AFRICAN RESOURCES TO AFRICAN MARKETS

MAKING ENERGY AND MINING WORK FOR AFRICA

Chapter from Africa 2025: Prospects and Challenges
Handbook by the HSE University Center for African Studies
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The chapter **African resources to African markets: making mining and energy work for Africa** addresses key energy challenges in Africa, analysing electricity generation market structures and providing with regional and country-specific forecasts. It includes one of the first discussions on the 'shadow generation' market in Africa — a network of small diesel generators that satisfy a significant portion of the electricity demand from households and small businesses. The chapter emphasises the balance between developing domestic markets and increasing exports, between national businesses and multinational corporations, and explores the prospects and challenges for African countries posed by the energy transition. The chapter serves as an integral part of the handbook Africa 2025: Prospects and Challenges prepared by the HSE University Center for African Studies.

Africa 2025: Prospects and Challenges is to serve as a handbook on Africa's development, challenges and prospects. Its target audience is government officials, businessmen, scholars and experts. The handbook aims to provide alternative positive vision on some issues that Africa faces, among them being the fight for food and energy sovereignty, debt crisis, digital transformation, rapid urbanisation and population growth.

The book was prepared by the team of experts and scholars coordinated by HSE University Center for African Studies (Moscow, Russia).

Digital version
of the Handbook
is available here:

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African resources to African markets: making energy and mining work for Africa

Role of energy in African economy

Estimates of the loss African economies suffer from energy deficits, ranging from 2% to 4% of continental GDP annually, have become mainstream, but do we understand these energy deficits correctly? Why, for example, is the economy of DR Congo, where electricity generation per capita has remained unchanged at 130 kwh annually for the last 20 years, is growing at an impressive rate of 5-6% of GDP per year? Why has Africa's economic growth not been matched by a proportionate increase in electricity generation?

This is because much – if not most – of the African energy generation is in the shadows. By focusing research on the grid segment of generation, governments and international organisations are ignoring the booming market of small-scale diesel generators.

We estimate that about 10 GW of diesel generators capacity is imported into Africa every year – this is almost as much as the grid installed capacity increase. Despite the seemingly simple and promising nature of this solution (1 GW of diesel generators costs USD 100-300 million, which is much cheaper than building a power plant of the same capacity), this trend itself is a consequence of systematic errors and imbalances in energy policy and threatens to have dire consequences.

Firstly, 1 GW of diesel generation is actually much less than 1 GW of gas-fired power plants or hydroelectric power plants (HPP), which is explained by the low capacity utilisation of diesel generators – 10-15% compared to 40% for natural gas and 30% for HPP. Secondly, such diesel generators will be insufficient for industrialisation of the economy and import substitution, as industry requires a stable source of energy. Thirdly, the diesel generation market itself remains beyond the control of African governments.

This chapter is devoted to the main constraints that have led to structural imbalances in African energy markets, while these theses should lay the groundwork for future discussions on how these challenges can be overcome.

What is African in African energy?

The issues of energy sovereignty, electrification, blackouts, oil and gas, and commodities extraction always come quickly to mind during discussions on Africa's economic development prospects: Nigeria loses USD 28 billion a year or 2% of GDP due to energy shortages[1], South Africa promises no load shedding on presidential election days[2], Ghana's parliament plunges into darkness right during the session due to debts to electricity supplier[3], violent clashes over discussions to remove fuel subsidies or impose additional fuel fees have become commonplace in African political life.

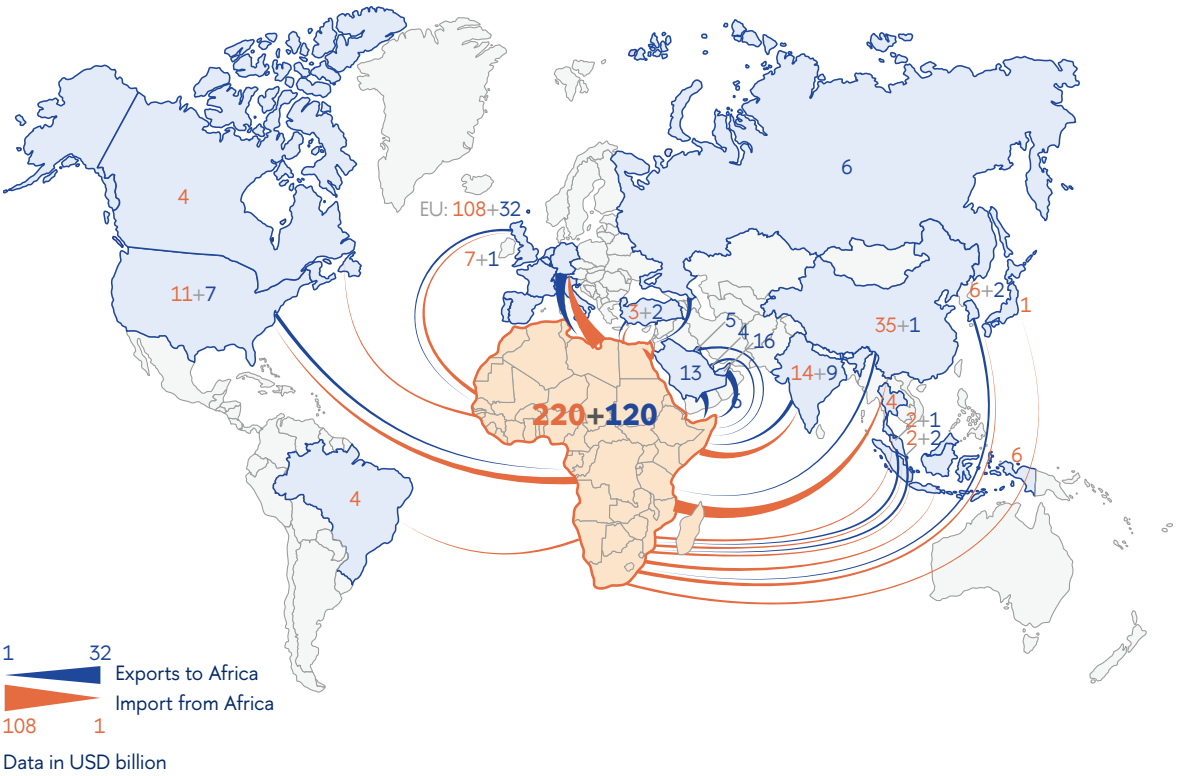
On the one hand, energy resources (crude oil, natural gas, coal, uranium) for some countries remain the sole source of export earnings feeding foreign exchange reserves and debt repayments. On the other hand, the prospects for economic development of most states in the region will be defined by the ability of governments to guarantee access to affordable electricity for the population and industry. Their ability

1 World Bank Group. Nigeria to Keep the Lights on and Power its Economy. URL: https://www.worldbank.org/en/news/press-release/2020/06/23/nigeria-to-keep-the-lights-on-and-power-its-economy

2 SA News. No load shedding on Election Day. URL: https://www.sanews.gov.za/south-africa/no-load-shedding-election-day

3 Reuters. Ghana electricity supplier briefly disconnects parliament over debt. URL: https://www.bbc.com/news/av/world-africa-68451286

Main Africa's trading partners in energy commodities, 2023



Source: prepared by the HSE University Center for African Studies based on ITC TradeMap and UNCTAD data.

to do so will determine whether the demographic transition will bring about an economic boom or lead to Africa having the largest share of people living without access to electricity. Without affordable electricity, fertilisers and cement (produced using natural gas), irrigation systems that depend on dams and HPP, and without oil refineries, African economies will not be able to achieve sustainable growth.

'Energy security' is a complex notion relating to the position of a state in the global energy markets. The term started being used in the 1970s and 1980s during energy crises and embargoes and initially referred to importing countries and implied guaranteed stable supplies that were not subject to political shocks and excessive price fluctuations – i.e. security of supply. However, for exporting countries, **security of demand** seems to be more relevant – i.e. long-term guarantees of demand for supplies at stable prices.

For energy-deficient Europe and Asia security of supply logic seems suitable, while for energy-rich Africa this means exposure to outer shocks and crises

It means draining its mineral resources for the good of other regions and economies. Furthermore, the African countries which depend on imports do not benefit from the security of supply logic. Indeed, they are the first to suffer during crises, since they lack the financial capabilities to compete with buyers from Europe and Asia and infrastructure to build up reserves.

Energy regionalisation seems to be more promising for Africa, meaning that suppliers should pay more attention to their domestic markets and neighbouring countries without relying on global demand, and vice versa – buyers should look for energy sources, which are more expensive but closer to them, without relying on international markets.

This would reduce dependence on external economic aid, strengthen collective regional efforts and establish regional markets.

In fact, the desired model of sub-regionalism, is at odds with the current model of globalisation[4], in which African resources are not used for the development of the region, but are used outside of it

It is illustrated, for example, by the position of African countries in most global value chains[5].

To put it bluntly, maintaining the logic of global energy security for Africa implies, for example, continued dependence on imports of energy amounting to USD 120 billion per year, imports of petrochemicals, most technologies, equipment, knowledge, concepts and ideas, as well as dependence on the global commodity markets. This is the cost of defining the country's economic growth in terms of the 'commodity booms' rather than sound economic policies, not to mention the need to sell oil at USD 10-20 per barrel[6] in years of crisis due to the lack of oil storage facilities.

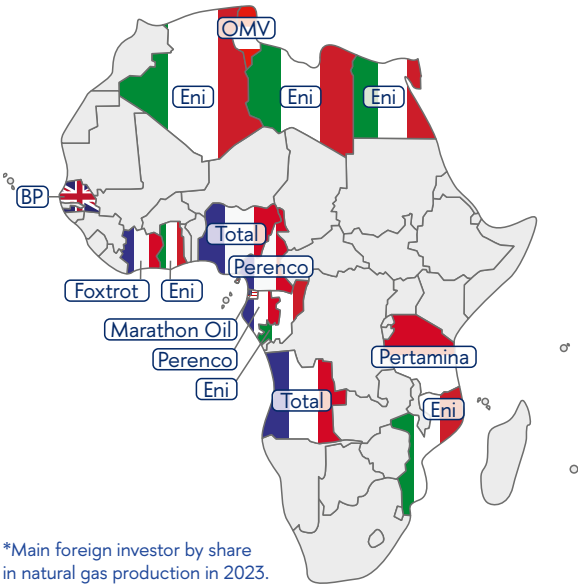
The previous chapters have already shown that excessive import dependence is one of the leading destabilising factors in the macroeconomic situation of most countries in the region, and energy resources play a key role in this.

At the same time, African countries are endowed with energy resources: for example, up to 9% of the world's proven natural gas reserves, 8% of the world's crude oil reserves and 60% of the world's solar resources are concentrated in Africa. In this regard, the problem of electricity and energy shortages in Africa is not attributable to an objective deficit, but primarily to improper distribution and management as well as a lack of relevant infrastructure.

One is used to African countries playing an important role in global energy markets as suppliers of crude oil, natural gas and uranium, but the question who really plays this role remains often overlooked. In fact, it is hard to say that African countries themselves, their governments and companies are actively involved in shaping global markets. After all, it is not just the control over resources but also over the channels of their delivery to the final consumer that allows exporting countries to effectively use the 'energy factor' for their political purposes and economic development.

Historically, Africa has been a region dominated by various non-state actors who have shaped the business environment and determined the development of entire industries, states and regions.

Who controls* Africa's natural gas production?



*Main foreign investor by share in natural gas production in 2023.

Source: prepared by the HSE University Center for African Studies based on companies' annual reports.

4 Mensah J. Neoliberalism and globalization in Africa: contestations from the embattled continent. New York-: Palgrave Macmillan, 2008.

5 OECD. Regional value chains in Africa for better global integration. URL: https://www.oecd.org/coronavirus/en/data-insights/regional-value-chains-in-africa-for-better-global-integration

6 Bloomberg. Nigeria's Banner Oil Hits $12, Millions of Barrels Remain Unsold. URL: https://www.bloomberg.com/news/articles/2020-04-17/nigeria-s-banner-oil-hits-12-millions-of-barrels-remain-unsold

Most export infrastructure in Africa is beyond the control of African governments. One of the few exceptions is Algeria, where there is a state monopoly on natural gas exports, and the state-owned oil and gas company Sonatrach owns and operates most of the export infrastructure and determines the geography of sales. Another example can be seen in South African coal mining, which is dominated by local businesses.

In most other African countries, however, the role of the state in resource production, processing and then export is minimal. This is due to a whole complex of factors: budgetary and technological deficit, which does not allow the states to independently engage in exploration, production and export of commodities; construction of export infrastructure; the legacy of the colonial era, which laid long-term strategic foundations for the development of energy industries and export specialisations; the dominant position of a limited number of multinationals in African energy markets. Thus, in most cases, African countries serve merely as a source of raw materials.

African countries are represented on the world markets by a very limited pool of multinationals, mainly Western

For example, with oil and gas those are Shell, BP, TotalEnergies, Chevron and ExxonMobil, Vitol, Glencore and Trafigura, and a number of other companies that dominate smaller markets like Perenco in Cameroon and Gabon and Marathon Oil in Equatorial Guinea.

Every market or international regime can be divided into 'rule-makers', who shape the agenda, and into 'rule-takers', who obey. In terms of this hierarchy on the energy markets, African countries are the rule-takers. The only component of influence they have so far is mineral reserves, while the main infrastructure (including tanker fleets, terminals, pipelines, etc.) is under the control of Western multinationals, and the basic principles, norms, rules, procedures and strategies are set without the involvement of African countries. Moreover, even projects within Africa aimed at developing regional energy markets and integration depend on the interests of extra-regional players who control the financing and technological support for such initiatives.

For African countries, the issue of control over their own energy and power is still pressing. Here we mean control – above all – in terms of norms, strategies and regulations

It means understanding what reserves and assets are available, who owns them, how they are being developed, how they interact with each other and with the environment and what their technical condition is.

In the meantime, excessive consolidation of the energy sector under state control in **terms of ownership and management** leads to long-term negative consequences. In South Africa, the state-owned Eskom owns facilities that generate more than 90%[7] of the country's electricity, and until recently the company controlled all the country's transmission lines. Lack of competition, non-payments by consumers and aging energy infrastructure have caused a crisis in the energy sector. However, private African businesses, with few exceptions, do not yet have the necessary technical competencies and free funds to ensure stable operation of power systems.

Partial privatisation of 'GenCos' (i.e. generation companies) in Nigeria is an important example: Nigerian companies took loans to buy out state-owned enterprises. Faced with non-payment for electricity, natural gas shortages and outdated transmission lines, they are suffering losses and cannot repay the loans, let alone reinvest money in infrastructure development.

7 Eskom. Integrated Report for the Year Ended 31 March 2023. URL: https://www.eskom.co.za/wp-content/uploads/2023/10/Eskom_integrated_report_2023.pdf

At an extraordinary meeting of the Council of Ministers of the African Petroleum Producers Organization (APPO) in early July 2024, it was decided that the headquarters of the new **Africa Energy Bank** (AEB) will be located in Nigeria. The founding documents and the AEB charter were signed in early June 2024 by Afreximbank and the Africa Petroleum Producers' Organization (APPO). The same two organisations spearheaded the project to establish the AEB, became its founders and committed themselves to provide a large portion of the initial capital. It is assumed that the bank's capital will initially amount to USD 5 billion. USD 1.5 billion will be provided by Afreximbank and APPO, another USD 1.5 billion will be contributed by the bank's member countries (the minimum contribution is set at USD 83 million, so the founders are counting on about 15-17 countries to join the bank) and another USD 2 billion will be provided by external investors. There is no definite information yet as to which countries will join the membership circle, but Nigeria and Ghana have already contributed funds and, in addition to Algeria, Benin and Nigeria, countries like Angola, Egypt, Côte d'Ivoire, Libya, South Africa, and others are interested in becoming members. The AEB's main task is to reduce and overcome Africa's dependence on external forces. By developing intra-African cooperation and diversifying contacts with non-regional players, it aims to solve the problem of underfunding or, rather, the dependence on external financing and, accordingly, an externally imposed energy and climate agenda. The establishment of the AEB is an important development for Africa and an attempt to strengthen energy sovereignty, but the main work lies ahead and finding money is the main problem. First of all, USD 5 billion is not enough to solve the problem of energy poverty in Africa, where 600 million people still do not have access to electricity. Secondly, the USD 2 billion (or 40% of the capital) that the bank plans to obtain from external investors is a 'black box' and potentially the project's biggest risk. The experience of other Pan-African financial institutions (such as the African Development Bank) shows that the shareholders are likely to be Western countries and Bretton Woods institutions (the IMF and the World Bank) that will form alliances, and as a result, their voice may become decisive at shareholder meetings, so they will get the opportunity to determine the bank's policy. As a result, the AEB may end up financing export-oriented projects like Mozambique LNG or EACOP, ruining the prospects for the development of the domestic markets.

Finally, the main players in the African energy sector (with only a few exceptions) are still Western and Chinese companies. They invest in projects and manage them and supply the necessary equipment and technologies, which means that any project will still depend on the position of non-regional players. All these risks are surmountable and, through further work, additional capitalisation, and greater sovereignty, the bank will be able to achieve its ambitious goals.

The establishment of the AEB indicates an important trend: African countries want to independently determine the development of their energy markets and move away from being subject to external control. The establishment of an independent infrastructure is a key step in this direction, but it must be complemented by other measures, including: developing an adequate energy strategy (at all levels, from the local to the continental); establishing project-evaluation criteria (in terms of the contribution to the energy sovereignty of Africa and not the export of energy resources from Africa); developing regulatory, technical, and environmental supervision tools; strengthening the legislative framework; and supporting African energy companies and knowledge sharing programmes[8].

8 RT. Can Africa seize control of its own energy? URL: https://www.rt.com/africa/601547-sovereignty-africa-energy-bank/

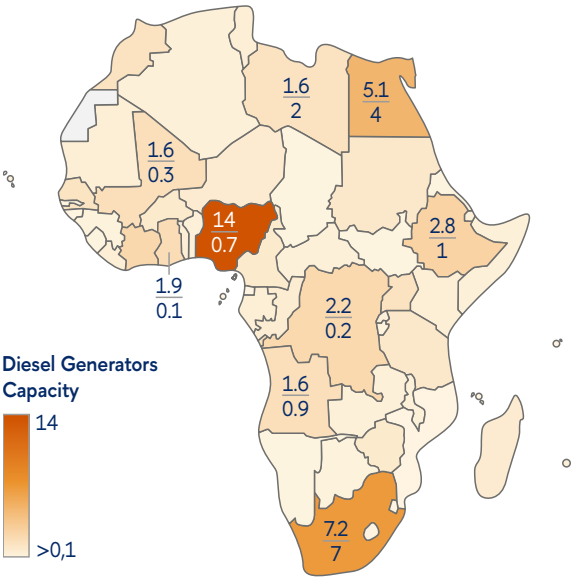
However, national and trans-African businesses are growing stronger in Africa. Large private holdings are being established, and regional financial institutions and banks are becoming more robust. Their role in financing energy projects is also growing, and they are ready to finance, among other things, projects targeted at the development of domestic markets. The number and weight of African companies in the continental energy market along the entire length of the value chain is growing every year – for example, Sasol, PetroSA, Oando, Axxela are successfully operating in the production and transportation of hydrocarbons; Dangote is in oil refining, cement and fertiliser production; Arab Contractors and El Sewedy are in engineering, procurement and construction (EPC) of power plants.

Common framework is being formed as well, AFREC and NEPAD have been joined by public and private initiatives: ACTING, LNG2AFRICA. The number of Pan-African energy conferences and exhibitions (Africa Oil Week, Africa Energy Week), publications (Africa Oil and Gas Journal, Petroleum Africa), etc. is growing.

Do we understand true African installed capacity?

Per capita electricity generation in Africa remains extremely low. With the world average per capita electricity generation at 3,664 kwh, in Africa it is around 600 kwh, but in the majority of sub-Saharan states it is around 100-200 kwh[9]. This ratio is explained by the lack of adequate statistics on electricity generation by **diesel generators**. With all the limitations of such comparisons, the example of Bangladesh, a country similar in economic size and population to Nigeria, but where grid electricity generation is almost three times higher than in Nigeria (100 TWh vs 37 TWh), may be illustrative. It is obvious that actual electricity generation in Nigeria, as in most other countries, is actually several times more than what is reflected in the statistics of national governments and international agencies.

Capacity of diesel generators imported in 2018–2022 (GW)



7.2 — diesel generators capacity imported in 2018–2022 (in gigawatts)
7 — grid capacity added in 2018–2022 (in gigawatts)

Source: prepared by the HSE University Center for African Studies based on UNCTAD, ITC Trade Map and Ember data.

That said, the actual installed capacity in most African countries remains unknown.

The statistics on grid generation in Algeria, Egypt and probably South Africa, is more accurate as it is more reliable.

In reality, the power systems of most African countries rely on small diesel generators (below 1 MW), which power most rural households, businesses, cafes, hospitals, airports, hotels and also serve as backup power in cities during grid power outages. In this context, the situation in South Africa with **load-shedding** or in Ghana with **dumsor** does not seem to be as catastrophic as the media tend to show it – during these outages, cities are not plunged into darkness, but turn on diesel generators.

In 2022, according to our estimate based on ITC and UNCTAD data, African countries imported about 200,000 generators with capacity up to 75 kW, 20,000 of 75 to 375 kW and 5,000 of more than 375 kW.

9 Ember. Electricity Data Explorer. URL: https://ember-climate.org/data/data-tools/data-explorer/

On this basis, about 10 GW of diesel generators capacity is imported into Africa annually

However, their installed capacity utilisation factor is much lower than that of grid power plants since they operate with a lower load 2-3 hours per day, meaning their output is much lower than it could be. Nevertheless, it is the estimation of the number of generators, their installed capacity and utilisation that is the key to a correct undestanding of the unaccounted installed capacity and therefore of the and potential demand.

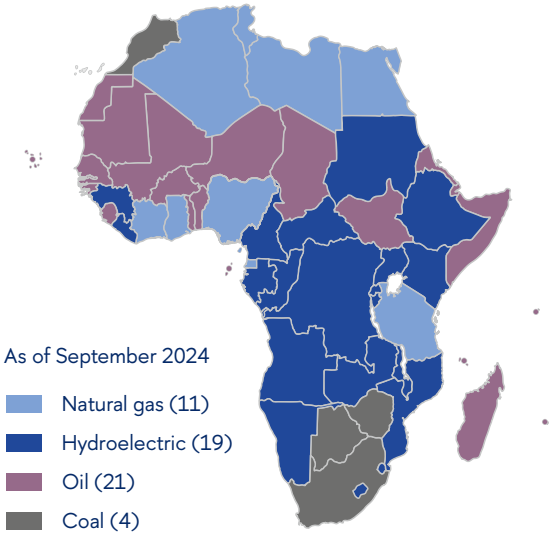
Key importers of generators are Nigeria (USD 1.3 bn and 14 GW over five years), Egypt (USD 0.6 bn and 5.1 GW), Libya (USD 0.4 bn and 1.6 GW), Algeria (USD 0.3 bn and 0.4 GW), Sudan (USD 0.3 bn and 1.1 GW) – together accounting for 44% of the market. Key suppliers of generators over five years are China (USD 10 bn), USA (USD 3.9 bn), UK (USD 3.7 bn).

However, analysing the grid segment of power generation is important in terms of understanding the long-term development prospects of individual countries. Clearly, imports of diesel generators – expensive and dependent on diesel fuel – are a sure indicator that energy policy is not yet leading to positive change and will be replaced by grid power plants.

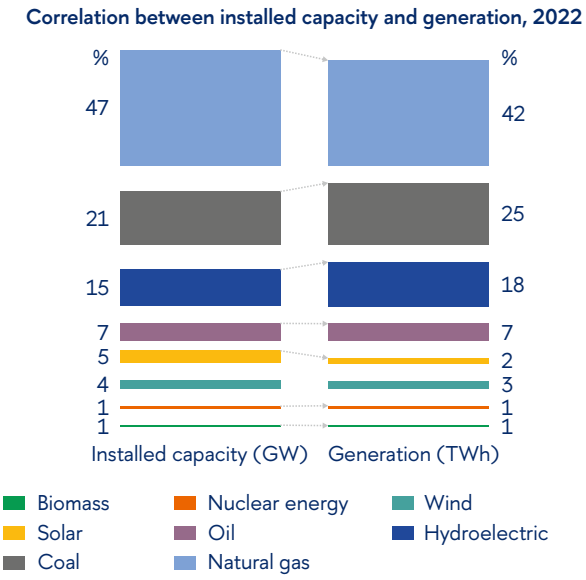
Gridlock?

In general, grid electricity generation in Africa is not growing as fast as population or GDP – the growth rate per annum for 2013-2023 was only 1.9%, which is slightly higher than in the CIS (1.4%)[10], but much lower than in the Middle East (3.8%) and Asia (4.5%). In 2023, a record 902.9 TWh was generated, or 3% of the world total (approximately the same amount is generated by power plants in Japan alone).

Main source of electricity generation in Africa



Estimation is based on nominal installed capacity and does not take into account off-grid capacities.



Source: prepared by the HSE University Center for African Studies based on AFREC, Climatescope, IMF and Ember data.

10 Energy Institute. Statistical Review of World Energy. URL: https://www.energyinst.org/statistical-review

So far, electricity generation is still very unevenly distributed, with seven countries cumulatively contributing more than 70% of continental generation. As of 2023, those are South Africa (25%), Egypt (22%), Algeria (10%), Morocco (5%), Nigeria (5%), Libya (3%) and Ghana (2%) – collectively totalling 650 TWh.

The structure of electricity consumption is still dominated by industry (40%), but almost half of industrial consumption is accounted for by one country – South Africa. On a continental scale, industrialisation is not expected to grow rapidly, and industry is unlikely to be a driver of energy consumption on a continental scale. Energy consumption growth will be driven by households: this is guaranteed by population growth and the gradual phase-out of biomass as the main source of primary energy.

Another driver of growth in electricity and energy consumption in general may be the development of the agriculture and the food and beverages industries. For example, food production enterprises in Algeria accounted for 10% of electricity, gas and oil products consumption by industry in 2021.

Another major factor of demand growth will be urbanisation and development of urban utilities, as well as processes related to freshwater solutions: its extraction, desalination, purification, delivery to the population in cities and to fields (irrigation). The supply of energy to desert and arid areas is necessary to overcome the consequences of climate change, droughts. In the future, this area will become one of the main drivers of energy consumption, as demonstrated by the experience of Algeria, Libya (Great River project).

The total installed capacity of Africa's grid electricity sector as of 2022 can be estimated at 248 GW[11], with gas accounting for 116 GW (47%), coal 53 GW (21%), hydropower 37 GW (15%), solar 12 GW (5%), wind 9 GW (3%), nuclear 1.9 GW (0.8%) and geothermal and biogas plants less than 1% of the total. In Sub-Saharan Africa, the lack of grid infrastructure has led to the widespread use of diesel generators and the proliferation of isolated power systems / generation facilities. With the establishment of grid infrastructure and transmission lines, gas-to-power and renewables are developing most rapidly.

At the moment, Africa has several energy zones defined by predominant energy source that largely coincide with the established division of the continent into sub-regions

Northern Africa is dominated by gas-to-power, Western Africa by oil, Central and Eastern Africa by hydropower and Southern Africa by coal.

Northern Africa is the only region where the problem of access to electricity can be considered solved. Even in Libya, despite political turmoil, the energy sector has been relatively stable. In all countries of the region, with the exception of Morocco, at least 90% of electricity is generated by natural gas. Morocco does not have significant gas reserves, so the country relies on a combination of coal and renewables. However, it is also looking to increase the share of gas through LNG imports.

In Sahel, the grid electricity deficit is the most pressing: there is no significant hydropotential or petroleum resources, so the countries of the region depend on imports of diesel and fuel oil to supply their few power plants. Even Nigeria, where most grid-connected power plants are gas-fired, actively imports diesel for off-grid generators due to frequent blackouts caused by interruptions in gas supply to power plants and outdated transmission lines. Among Western African countries, Ghana and Côte d'Ivoire have the most balanced energy policy. Over the past decade, they have taken a place among the leaders of electrification on the continent, started exporting electricity to neighbouring countries and kept electricity prices for end consumers at approximately the same level.

11 Ember. Electricity Data Explorer. URL: https://ember-climate.org/data/data-tools/data-explorer/

The topic of Africa's energy sovereignty is often limited to access to electricity, the development of electricity grid infrastructure and the supply of fuel for transportation. Households are left out of the discussion. Despite the seemingly small market in terms of volume, energy consumption by African households is growing annually. Moreover, households occupy key positions in the structure of energy consumption in all African countries, with their share ranging from 20-30% in countries with developed industry (Algeria, Morocco) to 90% in small, predominantly agrarian countries.

Along with the gradual increase in the quality of life, changes in consumer habits and urbanisation, the structure of energy consumption by households is gradually changing. Modern and more environmentally friendly fuels are replacing 'traditional' fuels. Methane, propane, butane, electricity are gradually replacing firewood, kindling and household garbage as a source of heat and energy. The specifics of Africa set a certain framework for the further process of providing access to energy for households. First, because of the warm climate, the usual mid-latitude solutions, often associated with heating infrastructure, are not suitable. Second, the lack of gas transmission infrastructure makes it almost impossible to gasify households with natural gas (methane). Third, the shortage of generating capacity and the state of the midstream infrastructure do not allow grid electricity to be considered as a reliable source of energy. All these factors are long-term, and their influence will be decisive over the next 20-30 years.

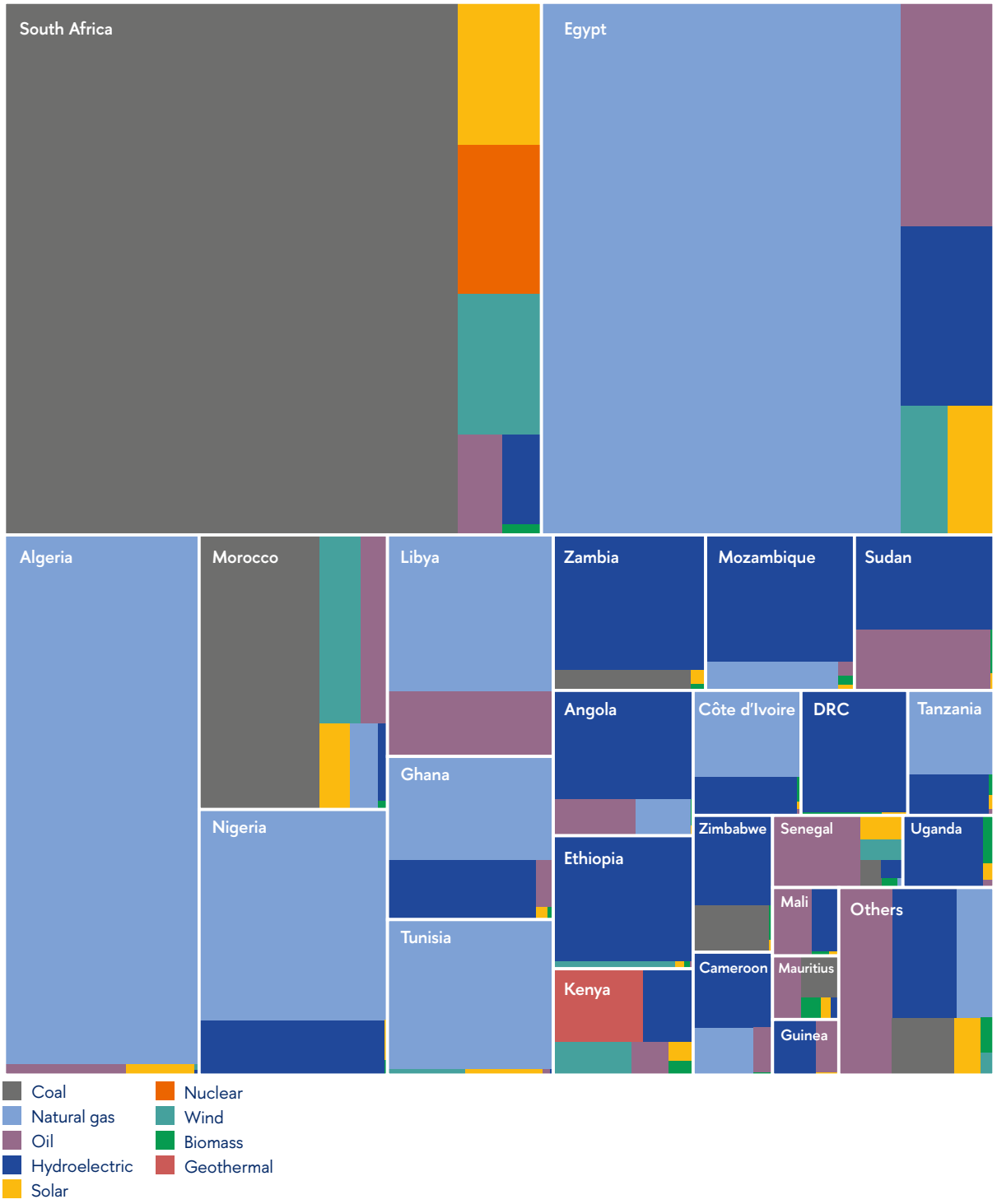
LPG: Tanzania Case

In Tanzania, households account for about 66% of final energy consumption, with biomass continuing to dominate – in the 2019/20 fiscal year, firewood, grass and garbage accounted for 64% of Tanzania's cooking energy consumption, charcoal for 26%, liquefied petroleum gas (LPG) for 5% and electricity for 3%. Against this backdrop, the consumption of LPG is growing in most African countries, including Tanzania. LPG imports to Tanzania are growing at an average annual rate of 16%. Back in the 2016/17 fiscal year, imports (no LPG is produced in Tanzania) amounted to 107,000 tonnes, in 2020/21 – already 217,000 tonnes, in 2021/22 – 252,000 tonnes, in 2022/23 – 293,000 tonnes. For consumers, LPG in a cylinder in Dar es Salaam costs about USD 2.3 per kilogramme.

LPG will continue to displace kerosene, firewood, garbage and dung as fuel in the domestic sector. It is important to take into account that LPG consumption in Tanzania is slightly lower than imports: due to re-export of LPG from Tanzania to other countries in the region (e.g. Zambia) – in 2022, of the 250,000 tonnes of LPG imported into Tanzania, 90,000 tonnes were exported. The key obstacle to increasing consumption of this environmentally friendly and safer domestic fuel remains the lack of infrastructure: receiving terminals, storage facilities and delivery vehicles. However, the overall trend is positive: in June 2024, Oryx in Zanzibar launched the first LPG terminal on the island, Mangapwani, and a new LPG storage facility in Tanga was built in 2023.

The Tanzanian authorities aim to strengthen Tanzania's position not only in the regional but also in the global LPG market. In December 2023, President Samia Suluhu Hassan's Africa Women Clean Cooking Support Program (AWCCSP) initiative was presented at the COP 28 Climate Summit in Dubai to attract funding for projects to improve African households' access to cleaner energy and move away from wood and garbage. In May 2024, Clean Cooking Summit was held in Paris, co-chaired by the President of Tanzania, the Prime Minister of Norway, the President of the African Development Bank and the Executive Director of the IEA. Also in May, the Tanzanian government published the National Clean Cooking Strategy for the period 2024-2034. LPG plays a key role in this strategy. For instance, it envisions construction and expansion of LPG storage facilities in all regions of the country; support for localisation of LPG equipment production in Tanzania; subsidisation of clean cooking projects; amendments to the sectoral legislation.

Electricity generation in Africa by source, 2022



Source: prepared by the HSE University Center for African Studies based on AFREC, IMF and Ember data.

The countries of Central and Eastern Africa are located by the basins of the continent's largest rivers – Zambezi, Congo, Nile, Ruvuma – and thus largely rely on HPP in the long term. They also include Angola (inland areas rich in rivers) and Namibia, where the only HPP on the Kunene River (bordering Angola) has so far become the main source of electricity in the country. Some Eastern African countries – most notably Tanzania – are effectively supplementing hydropower generation with gas-fired generation.

The dominance of coal in Southern Africa is due to the fact (apart from thermal coal reserves) that the coal-based power sector of South Africa and other SADC countries dates back to colonial times and the dependence of the economies on energy-intensive mining industry, as well as South Africa's long political and economic autarky and limited access to hydrocarbons (due to sanctions). South Africa, Botswana and Zimbabwe, have not rebuilt their power systems since then.

However, where Western and Eastern Africa has substantial gas reserves that could eventually replace obsolete diesel generation and Central Africa has significant hydropower potential, Southern Africa has neither. The backbone of the region's power sector is outdated coal-fired generation. It will not be possible to meet the growing demand and replace the decommissioned coal-fired generation only through renewable energy sources. The pillar of the region's economy – mining – is energy-intensive and requires an uninterrupted power supply. The solution could be the use of Mozambican gas in South Africa and Zimbabwe, but investors are protecting its main reserves for LNG supplies to China and India.

The prospects are linked to the growth of gas and renewables, but each of Africa's power belts will retain its own characteristics

Thus, in **North Africa**, **gas** will remain the basis of the energy sector in the long term, complemented by renewables. Algeria, Egypt and Libya have their own sources of natural gas sufficient to cover the needs of domestic markets.

Morocco and Tunisia are also dependent on natural gas in their energy consumption, but their own production is insufficient and they are forced to import it. These countries should expect accelerated development of renewable generation, as well as LNG import projects to diversify their natural gas sources. The renewable energy sector in all these countries has, at the same time, certain limits to growth due to seasonal factors, lack of significant hydroresources, etc. In this regard, Morocco, for example, complements renewables by building coal-fired power plants.

In **Western Africa**, **gas-to-power** is projected to develop, primarily in Ghana and Côte d'Ivoire. The currently prevailing oil in most countries of the region will be replaced by natural gas and renewables, with their respective shares determined by geographical location, as well as political and economic conditions. For example, the Republic of Guinea, with its altitude differences and rivers, has good prospects for the construction of HPP, while Senegal and Mauritania are most likely to rely on their own offshore natural gas reserves.

In **Central and Eastern Africa**, **hydropower** will retain its leading position, with renewables and natural gas serving as reserve or peaking capacities.

Coal-fired power in **Southern Africa** is likely to be gradually replaced by **natural gas** and renewables, the proportions depending on market conditions

Eastern Africa has comparable reserves to those of Western and Northern Africa, but they are still incomparably less utilised and are still intended more for export. For land-locked regions and countries, as well as island states, a significant increase in renewables is expected, but also with the option of importing LNG.

Access problem

As mentioned above, access to grid electricity for households and businesses remains a key challenge in Sub-Saharan Africa. Universal (over 99% population) access to electricity is still achieved only in Northern African countries and some island states (Seychelles, Mauritius).

The past decade (2013-22) has seen significant progress towards the electricity access target. The number of people with access to electricity increased by 200 million. However, the rate of electrification growth is uneven – half of the new connections came from six countries (Ethiopia, Nigeria, Egypt, Kenya, Tanzania and Uganda).

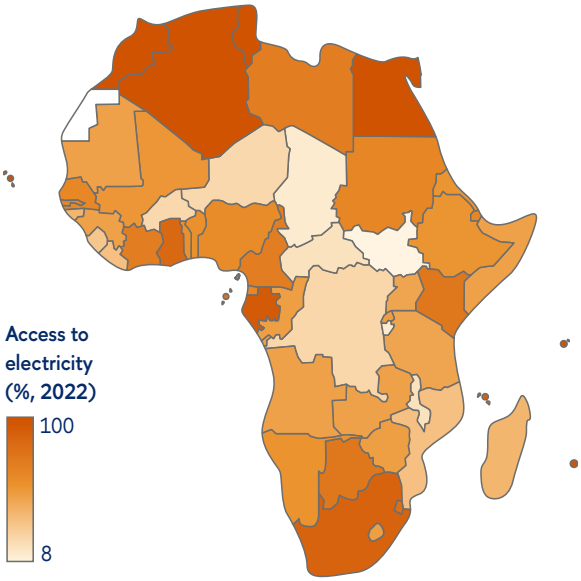
Growth in access to electricity in most countries has been absorbed by population growth

Only 15 countries were able to electrify faster than the population was growing – excluding Northern Africa and island countries, only six: Kenya, Ghana, Rwanda, Eswatini, South Sudan and Botswana. In a number of countries, however, the growth in access to electricity is not able to cover the growing population, including Nigeria, where the number of new connections during the decade amounted to about 20 million and population growth to 42 million, and the DR Congo, with 7 million and 27 million, respectively.

Kenya is the absolute leader in Sub-Saharan Africa in terms of electrification rates

There access to electricity increased from 40% to 76% over the decade, with 12 million new connections (population growth of 9 million). Ethiopia, Ghana, Rwanda and Côte d'Ivoire are also electrifying at high rates. In all these countries, electrification has been driven by consistent state policies: governments have either invested in capacity (Ethiopia), or provided very favourable regimes for private investors (Ghana, Kenya) or both (Rwanda). And it was state investment in the energy sector that became one of the drivers of faster GDP growth in these countries, not vice versa. It is worth noting that there is not a single 'oil' economy (except for sparsely populated Gabon) among the leading SSA countries in terms of electrification rates.

Electricity access rate, 2022



Source: prepared by the HSE University Center for African Studies based on OECD, World Bank and UNSD data.

The UN Sustainable Development Goal (SDG) No. 7 is to achieve universal access to electricity by 2030. The estimated investment required to achieve this goal is USD 33 billion per year. Most of African countries will not be able to meet the target by this date. Projections based on the ratio of electricity consumption to per capita GDP, population density and level of urbanisation yield 515 million people without access to electricity in 2030. Kenya, Ghana and possibly Rwanda have the best prospects for success. South Africa's strong performance may be undermined by economic stagnation and a general structural crisis in the energy sector. The biggest concerns are the pace of electrification in Sahel, CAR and DR Congo. The problem of energy supply in the interior of Africa requires significant investments – with some places requiring gas pipelines, others transmission lines and others autonomous generation and gasification.

What is hampering growth of domestic markets in Africa?

The problem of electricity and energy deficit in Africa is primarily an access problem, which is caused by a complex of factors: export-driven decision-making, when exports to global markets are prioritised over domestic consumption; transport and infrastructure deficit; non-compliance with standards; regulations and legal requirements; and ill-conceived policies on subsidies, tariffs and taxation. All of this, on the one hand, causes a shortage of resources and, on the other hand, a high price for the end consumer or unavailability of goods.

Many African countries still have laws in force that encourage the export of raw materials and energy resources, even if they are not sufficiently supplied to the domestic market. Often such post-colonial legislative frameworks are formed with the direct participation of multinationals, which artificially limit the access of African resources to domestic markets in order to secure those resources for their own production chains outside Africa. For example, in Nigeria the same Shell supplies gas to the export terminal at a price two times lower than the domestic market price[12].

The practice of multinationals influencing the legislation of African countries and directly lobbying their interests to the detriment of local communities and the environment has persisted and flourished. Tender procedures in some countries remain non-transparent, and licences are extended for long periods of time without allowing other companies to participate. Those countries that have taken the path of prioritising domestic markets, developing their own industry and supplying affordable electricity to the population are subject to external pressure. A prime example is Algeria, a country that has successfully solved the problems of energy access, including by restricting natural gas exports. In Algeria, the state-owned oil and gas company Sonatrach buys almost all natural gas output from operating companies, then prioritises supplying it to the domestic market at a subsidised price before finally exporting the surplus.

The problem of imperfect legislation and regulatory framework should not be solved with the help of foreign corporations, especially interested in importing commodities

The problem of imperfect legislation and regulatory framework should not be solved with the help of foreign corporations, especially interested in importing commodities. The arguments of foreign consultants (who may pursue their own hidden agenda) should be carefully checked and compared with solutions that work in countries that have already faced and solved similar problems. The lack of laws in Africa is compounded by the failure to enforce those that do exist. It is still often more cost-effective to violate regulations: fines for violations are less than the cost of compliance. Another facet of the same problem is the lack of tools to monitor compliance: bylaws, regulations, authorised institutions, personnel and technical means.

For African countries, an approach that combines empowering local communities with the necessary tools and power for environmental monitoring and making infrastructure operators fully liable for environmental damage that occurs because of normal or abnormal operations or any damage to the infrastructure they operate, regardless of the cause, may be recommended. Even damage from illegal taps and resulting spills of oil and oil products should also be compensated by pipeline operators, as they are ultimately responsible for the integrity of the infrastructure and are obliged to take care of it. Thus, regulators will then be better able to fulfil their functions: to correlate community signals with operators' reports on infrastructure condition and objective remote monitoring data. Operators, on the other hand, should provide regulators with

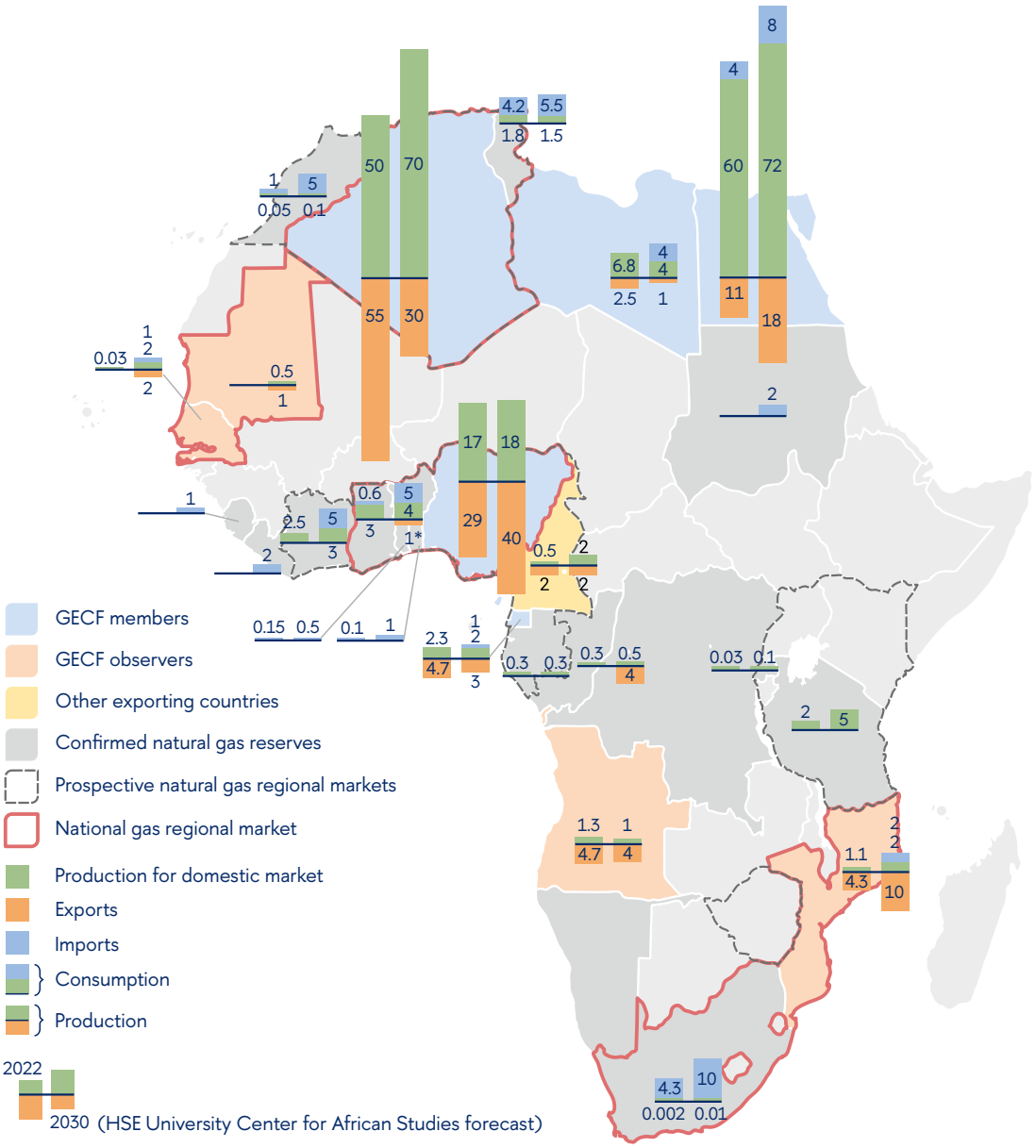
12 Thus, according to NNPC, the price of gas supplied by SPDC (a joint venture with Shell participation) to the Nigeria LNG plant in May 2021 was USD 1.3 per MMBTU. At the same time, the price for the same volume for power plants in the domestic market was USD 2.5 (reduced to USD 2.18 since July 2021), and for commercial consumers - USD 3.

timely and accurate information on technical parameters of infrastructure performance, problems and accidents, and should be held liable for failure to provide such information, commensurate with possible damage.

No continental – or even sub-regional – energy markets have emerged

In the 60 years of independence of most African countries, no continental – or even sub-regional – energy markets have emerged. In some cases,

Africa's natural gas markets, 2022–2030



*Reexports

Source: prepared by the HSE University Center for African Studies based on own research, operators' data, AFREC. JODI-Gas and GECF.

pairs or triplets of countries have been formed, connected by common infrastructure, but even here it is difficult to talk about a market in its full-fledged sense. Usually, it is two or three centres of gas or oil consumption, connected by a single pipeline. For now, regional markets with a common system of pricing, distribution, storage and reservation are still absent, and the prerequisites for their emergence do not exist. The concept of regional power pools, which are proclaimed at the level of each regional economic community, is at the most advanced stage. For some countries, electricity imports within such pools form the basis of the national energy system, but even in this case it is difficult to talk about complex market relations that would allow the formation of a single electricity price market or even a joint dispatch centre. There are still two or three high-voltage power lines connecting neighbouring states.

The prospects of African energy markets and their investment appeal – at least in the medium term – may be linked to the sub-regional cooperation

As long as individual countries cannot be considered as promising investment destinations due to their low population density, low degree of industrialisation, insufficient consumption of natural gas and underdeveloped power grids, investors will be able to justify the economic feasibility of projects through plans to re-export gas, oil products, LPG, electricity, diesel fuel, etc. to the regional market.

One positive example is the emerging sub-regional markets for petroleum products, and a marker of this are such 'statistical anomalies' in trade statistics as Senegal, Tanzania, Togo, Kenya, Mozambique. These countries import two and sometimes three times more oil products than they consume just for re-export to neighbouring countries in the region. Regional companies and traders (incidentally, owned by local investors) are formed for these needs and invest in infrastructure for import, storage, transshipment and distribution.

New energy transition – new prospects and challenges

Climate change and the energy transition occurring simultaneously will determine how African countries will cope with energy shortages. The transition to renewable energies is the second energy transition that African countries are experiencing as modern and independent states. The first energy transition of this kind occurred in the 1940s-60s, led to a significant increase in the share of hydrocarbons in primary consumption and coincided with the decolonisation process. The changes now underway in global demand for energy, semiconductors and critical minerals, although still relatively volatile, demonstrate the role that Africa will play in the global energy transition and the reshaping of the world economy in the 21st century. As the oil and gas industry shows, the norms and rules, ownership structure of the main assets, and the control of reserves are difficult to revise in a fundamental way.

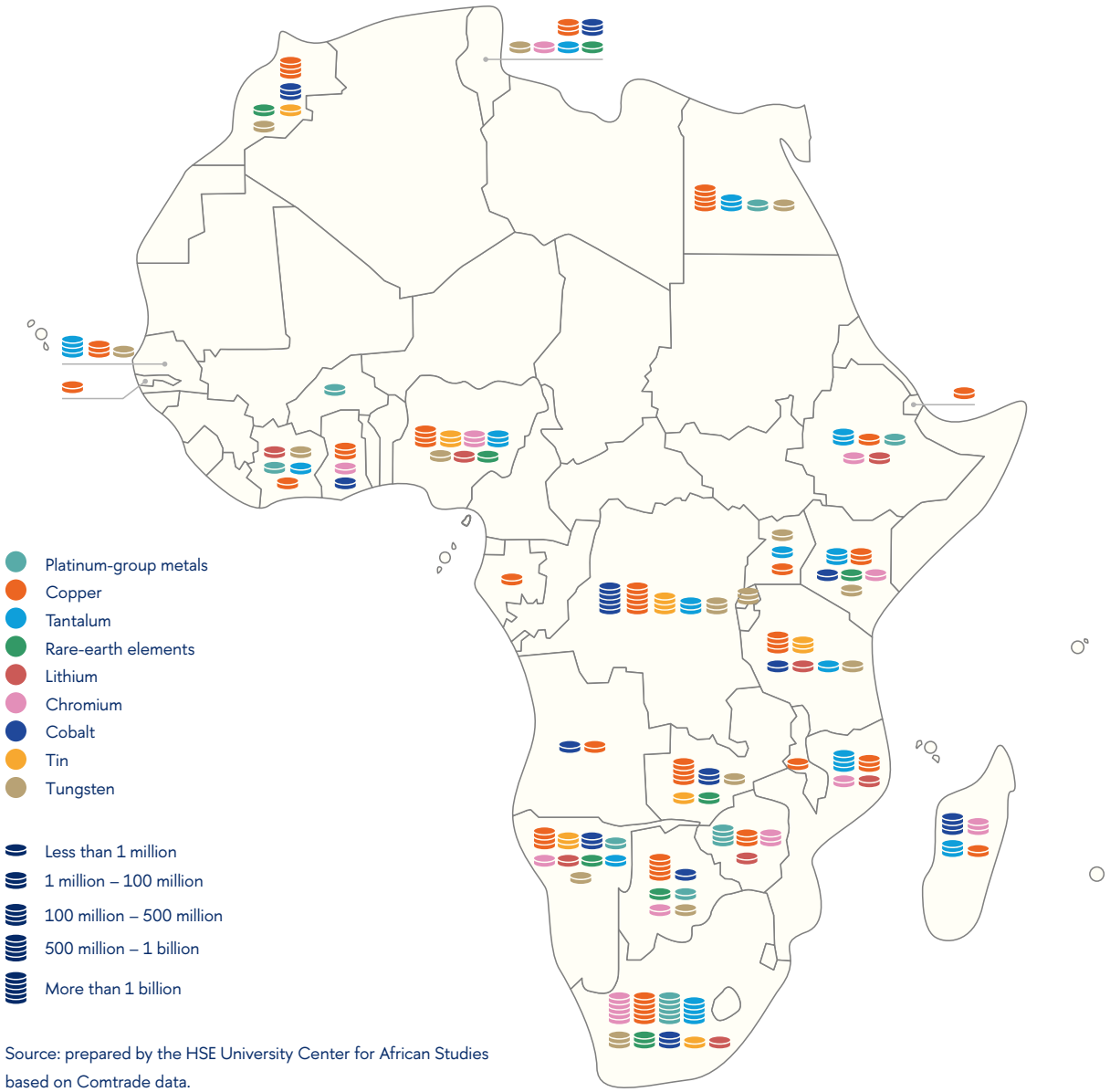
The oil and gas industries of Algeria, Angola and Nigeria, despite civil wars, changes in foreign and domestic policy, are developing according to the rules that were established shortly before, during and immediately after decolonisation. That influence on legislation, strategies and decision-making leaders allows foreign corporations to maintain their influence despite any political changes. Thus, the norm once established becomes rigid, a situation happening not only with oil and gas, but also with gold, platinum, uranium, etc. However, in Algeria, those norms were born in the struggle against colonial pressure, while in Nigeria they were formed by British citizens.

The competition between the United States and China in Africa is becoming fiercer by the year – e.g. in the struggle for access to the transportation and logistics infrastructure linking southeastern Congo to the ocean ports. This great power competition gives African countries the opportunity to use this for the benefit of their economic development, a right to decide and to tighten regulatory and environmental measures, as well as control over the activities of foreign investors.

African businesses are getting stronger, engaging not only in retail trade but also in large-scale investment projects across Africa

African countries are now much more independent politically and have already formed relatively stable institutions, nationally oriented political and business elites, as well as strong state-owned companies. Also, at long last, private African businesses are getting stronger, engaging not only in retail trade but also in large-scale investment projects across Africa (Oando, ARM, Dangote). The growth of domestic resources allows Africa to count on better negotiating positions with external players and, consequently, greater dividends from its natural wealth.

Critical minerals exports from Africa, 2023



Source: prepared by the HSE University Center for African Studies based on Comtrade data.

The main marker of the US interest in Africa's critical minerals remains support for the development of the so-called Lobito Corridor. The Lobito Corridor is the name for a group of projects aimed at developing transport infrastructure in Angola, DR Congo and Zambia to provide them with access to the Atlantic coast of Africa. The transport infrastructure (including the Benguela railway line from Tenke in DR Congo to Lobito in Angola with a total length of 1866 km, gauge – 1067 mm) connecting the southeastern regions of DR Congo (Katanga) with Atlantic coast was built during colonial times – in the early 20th century. At that time, some of its sections were used to export uranium, tin and copper from the Belgian Congo through the Atlantic ports.

Civil wars in DR Congo and Angola in the second half of the 20th century led to the destruction of the railroad and its fragmentation. Sections of the railroad were reconstructed in the 1990s and 2000s, but were operated separately. In July 2022, the Angolan government announced the results of the tender for the concession of the Angolan railroad section Lobito-Luao (1344 km) for 30 years. The winning bid was made by the Lobito Atlantic Railway consortium (in which Singaporean trader Trafigura and Portuguese construction company Mota-Engil own 49.5% each, and Belgian rail infrastructure operator Vecturis owns 1%), which beat the bid of a Chinese consortium (CTIC, Sinotrans and CR20). In July 2023, a ceremony was held to hand over the railroad to the consortium's management.

In February 2024, the first contracts for transportation of cargoes by rail were signed. Trafigura received the right to transport 450 thousand tonnes per year from 2025, and the consortium of Canadian mining company Ivanhoe Mines and Chinese Zijin Mining, which is implementing a copper mining project in the DR Congo (Kamoa-Kakula) received the right for transportation in the range of 120-240 thousand tonnes per year from 2025 (10 thousand tonnes in 2024).

In parallel, in December 2023, AGL (a division of Swiss shipping company MSC) received in concession the port of Lobito under the obligation to invest in its development at least USD 100 million. The project to develop the Lobito Corridor enjoys the support of Western countries. At the G7 summit in 2023, the US president J. Biden announced his intention to support the project as part of the global initiative Partnership for Global Infrastructure and Investment (PGI). In October 2023, the governments of the United States, Angola, DR Congo, Zambia, the European Union Commission and the African Finance Corporation (AFC) signed a memorandum of understanding to cooperate in the development of the Lobito Corridor. In February 2024, the US state-owned DFC Corporation approved a USD 250 million loan to AFC for the Lobito Corridor project to build a rail line that would connect Zambia and a section of the Benguela railroad in Angola. The loan must be approved by the US Congress.

The Lobito Corridor project is apparently aimed at creating an alternative logistics route for the export of minerals from Zambia and southeastern Congo as opposed to the 'eastbound' route. As of May 2024, most of the ore from Katanga and the Copperbelt is trucked eastward and further exported through the port of Dar es Salaam to China. In recent years, the PRC has also been actively investing in the development of railway infrastructure in Tanzania and Zambia to optimise ore exports. In September 2024, the PRC announced its intention to finance the TAZARA railroad connecting Zambia to the Tanzanian port of Dar es Salaam.

Central, Eastern and Southern Africa transport infrastructure

A trade and transport corridor is a coordinated bundle of transport and logistics infrastructure and services that facilitates trade and transport flows between major centers of economic activity.

Source: prepared by the HSE University Center for African Studies based on Tripartite Transport & Transit Facilitation Programme data.

Moreover, while Africa's share in the world's oil and gas reserves is 8-10%, which can be replaced by hydrocarbons from other regions of the world, of its reserves of a number of strategic minerals necessary for the energy transition, such as platinum, palladium, cobalt, copper, titanium, graphite, REM, are irreplaceable and provide about half of the world's production and world reserves, which, of course, will affect the interest of foreign investors in the African resource base and lead not to the Scramble for Africa, but rather for its attention[13].

Data control in its broadest sense becomes key in this context.

The lack of information, knowledge and data on Africa's natural reserves and ecosystems is another key risk preventing African countries from gaining energy sovereignty

The term 'resource curse' is often applied to Africa, but it can be complemented by another curse, namely 'the curse of non-existent resources'. There have been dozens of conflicts based on speculation about the alleged availability of resources or their scarcity, when in fact it turns out

13 In terms of critical minerals one can speak about 'Scramble for African Attention', not about 'Scramble for Africa'.

that either these resources have not been proven to exist, or they do not exist at all, or they are so scarce that only one small paramilitary group can enrich itself on them.

Speculation about the alleged presence of hydrocarbon reserves in Lake Malawi continues to contribute to tensions between Tanzania and Malawi, the myth of uranium reserves in the Central African Republic leads to ongoing conflict, speculations about declining water levels in the Nile nearly led to interstate conflict between Egypt and Ethiopia. It is not only the lack of information about resources, the political factor, military prestige, the interests of certain groups inclined to justify their actions by the presence of these or those resources play their role, but the lack of knowledge, geological information and even autonomy of African governments in analysing and interpreting geological information remains one of the most pressing issues.

Not all countries still have legal requirements to provide the host country with geological exploration results, so foreign investors do not file their survey results with the host government, but 'take' them with them and then resell them to third parties. Thereafter, the state gradually loses control over its own resources, as it does not understand the real condition of reserves and cannot take them into account when developing a general economic strategy.

The lack of data on domestic markets, real demand and consumption, as noted above, leads to stagnation of domestic markets

Companies interested in investing in domestic markets are faced with non-transparency, lack of information or deliberate manipulation by intermediaries and are forced to rely on information provided by Western consultants.

The most important problem remains the unreliability of measurements of climate indicators, such as precipitation levels, water levels in reservoirs, groundwater levels and their quality, climate zone boundaries, etc., which allows stakeholders – from governments to international non-governmental organisations – to freely speculate on baseline indicators to justify their own interpretations of climate change and recommendations within their own agenda.

From the African perspective, the industrialised countries bear the main responsibility for catastrophic climate change. However, Africa needs more tools to justify and defend this position – with the ultimate goal of receiving fair compensation in material and monetary form or in the form of other concessions from their former colonisers, China or the United States. Africa's response can be based on the establishment of its own network of measurements and observations of global climate change. Simply put, the climate agenda is owned by those who have relevant, reliable and, no less importantly, legitimate (i.e. recognised by international partners) information on the dynamics of indicators.

The great potential in this regard is clearly related to digital solutions. The spread of unmanned aerial vehicle technologies, the cheapening of data centre technologies, sattelite survey and, finally, maturing African national companies will allow African states to form integrated systems for managing their own natural resources and then integrated georgraphic information systems that can be used to monitor the state of soils and forests, water levels in rivers, fire danger, climate shocks, soil erosion and desertification dynamics. Such information systems can be both sectoral and country-wide, but they will make it possible to better understand the structure of domestic markets, forecast the dynamics of their development, and offer more promising projects to foreign investors.

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