

AFRICA: Outlook for Natural Gas and Fertilizers

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In order to power their economies and feed their growing populations, African nations must bring more of the continent's generous natural gas reserves out of the ground. They must balance incentives to turn some of that gas into fertilizers the agricultural sector so dearly needs.

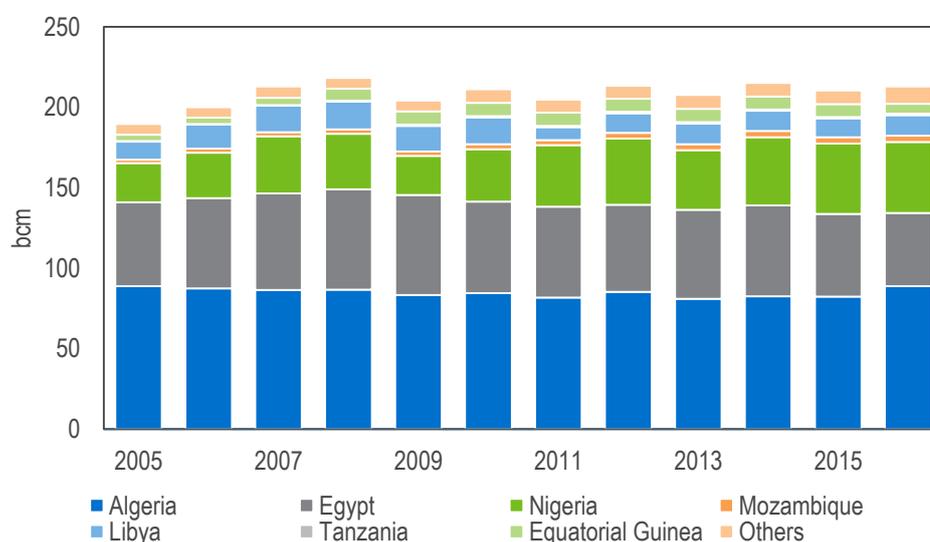
Despite the slowdown in the economy in 2016, Africa reported three percent growth in 2017 which was higher than the 2.2 percent growth in 2016. Sub Saharan Africa (SSA) recorded growth of 2.4 percent. Unlike in developed countries, where manufacturing and service industries contribute significantly to their gross domestic product (GDP), the agriculture sector in Africa accounts for over 15 percent of the GDP, or more than \$100 billion annually. The sector is highly concentrated, with Egypt and Nigeria alone accounting for one-third of total output and the top ten countries generating 75 percent. In Sub Saharan Africa, agriculture accounts for over one-third of GDP and export earnings and employs over 60 percent of the population. While most of the malnourished are located in Asia, the highest proportion of malnourished people (relative to total populations in these regions) is in African countries, with women and children constituting the most vulnerable groups.

Africa’s burgeoning population, economic growth potential, and rich endowment with energy resources combine to render the region a hotspot for significant global gas supply and fertilizer demand growth. Less than 20 percent of the world’s population lived in Africa as of 2017, but according to United Nations projections, more than half of global population growth between now and 2050 is expected to occur in Africa. Today, the region’s natural gas and fertilizer consumption levels are fairly modest relative to the size of its population. Uneven wealth distribution, a lack of creditworthy off takers to support large-scale gas-based projects, political instability, and the uneven distribution of indigenous energy resources are just some of the factors that have hampered the uptake of natural gas in the region’s energy supply mix. Improved gas supply availability is essential for Africa to develop economically and produce a higher standard of living for its inhabitants, but political and regulatory stability are critical for the development of the fertilizer sector in the continent.

AFRICA NATURAL GAS MARKET

Despite having more than 14 trillion cubic meters of proved reserves (almost 500 trillion cubic feet; eight percent of the global total), natural gas output in 2016 was just over 210 billion cubic meters: less than six percent of world output that year. The bulk of regional output originates in North Africa (70 percent), with Algeria and Egypt being the major gas producing regions. West Africa is the next-largest regional producing province, with the credit going largely to Nigeria. In recent years, Africa’s gas producers have experienced marked supply fluctuations owing to a myriad of factors such as security concerns in Algeria, Libya, and Nigeria; technical issues in Angola; and a lack of investment partly attributable to an uncompetitive commercial/regulatory environment in Algeria, Egypt, and Nigeria.

FIGURE 1 - AFRICA NATURAL GAS PRODUCTION BY REGION



Regional output is projected to grow by 60 bcm through 2025, as new production centers emerge in West Africa and East Africa. Capacity additions are expected in parts of North Africa too, where Algeria keeps its position as Africa's premier producer on the back of its already-large production base and conventional and unconventional gas production gains. But the most buoyant prospects over the forecast period belong to Egypt, Mozambique and Nigeria.

Nigeria's gains depend on the establishment of a bankable commercial structure for Nigeria's gas sector. The government needs to redefine the role of public companies, improve regulations and reform prices. Failure on this front will adversely affect the natural gas supply outlook.

In Mozambique, the discovery of gas reserves in 2010, estimated at 180 trillion cubic feet (five trillion cubic metres) in the surrounding Rovuma Basin, has positioned the country to become one of the top producers in Africa. Nexant's outlook for Mozambique is predicated on the start-up of two planned LNG export projects in the 2020s.

In the longer term, East African production rises further as export capacity is commissioned in Tanzania, but this will probably occur beyond the forecast period.

Algeria and Egypt account for 70 percent of African gas production. They are discussed in greater detail below.

ALGERIA

Algeria is the second largest gas reserves holder in Africa after Nigeria, and is the largest gas producer in Africa. The U.S. Energy Information Administration (EIA) estimates that Algeria contains 707 trillion cubic feet of technically recoverable shale gas and 5.7 billion barrels of oil. Half of the country's proven reserves are in the giant Hassi R'mel field in the Oued Maya basin.

The rest of Algeria's gas reserves are distributed among non-associated and associated gas deposits in the southeastern part of the country in the Illizzi basin and the in southwestern Ahnet and Reggane basins. Almost half of the country's gross gas production is re-injected in oil fields for pressure support to recover the more valuable crude oil and liquids.

The country's marketed production is around 80 b(s)cm, but this is only 40 to 50 percent of wellhead production since the remaining is re-injected for optimal recovery of liquids from the fields, flared or vented. Algeria's crude oil fields are therefore acting as gas storage which would ultimately be drawn upon as Algeria's crude oil reserves start depleting.

In addition to new developments in the south-eastern areas (Berkine Basin), and further south (In Amenas), the Algerian government is also looking at the south-western region for reserves replacement. The largest producing project in the south-west is BP and Statoil's In Salah group of fields. The rest of the southern gas reserves, however, are very commercially challenging as they are contained in small reservoirs separated by significant distances which makes their accumulation very costly.

It should be noted that no major upstream developments and gas discoveries have taken place since the 1990s, when Algeria ranked among the top countries with large new discoveries. The major impediment to the development of new hydrocarbon reserves was, initially, the uncertainty that affected the hydrocarbon investment climate in Algeria in the early 2000s. This happened when a very liberal new hydrocarbons law was issued by the then new minister of energy and mines, a law that was strongly opposed by the unions, civil society, and important segments of the political and military establishments. This law was subsequently amended, but instead of providing incentives for more upstream developments, it led to concerns expressed by the IOCs about new amendments, like the issue of windfall profit tax and resulted in litigation cases raised by some of the IOCs operating in Algeria. In February 2013, the final revised version of this hydrocarbons law was issued with new taxes replacing the controversial windfall tax.

Overall gas production is expected to increase towards the end of this decade as on-going gas developments come on-stream, but mostly after 2020 as the gas supply outlook could be reversed as output from old mature fields, such as Hassi R'mel, start to decline. Due to a current stagnation of its gas reserves base, Algeria could be facing some serious challenges in terms of declining gas production levels. With a rapidly growing domestic gas demand, this could have a serious impact on the country's future incremental gas export potential (and future export earnings). In recent years Algeria has experienced various fatal attacks by Islamic militants on its gas infrastructure which have caused some gas plants to shut down (at least partly). Security has been stepped up in some plants in order to prevent similar situations in the future.

EGYPT

Egypt is the second largest producer of natural gas in Africa, with an estimated production of over 19 bcm in 2017. In the 1990s a number of significant gas discoveries were made by ENI and BG Group in the deep waters of the Mediterranean, offshore the Nile Delta. With 2P gas reserves quickly jumping to a level of at least one thousand b(s)cm by the late 1990's, concerns started emerging from IOCs about the ability of Egypt to develop a gas market quickly enough to absorb the anticipated surge in production once development leases have been granted for gas discoveries. This led to the sanctioning of one LNG export train in the Egyptian LNG project in Idku, to alleviate those concerns. The domestic gas market in Egypt however did develop exceptionally fast, growing from just under 20 b(s)cm/y to about 48 b(s)cm/y in 2013. Arguably Egyptian demand was mismanaged as exports grew very quickly with the addition of another train in the Egyptian LNG project, a sanctioning of another major LNG export project in Damietta, and the sanctioning of a pipeline export project to Israel and Jordan resulting in shortages in supply for the growing domestic market.

With the exception of the mature GoS and Western Desert basin areas, and the quickly maturing Nile Delta, Egypt has very limited prospect for additional discoveries and hence Egypt's indigenous gas reserves are expected to deplete very quickly over the next two decades with an estimated reserves production ratio currently at about 15 years.

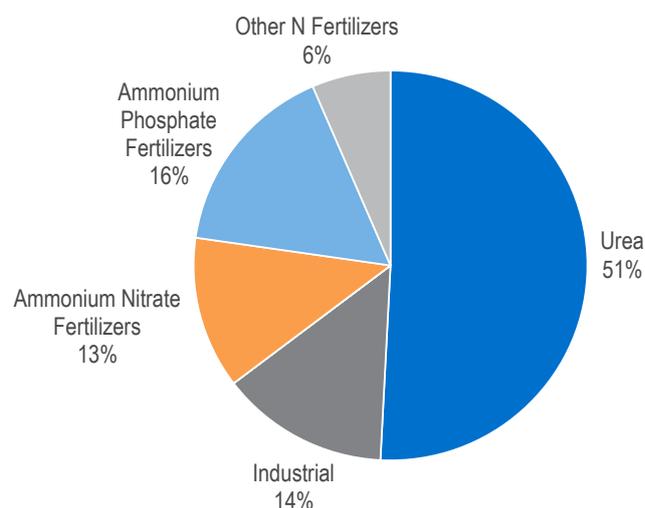
AFRICA NITROGEN FERTILIZER MARKET

Consumption

Ammonia

Africa consumes relatively small amounts of ammonia, especially considering the size and population of the region, consuming an estimated six million tons in 2017. The major end use of ammonia is in urea and ammonium phosphates production.

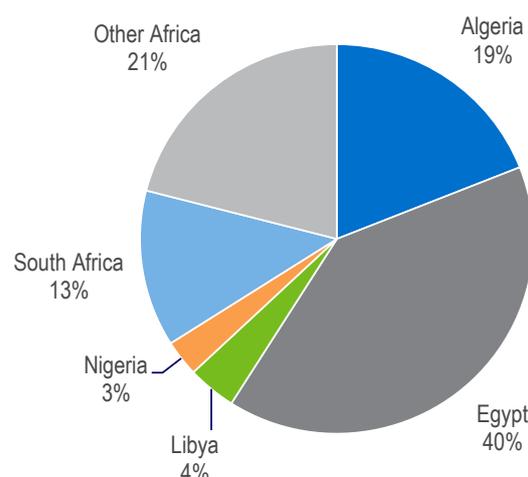
FIGURE 2 - AFRICA AMMONIA DEMAND BY END USE



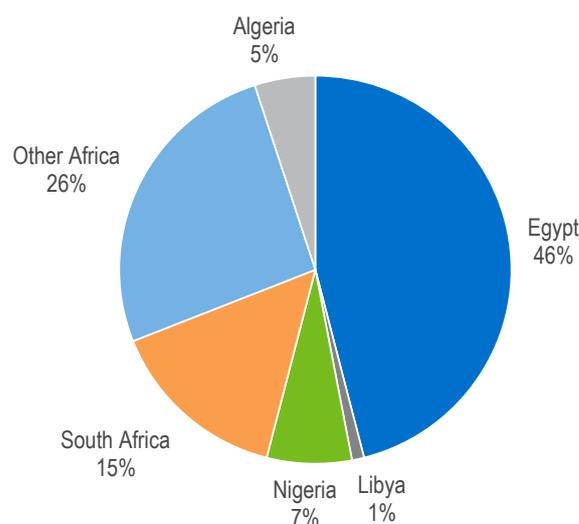
In the forecast period, ammonia growth rate is expected to average about 3.5 percent per year with demand estimated to reach about seven million tons by 2025. Approximately 51 percent of ammonia is used for urea production in the region. The majority of urea capacity in Africa is located in Egypt.

Ammonium phosphate fertilizers account for about 15 percent of consumption of ammonia. Phosphate rock supply is expected to increase in the region, resulting in increased consumption of ammonia into ammonium phosphates. Ammonium phosphates are mainly produced in Morocco and Tunisia. OCP finally brought another 2 million tons of DAP/MAP/NP capacity online in 2017 after slurry pipeline technical setbacks postponed such plans in 2015 in Morocco. NPK production is concentrated in South Africa and Morocco. NPK capacity increased by about 300 thousand tons in 2016 in Kenya, as a result of the capacity additions by MEA Limited and Toyota.

Ammonium nitrates production is concentrated in Egypt and South Africa. Ammonium nitrates (AN) demand in Africa consists mainly of AN with a relatively small market for urea ammonium nitrate and calcium ammonium nitrate. South Africa is by far the largest consumer of explosive grade ammonium nitrate (EGAN) with a share of around 80 percent of the region's demand. About half of the EGAN demand in South Africa is consumed in the coal mining industry. Rising demand for coal domestically and internationally is expected to increase the demand for EGAN in South Africa in the future.

FIGURE 3 - AFRICA AMMONIA CONSUMPTION BY COUNTRY**UREA**

Urea demand in Africa is estimated to be close to five million tons in 2017, with around 90 percent consumed in direct fertilizer use for food production. Maize and cereals and pulses are the major crops in the region. The largest consumers in Africa are Egypt and South Africa.

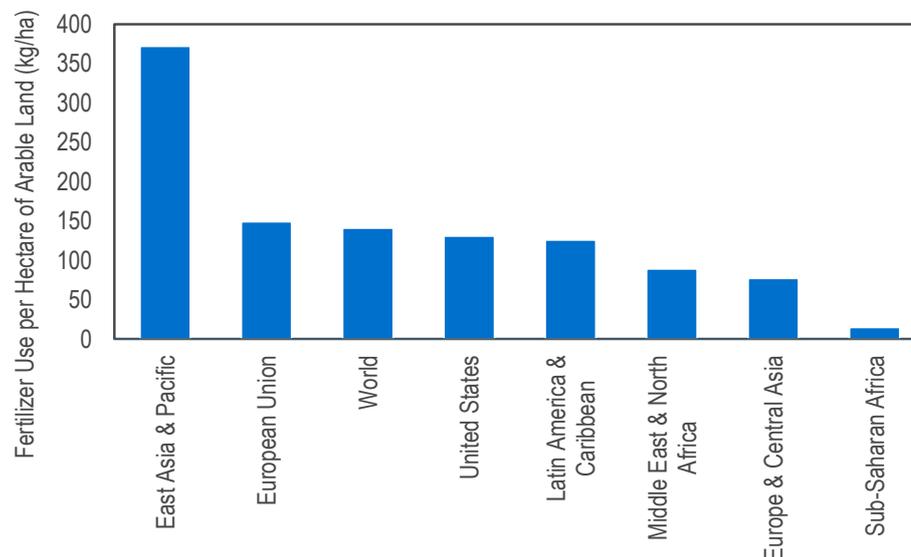
FIGURE 4 - AFRICA UREA CONSUMPTION BY COUNTRY

Sub Saharan Africa includes Nigeria, and Other Africa countries such as Liberia, Mali, Mauritania, Sao Tome and Principe, the Seychelles, Somalia, South Sudan, Sudan or Zimbabwe, etc.

Compared to the other developing regions, fertilizer consumption in Africa has increased only marginally over the past four decades. The low use of fertilizer results in low crop productivity and, in turn, in high prevalence of hunger and fast conversion of natural habitats to farming. In order to address this challenge, in 2006, African leaders adopted the Abuja Declaration, which called for increasing average fertilizer use in SSA from less than 10 kg/ha to at least 50 kg/ha by 2015.

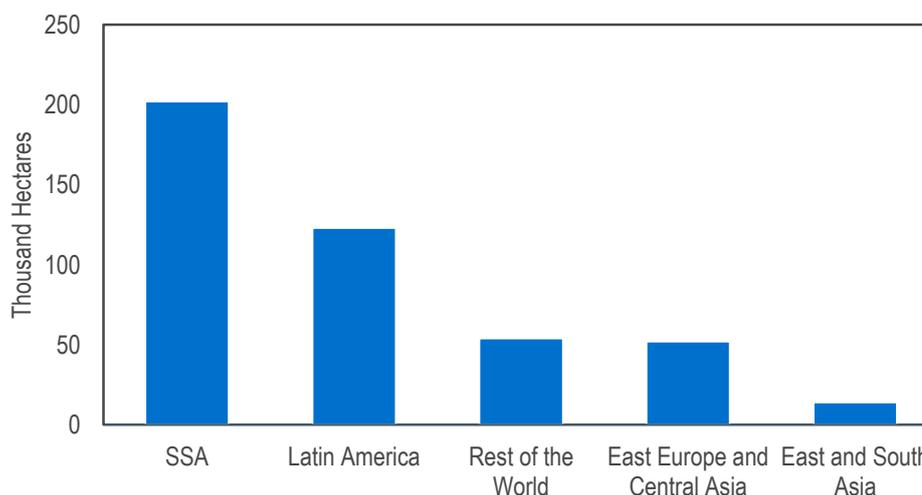
However, by 2014, the application rate was less than 20 kg/ha in Africa. Fertilizer application rates per hectare in SSA are the lowest in the world at an equivalent of 3 percent of Asia’s and 9 percent of North America’s application rates. The average application rate in North Africa is 120 kg/ha, which is the highest in the African region. In 2014, Abuja Declaration renewed its commitment to increasing agricultural productivity during the agricultural ministerial meeting in Malabo.

FIGURE 5 - FERTILIZER CONSUMPTION BY REGION



Sub Saharan Africa, representing about 15 to 20 percent of consumption, presents an enormous opportunity for fertilizer growth given the below average nutrient application rates. The uncultivated land in SSA, which is close to 50 percent of the global uncultivated land available, will support the cultivation of crops.

FIGURE 6 - UNCULTIVATED LAND BY REGION



According to IFDC, the consumption of fertilizers is two to three times lower than required in order to meet the needs of the agricultural sector in Africa. Some of the key challenges facing the agriculture sector in Africa are: soil nutrient depletion, low agricultural productivity, increasing population and declining arable land per capita and climate change.

About one-third of African countries have formal fertilizer policy and regulatory frameworks to guide the fertilizer sector, while the rest govern their sectors by administrative decree. However, many of these formal policies and regulations are outdated (enacted in the 1970s and 1980s) and often are not specific to fertilizers but cover a wide range of food items under the same law. While some have been updated since 2006 (as is the case of Uganda), they have not yet been signed into law and even then they often lack some key elements needed to encourage increased investments in the fertilizer markets. Moreover, even with the current regulations, the capacity for enforcement is weak due to poor inspection capacity and inadequate laboratory equipment for testing and enforcement*. The table below summarizes the status of fertilizer policy and regulatory frameworks for some countries in SSA.

FIGURE 7 - STATUS OF POLICY FRAMEWORK IN SELECT SSA COUNTRIES

Country	Status of Policy Framework
Ghana	<ul style="list-style-type: none"> ▪ Fertilizer policy in place ▪ The ECOWAS fertilizer regulation published in the national gazette. ▪ Quality regulations drafted, but labs and inspection capacity inadequate, adulteration of fertilizer occurring. ▪ A multi-organizational mission provided technical support on soil fertility in 2015 (MSU/IFPRI/IFDC/ITTA/USAID-APSP). ▪ Current subsidy faces challenges-late payment to suppliers and late delivery of subsidy to farmers; State seeking to improve current subsidy model.
Ethiopia	<ul style="list-style-type: none"> ▪ Mostly government-driven fertilizer sector. ▪ No private sector as government is involved in market and support services.
Nigeria	<ul style="list-style-type: none"> ▪ Soil maps completed, blending introduced in some regions ▪ Dysfunctional laws and regulations, no clear roles for monitoring and regulations; outdated frameworks, frequent changes in management and directives at federal and state levels; labs and inspection capacity inadequate to deal with adulteration, etc. ▪ Nigeria has taken a different route from ECOWAS's approved fertilizer quality regulations, and set its own regulatory framework: a draft Fertilizer Bill (2014) has not yet passed into law by the National Assembly. ▪ The Growth Enhancement Support (GES) program (2012-2015), under which an aggressive subsidy agenda was introduced under the Agricultural Transformation Agenda has not been renewed under the new administration. Subsidy program piloted in some states under electronic TAP system. ▪ Nigeria is also a producer of some fertilizers. ▪ A number of institutions are supporting Nigeria's fertilizer quality regulatory efforts including: AGRA, IFDC, USAID, and ECOWAS.

Nigeria is the only fertilizer producing region in SSA

**Developing Competitive Fertilizer Markets in Africa IFDC 2015*

Even though there are some fertilizer promotion programs in Africa, fertilizer use is not expected to grow significantly in the near term. Urea demand is forecast to slow to 2.5 percent per year in the next decade, despite increases in GDP, population, and food demand. Direct application for food crops will remain the dominant end-use of urea in the decade.

PROJECT ACTIVITY

The power sector consumes half of the continent's natural gas. The industrial sector uses less than a fifth of what's left to produce ammonia, urea, methanol and other products. There is room to add fertilizer capacity, especially in Egypt, Equatorial Guinea, and on the west coast, where there is increasing interest in monetizing new gas finds. However, new projects in Africa are uncertain. In addition to political and security uncertainties, investors in African countries encounter difficult bureaucracy and limited access to finance.

Ammonia capacity in Africa stands at about nine million tons while urea capacity stands at 8.3 million tons, with Egypt having more than 50 percent of the regional capacity. Misr Oil Processing Company started production at its second ammonia- urea complex in Damietta, Egypt at the end of 2016. Indorama Eleme Fertilizer & Chemicals Ltd (IEFCL) started production at its 1.4 million tons per urea plant and about 80 thousand tons per year ammonia plant in Port Harcourt, Rivers state in Nigeria in the first quarter of 2016. Urea from the plant will be sold into the domestic market as well as the export markets in Europe, Latin America and India. Nexant projects Africa to add about one to two million tons of ammonia capacity and urea capacity in the next ten years, with over 70 percent of the additions in Egypt. Recent project activity is listed in the table below.

FIGURE 8 - AFRICA AMMONIA/UREA CAPACITY DEVELOPMENTS

Company	Location	Capacity	Status	Start-up/Expected Start-Up	Comments
Misr Oil Processing Company	Damietta, Egypt	650 kton urea, 400 kton ammonia (MOPCO-2)	Operating	December 2016	
		650 kton urea, 400 kton ammonia (MOPCO-1)	Operating	June 2015	
Indorama Eleme Fertilizers & Chemicals	Port Harcourt, Nigeria	1.4 million tons per year urea, and 820,000 tons per year ammonia	Operating	March 2016	
Riaba Fertilizers	Riaba, Equatorial Guinea	1.5 million tons ammonia/urea complex	FEED completed; Technology not selected yet	Post 2021	Likelihood of materialization is low due to gas issues
Chemical Industries Holding (Kima)	Aswan, Egypt	430,000 tons per year ammonia plant, 576,000 tons per year urea	Feasibility stage	Post 2021	Likelihood of materialization is low due to gas issues
Brass Fertilizers	Brass Island, Nigeria	1.3 million tpy urea/ 770 tpy ammonia	under construction	Post 2020	

Egypt is keen to develop integrated ammonia/urea production facilities, despite the diversion of its natural gas supply to create electricity for a population ever more hungry to power air conditioners and consumer electronics. Dolphinus Holdings expects to be producing at the Zohr field in the Mediterranean by 2020. The initial yields will be low; production will likely peak in 2024. In the meantime, the government imports LNG from international oil and gas firms, including BP, Shell, and PetroChina, through two floating storage and regasification units (FSRUs). A third FSRU with an import capacity of up to 0.75 bcf per day is in the works.

While Nexant believes that some of the natural gas could be used to develop new ammonia/urea plants, the current natural gas based industries (such as LNG export) will most likely have priority for the allocation of new natural gas supplies. Hence, particularly with an increasing volume of urea available for global trade, it will remain a challenge to secure financing for new ammonia/urea projects in Egypt until the market and prices recover. Hence, Nexant maintains a conservative outlook towards ammonia/urea capacity additions in Africa in the next decade.

IMPACT ON SUPPLY DEMAND BALANCE

AMMONIA AND UREA

In several African countries including Egypt, Libya and Algeria, political instabilities in recent years have contributed to plunging production levels and operating rates. As political tensions in these countries have not yet eased fully, Nexant assumes operating rates to remain rather low in the short term, especially in the light of new capacity coming on stream globally. Despite the political challenges, capacity in North Africa will be highly competitive due to the anticipated low cost of natural gas. Operating rates are hence expected to increase over the forecast period partly fueled by increasingly strong domestic demand and rising exports.

As more urea capacity is commissioned in the next few years, Africa may make the switch from being a net importer to a net exporter of urea. It is not expected to rival the export giant, the Middle East. African urea will be applied to African farms.

Africa became a net exporter of ammonia in 2007 and is expected to remain a net exporter over most of the forecast period. Operating rates are expected to vary from country to country, but Africa as a region will have relatively low operating rates due to feedstock supply issues and low production rates in politically sensitive areas, at least in the near term.

FIGURE 9 - AFRICA AMMONIA SUPPLY DEMAND BALANCE

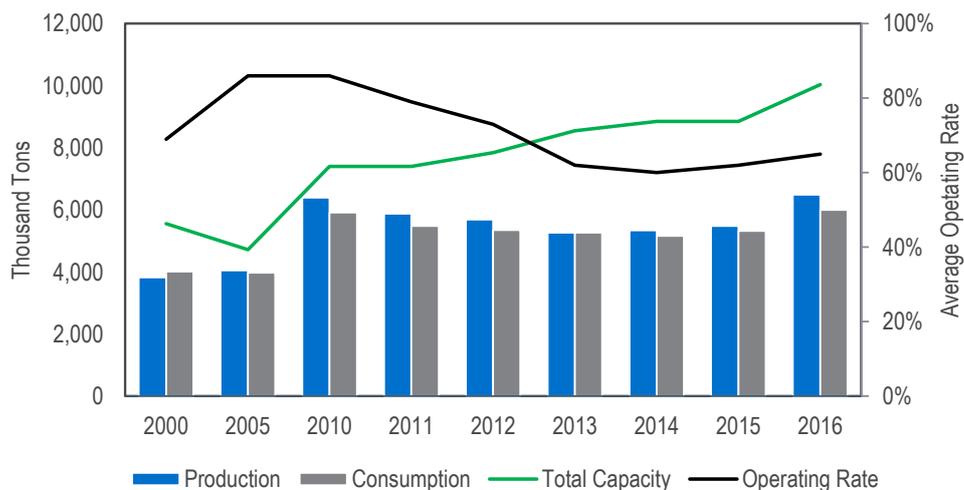
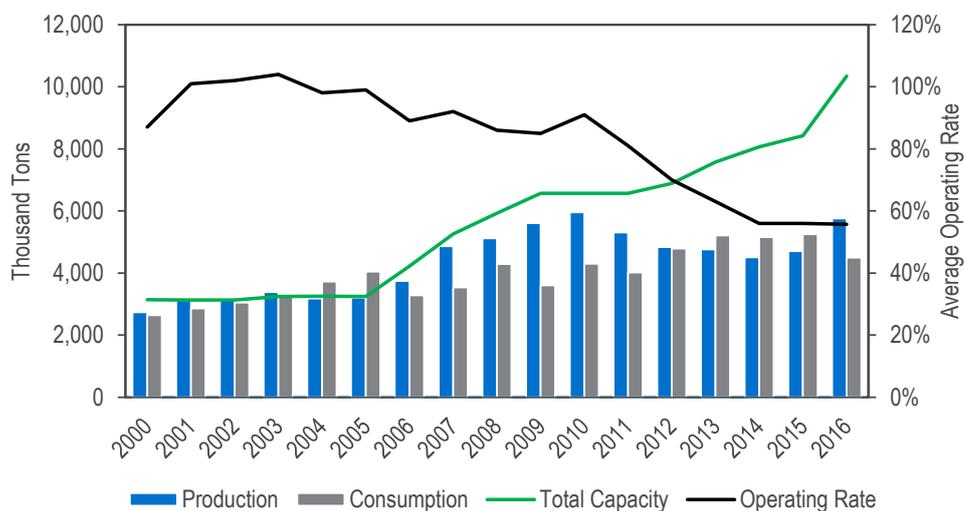


FIGURE 10 - AFRICA UREA SUPPLY DEMAND BALANCE



About the Author



Ms. Priyanka Khemka is a Consultant in Nexant's Energy and Chemicals and Consulting group based in White Plains, NY. Priyanka has been a key contributor to Nexant's Polyolefin Planning Service program for the past three years, and has led a series of market research activities investigating various aspects of the polyolefin businesses.

She has managed several global multi-client and single-client marketing and feasibility studies in the petrochemical sector. Priyanka is also the Program Manager for Strategic Business Analysis Ammonia Urea program, and has responsibilities for commercial management and project management of the fertilizer program.

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