



Natural gas: Africa's energy transition accelerator



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The role of natural gas in Africa's energy transition

Latest assessments of Africa's electricity sector show the progress being made, despite the underlying structural challenges. More Africans have access to electricity than before, currently fewer than 600 million people still cannot access electricity. However, progress must accelerate to connect millions more and close the daunting remaining gap. In 2017, for the first time, the growth rate of electricity access surpassed the rate of population growth in most regions of the continent, leading to a modest decline in lack of access. Progress in Ethiopia, Ghana, Kenya, Rwanda and Senegal and projections that they could attain full access to electricity for their peoples by 2030 at current trends demonstrate the unevenness, and also the possibility, in meeting targets under Sustainable Development Goal 7 in Africa.

Installed electricity capacity in Africa is also growing modestly. The rate of adding new electricity capacity, including the installation of 15.5 gigawatts (GW) in 2017, kept pace with the rate of population growth, except in Central Africa, and with the rate of growth in the economy, measured by gross domestic product (GDP), except in East Africa. Furthermore, there was modest growth in private-sector financing of energy investments, which is 90 per cent undertaken through public and international development finance (ICA, 2018). There was also modest growth in the private sector in electricity generation, with 6.8 GW of new capacity coming from independent power producers (IPPs). The continent's energy financing need of up to \$90 billion per year implies that the participation of the private sector will continue to be crucial.

The energy sector of Africa is facing major transformation, in the face of expected quadrupling of demand by 2040. Under the scenario of progress envisaged in the African Union's Agenda 2063, electricity supply is expected to expand by 600 GW of new capacity and demand to exceed 1,700 terawatt hours (TWh) (IEA, 2019). These bring both a significant financing challenge and new opportunities for Africa to shape its energy future. There are varying assessments of the direction that Africa's energy future will take. Latest analyses indicate that renewable energy will account for nearly 60 per cent of future capacity, and that the share of natural gas in electricity generation will rise to 30 per cent in Sub-Saharan Africa, from the current average share of under 5 per cent. Under this view, a combination of solar, wind and hydro energy and a calibrated role for natural gas is expected to drive the future direction of energy-sector transformation. It is within this context that this paper takes a closer look at the role of natural gas in powering Africa's energy future.

In many countries, particularly low-income countries, gas competes with coal, oil and hydro in the power generation market. Therefore, its success is often conceived as dependent on its pricing vis-à-vis these competing fuels. However, in Africa this scenario is often more complex. Except for South Africa, Zimbabwe and Botswana, very few countries use coal to generate electricity. The countries with significant gas deposits do not have large-scale coal reserves. Even in most of these countries, their default source of power generation is oil, when generation from hydro is curtailed. Therefore, renewables and other cleaner fuels are important in fast-tracking modern energy transition in Africa, and natural gas deployment should not only be conceived as displacing oil for power generation.

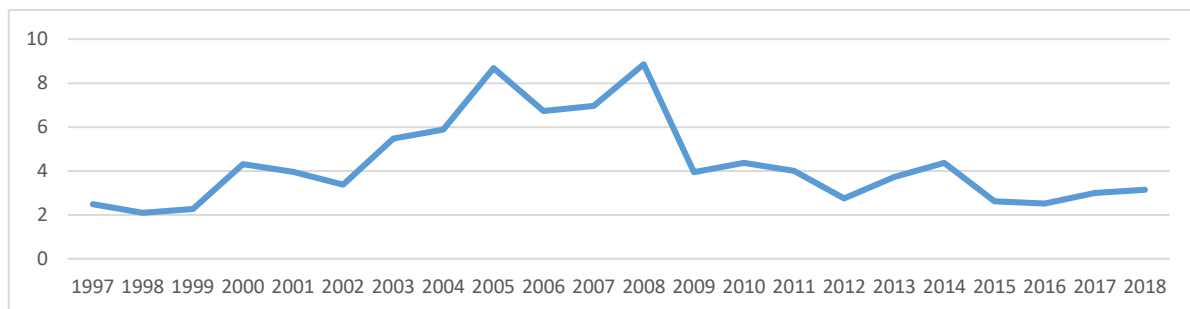
Powering Africa with natural gas

Globally, a number of factors are driving the expanding use of natural gas. First, natural gas prices have fallen markedly from their historic highs. Prices had declined in recent years, by 27 per cent compared with 2000, by 63 per cent compared with prices in 2005 and by 28 per cent when compared with prices in 2010.¹ Such stable and low prices have attracted demand for gas in both the industrial and electricity sectors and, to a limited extent, from the transport sector. In addition, there has been a trend of shifting gas prices from long-term to competitive short-term contracts.

Figure 1

World spot prices for natural gas

(measured at the Henry hub pipeline, in US dollars per million British thermal units Btu)



Source: Based on data from the US Energy Information Administration.

Second, technological changes, such as fracking of shale gas, have significantly expanded international gas supply, maintaining lower prices. Changes in the technology for liquefied natural gas (LNG), such as floating storage and regasification, have improved gas supply options when with infrastructure is limited and liquefaction has enabled the transport of gas to places with limited or no pipeline infrastructure.

Third, the high-cost of generating electricity largely from fuel-based sources required displacement to lower-cost alternatives globally, including gas. In Africa, more than 15 per cent of electricity supply was generated from diesel and heavy fuel oil, raising interest in alternative low-cost options.

Fourth, by far the most significant driver in recent years in Africa has been the discovery of sizeable natural gas resources across Africa, notably in Egypt, Mauritania, Senegal and significantly in the United Republic of Tanzania and Mozambique. These supplement the existing supply in Algeria, Benin, Cameroon, Congo, Côte d'Ivoire, Gabon, Ghana, Libya, Morocco, Nigeria and Tunisia. However, although Africa accounted for 41 per cent of the world's new gas discoveries between 2011-2018, the share of gas demand and production remained at a minimal 4 per cent and 6 per cent, respectively (IEA, 2019).

¹ Based on Energy Information Administration historical natural gas spot prices at Henry Hub pipeline per million British thermal units (Btu). The Henry Hub natural gas pipeline in Louisiana, United States of America, is the pricing point for natural gas futures on the New York Mercantile Exchange (NYMEX).

Table 1
Gas resources and gas production in selected African countries
(measured in billions of standard cubic feet bcf)

	Gas Resources (bcf)	Gas Production (bcf)
Nigeria	91 973	1 653
Equatorial Guinea	14 302	337
United Republic of Tanzania	114 915	53
Angola	32 792	197
Mozambique	204 747	152

Source: Rystad Energy, 2018; Fitch Solutions, 2018; fDi Markets, 2018.

Figure 2
Natural gas production and trade
(measured in terajoules TJ)

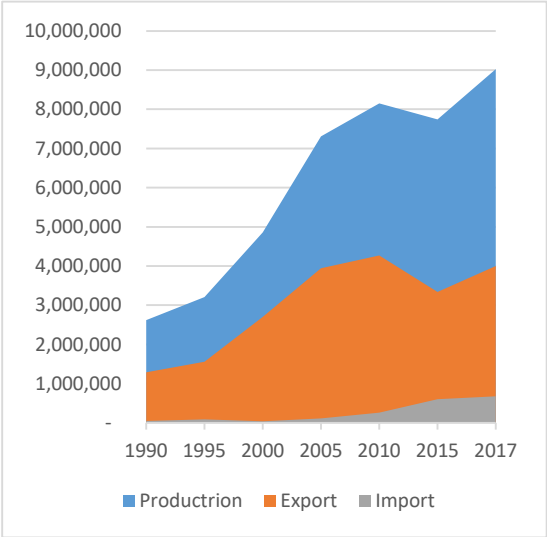
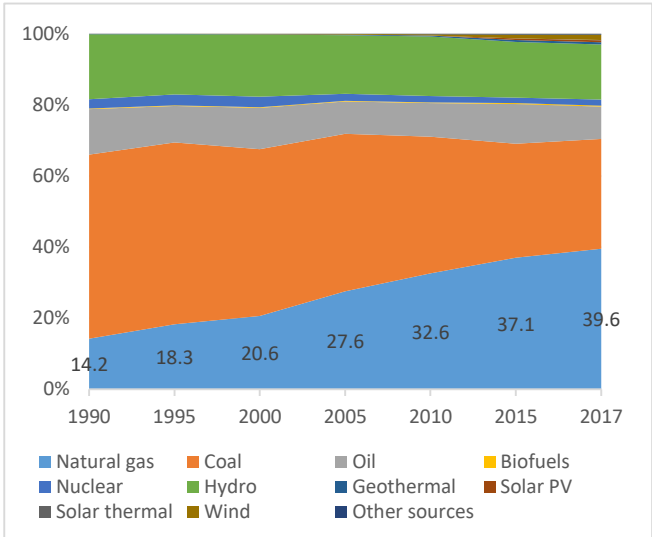


Figure 3
Evolution of Africa’s energy mix



Source: Based on data from the International Energy Agency (IEA).

The African economy in general, and the energy sector specifically, are affected by developments in the natural gas industry. Since 2000, continental production of gas, measured in terajoules (TJ) equivalent, increased by more than 85 per cent, and exports expanded by 48 per cent. Though limited, gas imports to the continent also increased by more than 1,600 per cent in the same period, demonstrating the growth of the gas industry and the fragmented nature of the gas market in Africa. Oil and gas exports generated about \$1.7 trillion net income to African producers in the 2000s, and the resource industry contributed a quarter of economic growth through 2008 (Leke and others, 2010).

Even more profound is the effect of gas in the transformation of Africa’s energy systems. The share of gas in electricity generation stood at 14 per cent in 1990 and grew to 21 per cent by 2000. By 2010, nearly a third of electricity generation was sourced from gas and this

increased to nearly 40 per cent by 2018, driven by high gas utilization, particularly in North Africa.

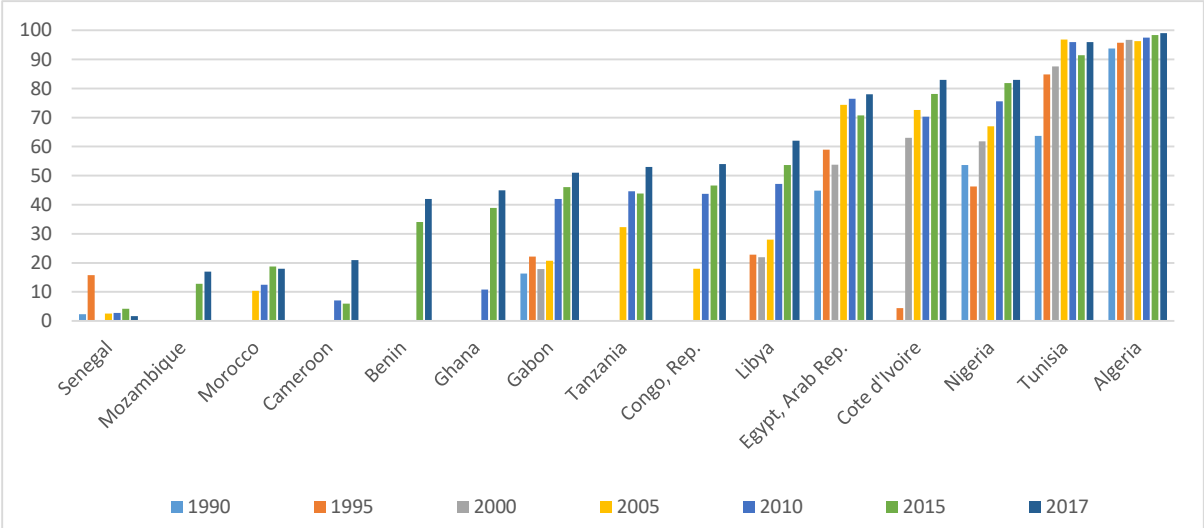
Despite the growth in production of natural gas and its effect in diversifying the energy mix, this promising overall picture masks the structural challenges to upscaling the role of gas in different regions of Africa, currently gas-based electricity generation is concentrated in resource-endowed countries. For example, one study (Castellano and others, 2015) highlighted that Africa has the potential to generate 400 GW of electricity using gas. The United Republic of Tanzania, Mozambique and Nigeria would account for 60 per cent of this capacity and this suggests that the penetration of gas for generation would be limited in those African countries that do not produce gas.

Patterns of natural gas usage in Africa

The utilization of natural gas in Africa follows three distinct patterns, which are symptomatic of the pattern and nature of the gas industry development in the continent.

First, integration of natural gas in the energy system in Africa is limited to 15 countries. In all of these countries, there is a level of natural-gas production activity that is benefiting the use of gas in energy. While the share of electricity generated from gas is limited in countries with recent gas discoveries, the share of natural gas has remained above 40 per cent in most cases.

Figure 4
Share of gas in electricity generation 1990-2017

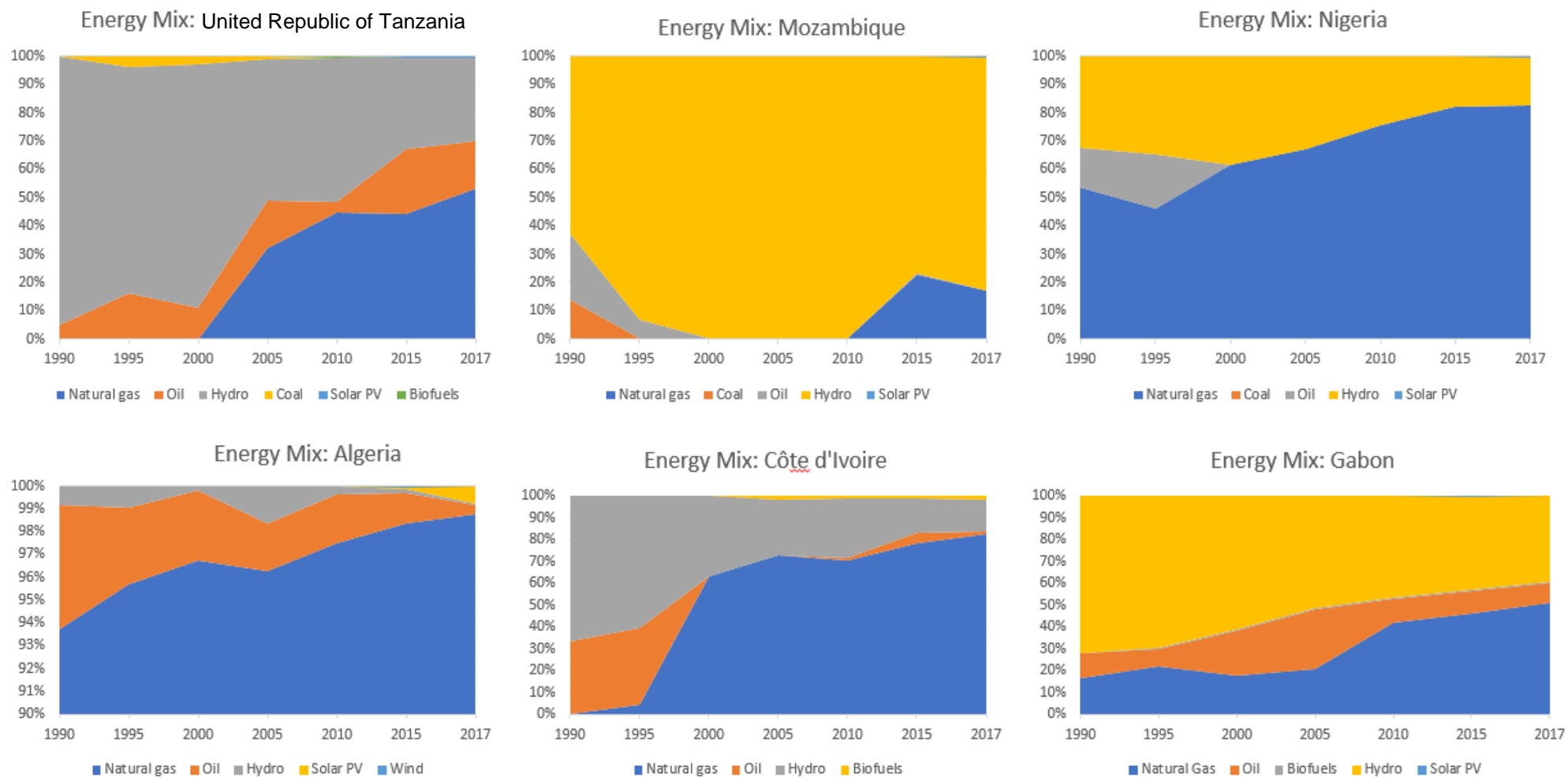


Source: Based on data from the International Energy Agency (IEA).

Second, in countries that are endowed with natural gas and produce it, the energy mix has markedly changed and there has been increasing integration of gas. In the United Republic of Tanzania, the share of gas in the energy mix was zero by 2000, rapidly increasing to 32 per cent by 2005 and 53 per cent by 2017. In Côte d’Ivoire, the share grew from 4.5 per cent in 1995 to 73 per cent by 2005 and 83 per cent by 2017. Similarly, Gabon saw a rising share of gas in the energy mix from 18 per cent in 2000 to 51 per cent by 2017.

Third, in African countries where there is no natural gas production activity, the use of gas in the energy mix is minimal or non-existent, despite the increasing global and regional supply of gas at lower prices, improved technology to deliver gas and the global supply chain. This calls for a new approach towards increasing the share of gas in the energy mix and integrating it in the energy mix of nearly 40 African countries.

Figure 5
The energy mix for generating electricity in selected African countries (%)



Source: Based on data from the International Energy Agency (IEA).

Challenges and opportunities to Africa’s transition to a low-carbon gas future

Key challenges stand in the way of rapid uptake of natural gas in the energy sector and in realizing the key role of gas in meeting challenges of energy access, capacity expansion, diversification and decarbonization of Africa’s energy sector.

- *Limited gas penetration in nearly 40 African countries:* Despite major gas discoveries in the continent, sharp increase in global gas supply and lower and sustained global gas prices, nearly 40 African countries have not benefited from diversifying their energy mix through the introduction of electricity generation based on natural gas. Energy officials in these countries will need to look closely on the transformative role which gas-fired plants can play as a transition fuel.

Figure 6
Share of natural gas in electricity generation in Africa



Source: World Development Indicators (through 2015), IEA (2017).

- *Charting a clean energy future:* Natural gas offers a baseload fuel complementing the rapid uptake of renewable energy sources in Africa. Managed integration of gas requires long-term planning. To realize the current forecast that gas-based generation will reach nearly 40 per cent of electricity generation in Africa, sound national energy planning is needed.

Figure 7

Pictures of gas plants in Egypt (left) and the United Republic of Tanzania (right)



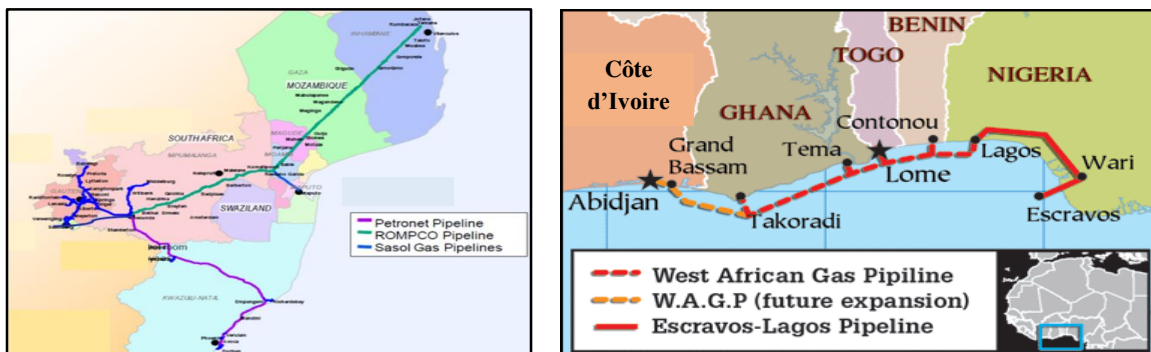
Source: <http://www.constructionweekonline.com>

Source: <http://www.thecitizen.co.tz>.

- *Critical shortage of gas infrastructure:* There is an acute gap in gas storage and distribution infrastructure in both gas-producing and non-producing countries. The Mozambique-South Africa pipeline (865 kilometres long, run by Sasol) and the West African Gas Pipeline (WAGP) connecting Nigeria to Ghana, Benin and Togo serve as case studies which can be used to evaluate the efficacy of regional infrastructure interconnections for gas, despite experiencing interruptions in gas supply and other challenges. The West Africa pipeline is 678 kilometres long and supplies gas from Nigeria’s Escravos Niger Delta region to Benin, Togo and Ghana, and there is a plan to expand it to Côte d’Ivoire. In anticipation of the role of gas as a transition fuel, member States should plan on expanding their domestic gas infrastructure and foster regional cooperation for inter-state gas infrastructure network. Upcoming regional projects require investment support from the public and private sectors, including the United Republic of Tanzania-Kenya and the United Republic of Tanzania-Uganda initiatives for gas interconnections.

Figure 8

Selected African gas pipelines



Source: <http://www.nogtec.com>

Source: <http://venturesafrica.com>

- *Commitment to limit flaring*: nearly 15 per cent of gas production is wasted by flaring in Nigeria, though the rate has dropped by 70 per cent since 2000. In 2018 alone, this imposed an economic loss of \$1.8 billion (IEA, 2019). The United States Energy Information Administration (EIA) estimates that nearly 85 per cent of Republic of Congo’s natural gas is either re-injected for oil recovery, or vented and flared, though efforts are underway to cut flaring. Reducing flaring and tapping the gas resource to reach alternative markets, such as electricity and clean cooking, offers better economic prospects.

Figure 9
Gas flaring illustrations



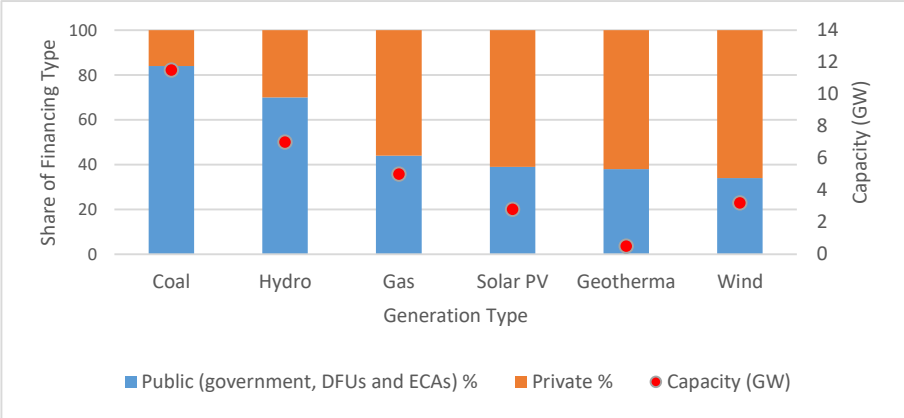
Source: <http://www.guardian.ng>



Source: <https://www.vanguardngr.com>

- *Developing a liquefied natural gas market*: Member States, such as Mozambique, the United Republic of Tanzania and Senegal, aim to develop liquefied natural gas (LNG) plants. Such infrastructure is crucial in expanding domestic and regional gas supply. African countries that do not produce gas can also aim to bridge the LNG infrastructure gap and develop competitive domestic and regional markets for LNG.
- *Required investment and finance*: The exploration, discovery and development of natural gas fields requires an improvement in policy regarding upstream energy developments, particularly oil and gas, and support for a conducive business climate for private-sector finance. On average, nearly 90 per cent of energy projects in Africa are publicly funded, including through collaboration with international development finance institutions (ICA, 2018). The role of the private sector remains minimal, though it has increased modestly in recent years. If the share of natural gas in generation is to rise in Africa as expected, private-sector participation and investment will be crucial. Nearly 42 per cent of investments in natural gas projects are undertaken through private finance, although public finance accounted for two thirds of new projects with final investment decisions between 2014-2018 (IEA, 2019, p143). It is necessary that member States develop and implement business models, along with conducive regulatory and business climate, that encourage private sector investment and partnerships.

Figure 10
Source of finance for electricity generation 2014-18 (%)



Source: Based on data from the International Energy Agency.

Conclusion

Africa is at the cusp of energy sector transformation driven by natural gas. Its ambitious economic and social goals require accelerated progress in expanding energy capacity. This can be met through investment in clean energy sources, supplemented by a rapid uptake of natural gas as a clean transition fuel. Already, appreciable level of the continent’s total power supply comes from natural gas, even though there are regional disparities, particularly in Eastern and Southern Africa, where there is limited integration of gas in the energy mix. In meeting the daunting prospect of quadrupling energy demand in the coming few decades, natural gas offers a clean base-load power to bridge the introduction of renewable energy. However, key challenges remain that limit the transformative role of gas in Africa. These include: limited use of gas in nearly 40 African countries; the need to expand gas infrastructure; development of competitive gas markets, including for liquefied natural gas; development of sound energy plans to steer the introduction of gas in the energy mix; promoting regional integration of the natural gas markets; minimizing flaring and venting of natural gas and tapping the resource to alternative economic uses, including in electricity and clean cooking; and mobilizing private-sector investment and finance. These measures will accelerate the transformative role of natural gas in Africa’s energy future. Natural gas is at the centre of the people, planet and prosperity agenda.

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