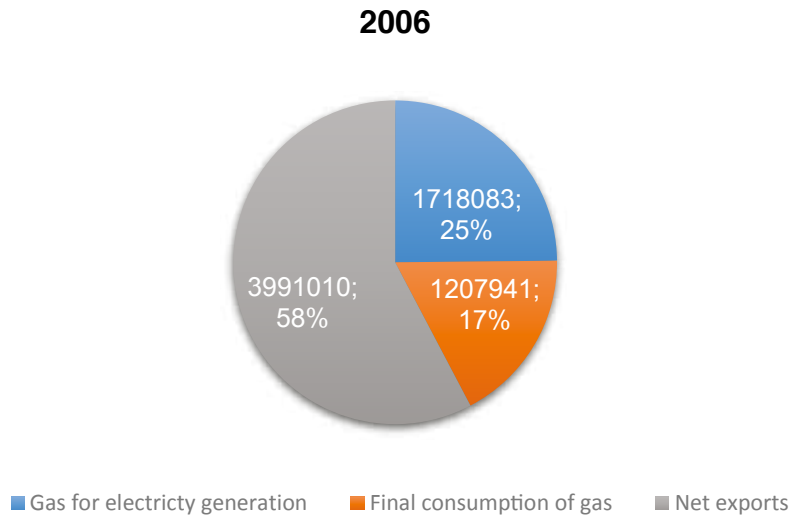
Chart 3.1 Africa countries use of gas, TJ



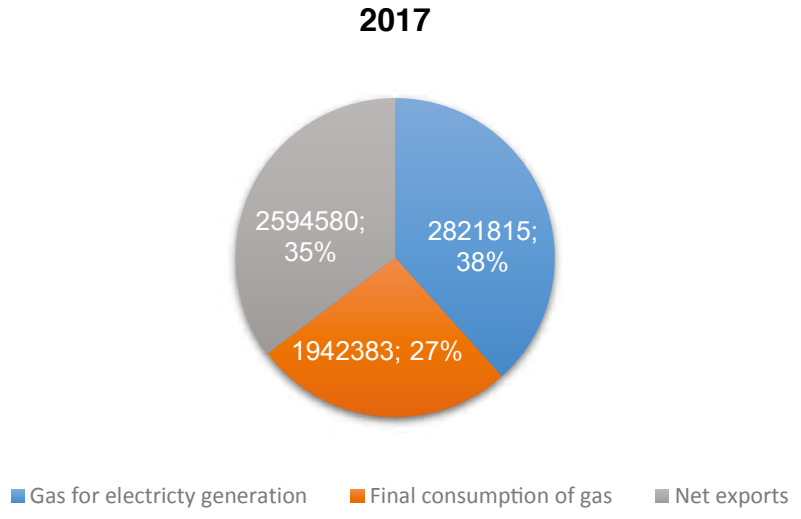
Data source: AFREC

Chart 3.2 below shows further how the use of gas in African is changing. In 2006, as had been the case in prior years, the main use of gas produced was exports, with African net exports of gas being 4 million TJ compared to 1.7 million TJ being used for power generation and 1.7 million TJ for final consumption. But in the latest year when full AFREC data are available, 2017, the situation is very different. At 2.8 million TJ, more gas is being used for power generation than for net exports 2.6 million TJ, with the share of final consumption also growing to 1.9 million TJ. However, in 2017 Egypt was importing a significant amount of gas, as described in Section 2, which reduced in more recent years, so it is perhaps too soon to say gas use for power generation has overtaken net exports on a continuous basis.

Chart 3.2 African Gas: Net exports, use for electricity generation and final consumption, TJ and percentage share



Data source: AFREC



Data source: AFREC

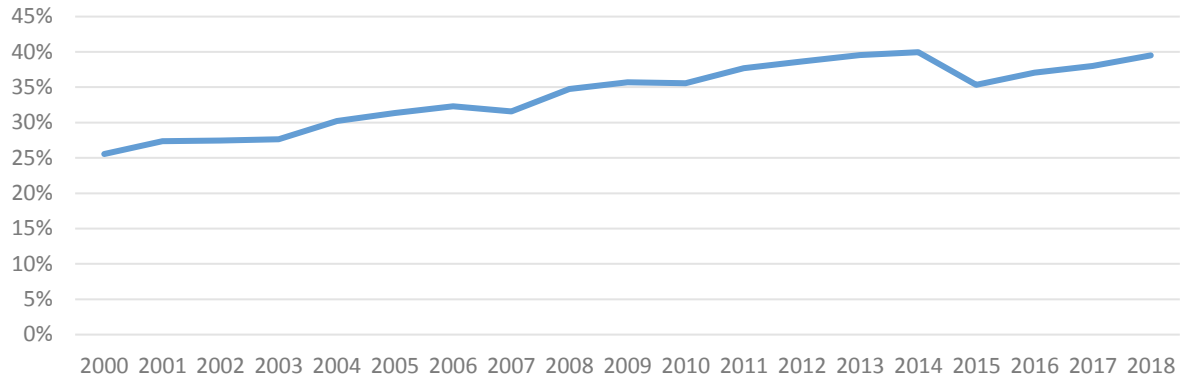
3.1 Gas use for electricity generation

The number of African countries using gas for electricity generation has grown steadily over the past 20 years.

In 2000, nine countries used gas for power, this then grew to 15 in 2010 and to 18 in 2018, all the gas producers except for Angola, plus Benin who use imported gas.

As a result, the share of electricity generated from gas has risen steadily over the period from just over a quarter in 2000 to close to 40% in 2018 (chart 3.3).

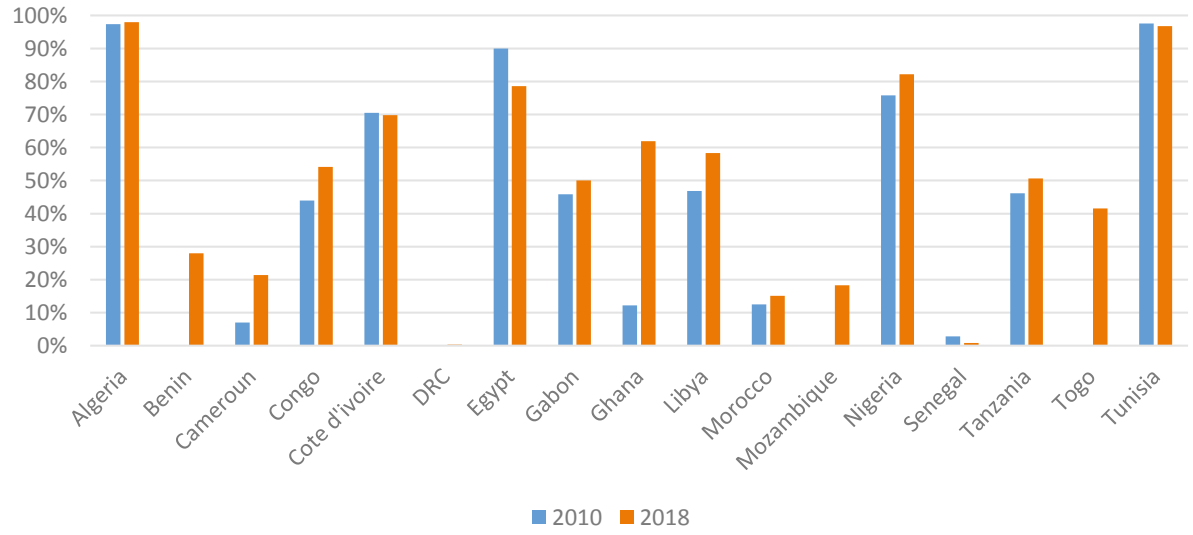
Chart 3.3 Share of African electricity generated by gas



Data source: AFREC

Chart 3.4 below shows that the share of gas fired generation has grown or stayed the same in nearly all countries, between 2010 and 2018. The exception being Egypt where the share of production is lower in 208 than 2010, (but 10 percentage points above the 2017 level) due to lower gas production in years to 2017, and some expansion of renewables.

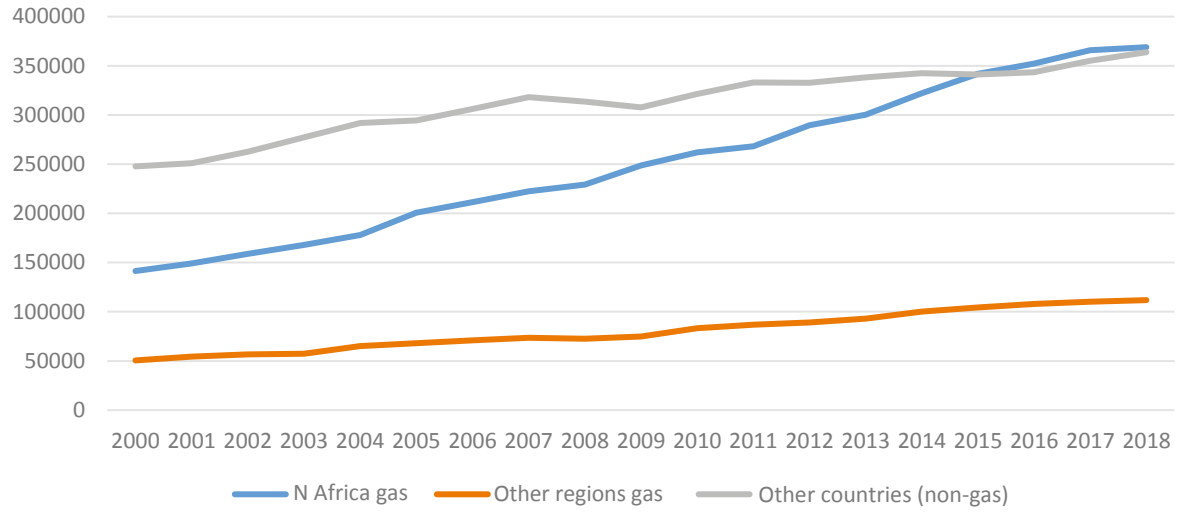
Chart 3.4 Gas share of electricity generation



Data source: AFREC
Notes: Equatorial Guinea is excluded due to data consistency issues. Nigeria is for grid supplied power only and excludes the significant use of petrol and diesel generators.

Many African countries, need more electricity than is currently produced to allow their economies to grow and to provide universal electricity access to all their people. As such it is interesting to see the impact of greater use of gas fired generation. Chart 3.5 shows the growth of electricity production split by countries who are using gas, split by North and other African regions and the aggregate of countries who are not (many currently cannot) use gas. This shows that in pure quantity produced, the countries of North Africa using gas are now producing more electricity than nearly 30 countries who are not using gas at all.

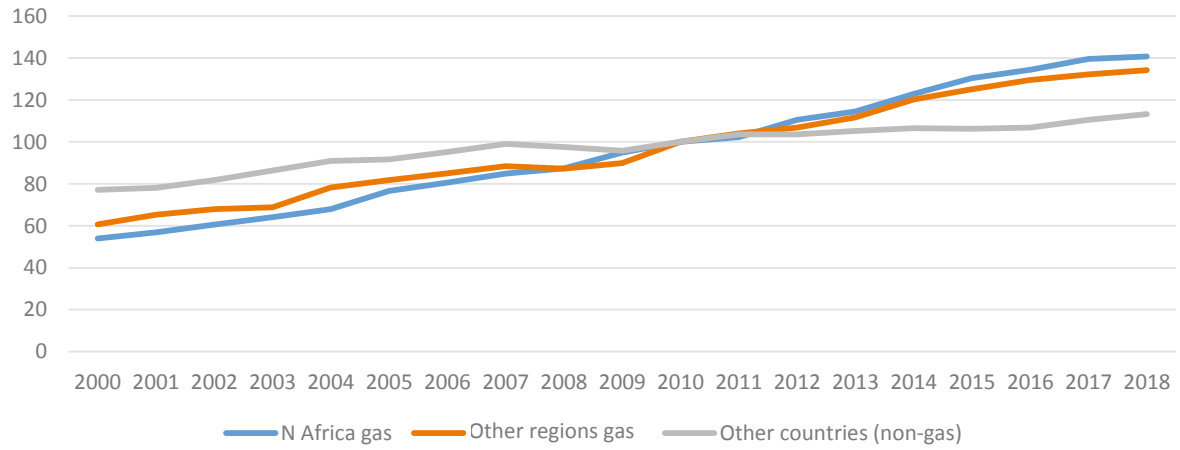
Chart 3.5 Total electricity generated in Africa, GWh



Data source: AFREC

To properly understand the change, it is useful to look at the data in index form. Chart 3.6 shows the same data but converted to an index with electricity production in 2010 set to equal 100. This shows that countries across Africa who have been able to use gas as a source of power generation have seen a significantly greater increase in electricity production. Between 2000 and 2018 countries in North Africa where gas is a component of power generation have witnessed a 161% increase and those using gas in the other African regions an increase of 127%, whilst countries not using gas have just seen an increase of 29%. The respective changes between 2010 and 2018 are 41% growth in North Africa, 34% in countries using gas in the other African regions and 13% in other African countries.

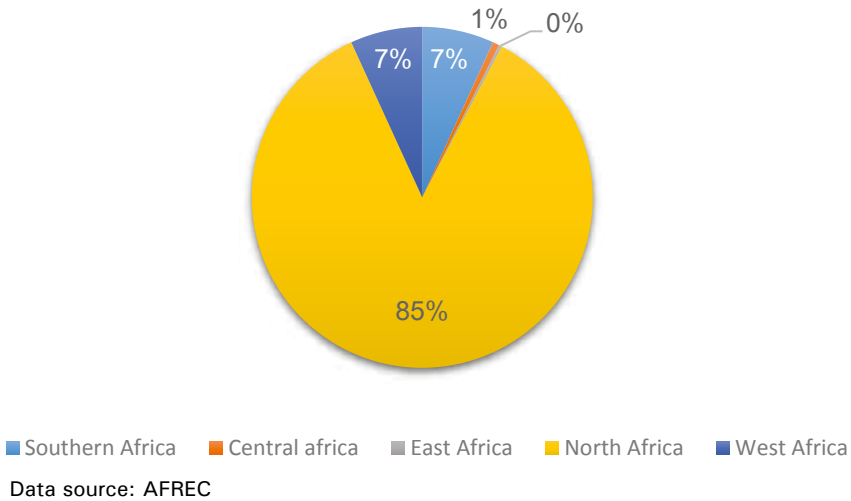
Chart 3.6 Total electricity generated in Africa, index 2010 = 100 :



Data source: AFREC

Electricity power cables

Chart 3.7 Total Final Consumption of gas, share by African region (data source)



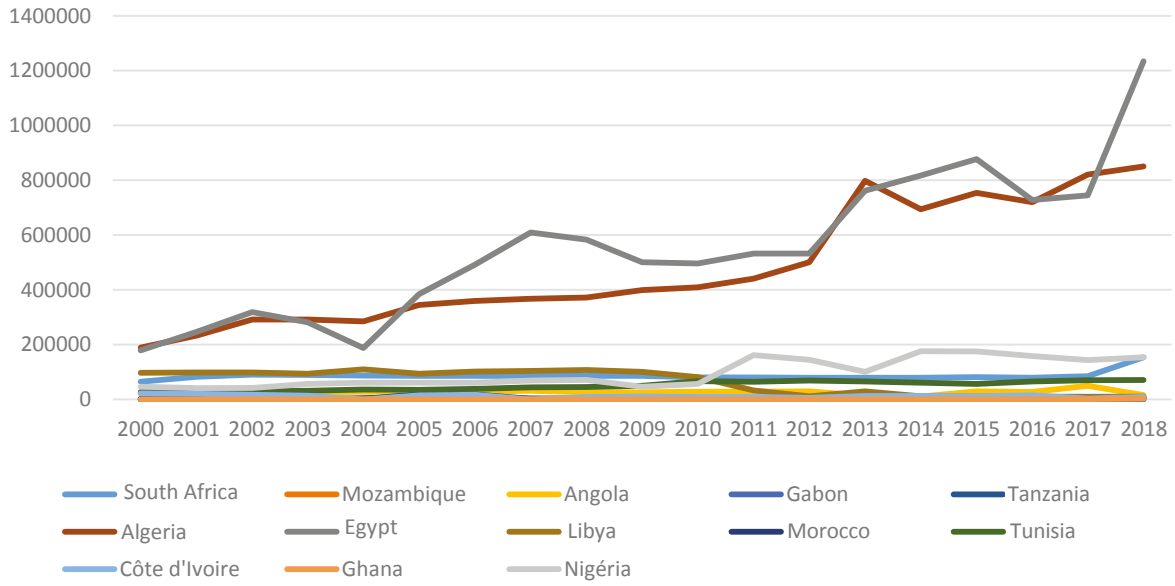
Data source: AFREC

Together North Africa accounts for 85% of all gas used by final consumers, with Egypt alone using nearly half (48%) of all gas final gas use in Africa and Algeria, a third. The next highest are South Africa and Nigeria, both with just over 6% of all Africa's use.

3.2 Final consumption of gas

Together North Africa accounts for 85% of all gas used by final consumers, with Egypt alone using nearly half (48%) of all gas final gas use in Africa and Algeria, a third. The next highest are South Africa and Nigeria, both with just over 6% of all Africa's use.

Chart 3.8 Total Final Consumption of gas by African country, TJ (data source)



Data source: AFREC

In general, final consumption of gas largely means industrial use. Across Africa it is only Algeria that has gas used by all final consumption sectors (industry, transport, services, agriculture and domestic). Tunisia has no use for transport reported to AFREC and Egypt no reported use by the commercial or agriculture sectors, although all these may simply reflect data collection issues.

The past 20 years has seen a steady increase in the industrial gas consumption across North African countries, expect for Libya where it has sharply declined since 2014, meaning industries across most northern African countries have benefited from additional gas to use and no doubt allow business to grow.

Industrial use in other countries has been quite stable, for example in Nigeria and South Africa, countries with the highest gas use by industry outside North Africa.

Table 3.1 below provides an illustration of differences in how gas is used across African nations. It is a simplification but provides an insight that may be useful for policy makers.

The table splits gas producers in four ways: countries who produce to export (exports above 60% of production), countries that produce to use (no or very small exports in 2017), countries that Produce and import to use (gas producers who also import, plus Benin who just import) and a mixed category of countries who are significant producers and users to varying degrees.

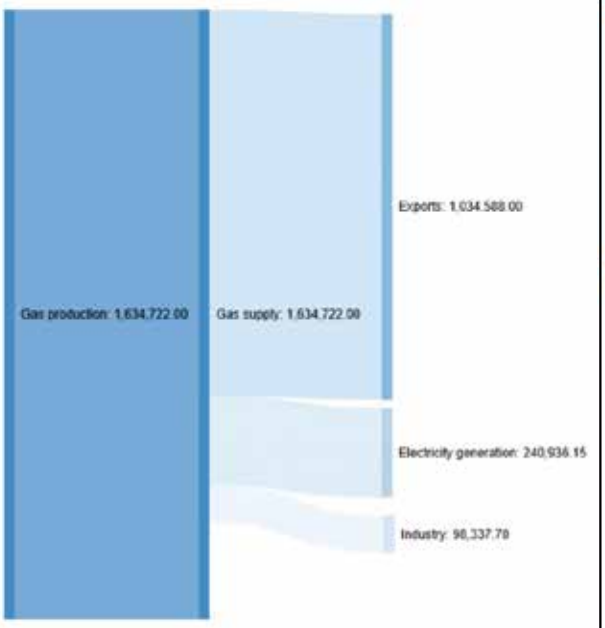
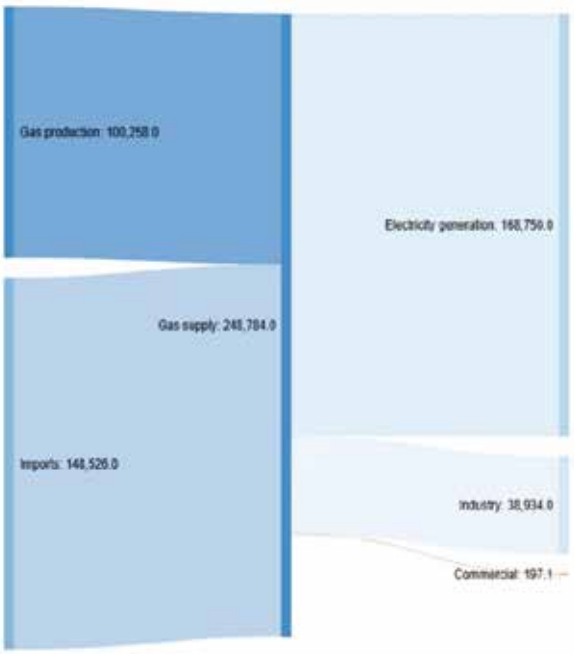
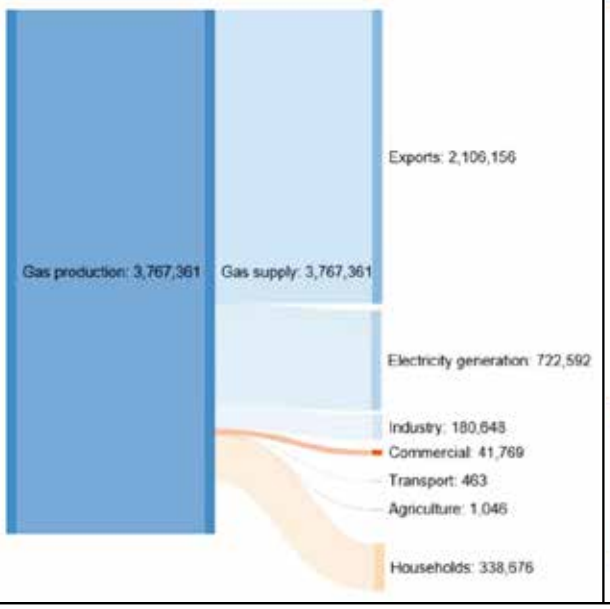
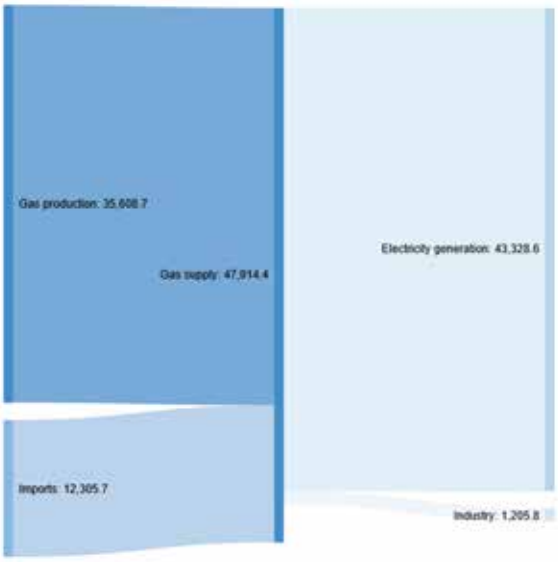
Table 3.1 A classification of African "gas" countries (data source)

Produce to export	Produce to use
Nigeria Mozambique Equatorial Guinea	Cameroon Congo Senegal Gabon Tanzania Cote D'Ivorie
Mixed	**Produce and Import to use**
Algeria Egypt Angola Libya	Morocco Tunisia Ghana South Africa Democratic Republic of Congo Benin

To illustrate the differences between supply and use of gas, simplified gas flow diagrams are presented below for a country from each of the categories. These aim to show how gas is sourced and used, but for simplification it omits a number of flows including stocks, energy industry use, and non-energy use. These charts are drawn on in Section 5 which presents thoughts for policy makers.

Gas for use and supply stored in tanks

Chart 3.9 Gas flow charts for selected African countries (data source)

Produce to export	Produce to use
Nigeria	**Tanzania**
	
Mixed	**Produce and Import to use**
Algeria	**Ghana**
	

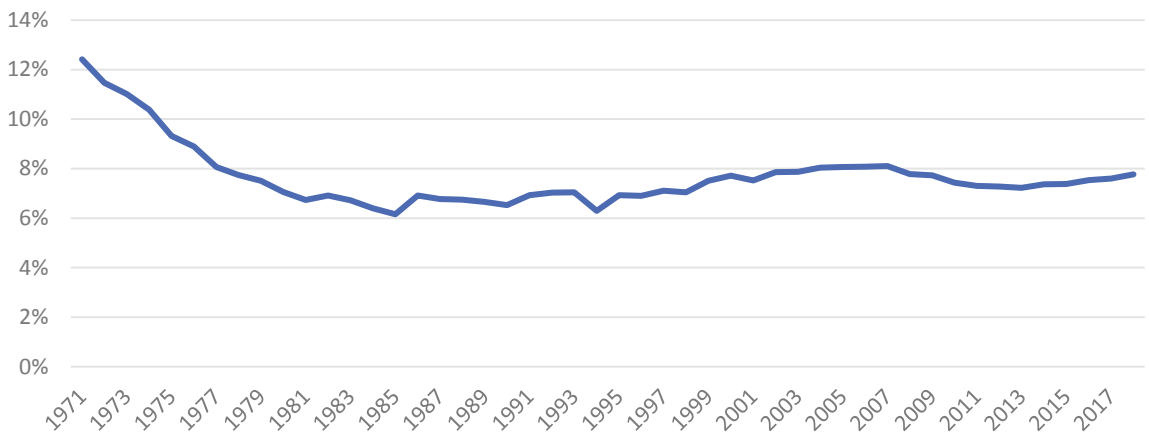
Data source: AFREC

Section 4 : Gas reserves

Estimates of African gas reserves range from around 7.4% of the world total (OPEC, but excludes Mozambique) to 8.8% (EIA) and 7.8% (BP), so given uncertainty around reserve estimates can be considered to be 8% (a figure just above Africa's current share of global gas production). In terms of volume BP estimate Africa's gas reserves at 14.7 trillion cubic meters.

Infrastructure of a gas reserve

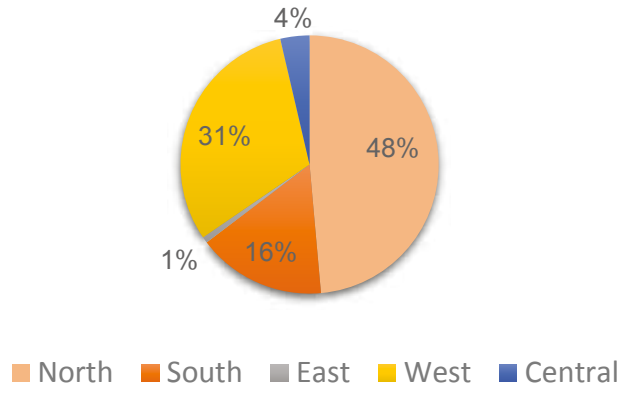
Chart 4.1 Africa's share of global gas reserves (Data source)



Data source: OPEC Annual Statistical Bulletin

Gas reserves are most concentrated in North Africa, which accounts for just under half the reserves, but it is Nigeria and Mozambique who hold the highest and third highest level of reserves by country respectively.

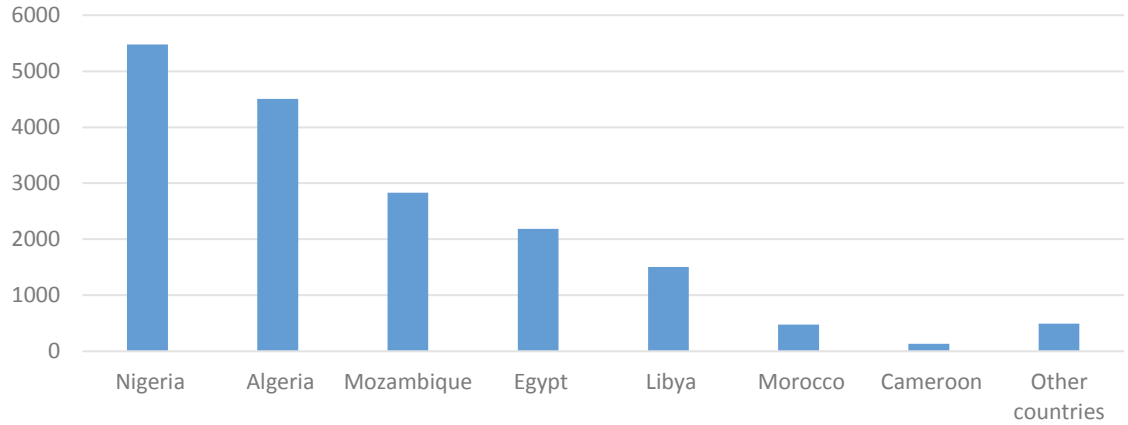
Chart 4.2 Gas reserves by African Region



Data source: EIA

Nigeria holds just over 30% of all African gas reserves, followed by Algeria with 25% and Mozambique with 15%. But reserves are very concentrated in a few countries. The top five countries, those mentioned plus Egypt and Libya hold over 90% of all African gas reserves.

Chart 4.3 Africa's gas reserves by country, billion cubic meters



Data source: EIA

Africa's reserve to production ratio has fallen over the past 30 years from around 110 years in 1990 to just over 60 years today (BP), which reflects higher production. This leaves Africa with the third highest ration of reserves to production, behind the Middle East at over 100 years and the countries of the former Soviet Union (especially Russia) at around 75. As such African countries can be an important producer of gas in the years ahead, but as reflected in Section 5 policy makers need to be consider how best to produce and use that gas form economic, environmental and social perspectives.

Section 5: Policy considerations

The purpose of this report has been to demonstrate, using AFREC data, how gas production and use has developed across Africa in the last half century. However, a key use of energy statistics is that they can be used to help inform policy for the future. This section provides some views on this. It is not a full analysis of options, rather it uses the available energy statistics reported in this paper data to show options that policy makers across Africa may wish to consider in much more detail. It starts with a brief summary of key global perspectives.

5.1 Natural gas in the energy transitions

Natural gas is the cleanest fossil fuel in terms of lower CO2 emissions than oil or coal, which is why it is often spoken about as a transition fuel that can help reduce emissions in the medium term, before gas has to be replaced with non-carbon sources. This role for gas was explored in the AFREC paper "Designing the African Energy Transition" which recommended that African countries "*determine to what extent it makes sense to, during the transition period towards full decarbonisation, unlock Africa's natural gas potential*".

5.2 Future demand for gas

Actual values and growth rates might vary, but a common theme in future energy projections are that gas demand (and hence supply) will grow. In its short term forecasts (Gas 2020) the IEA projected that gas demand would grow by 1.5 % per year to 2025 driven mainly by growth in Asia and Europe and driven by increased demand by industry and power generation. Looking further ahead McKinsey in their "Gas Outlook to 2050" projected gas demand will grow by 0.9% from 2020 to 2035 before, peaking in 2037 and then reduce by 0.4% per year.

Specifically, they project that LNG will grow to 3.4 % per year to 2035 and then still grow but at 0.5% from 2035 to 2050. The EIA's U.S. Energy Outlook published in February 2021 projected, in its reference case, that US gas demand in 2050 would be 37 quadrillion Btu of natural gas compared to around 30 today and that the US's LNG exports will more than double between 2020 and 2029.

The extent to which African countries can contribute to the increased demand is unclear. This might become clearer now that African Energy Ministers have decided to design a comprehensive continental power masterplan for electricity generation and transmission. In addition, the African Single Electricity market may encourage those countries with high reserves of gas to produce more electricity from gas, where they can, effectively allowing gas to be exported through power pools and regional transmission network.

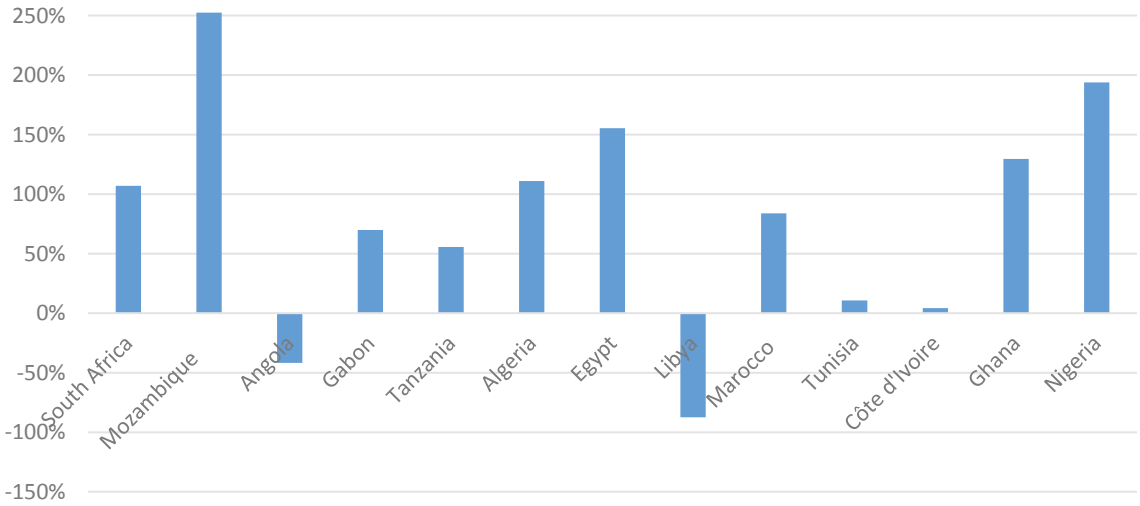
The export window will continue to grow however, as noted above, with the rise in LNG exports of Qatar, the US and Australia, Africa' share of global gas exports has fallen over the past five years, especially for LNG. It would be a reasonable to assume that trend might continue with the very largest producers able to achieve a price advantage and with that a market advantage.

With global demand increasing it is likely that some growth will come to African producers, who can develop their infrastructure, but perhaps it is Africa to Africa trade that is the real area of opportunity for expansion.

5.3 Increase demand in Africa

Chart 3.6 above showed the positive benefit to the supply of electricity from new gas fired power generation. But what is also quite clear from the data is the strong growth that emerges once gas starts to be used as a fuel for final demand, notably in industry and domestic use. The chart below shows the growth in final gas consumption for countries using gas in this way. Most countries have seen gas demand grow by more than 50% in the past 10 years and many by much larger amounts. The falls in Angola are largely linked to increased exports and Libya due to much lower production.

Chart 5.1 Percentage change in final consumption of gas, 2010 to 2019



Note: Ghana shows change since 2017
Data source: AFREC

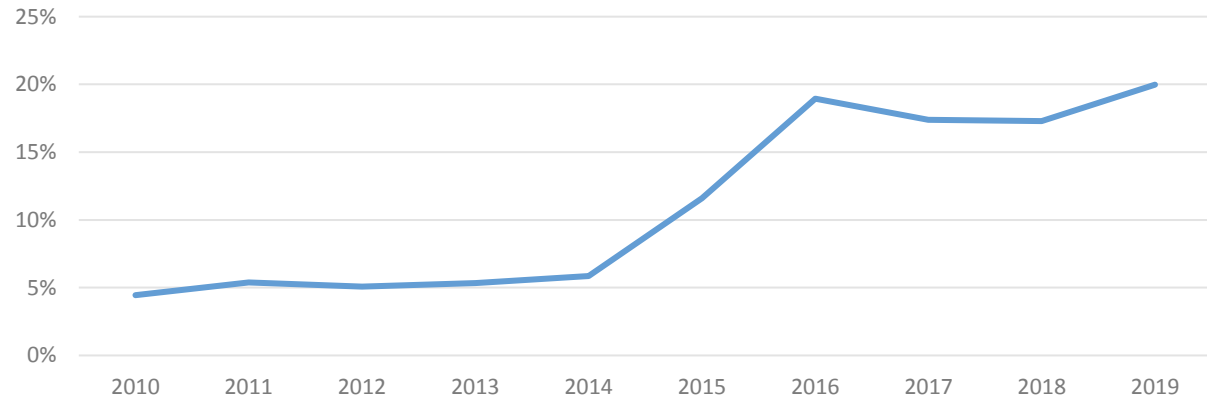
Increasing gas demand across Africa will be challenging, as it will require an expansion and strengthening of the gas network, which is explored below. However, what is likely to be more possible is to explore how gas use can be increased, especially in gas producing countries.

For example if gas networks can be extended, natural gas could start to replace firewood and charcoal use in homes and significantly improve the health of many households using wood stoves. Additionally it could replace diesel used in small generators, which is very significant in Nigeria.

One example of increased use of gas is in Mozambique. As noted Mozambique is an increasingly important gas producing country with significant gas reserves.

However, as the chart below shows, until 2014 the gas produced in Mozambique was largely (around 95%) exported. This changed with the development of gas fired powered electricity generation including through an expansion of Independent Power Producers (IPPs). This increased the share of Mozambique's gas used in country to 20% (chart 5.2).

Chart 5.2 Percentage gas produced used in Mozambique

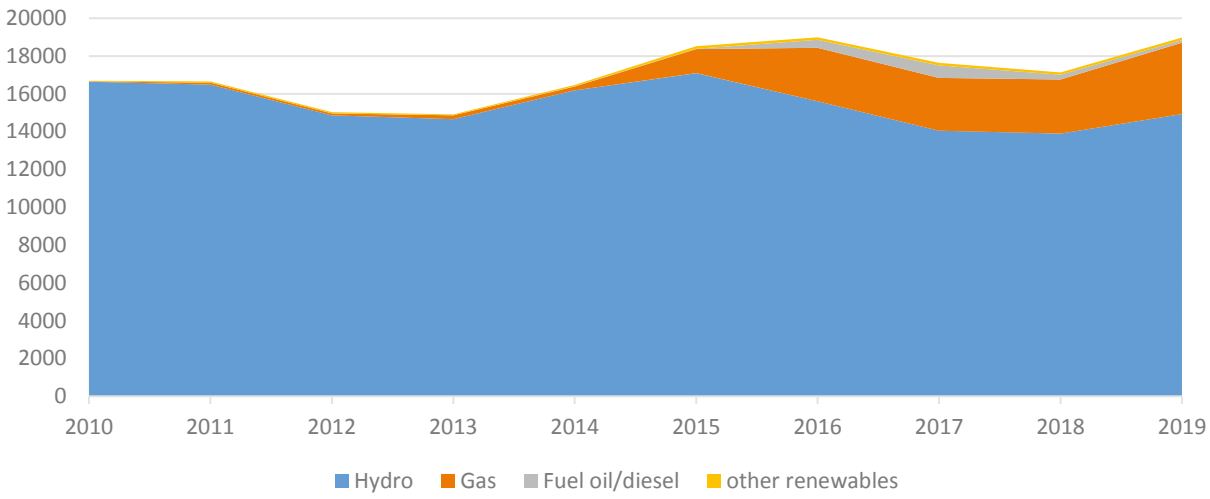


Data source: MIREME, Mozambique

The benefit of this change to Mozambique is clear from looking at electricity generation (chart 5.3). Mozambique is a country that needs to develop more electricity to ensure universal energy access and for supporting business development and improving the quality of lives for many thousands of households. It does have the benefit of significant hydro resources and hydro power has been the main part of its electricity supply.

However, hydro electricity output can fluctuate, mainly due to changes in rainfall. In Mozambique hydropower produced 17 TWh in 2015, but this fell for a number of reasons to 15 TWh in 2019 (and had been at the level for the previous couple of years) a fall of over 10%. However, over this period electricity supplied from gas increased from 1.2 TWh to 3.7 TWh. The increase in gas generation made up for lower hydro and ensured that electricity available for homes and business continued to grow. Had gas continued to be exported at levels seen prior to 2014, this would not have been possible and Mozambique would have faced a real reduction in electricity available.

Chart 5.3 Electricity generation in Mozambique, GWh



Data source: MIREME, Mozambique

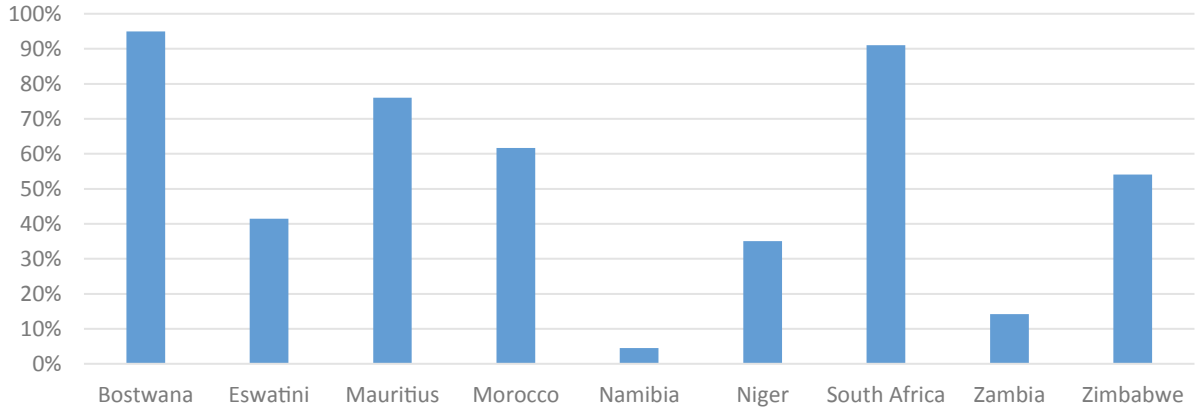
5.4 Gas as a transition fuel for power generation

Natural gas, due to its lower carbon content, can be considered a transition fuel that can help remove and reduce use of fuels which produce the highest emissions, before gas use itself is reduced to meet long-term climate needs. 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 (and the same would be true for oil).

As shown in chart 5.4 a number of African countries, specifically in Southern Africa have a high level of electricity produced from coal. These countries are often coal producers or are close to large coal producing countries and so coal is available and often competitively priced. But many of these countries (Botswana is the exception) also border countries who are significant gas producers (table 5.1).

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 is viable, the use of coal and oil.

Chart 5.4 Percentage share of coal generation (data source)



Data source: AFREC

Table 5.1 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		

5.5 Enhancing gas supply

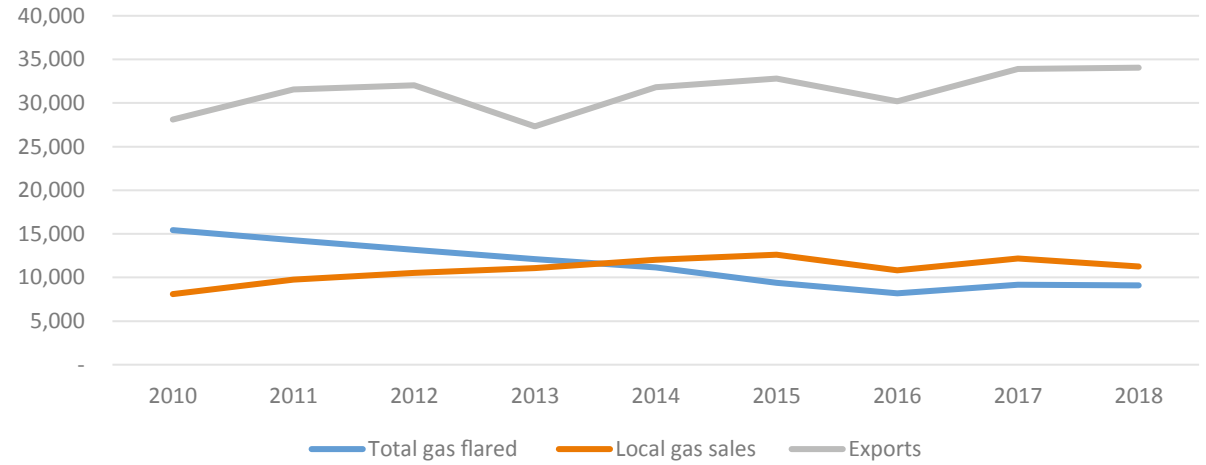
Gas production can be increased by developing new production sites and Africa has a great deal of potential, as covered in the section on reserves. However, a primary consideration for gas produces should be to minimise gas wastage. One example of this is gas flaring, which mainly occurs where gas is produced alongside the production of crude oil. Gas flaring is simply a waste of energy, gas that could be used for productive purposes is just burnt and through that combustion it contributes to Greenhouse Gas emissions.

Gas producing countries should look to minimise any waste of gas through the production of gas directly or associated gas with oil. One country striving to achieve this is Nigeria, who have a goal to reduce gas flaring as a key to their policies and a feature of their Initial Nationally Determined Contributions, as part of Paris climate agreement.

As the chart below shows, some good progress has been made with the amount of gas flared falling by nearly a half between 2010 and 2016, but since then it has stabilised, indicating that additional work is now needed. Crucially the gas that has not been flared is providing energy to Nigeria.

As gas flaring has fallen, the gas available for use has increased and nearly doubled over the period where gas flaring was reduced, although more recently it has been edging lower as exports have increased.

Chart 5.5 Gas Used, exported and flared Nigeria, Million M³



Data source: DPR, NNPC Nigeria

5.6 Infrastructure

Probably the biggest barrier to the expansion of gas use across Africa is the lack of infrastructure on the continent. North Africa is quite well connected from a main hub in Algeria with pipelines connecting Algeria to Morocco and Tunisia as well as through to Europe. Libya also has a gas pipeline to Europe and Egypt one to Jordan.

However, in the other African regions the only operational cross-border gas pipelines are the 678 km West African Gas Pipeline from Nigeria to Benin, Togo and Ghana and the 865 km pipeline from Mozambique to South Africa. That is a total of just over 1500 km or around 3% of the gas network operated by Snam in Italy.

Plans or proposals exist to expand the gas network across Africa including the Trans Sahara Gas Pipeline which would link Algeria to Nigeria and thus bring gas to Niger. In Mozambique there are plans to extend the network along the coast from its centre at Temane to reach Tanzania and a branch to Zimbabwe, whilst Kenya could be the point of an extension of the Tanzanian pipeline.

Financing such projects will be challenging, especially where increasingly investors are not looking to fund fossil fuel related projects. But, as noted above, providing gas to countries could help them move away from coal fired generation and thus help reduce harmful Greenhouse gas emissions as well as potentially helping business grow and providing power to homes.

Acknowledgements

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 and 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 the situation, which may assist them in taking 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.

Comments on the report are welcome and can be sent to: afrec@africa-union.org

This report has been produced for AFREC by Mr. Duncan Millard, International energy adviser, and coordinated by Mr. Yagouba Traore, Head of Policy Strategy and Support at AFREC. Contributions were made from Mr Sylvain Degolmal Ngaryo, Principal Policy Officer at AFREC, Mr Abdoulaye Oueddo, Senior Policy Officer at AFREC, Ms Ndahafa Nakwafila, Communication Officer at AFREC, Mr Fred Kabanda, Division Manager at the African Natural Resources Centre of AfDB, Mr Arron Tchouksa Singhe, Chief Oil Sector Officer at the African Natural Resources Centre of AfDB, Mr Simbini Tichakunda, Energy Infrastructure Expert at AUDA-NEPAD, Mr Benjamin Akobundu, Programme officer energy and infrastructure at AUDA-NEPAD, Mr Crispen Zana, Principal Energy Advisor at AUDA-NEPAD, Ms Afef Chachi, Director of the National Energy and Mines Observatory at Ministry of Industry, Energy and Mines of Tunisia and Mr Abdulkareem Aliyu, Director, Energy Training and Manpower Development at the National Energy Commission of Nigeria.

Sincere thanks go to the statisticians in all AU Member States working to produce the energy data that this report is based on and colleagues across African institutions for their comments.

African Energy Commission (AFREC)
02 Rue Chenoua, BP791, Hydra, 16035, Algiers, Algeria
Tel: +213 23 45 91 98 | Fax: 213 23 45 92 00
Email: Afrec@africa-union.org | www.au-afrec.org
Follow us on Social media@African Energy Commission

References

- African Energy Statistics Data (by AFREC):
  https://au-afrec.org/En/administration/index.php

- AFREC, 2021. Designing the African Energy Transition. Retrieved from
  https://au-afrec.org/publications/afrec-energy-transition-en.pdf

- BP Statistics Review.2020. Statistical Review of World Energy 2020

- EIA. 2021. Annual Energy Outlook 2021 (eia.gov). Retrieved from
  www.eia.gov

- IEA World Energy Balance and highlights
  https://www.iea.org/subscribe-to-data-services/world-energy-balances-and-statistics
  Monthly OECD Natural Gas statistics
  Monthly Gas Statistics - Data product - IEA

- JODI.2021.
  Joint Organisations Data Initiative | Oil and Gas Data Transparency (jodidata.org)

- McKinsey Global gas outlook to 2050
  Global gas outlook to 2050 | McKinsey

- OPEC Annual Statistics Bulletin
  Data download (opec.org)

Notes

Notes

African Energy Commission (AFREC)
02 Rue Chenoua, BP791, Hydra,16035, Algiers, Algeria

Tel: +213 23 45 9198 / Fax: 213 23 45 92 00
Email: Afrec@africa-union.org
www.au-afrec.org