



International
Energy Agency

Secure • Sustainable • Together

Africa Energy Outlook

EXECUTIVE
SUMMARY

A FOCUS ON ENERGY PROSPECTS IN SUB-SAHARAN AFRICA

World Energy Outlook Special Report

INTERNATIONAL ENERGY AGENCY

The International Energy Agency (IEA), an autonomous agency, was established in November 1974. Its primary mandate was – and is – two-fold: to promote energy security amongst its member countries through collective response to physical disruptions in oil supply, and provide authoritative research and analysis on ways to ensure reliable, affordable and clean energy for its 29 member countries and beyond. The IEA carries out a comprehensive programme of energy co-operation among its member countries, each of which is obliged to hold oil stocks equivalent to 90 days of its net imports. The Agency's aims include the following objectives:

- Secure member countries' access to reliable and ample supplies of all forms of energy; in particular, through maintaining effective emergency response capabilities in case of oil supply disruptions.
- Promote sustainable energy policies that spur economic growth and environmental protection in a global context – particularly in terms of reducing greenhouse-gas emissions that contribute to climate change.
 - Improve transparency of international markets through collection and analysis of energy data.
 - Support global collaboration on energy technology to secure future energy supplies and mitigate their environmental impact, including through improved energy efficiency and development and deployment of low-carbon technologies.
 - Find solutions to global energy challenges through engagement and dialogue with non-member countries, industry, international organisations and other stakeholders.

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Sub-Saharan Africa is rich in energy resources, but very poor in energy supply. Making reliable and affordable energy widely available is critical to the development of a region that accounts for 13% of the world's population, but only 4% of its energy demand. Since 2000, sub-Saharan Africa has seen rapid economic growth and energy use has risen by 45%. Many governments are now intensifying their efforts to tackle the numerous regulatory and political barriers that are holding back investment in domestic energy supply, but inadequate energy infrastructure risks putting a brake on urgently needed improvements in living standards. The data gathered for this *World Energy Outlook* Special Report – the first of its kind to provide a comprehensive picture of today's sub-Saharan energy sector and its future prospects in a global context – underlines the acute scarcity of modern energy services in many countries. The picture varies widely across the region, but, in sub-Saharan Africa as a whole, only 290 million out of 915 million people have access to electricity and the total number without access is rising. Efforts to promote electrification are gaining momentum, but are outpaced by population growth. Although investment in new energy supply is on the rise, two out of every three dollars put into the sub-Saharan energy sector since 2000 have been committed to the development of resources for export.

Power to shape the future

A severe shortage of essential electricity infrastructure is undermining efforts to achieve more rapid social and economic development. For the minority that has a grid connection today, supply is often unreliable, necessitating widespread and costly private use of back-up generators running on diesel or gasoline. Electricity tariffs are, in many cases, among the highest in the world and, outside South Africa, losses in poorly maintained transmission and distribution networks are double the world average. Reform programmes are starting to improve efficiency and to bring in new capital, including from private investors, and grid-based generation capacity quadruples in our main scenario to 2040, albeit from a very low base of 90 GW today (half of which is in South Africa). Urban areas experience the largest improvement in the coverage and reliability of centralised electricity supply. Elsewhere, mini-grid and off-grid systems provide electricity to 70% of those gaining access in rural areas. Building on successful examples of electrification programmes, such as those in Ghana and Rwanda, the total number without access starts to decline in the 2020s and 950 million people gain access to electricity by 2040 – a major step forward, but not enough. More than half a billion people, mainly in rural areas, remain without electricity in 2040.

Sub-Saharan Africa starts to unlock its vast renewable energy resources, with almost half of the growth in electricity generation to 2040 coming from renewables. Hydropower accounts for one-fifth of today's power supply, but less than 10% of the estimated technical potential has been utilised. The Democratic Republic of Congo, where only 9% of the population has access to electricity, is an example of the co-existence of huge hydropower potential with extreme energy poverty. Political instability, limited access to finance, small market size and weak transmission connections with neighbouring countries have all held

back exploitation of hydro resources. These constraints are gradually being lifted, not least because of greater regional co-operation and the emergence of China, alongside the traditional lenders, as a major funder of large infrastructure projects. New hydropower capacity in the Democratic Republic of Congo, Ethiopia, Mozambique and Guinea, among others, plays a major role in bringing down the region's average costs of power supply, reducing the share of oil-fired power. Other renewables, led by solar technologies, make a growing contribution to supply, with a successful auction-based procurement programme in South Africa showing how this can be achieved cost effectively. Geothermal becomes the second-largest source of power supply in East Africa, mainly in Kenya and Ethiopia. Two-thirds of the mini-grid and off-grid systems in rural areas in 2040 are powered by solar photovoltaics, small hydropower or wind. As technology costs come down, the attraction of renewable systems versus diesel generators grows (although they are often used in combination), especially where financing is available to cover the higher upfront expense.

Bioenergy is at the heart of the energy mix

Bioenergy use – mainly fuelwood and charcoal – outweighs demand for all other forms of energy combined, a picture that changes only gradually even as incomes rise. Four out of five people in sub-Saharan Africa rely on the traditional use of solid biomass, mainly fuelwood, for cooking. A 40% rise in demand for bioenergy to 2040 exacerbates strains on the forestry stock, with efforts to promote more sustainable wood production hindered by the operation of much of the fuelwood and charcoal supply chain outside the formal economy. Scarcity, along with efforts to make alternative fuels like liquefied petroleum gas available, results in some switching away from wood use, especially in towns. Promotion of more efficient biomass cookstoves reduces the health effects of pollution from indoor smoke. Nonetheless, 650 million people – more than one-third of an expanding population – still cook with biomass in an inefficient and hazardous way in 2040.

The rise of the African energy consumer brings a new balance to oil and gas

Almost 30% of global oil and gas discoveries made over the last five years have been in sub-Saharan Africa, reflecting growing global appetite for African resources. Nigeria is the richest resource centre of the oil sector, but regulatory uncertainty, militant activity and oil theft in the Niger Delta are deterring investment and production, so much so that Angola is set to overtake Nigeria as the region's largest producer of crude oil at least until the early 2020s. The value of the estimated 150 thousand barrels lost to oil theft each day – amounting to more than \$5 billion per year – would be sufficient to fund universal access to electricity for all Nigerians by 2030. A host of smaller producers such as South Sudan, Niger, Ghana, Uganda and Kenya see rising output; but, by the late 2020s, production in most countries – with the exception of Nigeria – is in decline. Additions and upgrades to refining capacity mean that more of the region's crude supply is processed locally. With regional production falling back from above 6 million barrels per day (mb/d) in 2020 to 5.3 mb/d in 2040, but demand for oil products doubling to 4 mb/d – an upward trend amplified in some countries by subsidised prices – the result is to squeeze the region's net contribution to the global oil balance.

Natural gas resource-holders can power domestic economic development and boost export revenues, but only if the right regulation, prices and infrastructure are in place.

The incentives to use gas within sub-Saharan Africa are expected to grow as power sector reforms and gas infrastructure projects move ahead but, for the moment, as much gas is flared as is consumed within the region. More than 1 trillion cubic metres of gas has been wasted through flaring over the years, a volume that – if used to provide power – would be enough to meet current sub-Saharan electricity needs for more than a decade. In our main scenario, natural gas nearly triples its share in the energy mix to 11% by 2040. Nigeria remains the region’s largest gas consumer and producer, but the focus for new gas projects also shifts to the east coast and to the huge offshore discoveries in Mozambique and Tanzania. The size of these developments and remoteness of their location raises questions about how quickly production can begin, but they provide a 75 billion cubic metre (bcm) boost to annual regional output (which reaches 230 bcm in total) by 2040, with projects in Mozambique larger in scale and earlier in realisation. East coast LNG export is helped by relative proximity to the importing markets of Asia, but – alongside the benefits from an estimated \$150 billion in fiscal revenue to 2040 – both countries are determined to promote domestic markets for gas, which will need to be built from a very low base.

Coal production and use gradually spreads beyond South Africa, but coal is overtaken by oil as the second-largest fuel in the sub-Saharan energy mix. Development of new coal resources is hindered in many cases by their remoteness and the lack of suitable railway and port infrastructure, considerations that also affect the outlook for South Africa as the existing mining areas close to Johannesburg start to deplete. Much of the 50% increase in regional output is used locally, often for power generation, with coking coal from Mozambique the only major new international export flow. Prospects for coal are also limited by policy: South Africa, the dominant player in African coal, is seeking to diversify its power mix with renewables, regional hydropower projects, gas and eventually additional nuclear capacity all playing a role in bringing the share of coal in power output down from more than 90% today to less than two-thirds by 2040. But coal’s relatively low cost remains an asset in societies concerned about the affordability of electricity.

Releasing the energy brake on development

In our main scenario, the sub-Saharan economy quadruples in size and energy demand grows by 80%, but energy could do much more to act as an engine of inclusive economic and social growth. The international arena brings capital and technology, but mixed blessings in other areas. An oil price above \$100 per barrel produces a continued windfall for resource-rich countries – the cumulative \$3.5 trillion in fiscal revenue is higher than the \$3 trillion that is invested in all parts of the region’s energy supply to 2040 – but few guarantees that this revenue will be re-invested efficiently, while the region’s oil product import bills grow, along with vulnerability to supply interruptions. Sub-Saharan Africa is also in the front line when it comes to the impacts of a changing climate, even though it continues to make only a small contribution to global energy-related CO₂ emissions; its share of global emissions rises to 3% in 2040. But the main challenges arise within the region, including not only the needs of a fast-growing population but also the impact of

weak institutions, a difficult climate for investment, and technical and political barriers to regional trade. Overall, our main scenario outlines an energy system that expands rapidly, but one that still struggles to keep pace with the demands placed on it. And, for the poorest, while access to modern energy services grows, hundreds of millions – particularly in rural communities – are left without.

Accelerating towards an African Century?

Three actions in the energy sector, if accompanied by more general governance reforms, could boost the sub-Saharan economy by 30% in 2040, an extra decade's worth of growth in per-capita incomes:

- **An additional \$450 billion in power sector investment**, reducing power outages by half and achieving universal electricity access in urban areas.
- **Deeper regional co-operation and integration**, facilitating new large-scale generation and transmission projects and enabling a further expansion in cross-border trade.
- **Better management of resources and revenues**, adopting robust and transparent processes that allow for more effective use of oil and gas revenues.

Broad improvements in governance, both inside and outside the energy sector, underpin the achievements of an African Century Case, involving, among many other things, heavy investment in the capacity to formulate and implement sound energy policies, as well as the consultation and accountability that is essential to win public consent. Although still not achieving universal access to electricity for all of the region's citizens by 2040, the outcome is an energy system in which uninterrupted energy supply becomes the expectation, rather than the exception. Unreliable power supply has been identified by African enterprises as the most pressing obstacle to the growth of their businesses, ahead of access to finance, red tape or corruption. Relieving this uncertainty helps every dollar of additional power sector investment in the African Century Case to boost GDP by an estimated \$15.

A modernising and more integrated energy system allows for more efficient use of resources and brings energy to a greater share of the poorest parts of sub-Saharan Africa.

A reduction in the risks facing investors, as assumed in the African Century Case, makes oil and gas projects more competitive with production in other parts of the world, allowing more of them to go ahead; and a higher share of the resulting fiscal revenue is used productively to reverse deficiencies in essential infrastructure. Electricity trade more than triples as more regional projects advance: 30% of the extra investment in the power sector goes to Central Africa, helping to unlock more of the huge remaining hydropower capacity and connect it to the rest of the continent. The addition of relatively low-cost electricity keeps the average costs of supply down, even as power demand rises by almost one-third. Of the extra 230 million people that gain access to electricity in this Case by 2040, 70% are in rural areas, the supply coming primarily from mini-grid and off-grid systems. This investment is instrumental in helping to close the gap in energy provision and economic opportunity between sub-Saharan Africa's rural communities and the people in its cities. Concerted action to improve the functioning of the sub-Saharan energy sector is essential if the 21st is to become an African century.

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A FOCUS ON ENERGY PROSPECTS IN SUB-SAHARAN AFRICA

Sub-Saharan Africa's energy sector can be improved to unlock a better life for its citizens. This report describes one of the most poorly understood parts of the global energy system, offers an authoritative study of its future prospects – broken down by fuel, sector and sub-region – and shows how investment in the sub-Saharan energy sector can stimulate rapid economic and social development across the region.

The report:

- Explores how quickly modern energy might be brought to the huge population currently deprived of it.
- Highlights key actions in the energy sector that can unleash more rapid economic and social development in sub-Saharan Africa.
- Evaluates the role of renewables in the region's energy future, and how important mini- and off-grid solutions can be in providing access to electricity.
- Examines how existing and emerging oil and gas producers can maximise the value of their resources for economic development.
- Identifies the benefits that greater regional integration of the energy sector can bring, as well as mapping the future role of sub-Saharan Africa in the global energy system.

For more information, and the free download of the report, please visit:

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