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Energy implications of higher economic growth in Africa

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Africa has a wealth of natural resources and a younger, faster-growing population than many other parts of the world. How Africa develops over the next 25 years may have a substantial impact on international energy markets. This analysis considers the uncertainty associated with future energy demand growth in Africa by examining an alternative case for the continent's economic growth over the next several decades.[1] In this sensitivity analysis, African gross domestic product (GDP) grows at an average rate of 5.0% per year over the 2015 to 2040 projection period, which is higher than the 3.8% per year GDP growth assumed in the *International Energy Outlook 2018* (IEO2018) Reference case.[2]

Assuming African annual GDP growth rates that are 1.2 percentage points higher than in the IEO2018 Reference case over the projection leads to per capita energy consumption that is about 30% higher than in the IEO2018 Reference case in 2040. The largest changes in consumption occur in Africa's industrial end-use sector. In terms of output, the manufacturing share of Africa's economy is 5 percentage points higher in 2040 compared with the IEO2018 Reference case, and the services share of output is 10 percentage points lower. Energy consumption in African energy-intensive industries is 26% higher in 2040 compared with the IEO2018 Reference case, and nonenergy-intensive manufacturing energy consumption is 38% higher.

Background

Over the past several decades, Africa has periodically been heralded by economic forecasters as ready for great expansion and development, but that potential has not been realized. Africa remains a relatively underdeveloped region and one that continues to face many challenges, particularly related to a lack of infrastructure development and investment in areas including electrification, transportation (roads, airports, ports), and commercial development.

More than half the people working in Africa contribute to the production of food—many on arable land spread throughout the continent.[3] However, this dynamic is rapidly changing—Africa is urbanizing quickly, and the growth of African cities is among the fastest in the world. Only Asian cities are expanding faster. These urbanization trends are one important factor helping to shape energy consumption trends in Africa. Economic growth is another factor.

Illustrating the challenges Africa faces, Figure 1 shows energy consumption per capita versus GDP per capita in 2015 and 2040 from the IEO2018 Reference case. Brazil, China, Japan, India, and Russia are shown for comparison. Africa had the lowest per capita energy consumption of the displayed countries in 2015 and also the lowest of any IEO region. Africa also had the lowest GDP per capita of any IEO region in 2040.

Only India was comparable in terms of both energy consumption and income per person in 2015. Brazil, China, Japan, and Russia all had far higher energy consumption and income per capita than Africa. In

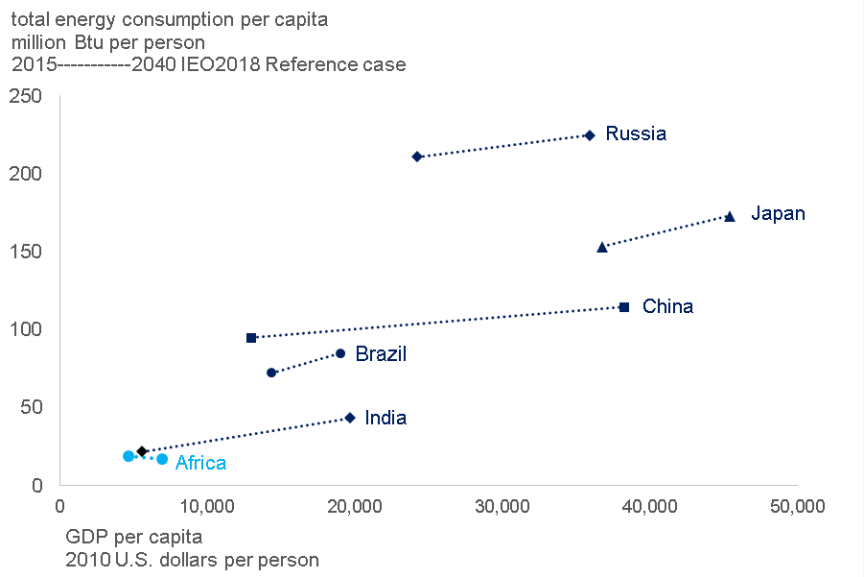
[1] Given the diversity of countries and governments within Africa, it is difficult for every nation to experience synchronized economic growth. Still, rapid and sustained growth in one or a few countries could greatly increase overall African GDP—which is consistent with EIA's assumptions underlying the case.

[2] The IEO2018 Reference case referred to in this document updates the IEO2017 Reference case with macroeconomic information, but no modeling changes were made to other end-use sectors.

[3] https://blog.nationalgeographic.org/2013/10/31/getting-to-know-africa-50-interesting-facts/

fact, African energy consumption per person was 9% of the Russian value in 2015, and GDP per person was less than 13% of the Japanese value in 2015.

Figure 1. Total energy consumption and GDP per capita in select regions, IEO2018 Reference case, 2015 and 2040



Source: U.S. Energy Information Administration, International Energy Statistics database (as of April 2018), World Energy Projection System Plus (2018)

Every country and region in the IEO2018 Reference case projection except Africa experiences an increase in per capita energy consumption from 2015 to 2040. African energy consumption per capita declines between 2015 and 2040 in the IEO2018 Reference case, even while income per capita grows. This trend occurs because the level of the African population rises faster than energy consumption, underscoring the difficulties the continent will have in meeting its energy needs.

Africa's low level of per capita energy consumption in 2015 is partly explained by the region's sizeable reliance on traditional, non-marketed fuels.[4] Although non-marketed fuels from plant and animal sources are important energy sources—especially in the developing nations of Africa—comprehensive data on the use of non-marketed fuels are not available and not considered in EIA's international data and projections. Not accounting for non-marketed fuels can affect both historical and projected energy consumption; for example, the International Energy Agency estimates that nearly 80% of Africa's building energy use in 2016 came from traditional biomass for which reliable data does not exist.[5]

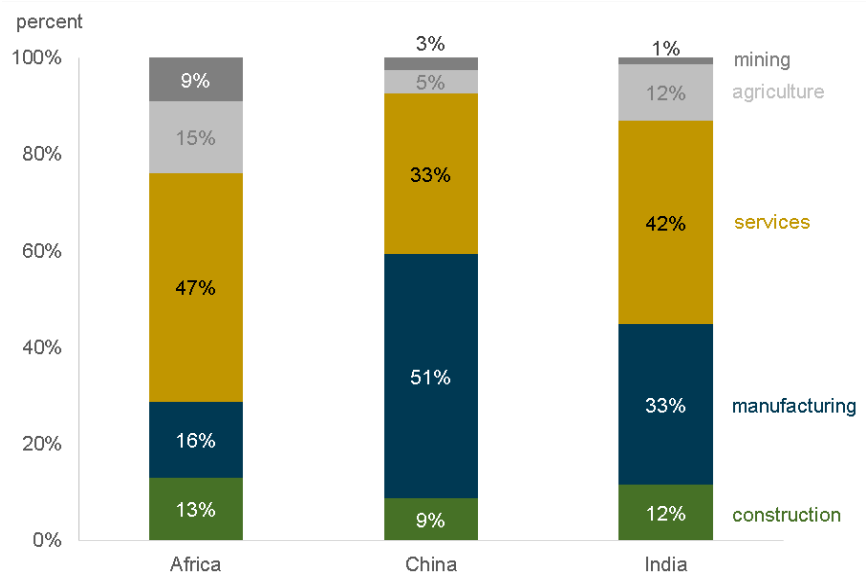
Another important reason that Africa had lower levels of energy consumption per capita in 2015 compared with other countries is the size of the region's industrial sector. The African manufacturing sector is relatively small compared with other regions such as China and India (Figure 2). Manufacturing is 33% of Indian output, more than double the African value of 16%—and the Chinese share of 51% was

[4] Non-marketed energy sources include selected energy sources that are not bought or sold, either directly or indirectly, as an input to marketed energy—particularly, traditional fuels such as fuelwood, charcoal, agricultural waste, and animal dung used for cooking and water heating.

[5] International Energy Agency, *World Energy Outlook 2017* (Paris, France, November 2017), p. 676.

more than triple that of Africa in 2015. The African mining sector was much larger in relative size than either China's or India's. In contrast, the relative shares of the service, construction, and agricultural sectors were similar between Africa and India. Chinese services, construction, and agriculture were smaller as a share of overall output in 2015.

Figure 2. Shares of major sector gross output in Africa, China, and India, 2015



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

Results

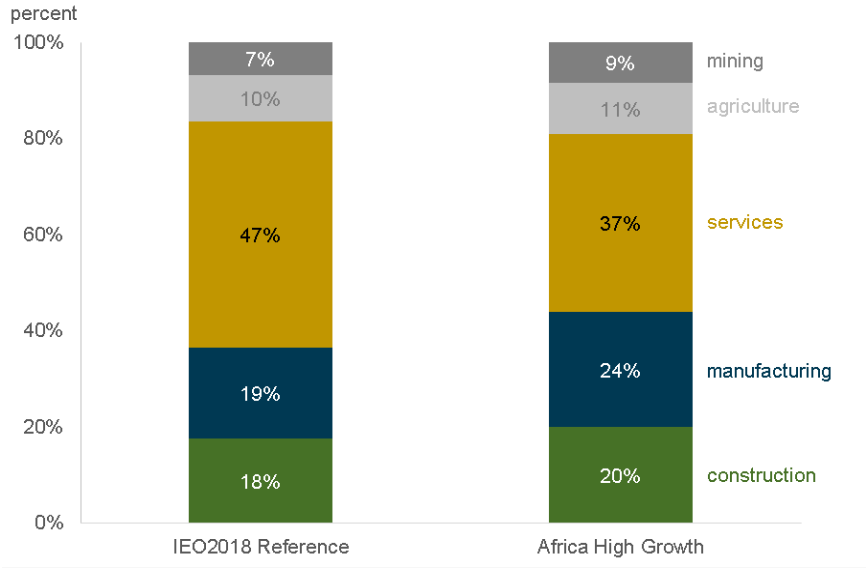
To better understand the energy implications of higher economic growth in Africa, EIA considered an Africa High GDP Growth case. In this sensitivity analysis, African GDP grows by an average 5.0% per year from 2015 to 2040, compared with the Reference case growth of 3.8% per year. The results for Africa are presented below, followed by a discussion of the potential spillover effects on other regions.

Africa

Figure 3 shows a key result of the Africa High Growth case—the manufacturing share of African economic output is higher in 2040 relative to the share in the IEO2018 Reference case. The projected increase in the manufacturing share of regional gross output in the Africa High Growth case contrasts with those for either China (Fast Transition case) or India (Consumption-led case) High Growth cases discussed in other IEO2018 articles, where the manufacturing shares either are the same or lower than in the IEO2018 Reference case.

In the IEO2018 Reference case, construction, agriculture, and mining account for about 35% of total African gross output in 2040, compared with 47% for services and 19% for manufacturing. The share of services is lower in the High Growth case in 2040. Instead, manufacturing and, to a lesser extent, construction and mining are higher in terms of the share of output. The agricultural sector share is also higher in the High Growth case relative to the Reference case in 2040.

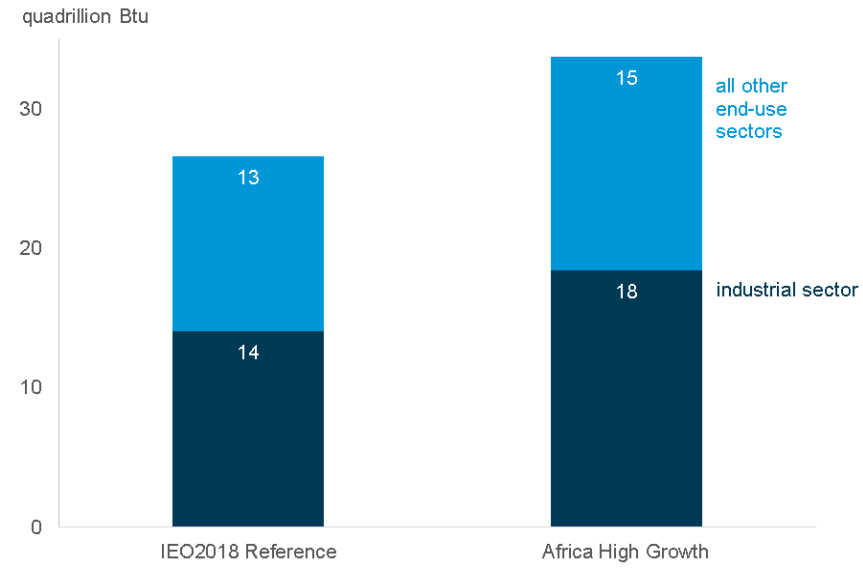
Figure 3. Africa major sector shares of gross output in the IEO2018 Reference case and Africa High Growth case, 2040



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

In terms of energy consumption, total delivered energy consumption in the Africa High Growth case is 22% higher than in the IEO2018 Reference case in 2040 (Figure 4). The industrial sector accounts for more than half of the difference, but the increase in other end-use sectors is also substantial. This increase is a result of rising per capita income—which spurs consumer demand for appliances and air conditioning in the residential sector, personal transportation, and commercial services such as hospitals and shopping centers.

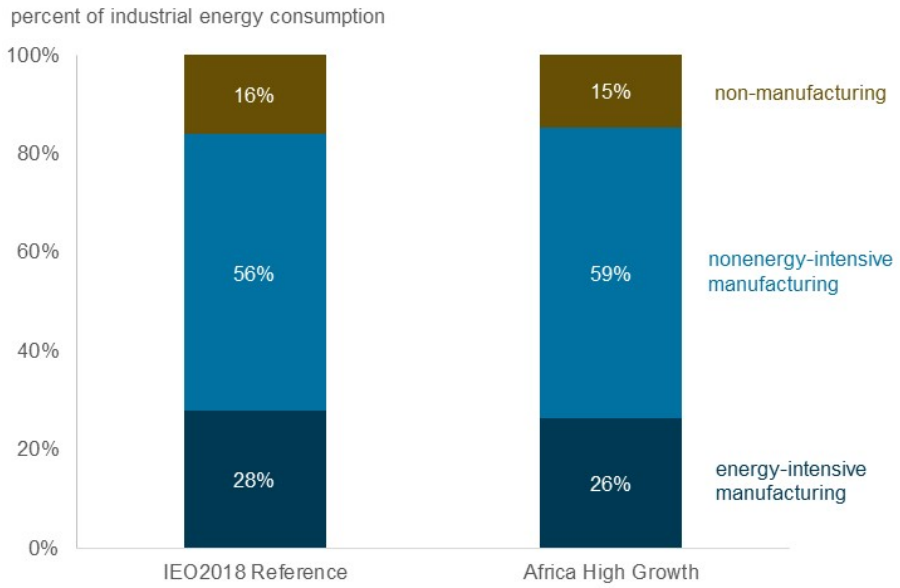
Figure 4. Africa energy consumption in the IEO2018 Reference case and Africa High Growth case, 2040



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

Energy-intensive manufacturing industries account for a slightly smaller share of total industrial sector energy consumption under the High Growth case compared with the Reference case in 2040 (Figure 5). The share of industrial sector energy consumption accounted for by nonenergy-intensive manufacturing is slightly higher in the High Growth case, and the non-manufacturing (construction, mining, agriculture) consumption share is slightly lower.

Figure 5. Africa major sector shares of industrial sector energy consumption in the IEO2018 Reference case and Africa High Growth case, 2040

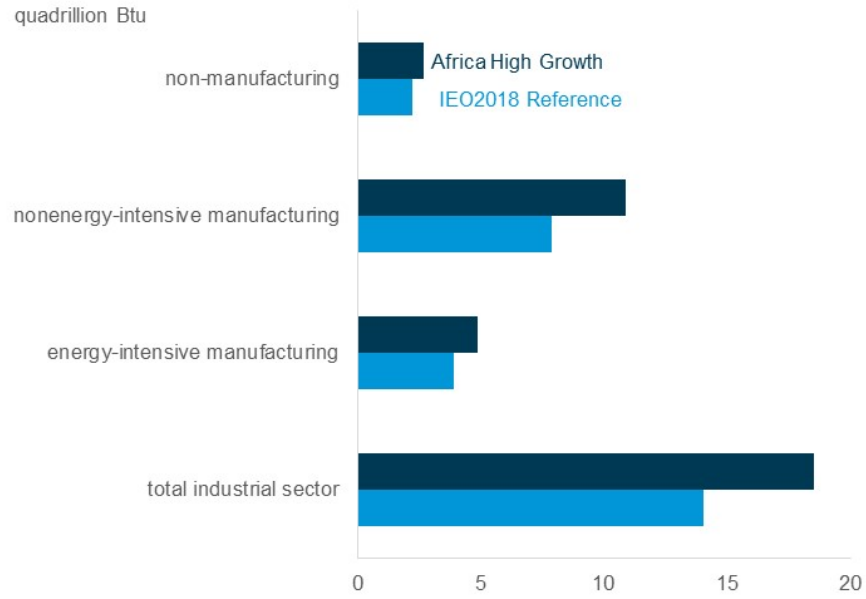


Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

These small changes in shares, however, are associated with larger changes in the levels of energy consumption. For example, industrial sector energy consumption is 4.5 quadrillion Btu higher in the High Growth case in 2040 compared with the Reference case. Nonenergy-intensive manufacturing accounts for most of the difference in industrial sector energy use—3.0 quadrillion Btu higher in the High Growth case in 2040 compared with the Reference case (Figure 6). Energy-intensive manufacturing is 1.0 quadrillion Btu higher, and non-manufacturing is 0.5 quadrillion Btu higher.

Because it accounts for a much smaller share of total industrial sector energy consumption, nonenergy-intensive manufacturing shows the largest difference in percentage terms in 2040. In 2040, nonenergy-intensive manufacturing is 38% higher in the High Growth case compared with the Reference case; energy-intensive manufacturing growth is 26% higher; and non-manufacturing is 21% higher.

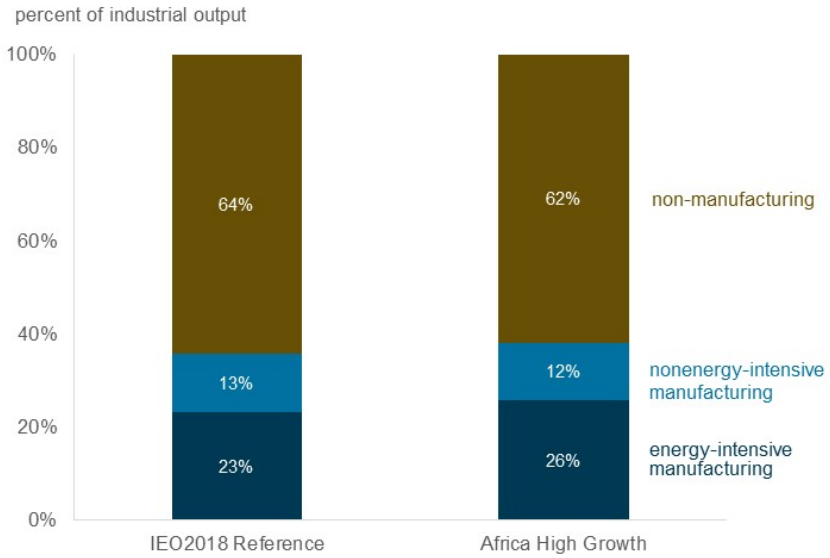
Figure 6. African industrial sector energy consumption in two cases, 2040



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

The changes in industrial sector energy consumption levels and shares are consistent with changes in the shares of industrial sector gross output. Non-manufacturing output in Africa is the largest part of the industrial sector in terms of gross output, and nonenergy-intensive manufacturing is the smallest (Figure 7). The manufacturing share of the economy (nonenergy-intensive and energy-intensive combined) is about 2 percentage points higher in 2040 for the High Growth case compared with the IEO2018 Reference case, and non-manufacturing is about 2 percentage points lower.

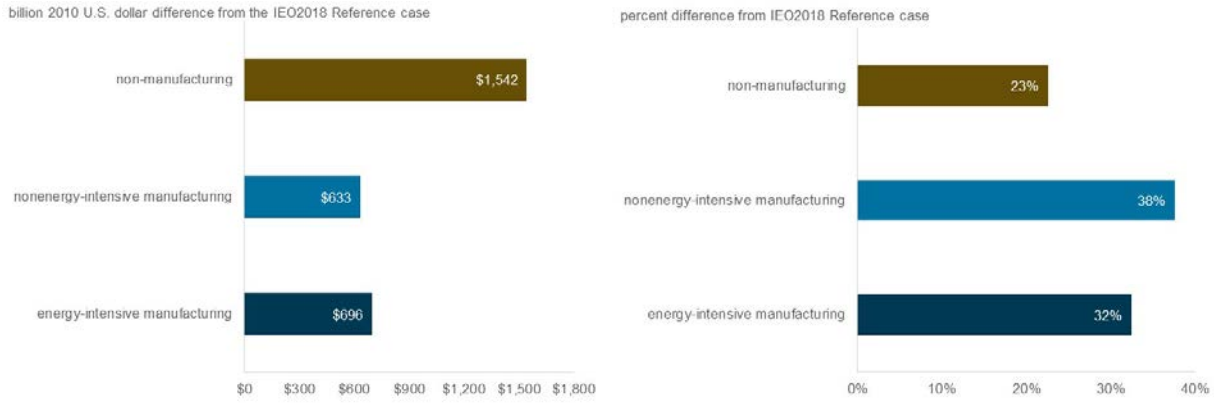
Figure 7. Africa major sector shares of industrial sector gross output in the IEO2018 Reference case and Africa High Growth case, 2040



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

Figure 8 shows that non-manufacturing has the largest increase in gross output in the High Growth case compared with the IEO2018 Reference case in 2040, but it has the smallest increase in percentage terms. In absolute terms, for 2040 the change in energy-intensive manufacturing in 2040 is slightly greater than the change in nonenergy-intensive manufacturing between the Reference case and High Growth case. Nonenergy-intensive manufacturing has the smallest increase in absolute terms between the two cases and the largest increase in percentage terms.

Figure 8. Africa difference between gross output in the High Growth case and the IEO2018 Reference case, 2040

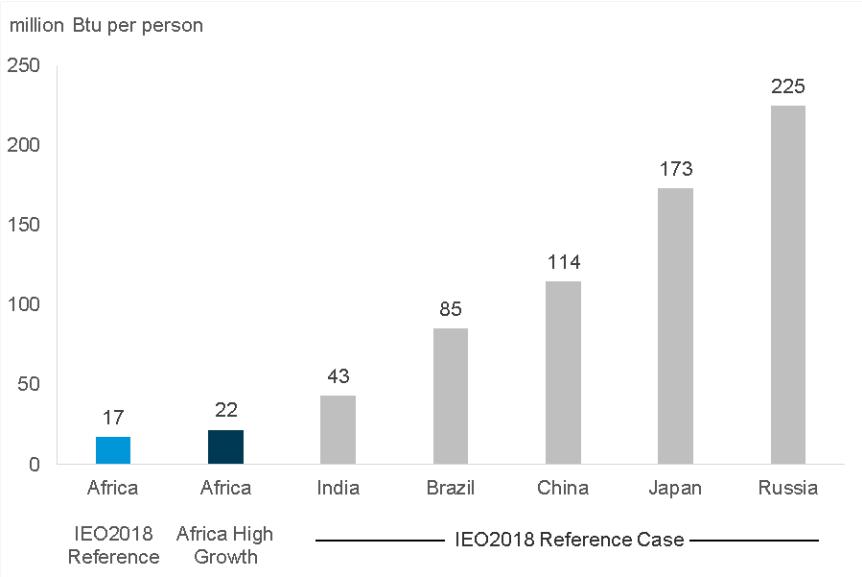


Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

Africa's per capita GDP is almost one-third higher in 2040 in the Africa High Growth case than it is under Reference case assumptions, although Africa's per capita income levels even under the High Growth case remain the lowest of any IEO region, at $9,150 per capita. The non-OECD as a whole has per capita GDP of $20,325 in 2040 in the IEO2018 Reference case.

Energy consumption per capita in Africa is about 30% higher in the High Growth case in 2040 compared with the IEO2018 Reference case (Figure 9). Although a relatively large increase in percentage terms, African per capita energy consumption in 2040 in the High Growth case is one-half of that in India, one-fourth of that in Brazil, and one-tenth of that of Russia—and still the lowest of any IEO region. Unlike the IEO2018 Reference case, however, African energy consumption per capita in the High Growth case rises over the projection period.

Figure 9. Energy consumption per capita in Africa High Growth case and the IEO2018 Reference case, 2040

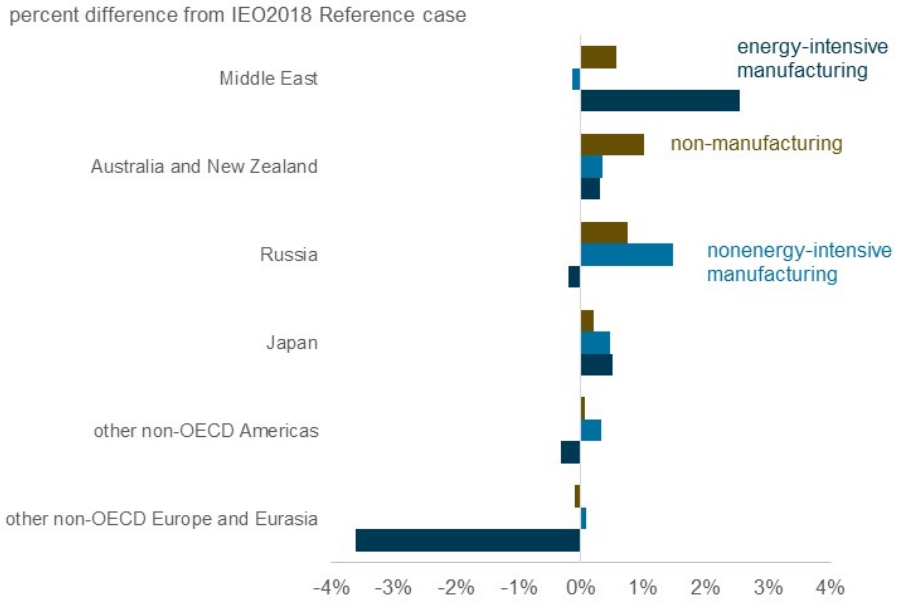


Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)

Other Regions

The net effect of the Africa High Growth case shows limited spillover on the rest of the world in terms of gross output, either positive or negative (Figure 10). African countries have a competitive advantage in manufacturing over the projection period because of the availability of low-cost labor and abundant natural resources. This advantage affects mainly energy-intensive manufacturing in Eurasian countries, where output is nearly 4% lower than in the IEO2018 Reference case.

Figure 10. Changes in gross output in Africa High Growth case compared with the IEO2018 Reference case, 2040



Source: U.S. Energy Information Administration, World Energy Projection System Plus (2018)