ELECTRICITY LAWYER

LRP Data Intelligence

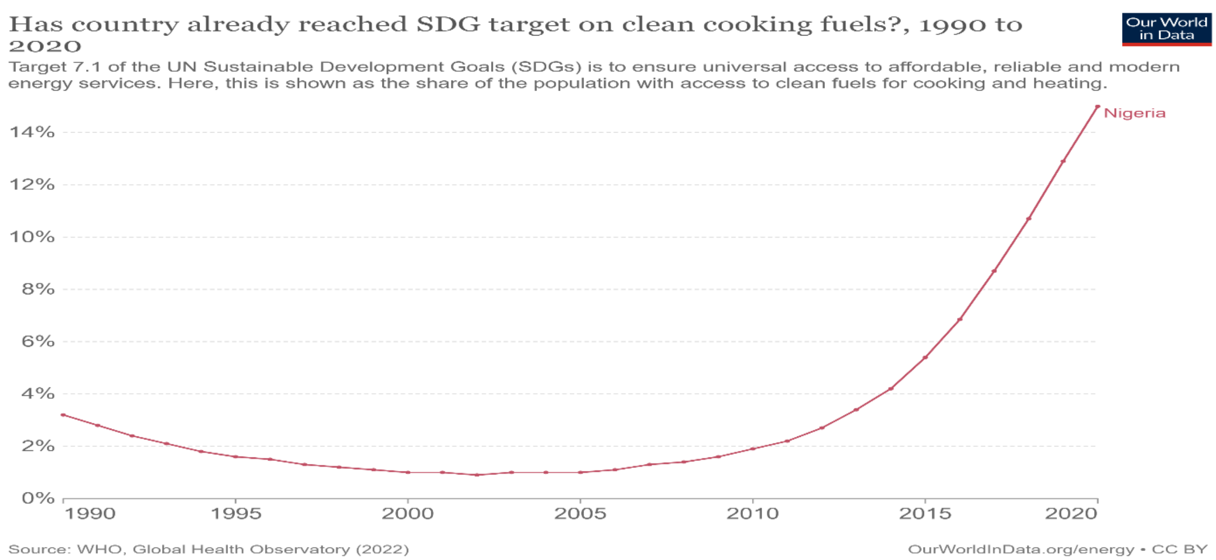
LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Level Of Access to Clean Fuels for Cooking in Nigeria

Electricity Lawyer is pleased to introduce its flagship and novel Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors and stakeholders in understanding the implications of energy market developments and make well-informed decisions on such basis.

The data intelligence highlights lessons for Nigeria regarding its attainment of the Sustainable Development Goal 7 (SDG 7) target for clean cooking.



The graph presented projects an increase from 2010 till 2020 for clean cooking fuel utilisation in Nigeria. The increase can be traced to the National Clean Cooking Scheme (NCCS), a project of the Federal Ministry of Environment's Renewable Energy Program that was introduced in September 2012, collaborating with the pot manufacturer Tower, and the energy company Envirofit, through its Rural Women

Energy Security (RUWES) program on the manufacture and distribution of a specially designed bio-mass stove across the country.[1]

The National Assembly Intervention on Clean Cooking Initiative (NAICCI) was also introduced to improve the health of women who deal with respiratory infections and ailments brought on by indoor air pollution and smoke inhalation.[2] This initiative also encouraged the adoption of clean cookstoves in members' constituents.

However, no concrete policy has been developed and adopted at the national level integrating clean cooking into national interventions to achieve the SDG target on modern energy service and clean cooking[3] Lessons and practices in African countries like Ghana and Ethiopia could inform policy decisions in Nigeria to propel a rise in clean cooking in the region by creating a framework for national policy, strategy, and coordination for the cookstoves industry; and enhancing the capabilities of businesses along the value chain that have the ability to increase production.

[1] Clean Cooking in Nigeria. Available at https://energypedia.info/wiki/Clean_Cooking_in_Nigeria

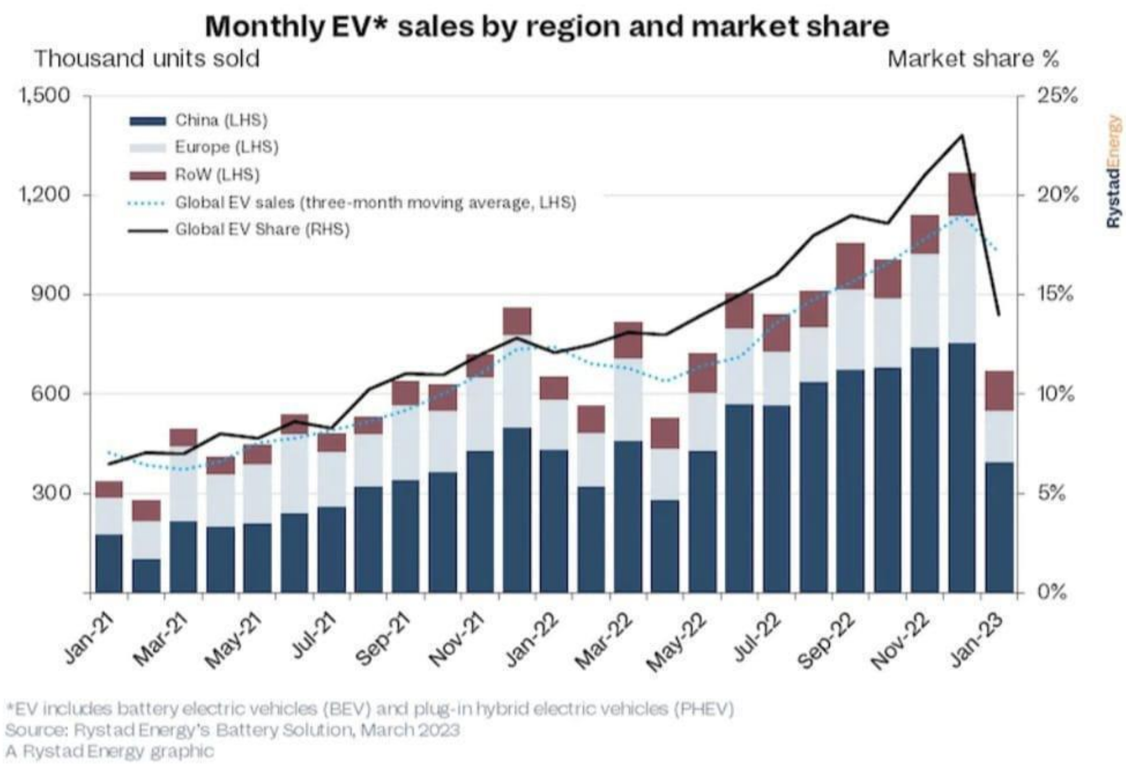
[2] Ibid

[3] Ibid

Practical Lessons for Africa in Deploying Electric Mobility

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights lessons for African countries in deploying electric mobility technology.



The graph projected above depicts that in January 2023, compared to the previous months from May 2022 onwards, Electric Vehicles (EV) sale in Europe and China, the world's largest market for EVs, fell by almost 50%.

Many European countries and mainland China cut EV subsidies at the start of the year 2023, and a significant return is highly unlikely in the near future.[4] The US market however, is rolling out tax credits based on the Inflation Reduction Act, thus portraying a positive outlook.[5] The United States was the only major market where both EV sales and market share increased.

African countries like Rwanda have exempted electric cars, spare parts, batteries and charging station equipment from VAT, import, and excise duties.[6]

Considering the reduction in the sale of EVs in Europe and China, due to the removal of incentives and subsidies, EV manufacturers will be willing to drive sales to Africa and take advantage of available incentives; however, there is no existing legal framework in Rwanda in this regard, similar to other African countries like Kenya, Egypt, etc.

It is recommended that African countries factor such incentives within a well-structured legal framework alongside other considerations and components such as electric vehicle recycling and re-use, battery recycling and reuse, technical and environmental standards, and regulatory verifications to manage the influx of electric mobility.

[4] EV Sales Collapes as subsidies & tax credits come to an abrupt end. Available at https://www.rystadenergy.com/news/ev-sales-collapse-as-subsidies-and-tax-credits-come-to-an-abrupt-halt

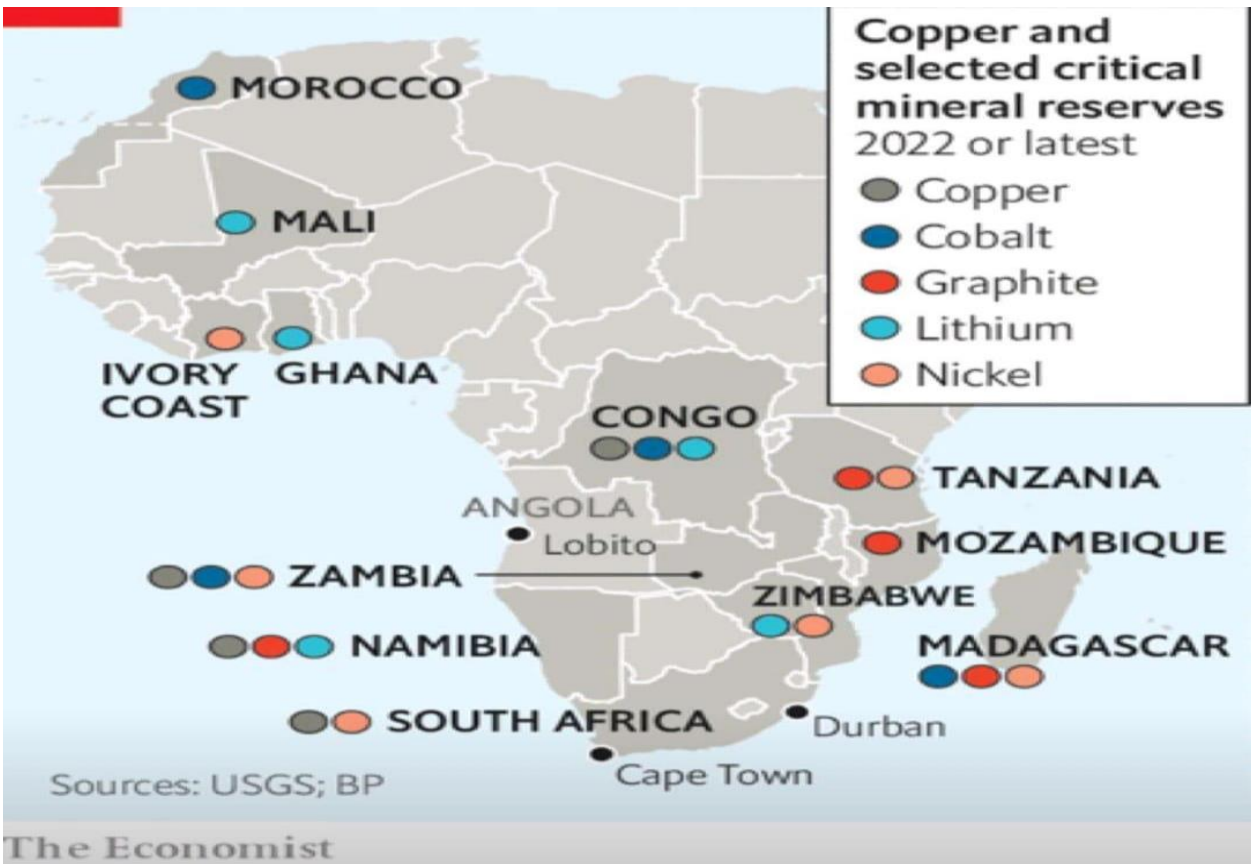
[5] Ibid

[6] Africa's push for Electric Vehicles. Available at https://www.howwemadeitinafrica.com/africas-push-for-electric-vehicles/150459/

Practical Considerations for Exploring Critical Elements in African Countries

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights practical considerations for African countries regarding the exploration of critical mineral elements.



The graph presented projects the critical mineral elements available in different African countries. Africa is a hub for critical minerals, which are on high demand by foreign countries for the production of electric vehicles and batteries to foster the global energy transition.[7] This has put foreign countries on a race to explore these critical mineral elements in Africa.[8] It is worthy of note that even with prior legal frameworks that govern the mining sector, African countries have put up different stance in relinquishing their critical mineral elements.

Zimbabwe has recently placed a ban on the export of its unprocessed lithium.[9] The government plans to stimulate the nation's processing capacity in a bid to keep the value chain of the critical mineral in-country and take advantage of surging global prices.

While Zimbabwe has taken a seeming defiant stance, South Africa has entered a collaboration with United Kingdom regarding its critical minerals, for future clean energy technologies; as part of the energy transition, in anticipation that the collaboration will lead to mutually beneficial projects and related initiatives, such as support of investment flows into the South African mining sector and promote new clean jobs.[10]

Namibia has also taken a similar stance regarding its critical materials by entering into a partnership deal with the European Union to sell its rare earth minerals critical to the energy transition program.[11] Morocco has also recently taken an initiative to

[7] Critical Raw Materials in Africa. Available at https://storymaps.arcgis.com/stories/79b2db81b98a42e69ef2a9390b2aab42

[8] Ibid

[9] Will Zimbabwe's ban on unprocessed lithium advantage China? Available at https://african.business/2023/01/resources/will-zimbabwes-ban-on-unprocessed-lithium-exports-advantage-china/#:~:text=In%20a%20circular%20issued%20on,from%20Zimbabwe%20to%20another%20country.%E2%80%9D

[10] Policy Paper: UK and South Africa working in Partnership on minerals for future clean energy technologies (November 23, 2022). Available at https://www.gov.uk/government/publications/uk-south-africa-joint-statement-on-partnering-on-minerals-for-future-clean-energy-technologies/uk-and-south-africa-working-in-partnership-on-minerals-for-future-clean-energy-technologies

[11] Namibia, EU reaches provisional deal on rare earth minerals. Available at https://www.reuters.com/markets/commodities/namibia-eu-reach-provisional-deal-rare-earth-minerals-2022-10-20/

grant an exploitation license to a U.S company for its manganese extraction and sales to create clean jobs and stimulate local economic growth.[12]

It is recommended that while African countries endeavor to take economic advantage of these critical mineral elements, recourse must be given to the environmental and social impacts of mining processes on citizens and prioritize proper accountability and appropriation of investment flows and revenue derived for the purpose of transparency. In addition, mining laws and regulations will need to be developed or amended to properly align with related laws and regulations in line with national and global energy transition agendas to ensure policy and regulatory clarity. Other key related factors for consideration include the interplay of supply, demand and pricing across multiple commodities resulting in possible materials substitution, technology shifts, alteration in demand, licensing framework, property rights, etc. Ultimately, government policy and macroeconomic trends will serve as key drivers in shaping the investment landscape on the back of the legal and regulatory framework(s).

[12] Elcora receives Manganese Production License in Morocco. Available at https://investorintel.com/member_news/elcora-receives-manganese-production-license-in-morocco/

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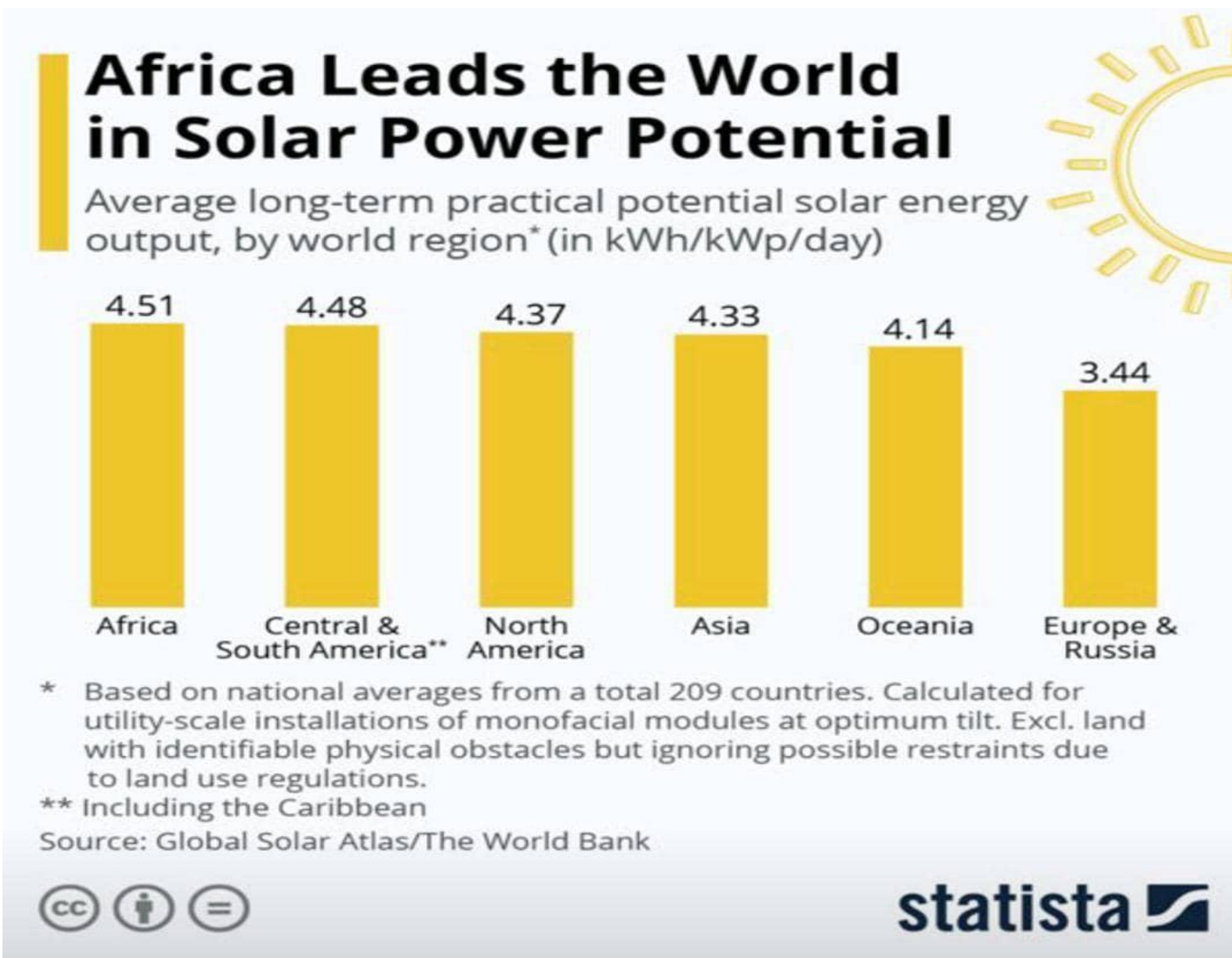
Practical considerations for exploring Africa's Solar Potential

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for Africa regarding the exploration of its abundant solar potential.



The graph presented projects that Africa has the world's largest solar energy potential. Africa is the only region in the world where "excellent conditions" for solar power are exceeded[13] yet still untapped. The International Energy Agency (IEA) estimates that Africa possesses 60% of the world's finest solar resources but only 1% of solar generation capacity.[14] Africa can change this narrative through regulation, policies and financial mechanisms.

Through legislation and policies, Africa can exploit its solar potential by putting in place, amending and/or retrofitting national legislations and policies tailored to drive the actualization of its solar energy potential. This could incorporate measures such as VAT exemptions on renewable energy equipment, import duty exemptions on photovoltaic products and components, license/operating permit exemptions, etc.[15]

Such policies can also translate commercial barriers to the deployment of solar energy into viable capacity. Thus, on the public sector front, African governments can generate substantial revenue by reducing the inefficiencies associated with fossil fuel subsidies, which primarily benefit coal and oil resources, at the expense of cost reflective tariffs and long-term attainment of grid parity.[16] Subsidies are estimated to amount to 5.6 percent of Sub-Saharan African's Gross Domestic Product.[17] Subsidies could be phased out gradually while protecting the vulnerable, and attracting funding for renewable-energy technologies like solar.

Additionally, on the private sector front, African countries should make significant efforts to attract private investment in its potential solar capacity. According to

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13 WeForum: Africa is leading the Way in Solar Energy Potential. Available at https://www.weforum.org/agenda/2022/09/africa-solar-power-potential/#:~:text=Africa%20has%20the%20world's%20greatest%20solar%20energy%20potential%2C%20World%20Bank,of%20greenhouse%20gas%20emissions%20globally.

14 Ibid

15 Ibid

16 GREGOR SCHWERHOFF & MOUHAMADOU SY: Renewable energy sources, especially solar, are ideal for meeting Africa's electrical power needs (Where The Sun Shines, International Monetary Fund March 2020) < https://www.imf.org/en/Publications/fandd/issues/2020/03/powering-Africa-with-solar-energy-sy >

17 IMF Working Paper, Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates. Available at https://www.imf.org/en/Publications/WP/Issues/2019/05/02/Global-Fossil-Fuel-Subsidies-Remain-Large-An-Update-Based-on-Country-Level-Estimates-46509

surveys, the greatest threat to private investment in solar energy in Africa is governance-related risks such as complex bureaucracy and changing regulation.[18] Attracting private financing will necessitate governance improvements to reduce political risk; reforming the financial sector to stimulate the nascent green bond market, and reducing financial risks by transferring some of the risks to public actors based on proper risk allocation, which can incentivise private investment.[19]

Multilateral financial institutions also play an important role at the international level in facilitating long-term financing to support clean energy investments.[20] These institutions provide tailored advice on the effective deployment of climate finance, in addition to identifying alternative sources of funding.[21]

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Practical considerations for the exploration of Liquified Natural Gas in Africa

[18] Ibid
[19] Ibid
[20] Ibid
[21] Ibid

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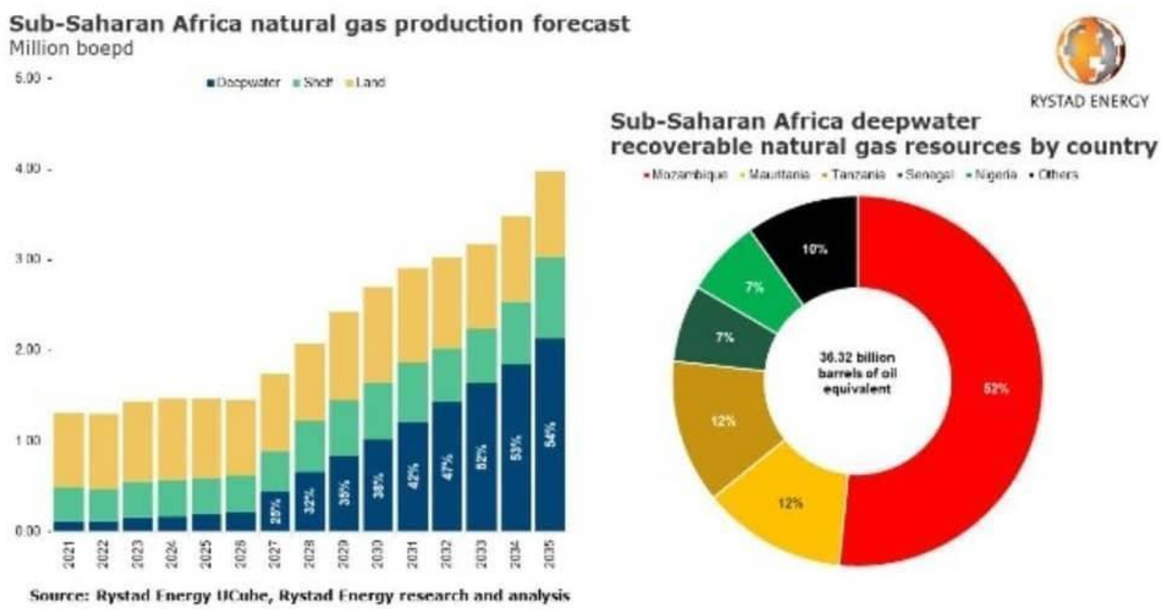
The data intelligence highlights recommendations for African countries regarding the exploration of Liquefied Natural Gas.



The graph depicts that Sub Saharan Africa is a hub for natural gas and production is expected to increase significantly in the coming years,[22] while it is forecasted that there will be a global shortage of LNG by 2026.[23] The use of gas as a transactional energy resource is being encouraged by energy transition policies adopted in several global economies, which will result in a rise in demand for liquefied natural gas (LNG). Africa's hydrocarbon-producing nations now have a big potential to earn sufficient

[22] SSA Gas output set to double by 2030. Available at https://www.oilreviewmiddleeast.com/gas/sub-saharan-africa-gas-output-set-to-double-by-2030-rystad-energy
[23] World will face Shortage of LNG through 2026. Available at https://www.marketwatch.com/story/world-will-face-shortage-of-liquefied-natural-gas-through-2026-says-exxon-ceo-11670347410

revenue(s) from LNG production.[24] But, in order to build infrastructure that will enable production to rise and LNG exports to improve, major investments must be made in Africa's dominant and developing gas producing nations, including Mozambique, Nigeria, Niger, and Tanzania.[25]

A lack of funding to build the necessary infrastructure to increase energy exports, despite Africa's potential to become a global energy hub, continues to be the principal obstacle preventing the region from fully utilizing its gas reserves for economic progress.
As a result, it is recommended that African producers must give top priority to creating capital-attractive regimes through commercial friendly legislations and policies that foster compliance with sanctity of contracts [26]

Additionally, African governments must foster an investment climate that attracts large oil and gas companies, regional and international financial institutions, to engage in infrastructure development for natural gas.[27] This is possible via the enactment and implementation of policies/legislation(s) that regulate appropriate pricing, competition and fiscal regimes of the gas industry.

In addition alternate methods of securing finance should be explored, beyond international funding and grants.[28] For instance, Africa can use a combination of domestic private sector and public sector funding, establish a rapport with Asian banks that are willing to finance oil and gas developments in Africa, and also deploy African-tailored solutions through institutions such as the African Development Bank, to accelerate the development of infrastructure for gas exports.

In conclusion, legislation(s), policies and incentives will be the driving force for African countries to foster their natural gas production and export, in order to take advantage of the forecasted global gas shortage(s) in the coming years.

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[24] Ibid
[25] Infrastructure Will Enable Africa expand LNG Exports. Available at https://guardian.ng/apo-press-releases/infrastructure-rollout-will-enable-africa-to-expand-lng-exports-and-meet-global-demand/
[26] Ibid
[27] Ibid
[28] Ibid

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Practical considerations for Trade and Investment of Critical Minerals in Africa

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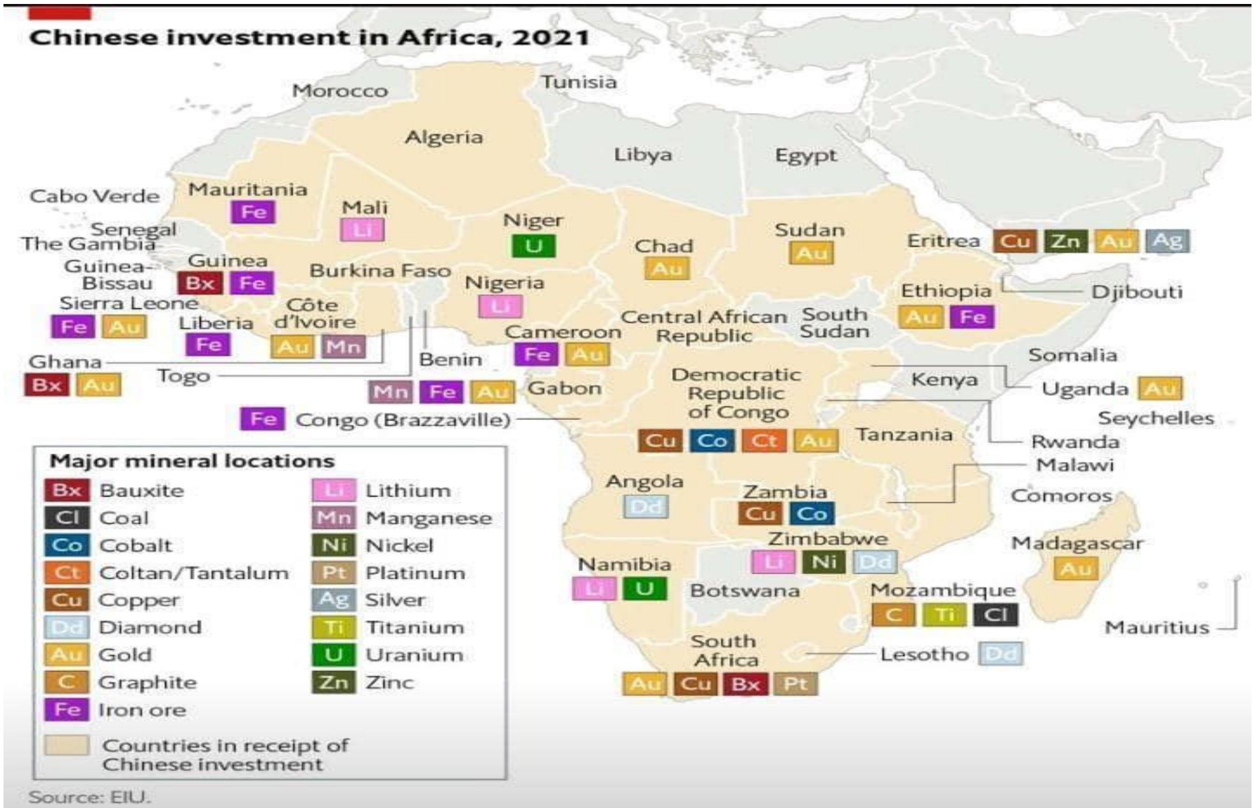
The data intelligence highlights recommendations for African countries, towards leveraging on foreign investment in her critical minerals.



The graph depicts China's investment in Africa, home to about 30 percent of the world's mineral reserves.[29] More than 40% of its mineral exports and about one-third of region's ore and metals export go to China. Notably, China is heavily investing in Africa, building infrastructure and participating in numerous projects to increase access to electricity. It is anticipated that Africa will not only or primarily be a source of natural resources and raw materials, but the development of the continent will also present incredible opportunities for trade and investment.

As a result, it is recommended that African nations review their respective investment laws and policies that will position the region to leverage on China's investment.

[29] Mapping Africa's natural resources. Available at https://www.aljazeera.com/news/2018/2/20/mapping-africas-natural-resources

Although the majority of African nations have adopted generous investment laws, many of them have also implemented excessively high corporate taxes, high interest rates that are out of line with the needs of productive investments, uncompetitive wage rates, and strict labor laws, all of which act as deterrents to investment.[30] As a result, many other African nations have not witnessed the anticipated results from their investment incentive packages.

Investment incentive systems are the primary policy instruments that can directly influence investment volumes and allocation. Given the competitive global investment environment, African governments may need to overhaul their respective investment incentive packages, drawing from the experiences of other developing regions. Components like tax breaks, minimum wage and employment legislation, interest rate policies, training allowances, depreciation allowances, profit repatriation policies, and foreign exchange transactions are few considerations that must be taken into account.[31]

Also, the banking and non-banking financial systems should be shaped to fulfill their responsibility for encouraging profitable investments and offering investors and corporate operations effective services.[32] It is also important to encourage banks to finance profitable investments.

In conclusion, Africa's potential for attracting investment is immense, yet constraints within the investment climate are numerous. Africa can overcome the constraints by adopting the right policies, in addition to formulating, and implementing tailored incentive packages.

[30] Reviving Investment in Africa: Constraints & Policies (Economic & Social Council). Available at https://www.africa.upenn.edu/ECA/ECAmin_invest.html

[31] Ibid

[32] Ibid

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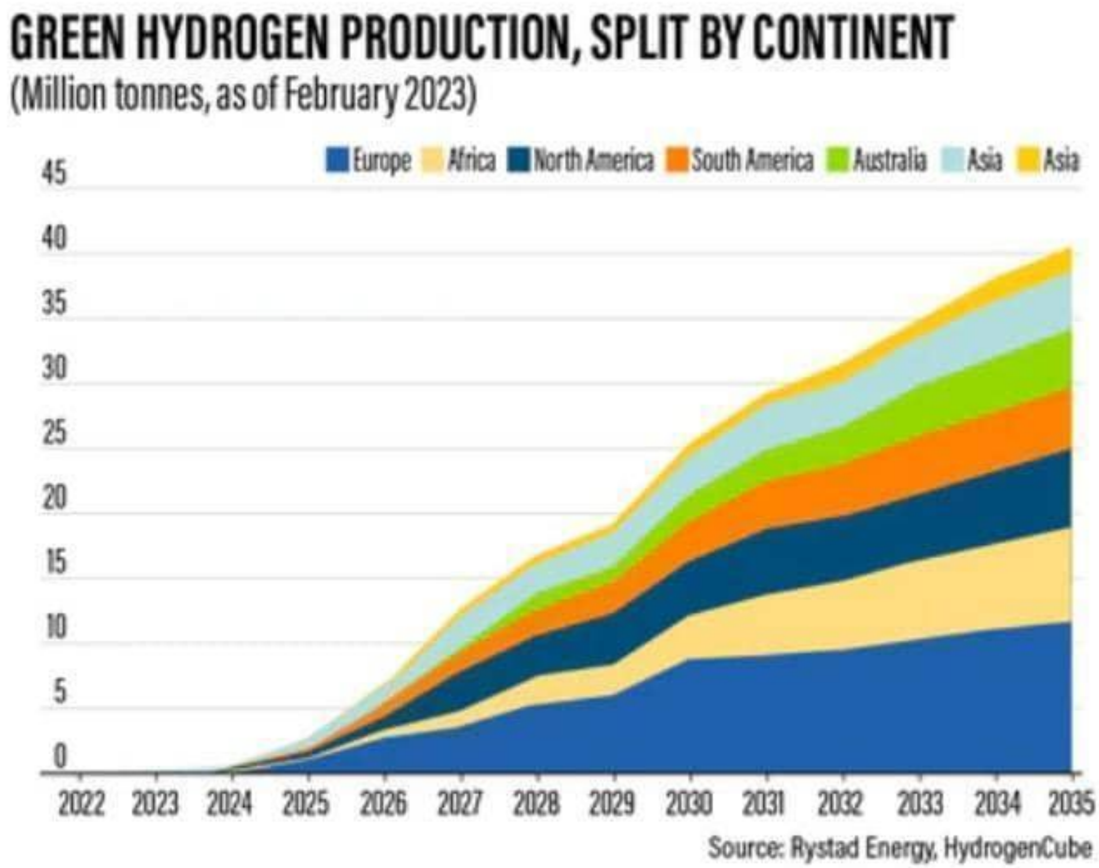
Practical considerations for Green Hydrogen Production in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for Africa towards leveraging on the region's green hydrogen potential.



The graph depicts green hydrogen production per continent, of which Africa is projected to produce about 15 million tonnes of green hydrogen by 2035. Africa's abundance in renewable energy and its unparalleled minerals are critical not just for green hydrogen production, but also to produce electrolysers, needed for hydrogen (H2) production.[33]

[33] Green hydrogen: A viable option for transforming Africa's. Available at https://www.un.org/africarenewal/magazine/july-2022/green-hydrogen-viable-option-transforming-africas-energy-sector

According to a study by Rystad Energy, Africa's total declared electrolyzer pipeline capacity has reached 114 gigawatts (GW), 61% of which are associated with Sub-Saharan African nations.

An estimated 70GW of electrolyzer pipeline for this African region has been announced, with Mauritania accounting for 50%, followed by South Africa and Namibia. As South Africa possesses nearly 90% of the world's platinum group metal reserves, essential to produce polymer electrolyte membrane (PEM) electrolyzers, Sub-Saharan Africa is in a unique position to establish a sustainable green hydrogen economy.

A green hydrogen economy will need aspirational policymaking, imaginative leadership, and substantial additional funding to[34]:

- Create collaborative innovation platforms to advance research and the creation of sustainably produced technology from Africa to sustainably increase the sector's competitiveness.
- Build the infrastructure for hydrogen energy to support H2 production and facilities for efficient H2 storage, transport, and refueling.
- Establish or enhance the legal framework(s) for green hydrogen, to support the entire value chain– from production to distribution.

The biggest barrier to constructing these hydrogen projects and the necessary infrastructure will be funding.[35] However, alliances in Africa have been sought after by European nations. Hence, there is a demand on African countries to enact legal frameworks that will cater to such alliances with foreign countries, towards the production of green hydrogen, and electrolysers, which will bring in investment and economic opportunities to the continent.[36]

It is recommended that experts and stakeholders across the green hydrogen value chain, form a synergy that will spur the enactment of a robust legal framework for a

[34] Africa & Europe set to be dynamo for the global green hydrogen economy. Available at https://www.rystadenergy.com/news/Africa-and-Europe-set-to-be-the-dynamos-for-the-global-green-hydrogen-economy

[35] Ibid

[36] Ibid

hydrogen economy in Africa, which will eventually dovetail towards other economic benefits such as investments and green jobs across the continent.

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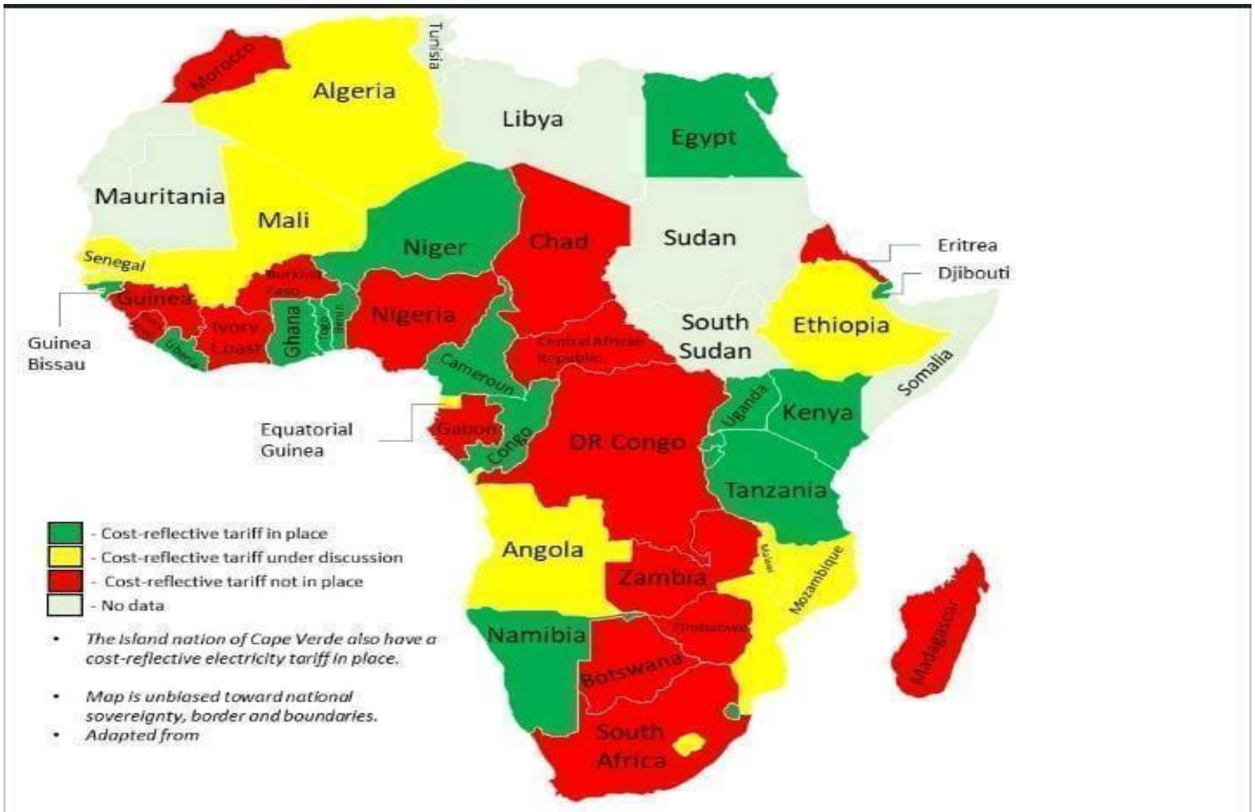
Practical considerations for Optimizing Cost Reflective Tariffs in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for African countries towards optimising cost reflective tariffs in the electricity supply industry.



Status of Cost reflective electricity tariff reform in Africa countries (Adapted from AfDB & IEA data)

The graph depicts that majority of African countries still run an electricity market without cost-reflective pricing/tariffs. This indicates that majority of African countries' power tariffs do not accurately reflect the full cost of supplying electricity, leading to ineffective markets and significant revenue collection shortages.

In an effort to maintain low rates and assure universal affordability, the government typically replaces this revenue loss with subsidies.[37] The governments' subsidy/shortfall coverage system, which is an inefficient instrument for reducing poverty, has made it difficult for utilities to meet their operating expenses, and earn appropriate return on investments. Non-cost-reflective tariffs and other losses make

[37] ESI Africa, Utility CEO's Persepective on Cost Reflective Tariffs (ESI Africa October 13, 2022) < https://www.esi-africa.com/business-and-markets/utility-ceos-perspective-on-cost-reflective-tariffs/ > accessed 14th April 2023.

it difficult for the sector to draw in investment, preventing infrastructure growth and extension.

It is recommended therefore that to prevent power utilities from defaulting on their debts due to rising expenses and Aggregate Technical Commercial and Collection (ATC&C) losses, tariff reform and regulations should be considered. It is necessary to implement a cost-reflective pricing system where end users, free from government interference, pay the full and actual cost for the electricity consumed.
This framework will increase utility companies' financial stability for the delivery of better services and relieve governments' financial burden based on subsidies, tailored towards targeted consumers not able to afford cost reflective tariffs based on the applicable electricity tariff band.[38]

Africa's electricity sector needs major investment, and implementing a cost-reflective tariff system is an important first step to attract private investment in electricity infrastructure across the power supply industry, to drive the much-needed electricity access.[39]
Furthermore, it will serve as a check on electricity distribution companies, as they will be evaluated on the basis of availability (hours of supply), dependability (frequency and duration of interruptions), and quality (voltage and operating frequency)[40].

In conclusion, tariff reform via regulation(s) is a first step towards Africa's goal to achieve universal access to electricity, in addition to addressing other challenges in its power utilities industry.

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[38] Ibid
[39] Op. Cit ii
[40] Chigozie Nweke-Eze, What will Cost and Service Reflective Tariff System mean for the Nigerian Electricity Sector? (Energy for Growth Hub, May 11 2021) < https://www.energyforgrowth.org/memo/what-will-cost-and-service-reflective-tariffs-mean-for-the-nigerian-electricity-sector/ > accessed 14th April 2023.

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Practical considerations for Closing the Metering Gap in Nigeria

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations in putting an end to estimated billing and closing the metering gap in Nigeria, as proposed by the President-elect in his manifesto and further evaluated by Electricity Lawyer (EL) in the Power Sector

Scenario Analysis Report titled **'EL Power Sector Scenario Analysis : Projecting the Future of Nigeria's Power Sector based on the Six Point Power Sector Plan of the President-elect.'**

Figure 1: Closing the metering gap in Nigeria based on the RATS and HATS Scenarios

Source: Electricity Lawyer

The graph projects a 99% metering penetration in Nigeria by 2026, on a Reasonable Ambitious Target Scenario (RATS), and a 100% metering penetration by 2025 on a High Ambitious Target Scenario (HATS), in so far as the appropriate framework(s), policies, and programs are in place.

Over 5.85 million Nigerians on average were recorded to be on estimated billing as at the second quarter of 2022.[41] Over the years, the Nigerian government has come up with different initiatives like the National Mass Metering Programme (NMMP) aimed at putting an end to estimated billing, increasing the metering rate and reducing

[41] The PUNCH, Estimated Bill Consumers Rise to 5.58million. Available at https://punchng.com/estimated-bill-consumers-rise-to-5-85-million-report/

collection losses in the Nigerian Electricity Supply Industry (NESI).[42] The NMMP is a policy intervention, backed by the Central Bank of Nigeria (CBN), which grants electricity Distribution Companies (DisCos) long-term (10-year duration) loans with single-digit interest rates solely for the purpose of providing customers with meters.[43] Based on the policy objectives, the NMMP may only be used by local meter manufacturers or assemblers. Through the NMMP, a total number of 793,978 customers have been metered, since the inception of the policy intervention in 2021.[44]

To close the ratio of metered to unmetered customer(s) gap, it is recommended that the government develops and implements similar policies and programmes like the NMMP that can run concurrently and cushion the financial constraints of DisCos, given the huge metering gap.[45] Also, putting in place a cost-reflective tariff structure will help DisCos recoup their metering expenditures, within regulatory boundaries.[46]

In addition, it is recommended that meter deployment and installation should be undertaken in areas with the highest collection losses, to further accelerate the closure of the current metering gap which will in turn result in the ability of the DisCos to earn sufficient revenue that can be geared towards network improvements, thus spurring increased energy access.

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[42] NERC, 57% of Consumers are on Estimated Billing. Available at https://guardian.ng/news/57-electricity-consumers-on-estimated-billing-says-nerc/

[43] Ibid

[44] Ibid

[45] The Challenges of Estimated Billing on Electricity Consumers in Nigeria: A Review. Available at https://iopscience.iop.org/article/10.1088/1755-1315/730/1/012025/pdf

[46] Ibid

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Practical considerations for Promoting Domestic Manufacturing of Prepaid Meters

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for promoting the domestic manufacturing of meters in Nigeria, as proposed by the President-elect in his manifesto and further evaluated by Electricity Lawyer (EL) in the Power Sector Scenario Analysis Report titled **'EL Power Sector Scenario Analysis: Projecting the Future of Nigeria's Power Sector based on the Six Point Power Sector Plan of the President-elect.'**

Figure 2: Local Meter Manufacturing in Nigeria based on the RATS and HATS Scenarios

Source: Electricity Lawyer

The graph projects a 25% increase in local manufacturing of prepaid meters in Nigeria by 2025, on a Reasonable Ambitious Target Scenario (RATS), and a 40% metering penetration by 2025 on a High Ambitious Target Scenario (HATS), in so far as the appropriate framework(s), and financial schemes are in place.

One option for closing the metering gap in Nigeria is via the deployment of smart metering technology, however, challenges regarding the financial cost, investment requirements, manpower and technological know-how amongst others have to be considered beforehand. A possible short-term solution for the realisation of long term benefits is to incentivise local meter manufacturers and invest in capacity building and training for the adoption of local content.

Research reveals that the success stories of smart meter rollouts in other jurisdictions like Finland and Sweden were primarily based on regulatory mandates, favourable financial regulations for distributed system operators (DSOs), and social acceptance policies.[47] However, due to a lack of standard policies and financial initiatives to drive the metering revolution, African countries are yet to fully embrace metering and the attendant local manufacturing of meters.[48] Egypt, on the other hand, is one African country that is expected to play a critical role in propelling Africa's metering activity, and this has been traced to its regulatory framework that promotes favourable conditions for meter manufacturing and implementation.[49]

The much applauded National Mass Metering Programme (NMMP) that provides funds for local meter manufacturers is one of such policies that has contributed to the closure of the metering gap in Nigeria[50] Also the social initiative of Momas Electrical Meters Manufacturing Company Ltd (MEMMCOL); training youths on meter manufacturing and installation is a measure that drives domestic manufacturing of meters through knowledge impartation and capacity building.[51] Proliferation of like polices and measures will propel the country on the path to achieving similar metering success stories, as experienced in other jurisdictions and ultimately achieve the projected target scenarios as highlighted in the EL scenario analysis report.

Hence, it is recommended that Nigeria also rolls out legal, social and financial frameworks that can drive the retention of local content and investment in the meter manufacturing industry, such as via funding the capital take off of local manufacturers, initiating skill and expertise programmes for upskilling and retaining local content, alongside the implementation of an appropriate legal framework that stiffens the importation of meters, in order to promote the development of local meter manufacturing capacity in-country.

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[47] Consumer-centric factors for the implementation of smart meters in South Africa. Available at http://www.scielo.org.za/scielo.php?script=sci_arttext&pid=S2313-78352021000200003

[48] ESI Africa, Africa's bumpy route to smart meter adoption (July 29, 2019). Available at https://www.esi-africa.com/industry-sectors/metering/africas-bumpy-route-to-smart-meter-adoption/

[49] ESI Africa, Celebrating Smart Meter Success, (January 21, 2019). Available at https://www.esi-africa.com/top-stories/celebrating-smart-meter-success/

[50] CBN Intervention in Metering. Available at https://www.thisdaylive.com/index.php/2022/10/04/n120bn-cbn-intervention-experts-seek-focus-on-local-meter-manufacturing/

[51] Metering School to train 4000 Nigerians. Available at https://businessday.ng/news/article/metering-school-to-train-4000-nigerians-on-manufacturing-installation-of-meters/

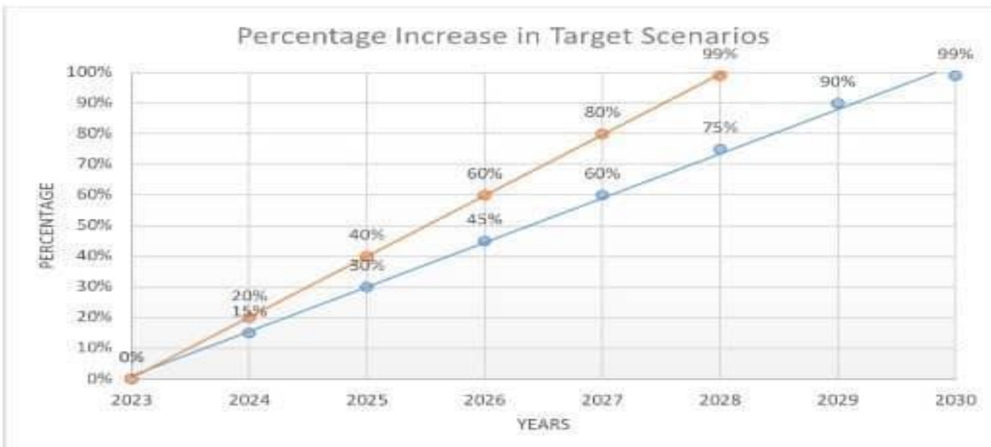
EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for integrating solar energy in Nigeria's energy mix

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for integrating solar energy in Nigeria's energy mix, as proposed by the President-elect in his manifesto and further evaluated by Electricity Lawyer (EL) in the Power Sector Scenario Analysis Report titled

Figure 3: Solar Energy increase in Nigeria based on RAT and HAT Scenarios



Source: Electricity Lawyer

The graph projects a 99 % of solar energy mix capacity in Nigeria on a High Ambitious Target Scenario (HATS) by 2028, and the same 99% by 2030 on a Reasonable Ambitious Target Scenario (RATS), depending on the availability of cogent solar renewable energy framework, in terms of incentives, exemptions and financial investment.

Solar installation capacity in Africa has historically been driven by a limited number of "hot spots" such as South Africa, Morocco, and Egypt[52], and more countries are beginning to adopt solar initiatives. As of 2021, the solar energy capacity in Nigeria amounted to around 33 megawatts.[53] Research has proven that Nigeria has an abundance of renewable energy resources that are ready to be utilised and integrated into the country's energy supply mix, with solar PV holding the most promise.[54] Nigeria's population is expanding quickly, and this has led to a significant imbalance between supply and demand for energy.[55] Moreover, an excessive reliance on fossil fuels has negative socioeconomic, environmental, and health implications.[56] As a result, the government needs to give the development of solar PV systems a high priority nationwide.

Although the country has regulations such as the Nigerian Electricity Regulatory Commission (**NERC**) **Mini-Grid Regulation (2016), and National Renewable Energy and Energy Efficiency Policy (NREEEP), 2015** that emphasize the integration of renewable energy in the electricity mix with tax incentives and exemption(s), implementation, and pursuit towards it's actualisation has been minimal due to financial costs.[57] Thus, in order to make solar photovoltaic technology more affordable,

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[52] The Sun, Nigeria not listed among the Solar Power Users in Africa. Available at https://sunnewsonline.com/nigeria-not-listed-among-top-solar-power-users-in-africa/

[53] Statista, Solar Energy Capacity in Nigeria. Available at https://www.statista.com/statistics/1278096/solar-energy-capacity-in-nigeria/

[54] Yusuf Chanchangi, Nigeria's energy review: Focusing on solar energy potential and penetration. Available at https://link.springer.com/article/10.1007/s10668-022-02308-4

[55] Ibid

[56] Olusola Bamisile, A review of renewable energy potential in Nigeria; solar power development over the years. Available at https://www.researchgate.net/publication/321384759_A_review_of_renewable_energy_potential_in_Nigeria_Solar_power_development_over_the_years

[57] Ibid

additional components that are related to the solar photovoltaic can be subsidized.[58] Additionally, the government should provide and implement incentives for the sector, such as subsidies, tax exemptions, etc. The initial high cost of solar technology in the nation can be reduced by these financial subsidies which will further incentivise private and international investments in the sector.[59] Encouraging financial institutions to provide loans with 0% interest for the installation of solar power will also reduce financial constraints.[60]

To fully entrench its implementation, it is recommended that there should be legal benchmarks and authorities, such as standardization organizations, that should ensure that low-quality renewable energy items, solar components, in this instance, are kept out of the local market.[61] Prior to being accepted into the local market, all renewable energy items could be mandated to go through stringent certification examinations.

Finally, additional funding for research and development, capacity building and expertise is required from both the public and private sectors to assess the performance of different solar PV technologies across the nation and provide standards for future innovations that would be appropriate for local conditions.[62]

[58] Ibid
[59] Ibid
[60] Yusuf Chanchangi, Nigeria's energy review: Focusing on solar energy potential and penetration. Available at https://link.springer.com/article/10.1007/s10668-022-02308-4v
[61] Ibid
[62] Ibid

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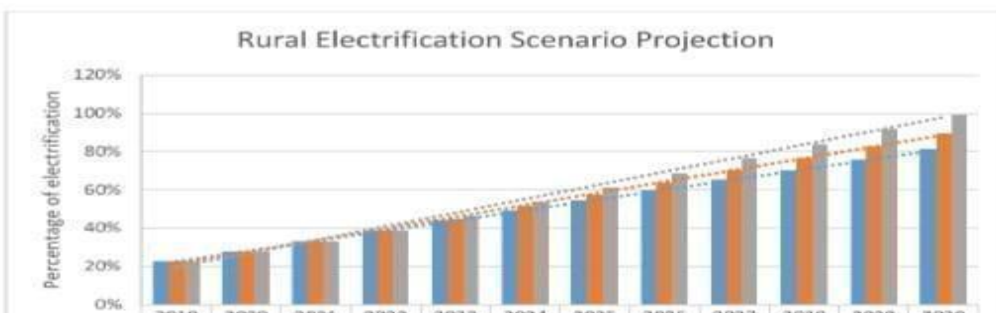
The data intelligence highlights recommendations for increasing rural electrification in Nigeria, as proposed by the President-elect in his manifesto and further evaluated by Electricity Lawyer (EL) in the [Power Sector Scenario Analysis Report] titled **'EL Power Sector Scenario Analysis: Projecting the Future of Nigeria's Power Sector based on the Six Point Power Sector Plan of the President-elect.'**

Figure 4: Rural Electrification Scenario Progression between 2023-2030 under the BAU, RAT and HAT Scenarios



	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
Series1	23%	28.30%	33.60%	38.90%	44.20%	49.50%	54.80%	60.10%	65.40%	70.70%	76%	81.30%
Series2	23%	28.30%	33.60%	38.90%	45.20%	51.50%	57.80%	64.10%	70.40%	76.70%	83%	89.30%
Series3	23%	28.30%	33.60%	38.90%	46.50%	53.80%	61.40%	69%	76.60%	84.20%	91.80%	99.40%

Series 1 (Blue) = BAU Scenario, Series 2 (Orange) = RAT Scenario, Series 3 (Grey) = HAT Scenario

Source: Electricity Lawyer

The graph projects a 90% of rural electrification in Nigeria on a Reasonable Ambitious Target Scenario (RATS) by 2030, and the same 100% by 2030 on a High Ambitious Target Scenario (HATS), which is dependent on the availability of favourable laws, polices, and plans relating to the rural scenery of Nigeria.

With an estimated national electrification rate of 55% and a rural electrification rate of only 39%, Nigeria has one of the lowest net electricity generation per capita rates in the world.[63] Nigeria will need to connect between 500,000 and 800,000 households each year, concentrating particularly on the rural areas, to attain universal access to electricity by 2030.[64] However, Nigeria intends to connect 513 000 households annually between 2020 and 2040 in order to obtain a 100% electrification rate by that time.[65] Both conventional and renewable energy sources—the latter having on-grid and off-grid applications—will be used to increase the rate of electrification.[66] This is being implemented through initiatives like the Rural Electrification Strategy and Implementation Plan of Nigeria 2006[67], Nigerian Rural Electrification Agency (REA) created by the Electric Power Sector Reform Act in 2006[68]; and the recent Nigerian Electrification Project[69] to make it easier to deliver affordable electricity for domestic, commercial, industrial, and social activities throughout the nation's peri-urban and rural areas. However, the initiative has been limited due to factors such as domestic financing, and lack of subsidies.[70]

One African country that has made positive strides in rural electrification is Morocco which has been linked with long-term viability of financial capacity and effective

[63] Chigozie Nweke-eze, The Nigerian Electrification Project – An example of a successful rural electrification design? (RIFS POTSDAM 1st November 2022) < https://www.rifs-potsdam.de/en/blog/2022/01/nigerian-electrification-project-example-successful-rural-electrification-design#:~:text=Nigeria%20has%20one%20of%20the,electrification%20rate%20of%20only%2039%25. > accessed 12th May 2023

[64] Ibid

[65] IEA/IRENA Renewables Policies Database, Rural Electrification Strategy and Implementation Plan of Nigeria (IEA 21st August 2017) < https://www.iea.org/policies/6376-rural-electrification-strategy-and-implementation-plan-of-nigeria > accessed 12th May 2023

[66] Ibid

[67] Ibid

[68] Chigozie Nweke-eze, The Nigerian Electrification Project – An example of a successful rural electrification design? (RIFS POTSDAM 1st November 2022) < https://www.rifs-potsdam.de/en/blog/2022/01/nigerian-electrification-project-example-successful-rural-electrification-design#:~:text=Nigeria%20has%20one%20of%20the,electrification%20rate%20of%20only%2039%25. > accessed 12th May 2023

[69] Ibid

[70] Ibid

regulation that attracted steady investments.[71] Morocco is a leading performer in executing its renewable energy strategies/targets which has led to electricity access and has nearly 100% of its rural areas electrified.[72] Private companies contribute significantly to both the generation and distribution of more than half of the nation's electricity.[73] Morocco also has an ambitious electrification plan that guided rapid growth in rural access from 18 percent in 1995 to 99.5 percent by 2017.[74] Additionally, a financial restructuring process and a new regulatory agency also improved its operational and utility performance.[75] The country also pursued reforms in a selective and incremental manner.[76]

It is thus recommended that Nigeria adopt practices like invitation of the private sector into the rural electrification initiative, especially through renewable energy resource and mini grid development. Electrifying the rural areas using the off-grid option will not only provide clean, sustainable energy, it will also provide revenue to the government and save some cost.

Additionally, policies and plans for rural electrification should include subsidies for rural electrification initiatives and plans, and availability of domestic financial institutions to subsidize costs.

Lastly, the Rural Electrification Agency should pursue reforms that will attract the inclusion of private and international investments in rural electrification for robust financial sustainability. There should also be a well laid regulation for a step-by-step guide to increase rural electrification in an incremental manner at every stage of electrification with the help of electricity experts and professional personnel.

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[71] Zainab Usman, What Can Developing Countries Learn from Morocco's Experience with Power Sector Reforms? (World Bank Blogs 19th November, 2019) < https://blogs.worldbank.org/energy/what-can-developing-countries-learn-moroccos-experience-power-sector-reforms > accessed 12th May 2023

[72] Ibid

[73] Ibid

[74] Ibid

[75] Ibid

[76] Ibid

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Increasing Gas to Power in Nigeria

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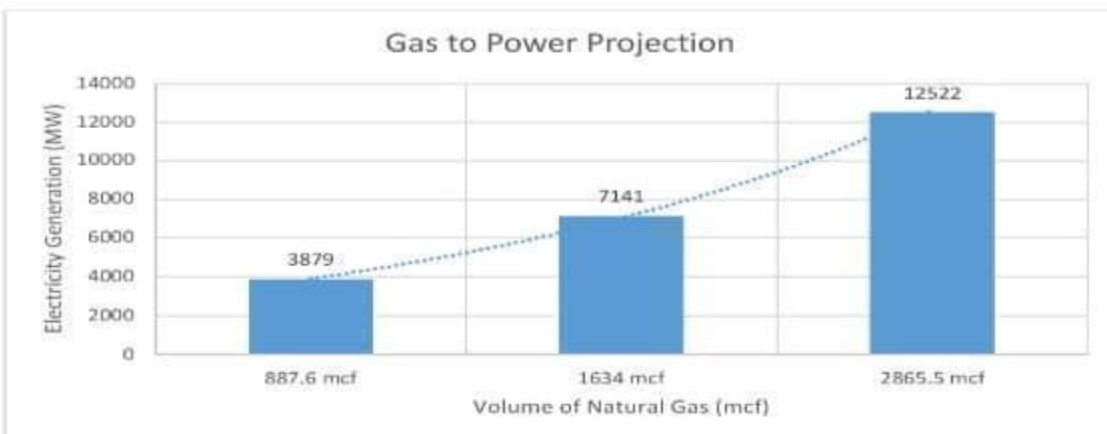
The data intelligence highlights recommendations for increasing gas to power in Nigeria, as proposed by the President-elect in his manifesto and further evaluated by Electricity Lawyer (EL) in the Power Sector Scenario Analysis Report titled **'EL Power Sector Scenario Analysis : Projecting the Future of Nigeria's Power Sector based on the Six Point Power Sector Plan of the President-elect.'**

Figure 5: Gas-to-Power Scenario Progression between 2023-2030 under the BAU, RAT and BAT Scenarios



Source: Electricity Lawyer

The graph projects an average available generation capacity of 7141MW of gas per day on a Reasonable Ambitious Target Scenario (RATS), and a total installed generation capacity of 12522MW per day on a High Ambitious Target Scenario (HATS).

Gas remains the cleanest of fossil fuels, and demand for gas is increasing due to a variety of factors, the most important of which is its status as a cleaner and preferable fuel for power generation.[77] Most crucially, the increase in gas demand is being driven by the global desire for cleaner fuels, with gas emerging as the preferred replacement for fossil fuel.[78] It has been proposed that gas will be the last of the fossil fuels to be superseded by alternative energy sources.[79] Nigeria is taking steps to join the trend of increasing gas use due to its large natural gas reserve. However, inadequate infrastructure, sabotage, insecurity, pricing, and allocation of resources to the domestic market, etc., have made the drive challenging.[80] Furthermore, the lack of an appropriate gas-pricing structure vis-à-vis a legal and regulatory framework is a key hurdle to the commercialization of gas for power.[81]

According to the Ministry of Petroleum Resources (MPR), Nigeria flares an excess of 700 million standard cubic feet (SCF) of gas per day from 178 flare sites, resulting in a loss of approximately $10 billion in revenue annually, due to the country's inability to capture and commercialize flared gas.[82] Nigeria can produce 600,000 MT of LPG per year and create 2.5 GW of power from new and existing Independent Power Plants if flared gas is adequately harnessed.[83] The goal of the gas-to-power plan is to promote the use of locally produced natural gas for power generation, hence increasing power supply to fulfill the country's domestic power needs.[84]

Thus, it is recommended that the current legal framework for gas must be changed to align with international best practices by reducing/eliminating the current high degree of 'state controlled' pricing.[85] To encourage local gas trading, domestic gas

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[77] Boosting gas Supply to Improve Power Generation < https://leadership.ng/boosting-gas-supply-to-improve-power-generation/#:~:text=Gas%20is%20a%20major%20feedstock,cost%20and%20low%20carbon%20emissions > accessed 19 May 2023.

[78] Ibid

[79] Ibid

[80] Ivie Ehanmo, Gas to Power Nexus Nigeria: Challenges, Prospects, and Outlook for Investment (LinkedIn April 28, 2021) < https://www.linkedin.com/pulse/gas-to-power-nexus-nigeria-challenges-prospects-outlook-ivie-ehanmo/ > accessed 19 May 2023.

[81] Ibid

[82] Ibid

[83] Ibid

[84] Ibid

[85] Power Supply: Natural Gas, Natural Solution (This Day April 19, 2016) < https://www.thisdaylive.com/index.php/2016/04/19/power-supply-natural-gas-natural-solution/ > accessed 19 May 2023

prices can be subsidized or benchmarked against international prices.[86] Additionally, considering the government's objectives of developing the domestic gas-to-power industry, it is critical that the government provide adequate funds or cooperate with the private sector to develop the necessary infrastructure.[87]

Furthermore, proper security measures must be implemented to combat the threat of security-related activities, one of which is the infamous gas pipeline vandalism, which has a negative impact on gas availability and electricity generation.[88] The penalty for gas flaring must be enhanced to levels higher than those for marketing or re-injection, just like the Flare Gas (Prevention of Waste and Pollution) Regulation, 2018, which encourages producers to market gas by increasing flaring fees, which should prevent routine gas flaring.[89]

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for achieving Renewable Energy Targets across Sub-Saharan Africa (SSA)

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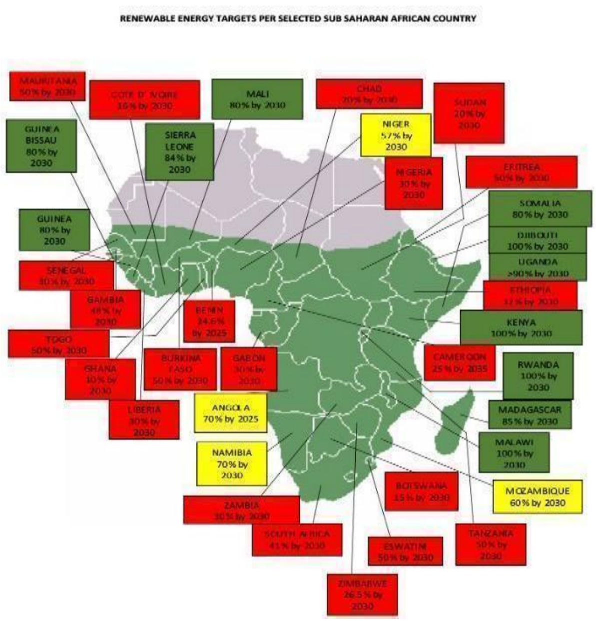
86 Ivie Ehanmo, Gas to Power Nexus Nigeria: Challenges, Prospects, and Outlook for Investment (LinkedIn April 28, 2021) < https://www.linkedin.com/pulse/gas-to-power-nexus-nigeria-challenges-prospects-outlook-ivie-ehanmo/ > accessed 19 May 2023.

87 Ibid

88 Power Supply: Natural Gas, Natural Solution (This Day April 19, 2016) < https://www.thisdaylive.com/index.php/2016/04/19/power-supply-natural-gas-natural-solution/ > accessed 19 May 2023

89 Ivie Ehanmo, Gas to Power Nexus Nigeria: Challenges, Prospects, and Outlook for Investment (LinkedIn April 28, 2021) < https://www.linkedin.com/pulse/gas-to-power-nexus-nigeria-challenges-prospects-outlook-ivie-ehanmo/ > accessed 19 May 2023.

The data intelligence highlights recommendations for improving and achieving renewable energy targets across Sub Saharan Africa (SSA).



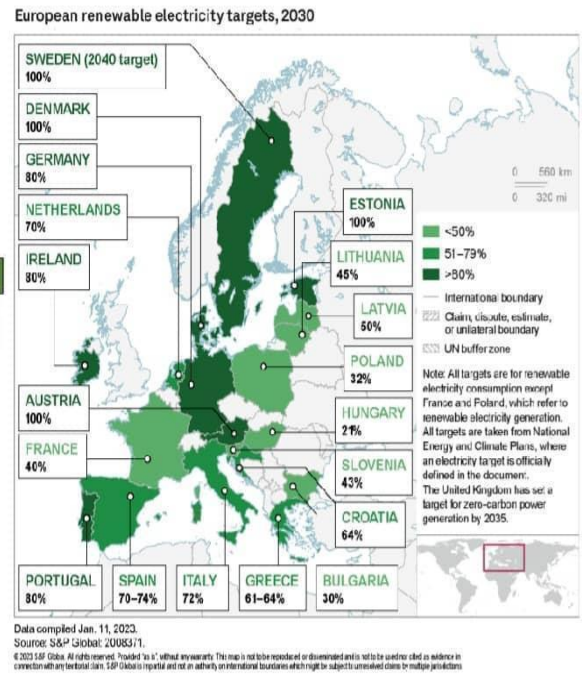


Figure 1

Figure 2

Figure 1 is sourced from Electricity Lawyer. Figure 2 is sourced from S&P Global.

Modern renewable energy sources and technologies are gaining popularity around the world. These technologies have been supported for many years due to environmental and energy security concerns. In a variety of cases, they are currently regarded as the most cost-effective solution. The electricity sector offers great potential for transformation through expanded deployment of renewable energy technology, and as such countries have set renewable energy targets in a race to reach net zero by 2050, as portrayed in the figures in the schematic representation above. However, when the renewable energy targets of European countries and that of Sub-Saharan Africa are placed side by side, it is clear that European countries are more ambitious in their targets in comparison with SSA.

African countries are in a unique position; as they have the capacity to break free from the old, centralized utility model of energy provision, due to the abundance of renewable energy sources. Over the last decade, Africa has seen a rapid uptake of renewable energy. To date, 41 of the 54 nations have implemented at least one form of renewable energy target for specific technologies or sectors, in addition to dedicated off-grid policies for rural electrification and sustainable cooking. However, the fair ambitions being spun out across the continent has been traced to the dearth of financial resources and appropriate legal and regulatory framework(s).

Mobilizing the necessary investments needed in Africa for the uptake of renewable energy would necessitate governments and other stakeholders collaborating to create a favourable environment based on enabling policy and regulatory framework(s). It is recommended that to implement investment promotion measures and attract both domestic and foreign investors to support the sector's development, African governments must do more than rely on foreign donor support. Governments must also improve the availability of local financing by raising awareness of renewable energy applications in both grid-connected and off-grid market segments among local commercial banks and financial intermediaries. Also, to entice private sector engagement and financing, governments must form public-private partnerships to share costs and risks.

It is also recommended that the development of national energy plans and renewable energy targets must be accompanied by supportive policy frameworks, within a broader set of cross-cutting policy tools. Policy options should be customized to specific country conditions and sector maturity, aimed at boosting firm-level competencies, building a domestic industry, encouraging education and research, and facilitating investment and technology transfer.

Another way forward is to deploy regional energy plans across the continent. Governments in the region should collaborate to strengthen the role of power pools in harmonizing regional market trends, to further boost interconnections. However, coordination on regional planning, harmonisation of standards and procedures, and other technical and institutional issues would need to be factored.

Additionally, a focus on rural electrification across countries within the region, will require beyond off grid technology and finances, but will also entail creating an institutional structure that promotes conversation and cooperation among the various parties participating in off-grid electrification projects to improve clarity and define roles and responsibilities.

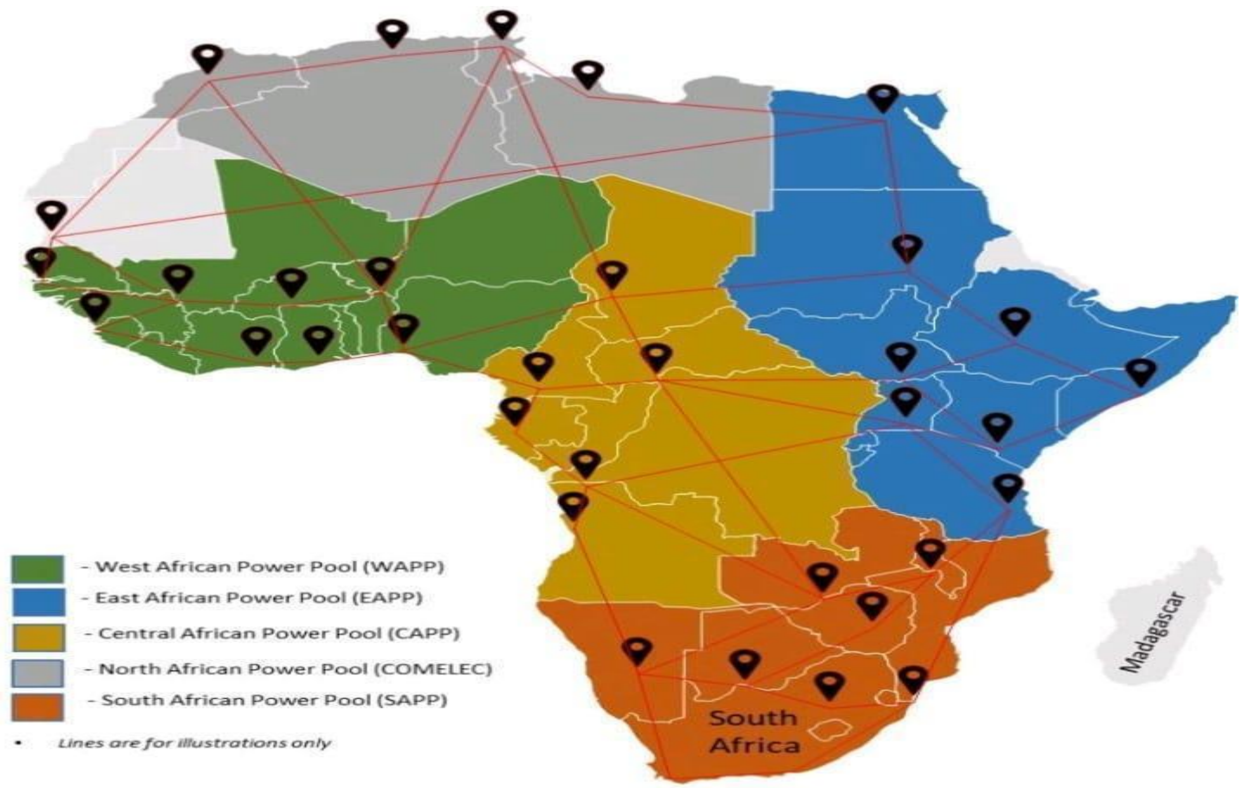
In conclusion, the uptake and implementation of Africa's renewable energy targets will demand a collaborative approach from all applicable stakeholders.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for achieving Successful Power Pool(s) Interconnection Across Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for power pools interconnections in Africa.



Source: IRENA, Africa-EU Energy Partnership

The map depicts the African Continental Power System Masterplan, undertaken by the African Union Development Agency (AUDA-NEPAD) leading the development of the master plan. The Continental Power System Masterplan will act as a road map for the continent's electricity system integration, by creating a sustainable integrated power transmission network.

Although, governments in Africa currently trade energy through "power pools" (electricity infrastructures and markets shared across economic blocs) to assist and fulfil territorial demand, a unified transmission network in Africa will facilitate cross-continental commerce with Europe and Asia, via existing lines in North Africa, allowing African countries to source power from a diverse spectrum of competitive, clean energy sources. It would also provide significant socioeconomic prospects within the continent by Boosting inter-regional access to inexpensive African renewable energy resources can stimulate investment opportunities, promote employment growth, and contribute to the region's sustainable development. The Continental Master Plan aims to connect the power pools, creating the world's largest geographical interconnectivity. An integrated transmission system will allow for the trade and development of power across numerous potential energy resources, including solar in North Africa, hydrogen development initiatives in Southern Africa, hydro resources in Central Africa, and geothermal in East Africa.

The framework will promote long-term development by encouraging investment, creating employment, and enhancing human capability in developing Africa's potential power resources. However, power pools can only be operational in regions with fairly developed grid interconnections, adequate generating capacity to meet pool demand, a legal framework for cross-border electricity exchanges, trust and mutual confidence among pool members, and regional regulation and dispute resolution mechanisms. Most of the sub-Saharan African power pools do not meet these requirements.

It is recommended that African governments address the issue of lack of trust and confidence among pool members through efficient governance and upholding the rule of law; revamp transmission networks and tie lines; boost their generating capacity and reserve margin; create and/or reform the legal framework for electricity trading; provide adequate rules for access to the transmission grid, including the establishment of wheeling charges; and develop regional regulation and an appropriate mechanism for resolving disputes.

The availability of an adequate legal framework for contract enforcement in each of the participating countries in the interconnection is critical to the seamless negotiation and enforcement of contracts linked to power interconnections. The establishment of an independent, skilled court with predictable channels for registering and prosecuting legal complaints allows participants and contractors to continue with more confidence in agreeing to perform interconnection construction and/or operations. Reliable and impartial national courts also provide trading partners with the necessary confidence that their interconnection-related disputes (if any) will be adequately resolved.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for achieving Improved Electricity Data System Across Africa

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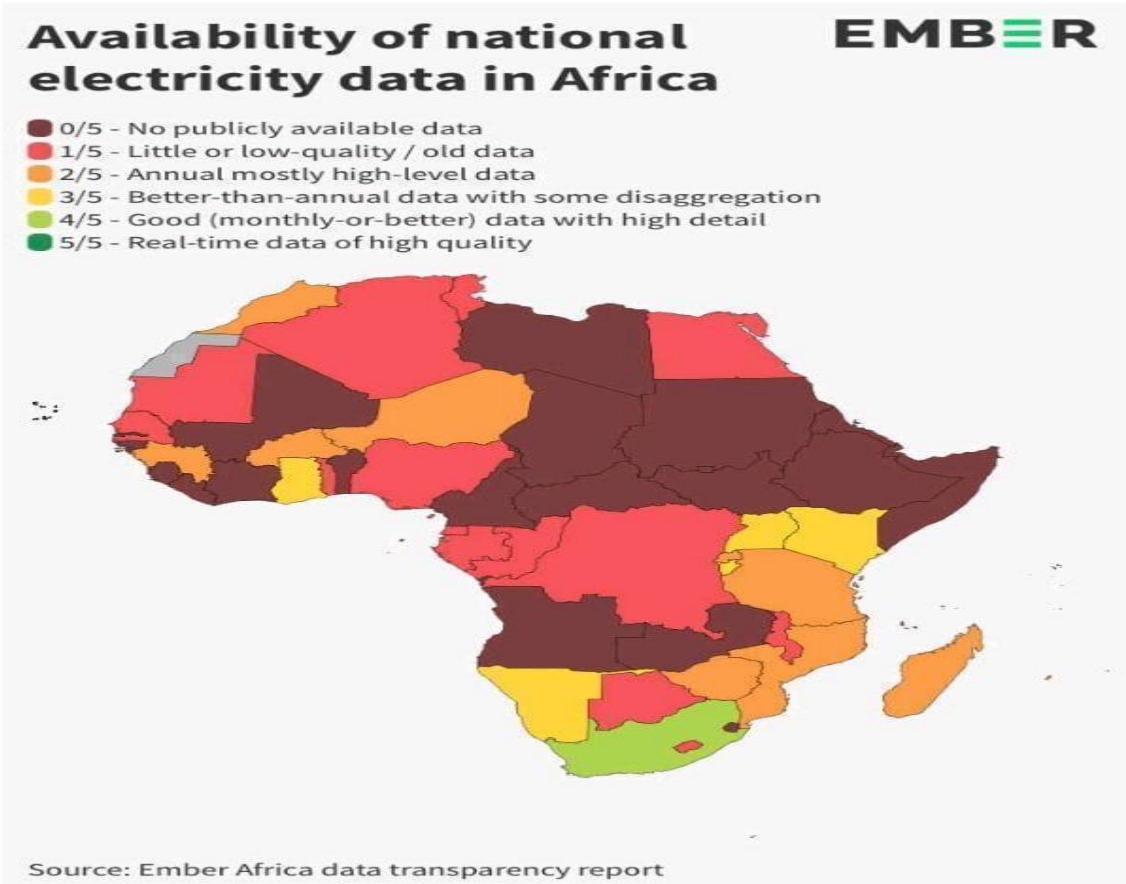
The data intelligence highlights recommendations for achieving electricity data system in Africa.



Africa's energy sectoral growth is hampered by a lack of reliable data on its energy grid.

This map shows how weak territorial electricity system statistics are present in almost all African nations. It is impossible to overstate the value of real-time information on the power grid. It is crucial for power sector governance, system planning, infrastructure development, R&D, market price, and investment stimulation.

To enhance data management in the African energy sector, technology must be included in upcoming system developments in addition to the generating fleet, transmission grid, and distribution systems. The following data are germane to the continent upscaling its energy access: installed base capacity, generation data, electricity supply mix, electricity import and export data, electricity demand and supply data, system operation data, energy generation, consumption and storage data, live electricity price data, generation, transmission and distribution updates and impacts, and technical, commercial, and policy data.

Improving power sector data requires the cooperation of all stakeholders and market participants in the sector. However, lawmakers and policymakers are an integral part of it. Legal frameworks and policies that consider the need for technologies in the electricity industry will provide incentives that can promote investment in such infrastructure. Technologies like smart grids, smart metering, drones, grid automation, power asset integrations, intelligent demand integration, etc., are capital-intensive. Only a favorable legal and regulatory framework can draw the necessary investments to the industry.

As a result, more reliable, consistent, and thorough datasets will be made available, enhancing the understanding of power access tracking and analysis. This is also anticipated to lead to more intelligent, targeted, and effective policy interventions. For example, digital technology can make it possible to gather extensive amounts of real-time, highly disaggregated data on power usage. Advanced analytics may be used to manipulate huge data sets to reveal valuable consumer consumption insights that are crucial for business development and further investments. This kind of innovation in data collection and manipulation can therefore be useful in expanding energy availability in Africa.

Africa must therefore invest in data-smart technologies that will upscale its electricity infrastructure. This can also redirect more investment towards the continent, hinging on data availability, allowing international investors and business developers to make informed decisions.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for achieving Strong Regulatory Systems in the Energy Industry Across Sub Saharan Africa

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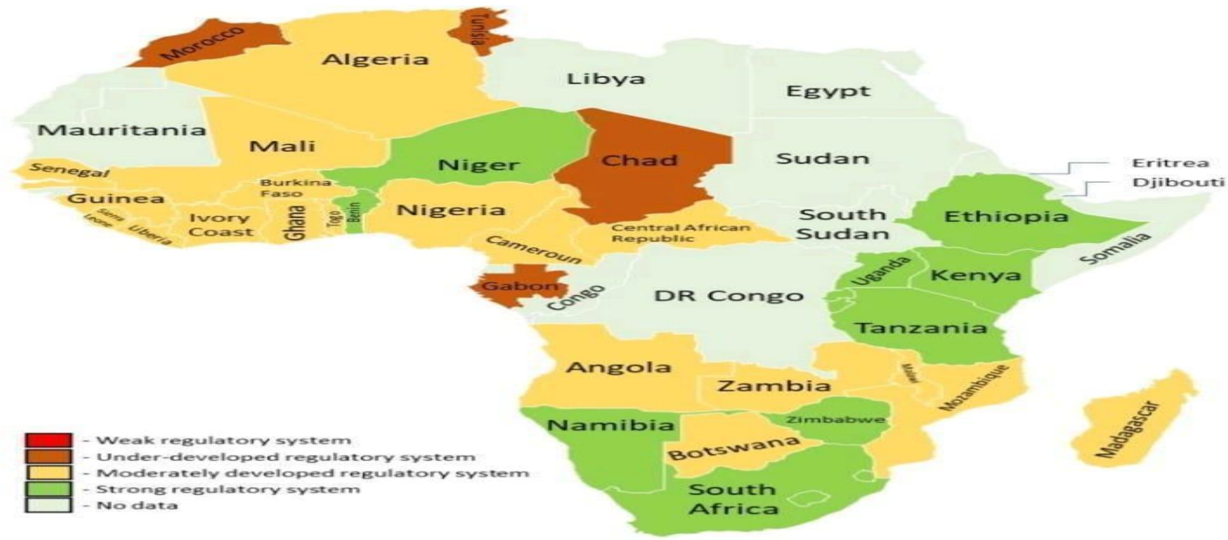
The data intelligence highlights recommendations for achieving strong regulatory systems in the energy industry.



GERI 2022: Global Electricity Regulatory Index

According to a recent Global Energy Regulatory Index (GERI) research, African and Latin American nations have the highest index for energy regulation, with Uganda having the highest index, amongst the examined African countries. The GERI compares a country's legislative frameworks, decision-making processes, and economic and technical regulations in the electrical sector to theoretical best practices to determine how sectoral rules are positioned for long-term development. A high GERI suggests a strong regulatory framework for the electricity industry.

Many nations may have established good legal frameworks, but it does not always imply that the rules are being executed properly. In SSA, the pace of implementing and democratizing created regulations has been slow. In many circumstances, international and transnational organizations fund, assist, and encourage the development of a regulatory system, indicating a possible low organic development.

The following are the major issues of power sector regulation in SSA: poor tariff methodology; lack of political and financial independence of regulators; implementation and enforcement of legislation; and regulatory body capacity development gaps. While 75% of the countries surveyed have documented tariff methodologies, the majority lack essential features such as automatic tariff adjustments (absent in 85% of cases), schedules for major tariff reviews (missing in

81% of cases), and publication of the formulas used to determine end-user tariffs (not provided by 55% of countries).

The most common weaknesses in regulatory governance were in stakeholder independence (with an average score of just 29%). Many nations' energy laws lack provisions prohibiting regulatory authority heads and board members from participating in conflicts of interest, such as working for regulated utilities at any time in their careers. The financial independence of regulators (with an average score of 59%) was another area of weakness in regulatory governance. In particular, motivating regulatory authority workers remains an issue in many nations (average score 31%). In 41% of the nations polled, regulatory authorities set lower pay than the utility businesses they monitor.

It is recommended that legal frameworks should be updated to incorporate measures for improved regulatory governance and administration. This will allow the regulatory process to be more predictable, as stakeholders will be informed of the necessary regulatory procedures. Also, the tariff system, tariff review processes, and timeframe must be clearly specified in the regulatory framework across all regions. Tariff schedules must be incorporated into the tariff approach.

Furthermore, updating material on regulatory websites is an issue in many countries across Africa. Some websites include a wealth of information on main and secondary regulations, but far less on industrial activity. It is recommended that to maintain the websites and disseminate materials, regulators must hire specialized IT and communications crews. Also, to promote compliance, legislative frameworks should be updated to incorporate mandatory submission of data and information to authorities on defined deadlines, with penalties for non-submission.

All legal frameworks should be revised to incorporate prohibitions on cross-appointment of upper management between utilities and the regulator. Provisions for staggered tenure should be included in sector legislative frameworks in all areas to protect institutional memory and allow for knowledge transfer. When regulators are autonomous and have less political involvement, they are more effective. Provisions in legislative frameworks governing board appointments and dismissals should be consistent with global best practices.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for achieving Clean Energy Electricity Source in Africa

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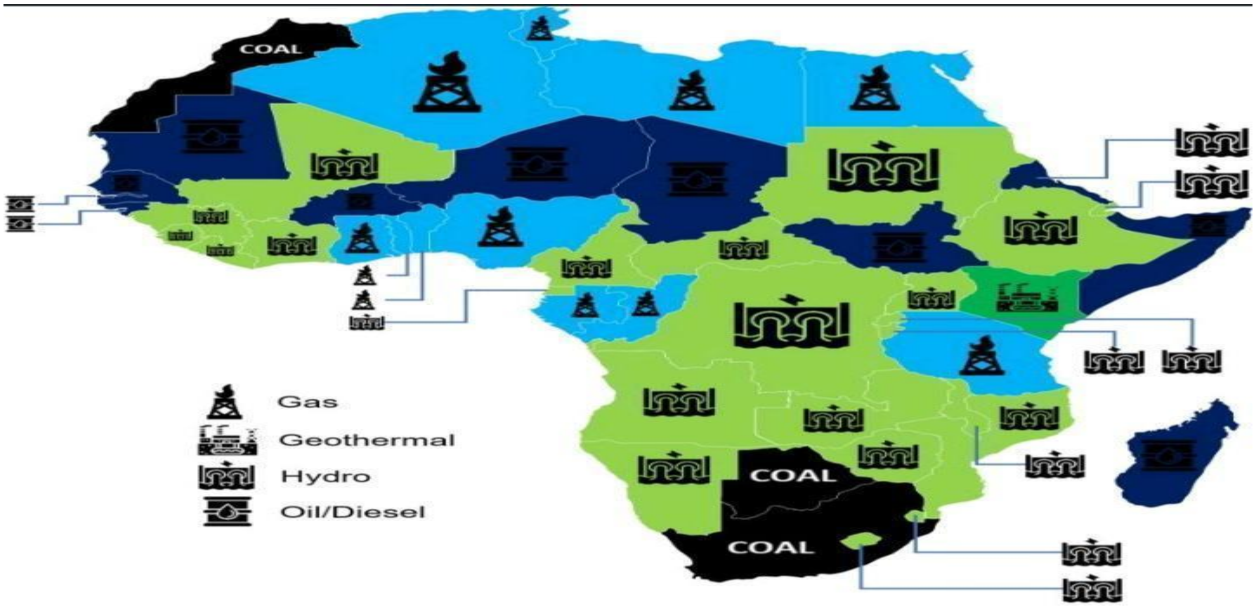
The data intelligence highlights recommendations for achieving a clean energy electricity source in Africa.



The map depicts the dominant source of electricity in African countries, with hydro being the most dominant source. The possibilities for Africa's energy transition appear promising, but the regulatory structure must be retooled to meet the continent's energy demands.

With the global focus changing away from fossil fuels like petroleum and natural gas and toward zero-carbon energy in order to achieve sustainable development and climate resilience, it is anticipated that a fortunate Africa will prosper during the transition.
However, institutional, regulatory, legal, tariff structure, and frameworks for renewable energy are mostly absent or poorly implemented.[90] The proper legal and regulatory environment is critical, and this must be led by a policy that encompasses everyone – no one is left behind.

To enable businesses, a regulatory framework must be imposed. Regulations must be certain, transparent, uniform, and predictable. A clear source of funding, backed by

[90] Shaping Africa's

legislation, is essential. To optimize its energy resources, Africa must partner on finance and infrastructure.

Furthermore, a continental integrated energy market can function as a stimulus to strengthen finance institutions to support energy development projects, fund innovative technologies to lower production costs, increase capacity, and maximize energy generation, which can improve access to various energy products. When investment expands, more capital becomes available for governments to allocate.
Closing the energy access and transition gap will require strategic deployment of all available resources, such as natural gas; a legal and regulatory overhaul to promote investment, a shift in domestic public finance away from fossil fuel subsidies and toward clean energy access, ambitious policies and programs, and institutional capacity building.[91] Skills development, reskilling, and job creation in the framework of a "just transition," research and gender mainstreaming, grid connection, expansion, and integration programs, and decentralized solutions (renewable energy) with customised consumer finance business models are all part of the picture. All of which are dependent on efficient legislations and policies in all sectors.

Policymakers must build a sound policy framework that can impact the cost-competitiveness of renewable energy. A well-designed long-term laws and an enabling environment for the implementation of renewable energy technology are required to provide investment security.
Policymakers must base their decisions on data and the experiences of individuals and communities to ensure that efforts to transition to clean energy are effective and sustainable. This necessitates a detailed awareness of the African continent's socioeconomic conditions, as well as the individual requirements and challenges faced by various governments and areas. This will ensure that the transition to sustainable energy is egalitarian and inclusive, benefiting all members of society.

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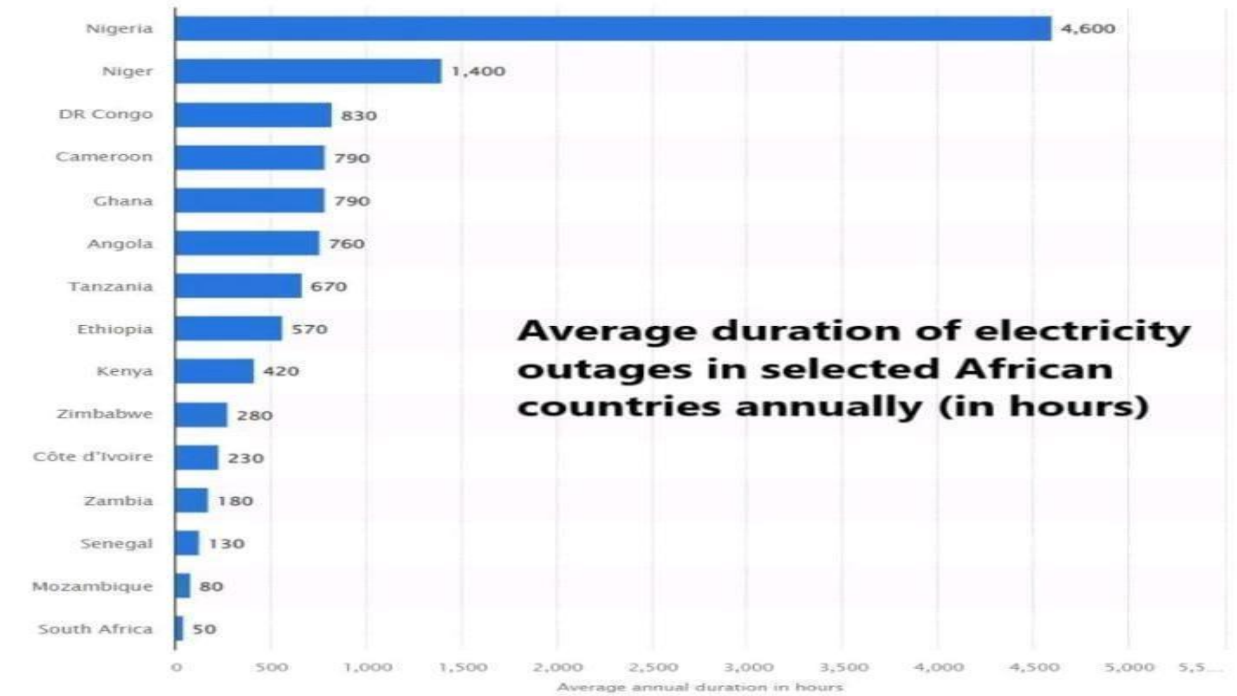
[91] Legal Framework for Energy Transition <https://thenationonlineng.net/shaping-Africa's-Legal-Framework-for-Energy-Transition . Accessed 16 JUNE 2023
The Role of Law in Energy Transition in Africa https://www.researchgate.net/publication/345370788_Role_of_Law_in_the_Energy_Transitions_in_Africa_Case_Study_of_Nigeria%27s_Electricity_Laws_and_Off-Grid_Renewable_Energy_Development . Accessed 16 JUNE 2023

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for managing Power Outages in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for putting a stop to power outages in Africa.



In terms of power outages on a continental level and (perhaps) globally, Nigeria is without a doubt the lead, with an estimated average of 4600 hours per year, Nigeria outpaces all other African nations in terms of the length of electrical outages, with Niger coming in a distant second with 1400 hours.

Energy supply in Africa's enormous cities is sporadic, but there is a lack of electricity in a sizeable portion of the continent's rural arears. According to the International Energy Agency, 590 million people in sub-Saharan Africa — or 43% of all Africans — did not have access to electricity in 2021

According to estimates from the World Bank, annual investments of close to $20 billion are needed to achieve universal electricity throughout sub-Saharan Africa. Nearly $10 billion of that amount is required each year to provide electricity to West and Central Africa. There are numerous factors contributing to Africa's poor energy supply, including a lack of government oversight, and a lack of skilled workers to operate the national grid amongst other.

infrastructure is by far the biggest contributor to power outages in Africa. Many African nations are unable to meet the enormous demand of producing and distributing power, brought on by a rapid rise in population. Also, due to difficulties with backup generator operation, only the wealthy population and large-scale businesses have reliable access to energy. Theft and vandalism of electricity infrastructure in Africa, such as transformers and transmission lines, also present a serious problem.

The solution to most of these issues, according to research, is for utilities to guarantee maximum billing efficiency and collection. Cost reflective tariffs may be adopted, but large- and medium-sized consumers should be prioritized and there should be consistency in increasing service quality. These can be measured via meter installations. The funds derived by utilities from the indicated measures can be used in improving infrastructure, which will in turn attract private investments into the industry.

Another crucial recommendation is to urge homes to install individual electricity meters to track energy usage. This will assist utilities to identify and precisely target disadvantaged consumers for possible subsidy disbursement. Prepaid meter installation can be advantageous for utilities and customers because it allows low-income households to pay in modest amounts throughout the month rather than all at once, thus contributing to revenues for the utility.

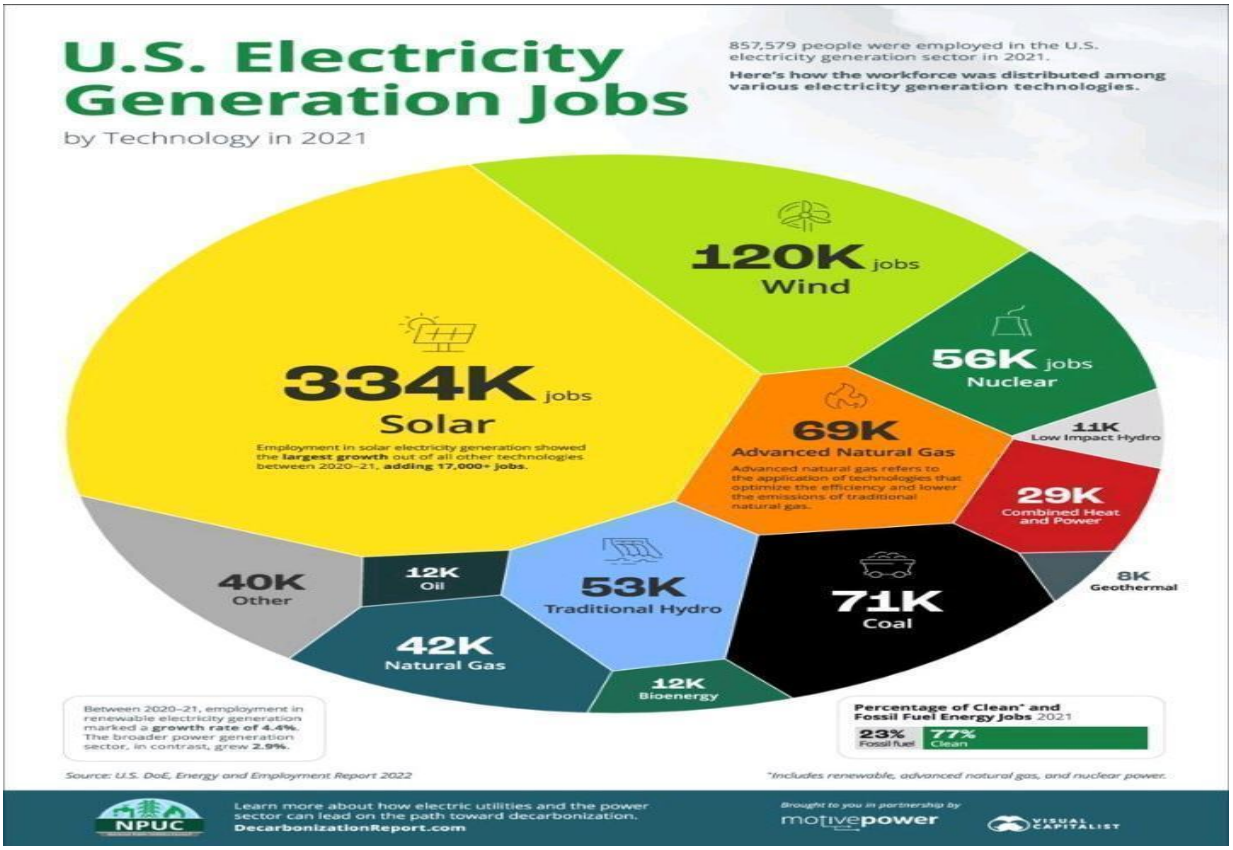
Although many Africans may electrify their homes by connecting to the grid, research reveals that mini- and off-grid power, particularly from sources like solar, are necessary to electrify dwellings in many rural, and even urban parts of Sub-Saharan Africa. Solar energy which is transformed into electricity via a photovoltaic panel, can subsequently be used to directly power users or charge a bank of batteries. The grid can receive the stored energy from the batteries at times of peak demand, depending on the grid receptivity. Africa may greatly alleviate its energy crisis by developing new facilities that include battery storage systems powered by photovoltaics. This may however pose significant costs, considering the utilisation of new technology, such as large-scale solar farms that are connected to the grid and connected to battery energy storage. To promote these technologies, it is important that favourable laws and incentives are in place, that will support in boosting both international and private investments in the industry, such as via clean technology transfer, incentives and rebates for renewable energy technologies, etc.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Increasing Clean Energy Jobs in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for increasing clean energy jobs in Africa.



SOURCE: Element

The chart gives an overview of the job opportunities in the power sector of the United States of America (U.S.A), with solar alone accounting for close to 40% of the total employment in the power sector in the year 2021. Overall, renewables account for a significant portion of job opportunities alongside other traditional energy sources.

According to an analysis carried out by the International Energy Agency (IEA) World Energy Employment Report, Power generation employs over 11 million people worldwide and renewables provides for about 7 million jobs. It is evident from this data that there is a global shift in employment towards renewables, which will require careful management, through the creation of policies that will aid a successful transition to green employment(s).

The case study of the U.S.A is a lesson for African countries. Increased investment in renewable energy might result in at least 26 million additional jobs by 2050. According to a report by the African Development Bank (AfDB) and the International Renewable Energy Agency (IRENA).

However, despite the lustrous outlook, Africa continues to trail behind in terms of growth and investment in renewable energy. According to IRENA's modeling, a systematic transition of Africa towards an energy system based on renewable energy could result in 6.4% higher GDP, 3.5% more job creation across the economy, and a 25.4% higher welfare index throughout the outlook period of 2020 to 2050, when coupled with the right policy mix. Greater fiscal stability and job creation are two of the most prominent prospects related to the energy transition in African countries, as recognized by IRENA and the AfDB.

According to IRENA's model, jobs gained through the switch to renewable energy will outweigh those lost through the switch from traditional energy, including in many nations that produce fossil fuels. In view of this prospect for Africa, strengthening institutional capacity, wise policy choices, and a sizable financial and technological contribution from the international community will be required going forward.

It is recommended that Africa increase the capacity building opportunities for engineers and technicians in Africa's renewable energy sector. This will facilitate trainings, jobs acquisition, and career advancements in the renewable energy sector, through supporting technical colleges, taking online courses, and upskilling workers. Additionally, through policy implementation, leadership development, and advocacy, partnerships with African government officials can help hasten and strengthen policymaking for green manufacturing and investments. Financial provisions that cover the entire grant cycle—from planning and funding through project operations and sale—should be made available for green manufacturing enterprises in Africa.
In order to attract the required investments and put in place regulatory guidelines that will usher in green jobs to the continent, African countries must put in place strong legislative frameworks that make provision for renewable energy integration in every sector of the economy. An all-inclusive legislative framework will be integral to Africa's smooth transition to greener jobs, and sustainable development across the continent.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for increasing Gas Commercialisation in Nigeria

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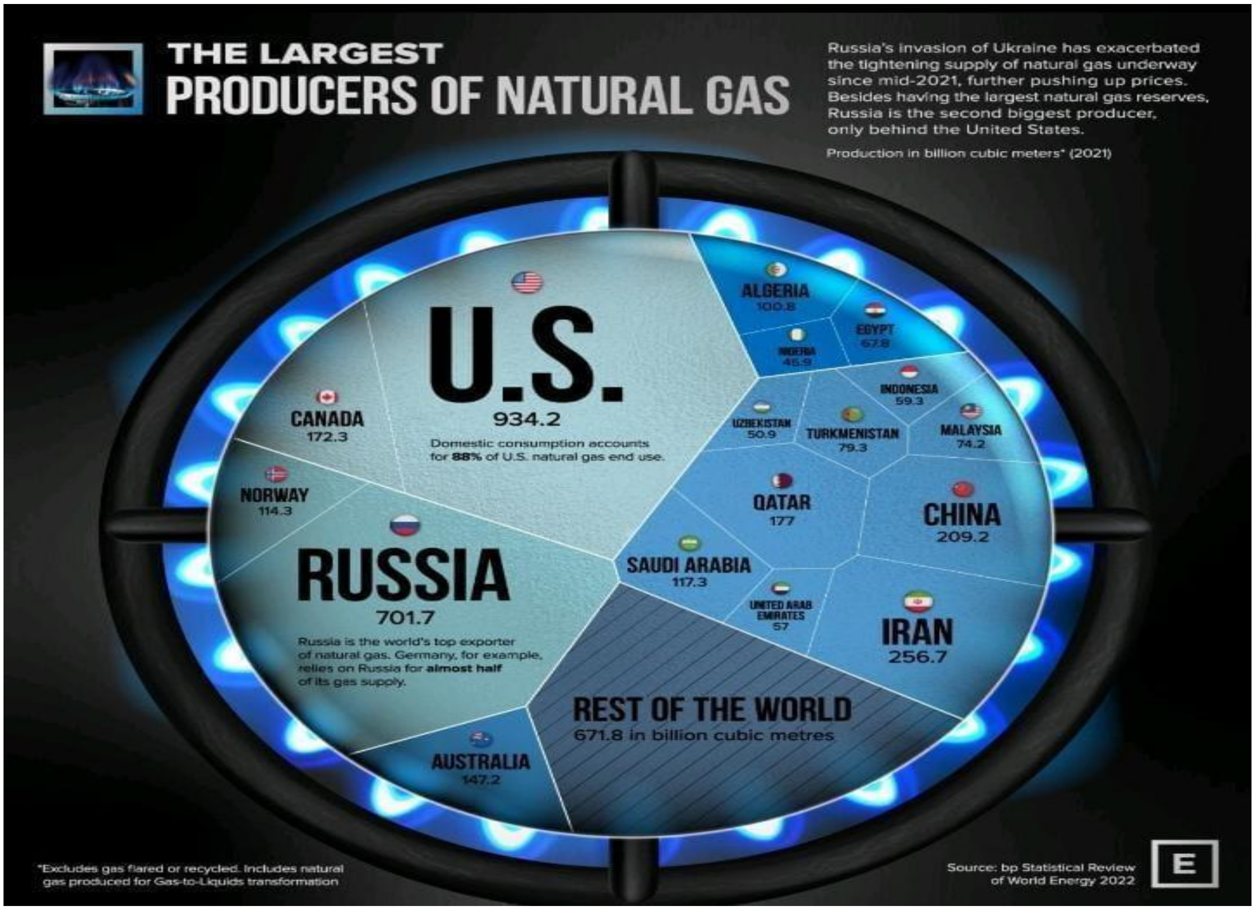
The data intelligence highlights recommendations for increasing gas commercialisation in Nigeria.



SOURCE: Element

The image depicts Nigeria as one of the top producers of natural gas compared to other Sub-Saharan Africa (SSA) countries in Africa. Nigeria contains the largest gas deposits in Africa and is currently the largest LNG exporter on the continent, with over 200 Tcf of proven gas reserves. The Nigerian government launched a "Decade of Gas" campaign last year to promote investments in gas infrastructure and boost gas penetration throughout the economy. However, a number of issues still need to be resolved in order to fulfil present demands and address supressed demand, including the supply of gas, dispersed demand centres, an unclear macroeconomic outlook, and a continuous lack of foreign currency.

As a by-product of oil extraction, associated gas accounts for the majority of Nigeria's gas production. Sadly, the nation is currently dealing with high levels of resource theft that has caused its oil production to drop to historic lows, significantly affecting the supply of gas. Such instability has an impact on the entire value chain: earlier last year

2021, Nigeria LNG made a notable disclosure that it was only producing at 68% of its capacity because of theft of crude oil and pipeline vandalism, among other issues.

Despite efforts from both the public and commercial sectors, gas infrastructure continues to be insufficient. The creation of an enabling environment and the futureproofing of its projects will determine its ability to attract investments. Between 2022 and 2030, investments in LNG supply will be concentrated on low-cost, adaptable projects with a small carbon footprint and a rapid time to market. Unfortunately, Nigeria has a reputation for project execution delays and expense overruns. There is need for the country to improve on project delivery timescales, as timeliness of project completion is becoming a deciding element in investment choices.

Although the federal government has been commended for the numerous frameworks like Nigeria Gas Flare Commercialisation Programme in 2016, The National gas policy of 2017, and Gas Flare (Prevention of Waste and Pollution) Regulation 2018, their implementation must be taken seriously and the long-term action plans in the 2017 policy must also be adhered to. Additionally, the government continues to control the domestic price of natural gas, a practice criticized by many business leaders as encouraging inefficiency, because the price set may not accurately reflect the true cost of gas. To maximize profits from gas across the value chain, proper gas pricing procedures that consider the present and future dynamics of the gas market must also be rigorously implemented.

Gas infrastructures can be rehabilitated through concessions and improved to be automated and equipped with the right technology for proper monitoring. Due to the limited capacity of Nigeria's transmission network, gas usage in the power sector is restricted. To enable the evacuation of more power from the current power plants, regional power transmission infrastructure development and/or expansion of the existing national transmission system is required. Also, investments in power transmission infrastructure will enable evacuation of more electricity and increased gas utilisation for power generation.

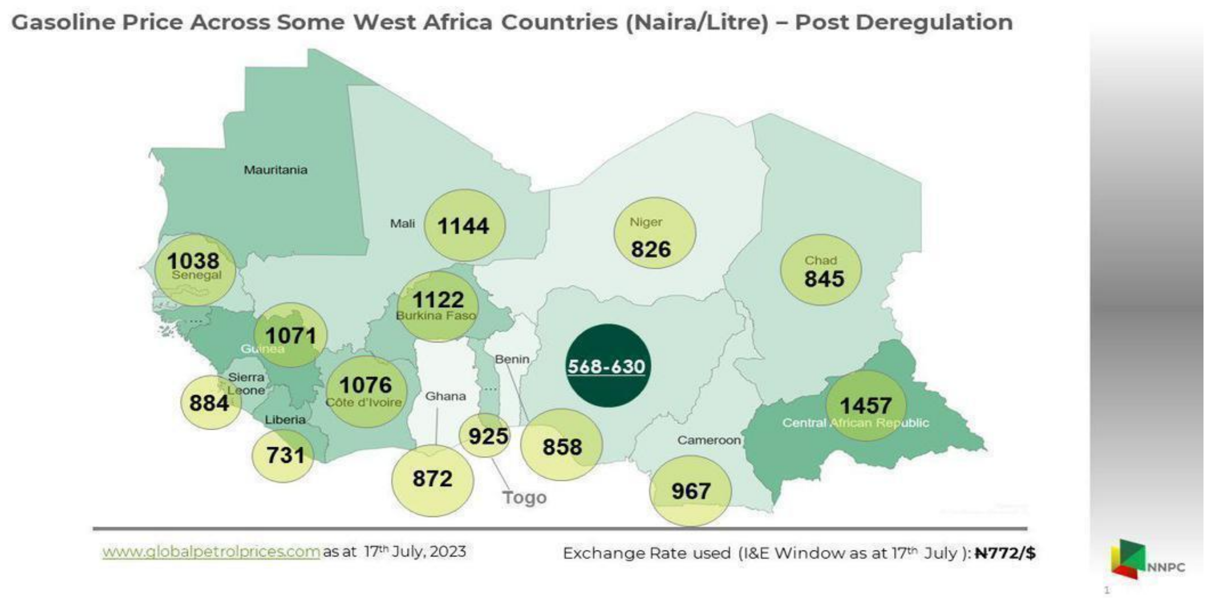
Finally, there is low awareness of the cost-effectiveness of using gas, particularly for transportation and home needs, which the government and private institutions can alleviate via awareness programmes to promote national and global clean cooking agenda within the overall energy transition framework.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Mitigating the Effect of Fuel Subsidy Removal in Nigeria

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for mitigating effects of fuel subsidies in Nigeria.



The chart shows petroleum prices in Africa, which indicates that at the current rate of petrol, the only difference between petrol prices in Nigeria, and the neighboring countries is the absence of taxes on the prices, because Nigeria does not charge tax on petrol. Nigeria must eliminate its subsidies to enhance its debt management portfolio. Due to the increasing debt burden, Nigeria's revenue receipts are being crowded out by its debt service obligations. In 2016, Nigeria's debt service as a percentage of revenue was 96.8%. While this number decreased to 70.4% in 2019, it increased to a projected 102% in 2022. At this rate, Nigeria's debt service obligations will increase to as high as 160% of its revenue by 2027.

These and other considerations seem to have influenced the decision of the Government to adopt the "sudden death" approach to removing Premium Motor Spirit (PMS) subsidy without delay to address the country's insufficient revenues, growing fiscal deficits, and crowding out effect on public investment spending. As a result of the subsidy, the price of fuel in Nigeria is lower than in neighboring countries, creating an arbitrage opportunity for merchants to buy petrol in Nigeria and sell it at a higher price in those nations.

Targeted social safety net programs will assist to alleviate the burden on low-income households, but a variety of measures at each level of government will be required to

reduce the negative impact of subsidy elimination on the various segments of the working population.
The implementation of mass transit schemes for the urban working population at the state and federal levels could provide additional assistance to the commuting poor in key states such as Lagos, Kano, Rivers, Ogun, and the Federal Capital Territory of Abuja.

The importance of Gas as a transition fuel has been highlighted by the Government in terms of its Transition to Net Zero in line with the Paris Agreement. Crowding in private sector and multilateral resources to increase gas utilisation should also be considered, given the Government's limited fiscal resources. In this regard, partnership with the private sector to bring in investments, expertise, and innovation provides numerous benefits beyond sharing the financial burden(s). This collaboration will allow the government to tap into private sector resources and efficiency to implement development projects. The deployment of new technologies to improve the welfare, health and economic conditions of poor and vulnerable Nigerians is recommended. Some of these technologies include utilising greener and more environmentally friendly energy sources in fuelling public transportation.

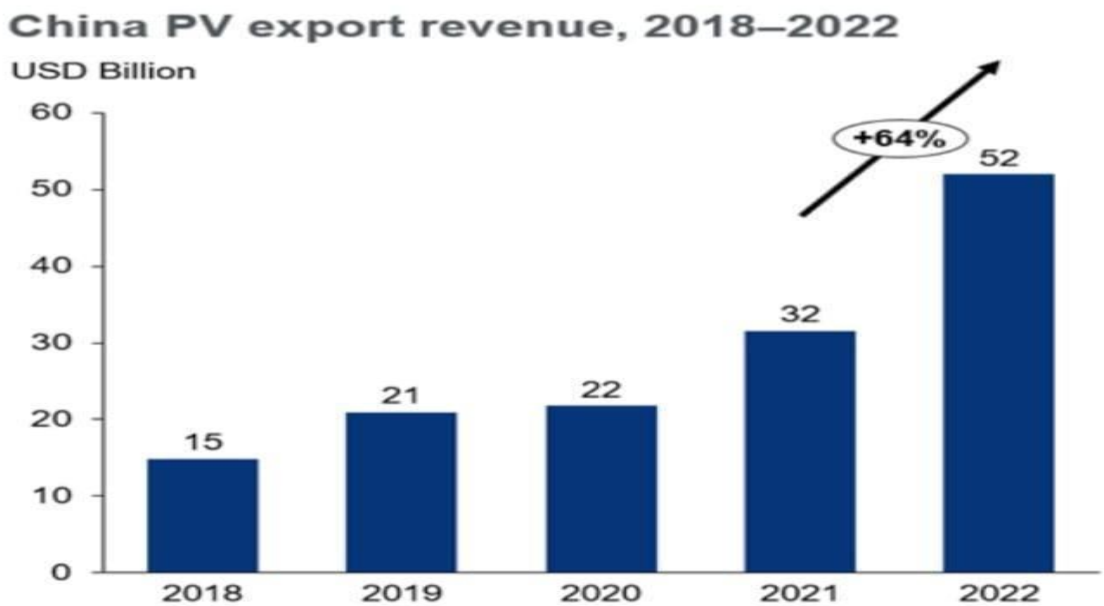
There can also be acceleration of investment in infrastructure projects and public works. With an increasing urban population comes a need for larger and better social amenities and Nigeria currently faces challenges in providing sufficient public amenities to its growing population. Therefore, by providing temporary employment opportunities, similar programs have the potential to serve as a valuable tool for providing employment opportunities, while at the same time upgrading infrastructure, for the benefit of the entire economy.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for promoting Solar PV Manufacturing in Nigeria

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for promoting solar PV manufacturing in Nigeria.



(Source: Wood Mackenzie)

The graph depicts the export revenue of China from solar Photovoltaic (PV) manufacturing between 2018 and 2022. This can be a lesson for Nigeria, as a country with the availability of silicon, a major component of solar panels.

Sustainable Energy for All, a United Nations-affiliated Non-Governmental Organisation, has identified benefits that can ensue from African local production of renewable energy technology. Sustainable Energy for All's Renewable Energy Manufacturing Initiative (REMI) notes in its Africa Renewable Energy Manufacturing: Opportunity and Advancement report, that growing renewable energy adoption and the availability of raw materials needed to produce renewable energy technology can help the continent expand its clean energy industry. However, the REMI research emphasizes that hurdles such as insufficient enabling regulations, high capital expenditures for setting up production units, and insufficient energy to power manufacturing activities must be overcome.

According to the International Renewable Energy Agency (IRENA), Nigeria can meet about 60 percent of its 2050 energy demand with renewable energy sources. However, this will require the implementation of initiatives that reduce solar energy costs locally. One such initiative that IRENA recommends is the development of local renewable energy technology manufacturing capacity.

While Nigeria has some policies in place to help businesses migrate to clean energy, local manufacturers and prospective entrepreneurs do not have easy access to finance. However, with favourable investment attitude towards local manufacturing capacity growth, this may be changing. Blue Camel developed a solar PV panel assembly in Kaduna in 2018, capable of generating 10,000 solar panels. All On, an impact investor, and Auxano, a Lagos-based solar panel assembler, struck a $1.5 million investment agreement in 2020. The funding will allow the company to increase its capacity by more than 50%. Kaduna State and China's Ming Xin Mineral Separation Nig Ltd. formed a partnership in January 2023 for the construction of the country's first lithium-processing plant, which will manufacture lithium-ion batteries.

It is therefore recommended that for Nigeria to meet the large-scale market demand for solar PV and generate economic revenues as has been the case in China, certain measures must be undertaken. The Nigerian government should establish incentive packages, to attract investments in this area, including providing land at nominal prices for potential industries; government support for industrial workforce training; providing free worker recruitment services; income tax reductions; tax deductions for labour cost; developing targeted customs duties for importing critical components; and financial incentives for research and development. There can also be an introduction of utility procurement policies, which have the potential to encourage users to buy locally manufactured technologies, with preferential prices over and above imported technologies.
Localization encompasses not only the manufacture of technologies, but also the full value chain of the energy industry, to generate sustainable energy for all. Localization such as enabling a local environment, localization of funding, and local participation in the design, development, and marketing value chain are regarded as critical aspects in supporting local capacities in the growth of the Nigerian energy sector. As

a result, governments should seek to include the concept of localization into their efforts to build resilient energy infrastructure.

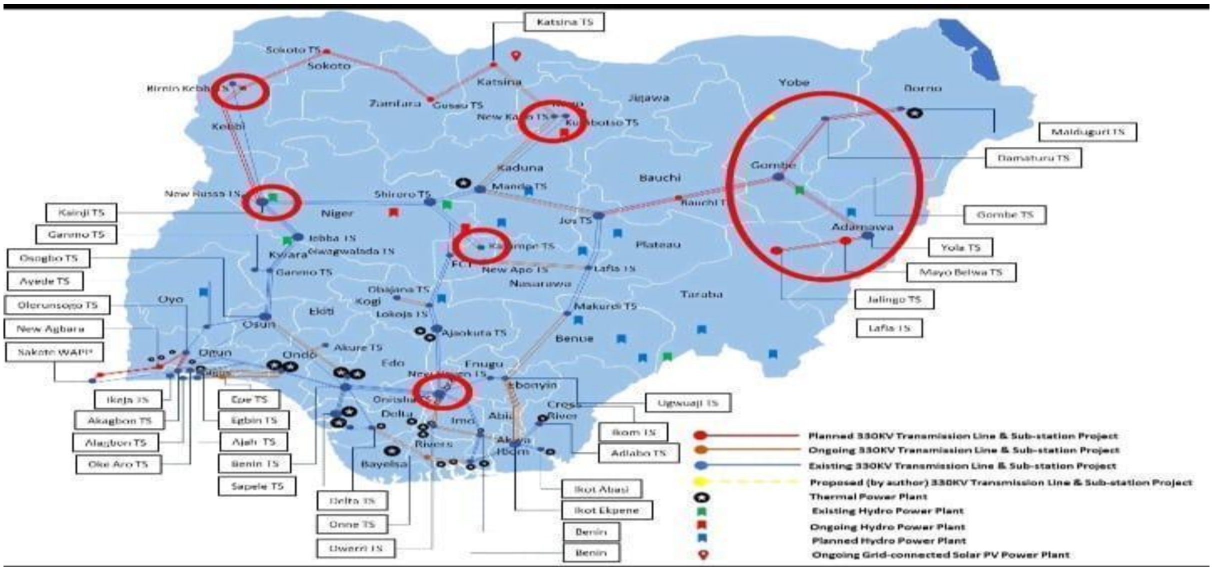
Using the Triple Helix Model (University-Industry-Government) which is considered as one of the effective ways of producing and disseminating organized knowledge for the economic development of countries, the government can inculcate solar manufacturing in each of the systems. This model provides the opportunity to synergize resources of the three actors in order to facilitate innovation and technology development activities. The summation of the above can be achieved by developing enabling policies to promote allocation of sufficient funding for technology development and deployment of Solar PV manufacturing within the overall renewable energy sector in Nigeria.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Improving the Transmission System in Nigeria

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights recommendations for improving transmission system in Nigeria.



SOURCE: Transmission Company of Nigeria

The map portrays Nigeria transmission grid/lines with the weakest points of the national grid being the transmission stations around three regions: Gombe, Yola and Kano.

Nigeria's transmission network has long been a weak link in the country's electricity value chain. Despite recent advances, the Transmission Company of Nigeria (TCN) has repeatedly failed to deliver more than 5.4GW of power to a country with a population of over 200 million people. The national grid is prone to system failures and frequently fails to transmit the available generation capacity. In 2017-18, about 28 system breakdowns occurred owing to faults and load disturbances, resulting in partial or total blackouts across the country.

Most the transmission grid's weak areas are in northern Nigeria, distant from the power generating firms in the south. This highlights the importance of siting power generation infrastructure closer to northern Nigeria in order to reduce transmission losses, that are prevalent in the current system.

It is also required that the Nigerian government expands transmission lines and constructs more substations to extend its reach and improve the reliability of power supply. The construction of additional relief lines to critical 330kV lines, such as the Alaoji-Onitsha line to correct current disturbances within its coverage should also be explored.

Furthermore, it is recommended that the government remove overgrown vegetation from distribution network lines by installing poles and properly tensioning lines. Rainstorms and other severe weather conditions can destroy vulnerable wires, resulting in large-scale distribution load outages. To reduce the occurrence of equipment failures, the government should equally consider the refurbishment of sky wires and transmission equipment, replace vandalized sky wires that expose the lines to lightning strikes, and replace antiquated transmission equipment.

More importantly, there is need to purchase more reserves for generating power stations equipped with functioning automatic generation controls in order to regulate frequency changes and prevent system collapses. There is also a need for digital control center construction to be expedited. The TCN will be able to digitally monitor the grid in real time, trace and rectify system collapses and faults after the Supervisory Control and Data Acquisition (SCADA), Electricity Management System (EMS), and telecommunication networks are completed.

Finally, protection mechanisms for important transmission-distribution interfaces need to be augmented, to reduce tripping of vital transmission lines and substation damages occasioned from faults.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Achieving Energy Transition in South Africa

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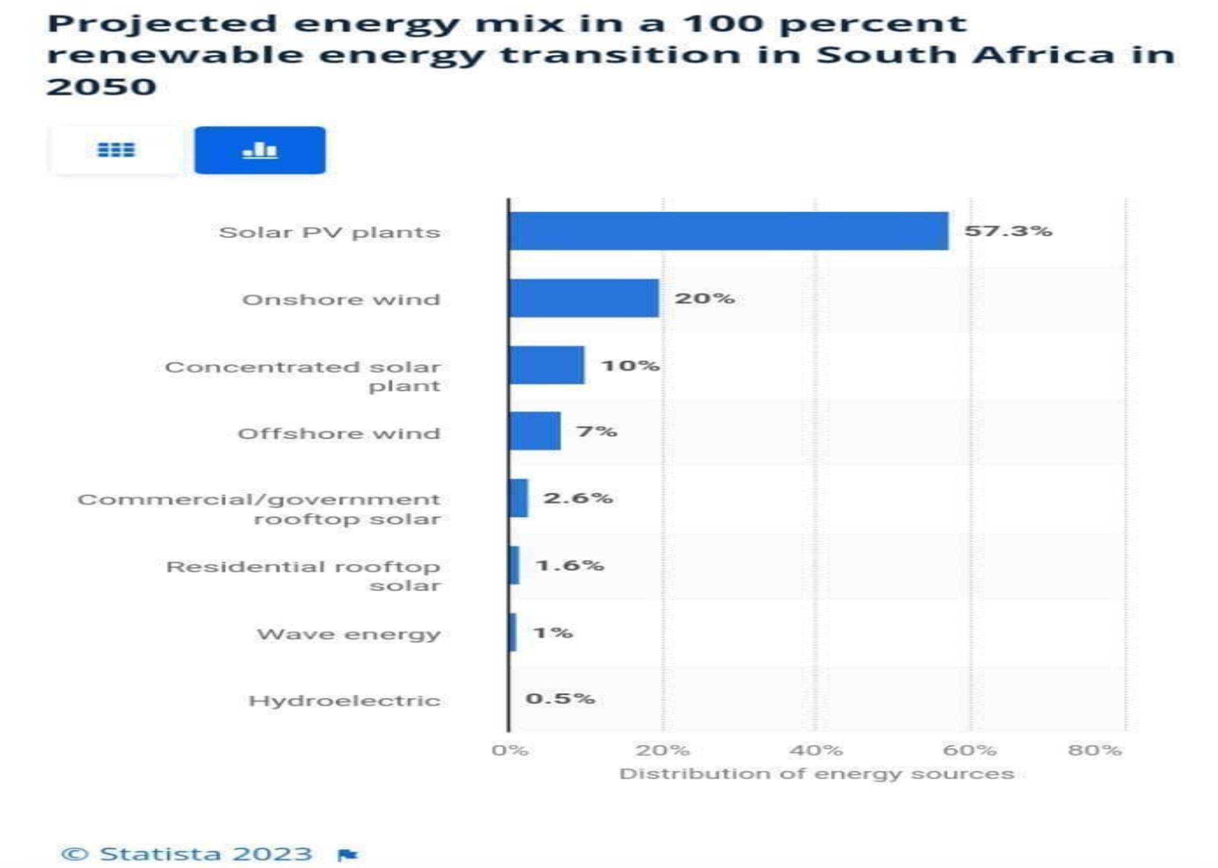
The data intelligence highlights recommendations for achieving energy transition in South Africa.



The graph depicts South Africa's plan for its energy mix in order to achieve 100% energy transition by 2050. However, South Africa's renewable energy sector is finding it challenging to infiltrate the energy system and markets. This is owing to the exclusionary effect of existing energy laws, which were created to suit conventional fossil fuels in centralized and vertically integrated energy systems

energy systems have not achieved full liberalization. In a fully liberalised electricity market, renewable sources may find it easier to penetrate the market, given the activeness of the market; stemming from private sector engagements. This is in stark contrast to the situation in several developing nations, where state-owned utilities continue to monopolize the industry, and also partly attributable to how the industry is regulated, in addition to dictating policy orientations. Thus, climate change, security of supply concerns, corruption and the inefficiency of Eskom's monopoly calls for the opening of the electricity supply industry to decentralization for further integration of decentralized renewable energy systems.

It is also recommended that stimulating a renewable energy market for the proposed energy mix in South Africa can be effected through legal and policy framework(s) underpinned by key minimum features. Firstly, the objects of the framework must be to promote a gradual transition that is founded on sustainable energy, energy security, climate change policy and the national development plan, with less dependence on conventional fossil fuel sources. Secondly, the framework should be embedded in principles of energy justice, environmental justice and climate justice, as governing norms for participatory decision-making for stakeholders and the public. Thirdly, while providing incentives and possible state support, the framework should promote socially owned renewable energy structures across the proposed energy mix to allow the private sector to participate in projects.

Furthermore, it is recommended that the government should bring together a plethora and variety of organizations, all of which have an important role to play in advancing the energy transition movement in South Africa — including unions, academia and the private sector. Researchers and non-profits can work together to increase pressure on the government to take action, in keeping with the energy transition, via research and development; social programmes, and corporate commitments relating to renewable energy in the corporate world.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for promoting Climate Resilience in Africa

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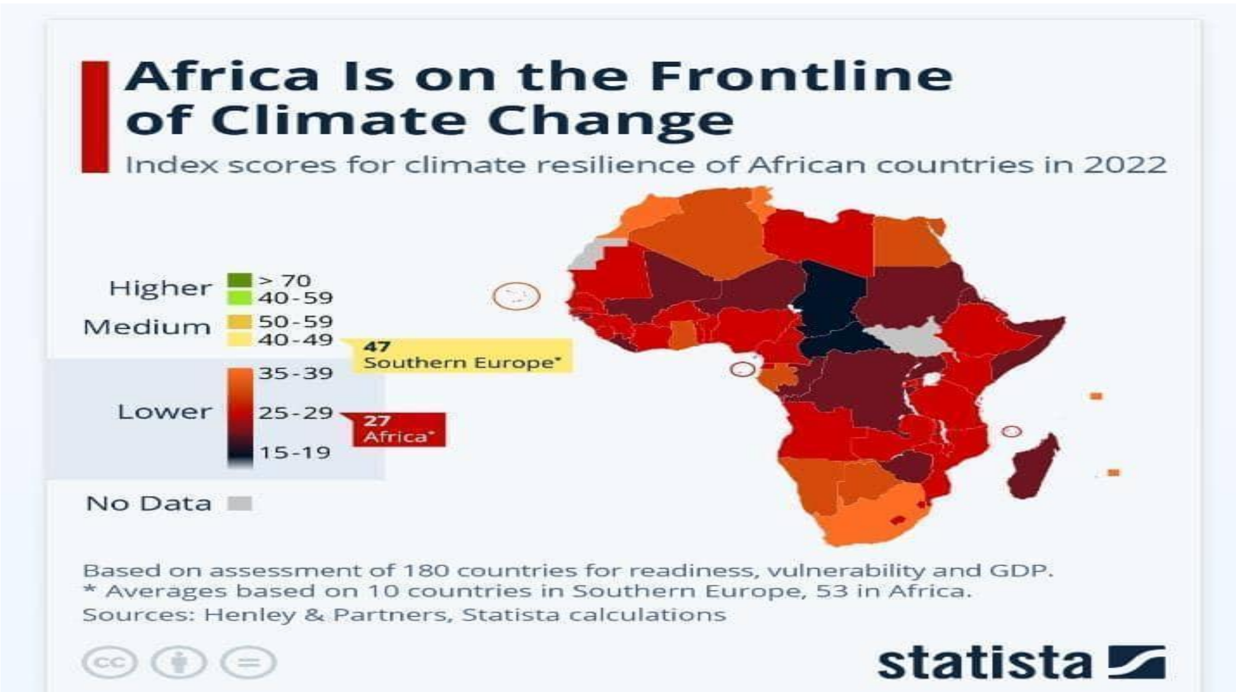
The data intelligence highlights recommendations for encouraging climate resilience in Africa.



The data intelligence highlights recommendations for promoting climate resilience in Africa.

Statistics reveal that Africa contributes the least to climate change. Although Africa has made a very small contribution to the greenhouse gas emissions that have triggered the current climate emergency globally, Africa stands as the most vulnerable to the effects of climate change. Consequently, Africa must fight just as hard as the rest of the globe to build resilience and combat the effects of climate change.

Climate resilience is the ability to successfully manage and adapt to the effects of climate change, while halting the deterioration of those effects. Climate change induced challenges have so far arisen across several sub-regions of the continent. This has placed a sense of urgency on regional climate adaptation and climate resilient action for the sustenance of African nations.

Road assets are particularly vulnerable to climate stressors. The World Bank predicts that climate change will take a heavy toll on the African road systems. Climate stressors such as higher temperatures, increased precipitation, or flooding affect the durability of road assets and infrastructure. Climate-related damage to the road infrastructure will also result in frequent disruptions to the movement of people and goods, with direct consequences on economic productivity. Therefore, proactive investments for road pavement improvements are recommended to account for higher temperatures, especially considering that the incremental cost of such resilient measures is relatively low.

Climate resilience has great potential to alleviate the negative impacts of climate change. However, the planning and design of infrastructure in Africa are consistently conducted largely without taking climate change into account. At the project level, a World Bank report demonstrates that adapting infrastructure planning and design has great potential to reduce climate change impacts. Thus, failing to adjust designs to improve infrastructure performance over a range of climate futures may result in economic loss for societies in the long term. As such, there is a need to develop new technical standards for project design and planning. A multi- stakeholder technical working group could be established, to develop voluntary technical guidelines on how to apply the notion of climate resilience, to real-life infrastructure planning and design.

Although climate resilience analysis must necessarily become a regular part of Africa's program and project preparation, experience on the ground is limited and technical capacity is scarce. As a result, applied knowledge hub(s) that could provide technical assistance services across the continent for the assessment of climate impacts and, in particular, the analysis of adaptation options in project design is recommended. Africa's lack of modern energy access jeopardizes its development ambitions and ability to build climate resilience. Consequently, advancements toward low-carbon energy sources are critical for reducing global greenhouse gas (GHG) emissions, but they must be compatible with attaining the continent's development goals and satisfying the unmet energy demand constituting around 600 million Africans. Africa is richly endowed in energy and mineral resources, such as lithium, graphite, cobalt, nickel, copper, and rare earth minerals—all of which are new market opportunities for the energy transition. With Africa's limited lock-in to fossil-based energy technologies, these opportunities could help the continent build a climate-resilient and integrated sustainable energy sector.

Policies to achieve climate resilience and a just energy transition in Africa should be inclusive, and all round, "leaving no one behind." The transition requires close consideration of the equity implications and challenges associated with prevailing energy poverty, low energy consumption and overall energy needs for economic growth and transformation.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Increased Renewable Energy Capacity in Africa's Energy Mix- Lessons from Kenya

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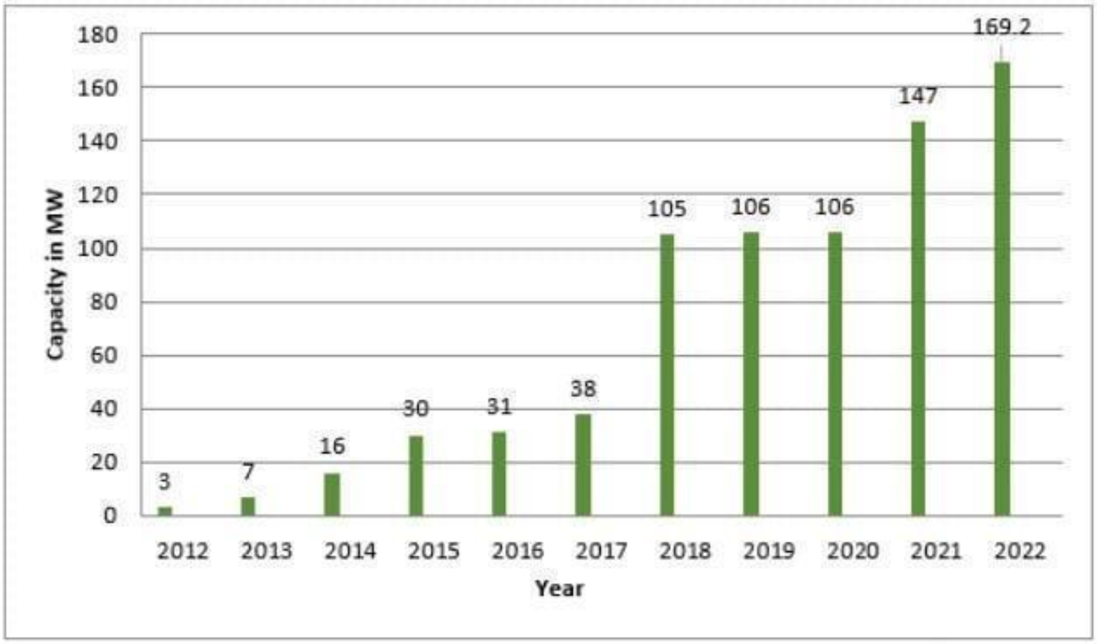
The data intelligence highlights lessons African countries can learn from Kenya to achieve increased renewable energy capacity in their energy mix.



Kenya's total installed solar energy capacity 2022 *Source: IRENA; AFSIA; KENPRO*

The graph shows Kenya's solar energy capacity from 2012-2022. The steady increase occurred between 2017-2020 which represents the phase of ushering policies, plans, and legislations in relation to renewable energy in the country.

The data intelligence highlights lessons African countries can learn from Kenya, to achieve increased renewable energy capacity in their energy mix.
The graph depicts Kenya's solar energy capacity from 2012-2022.
The steady increase occurred between 2017-2020, which represents the phase where policies, plans, and legislations were formulated and implemented, to promote the deployment of renewable energy in the country. For instance, the development of the National Energy Policy, 2018 was instrumental to the government of Kenya's commitment to the provision of affordable quality energy for all Kenyans. The government aims to achieve affordable quality energy for all Kenyans through the provision of clean, sustainable, affordable, competitive, reliable, and secure energy

services at the least cost, whilst protecting the environment. The National Energy Policy document offers a thorough

analysis of the energy sector's current state and the policy framework as of 2018. It also contains policy recommendations for a number of subthemes, including coal, renewable energy (particularly geothermal and hydro), electricity, energy efficiency and conservation, land, environment, health, and safety, energy services, energy financing, pricing, and socioeconomic issues. This paved the way for the adoption of the Energy Act No. 1 of 2019 (the Energy Act) to, among other objectives, promote the generation of renewable energy in Kenya. African countries can take a cue and thoroughly assess the current status of their respective energy sector(s) across various economic sectors, to decipher the lapses and proffer solutions for the integration of renewable energy in each sector.

Furthermore, the Energy Act established the Renewable Energy Resource Advisory Committee intended to play an advisory role to the Cabinet Secretary for the Ministry of Energy and Petroleum, regarding the criteria for the allocation of renewable energy resource, licensing of renewable energy resource areas, management of water towers and catchment areas, development of multi-purpose projects such as dams and reservoirs for power generation and management and development of renewable energy resources. African countries can adopt a similar mechanism, by putting together similar advisory committees, constituted of energy experts, to advise and advance the deployment of renewable energy in their respective countries.

Also, the Energy Act allows grid-connected consumers who own an electric power generator of a capacity not exceeding one megawatt to supply the excess power to a distribution licensee or retailer, if that consumer has a generation facility that is located in the area of supply of the distribution licensee. Under the Energy Act, every distribution licensee is mandated, upon receipt of an application, to make available net metering services to any electricity consumer that the licensee serves. African countries can adopt net metering provisions like Kenya, to encourage private investment in the industry.

Finally, the Energy Regulatory Commission ("ERC") passed the Energy (Solar Photovoltaic Systems) Regulations (the "Regulations") in 2012. These rules were created as a consumer protection tool to prevent the entry of subpar solar products and professionals who are either underqualified or poorly trained. All individuals designing and installing solar PV systems, and all manufacturers, sellers, distributors, and contractors for solar PV systems, are required by the Regulations to hold an ERC license. A list of licensed technicians and contractors is also provided on the ERC website. African countries can follow suit in making renewable energy technology and expertise subject to regulations, which will promote standardization across the sector, and lead to increased private sector investment in renewable energy.

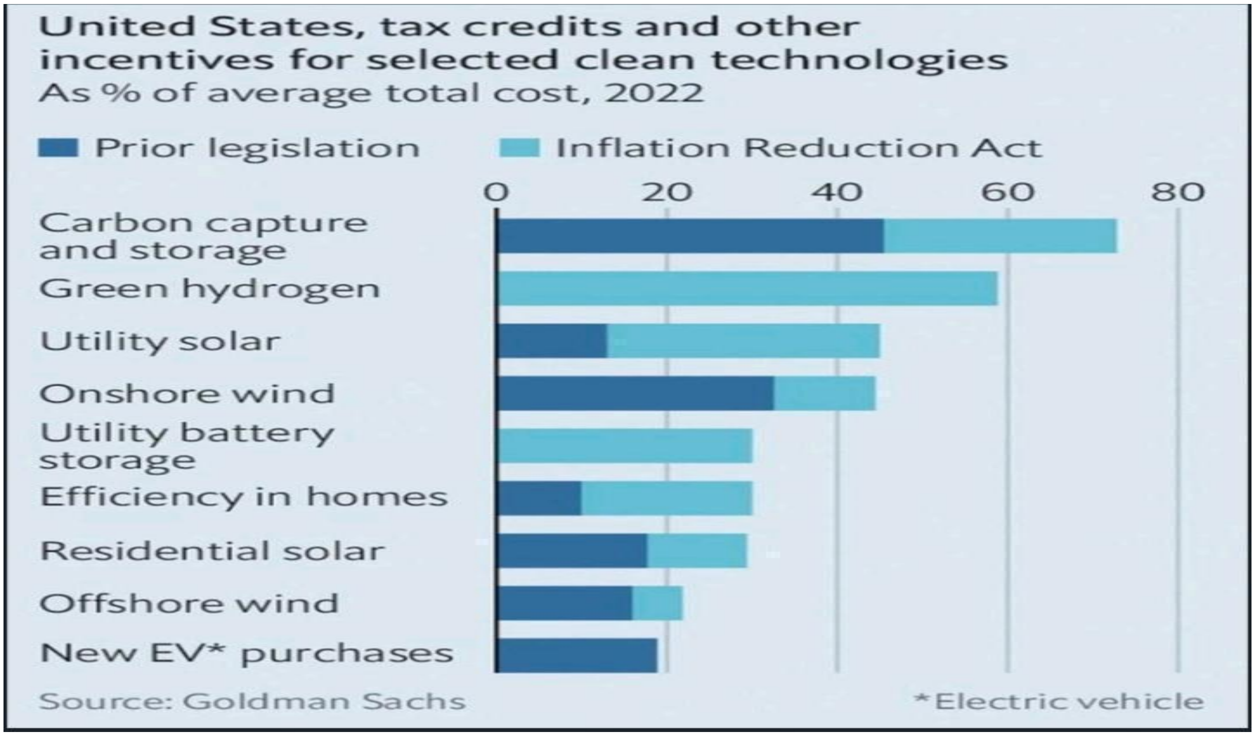
EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Improving Investment in Clean Energy Technology in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in

understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights lessons African countries can learn from the United States of America for improving investment in clean energy technologies.



SOURCE: Goldman Sachs

The data intelligence highlights lessons African countries can learn from the United States of America for improving investments in clean energy technologies.

The United States Inflation Reduction Act (IRA), 2022 has become widely recognized for being a game-changer in the push for green technology and domestic clean energy manufacturing via tax credits and other incentives. These incentives serve as examples for African countries to emulate in each country's bid to drive investments in the clean technology space.

The Inflation Reduction Act makes provision for incentives to promote private investment. Most of the energy and climate funding is in the form of tax credits and corporations are the largest recipients, with an estimated $216 billion worth of tax credits; designed to catalyze private investment in clean energy, transport, and manufacturing. Many of the tax incentives in the law are direct pay, meaning that an entity can claim the full amount even if its tax liability is less than the credit. African countries can also inculcate this system of providing tax credits for companies in the clean energy technology space throughout the entire value chain activity, to encourage the deployment of these technologies.

The Act also provides for consumer incentives. About $43 billion in IRA tax credits aim to lower emissions by making electric vehicles (EVs), energy-efficient appliances, rooftop solar panels, geothermal heating, and home batteries more affordable. Under the Act, qualifying electric vehicles are eligible for a tax credit of up to $7,500 and $4,000 for new and used vehicles, respectively, while qualifying home improvements are eligible for a tax credit of up to 30 percent of the total cost, capped at $1,200 per year. For heat pumps, the credit is capped at $2,000 per year. The energy-efficient home improvement credit may be available to homeowners who upgrade and adapt their house heating and cooling systems. This credit is offered for the installation of new doors, windows, skylights, insulation, and heat pumps that help the temperature of a home to be more efficiently controlled. The credit may also pay for a home energy assessment, water heaters, and electrical system modifications required for the installation of new electric equipment. African countries can also formulate consumer incentives that will encourage household utilization and investment into clean technologies.

A further mechanism by the IRA to drive investments and unlock the full EV consumer credit, is the requirement for a scaling percentage of critical minerals in the battery to have been recycled in North America or have been extracted or processed in a country that has a free-trade agreement with the United States. The battery must have also been manufactured or assembled in North America. African countries can also come up with similar mechanisms to trap investments in the critical minerals sector and encourage local content and local investments.

Also, the European Commission recently revealed its rules for its first European Hydrogen Bank auctions, offering renewable hydrogen production subsidies of up to €4.5/kg ($4.9). African countries can adopt a similar route by providing subsidies across renewable energy technologies that are feasible in each African nation, in place of fossil fuels subsidies, to further encourage investment in all renewable energy sources; based on the energy mix dynamics of each country.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Improving Investment in Battery Storage Manufacturing in Africa

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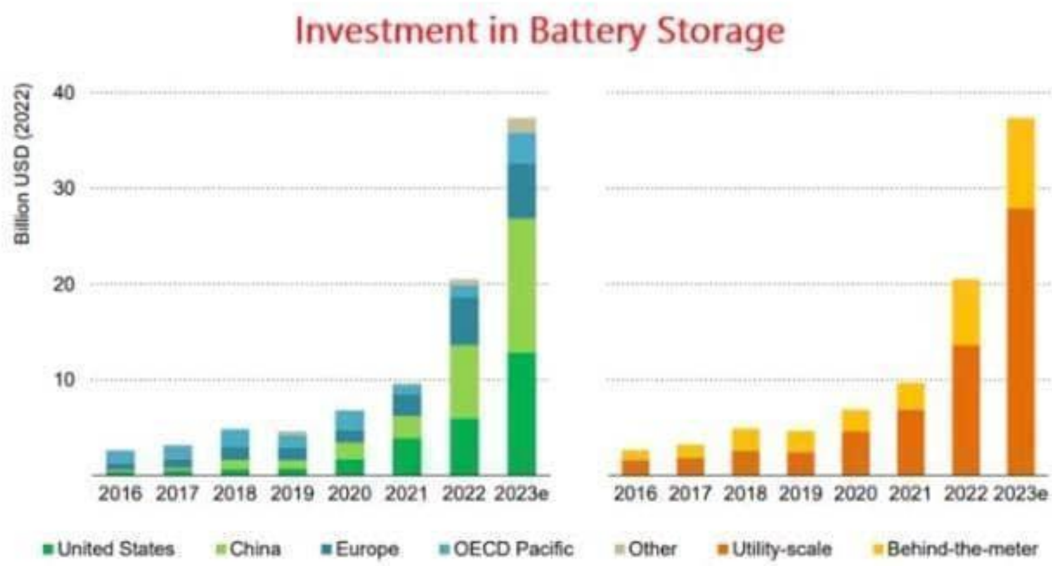

SOURCE: International Energy Agency

The data intelligence highlights considerations for improving investment in battery storage manufacturing across Africa.

The graph depicts recent investment in battery energy storage in countries in the Global North, owing to the advancement of renewable energy generated electricity and the need to address the challenge of seasonal variations. African countries have large deposits of the mineral resources essential for battery manufacturing. Africa possesses 80% of the global platinum reserves, 50% of the global cobalt deposits, 40% of the global nickel deposits, and significant lithium deposits. This has positioned Africa as an important supplier of integral minerals and metals incidental to developing clean energy technologies, such as electric vehicles and utility- scale battery storage.

Furthermore, the cost of developing a lithium-ion precursor factory in Africa has been estimated to be three times less expensive than in China and the United States (US). As a result, Africa is an ideal location for the production of lithium-ion batteries. However, Africa must set itself up to produce lithium-ion batteries and utility scale battery storage in order to tap into the future market of electric vehicles and battery energy storage, which is estimated to be worth several trillion dollars.

Battery energy storage can help to stabilize the grid by providing reserve power to mitigate grid disruptions. It can also help improve the reliability of power supply by providing backup power during power outages. However, the set-up of battery manufacturing facilities in Africa faces major challenges.

According to the Natural Resource Governance Institute's (NRGI) Triple Win report, no single African country has all of the minerals required to build batteries, hence countries will need to pool mineral supply to attain the minimum scale and reliability. They will also need to ensure that they are not devoting too much of their mineral resources for export.

Institutional issues also need to be considered. The Peterson Institute for International Economics discovered that none of the four critical mineral-rich African countries – the DRC (cobalt), Mozambique (graphite), Madagascar (graphite and nickel), and Guinea (bauxite) – have the energy infrastructure needed to expand capacity for refining, in which raw critical minerals are processed into the ingredients for green energy technologies. The identified barriers can be tackled by African countries investing in their minerals production and refining capacity.

Despite its strong reliance on raw battery metals from Africa, China manufactures 74% of the world's lithium-ion batteries and continues to expand battery plant operations. Even American manufacturers are compelled to rely on Chinese imports. However, this is changing. Tariffs on Chinese exports to the US are forcing American companies to diversify their battery production away from China. African countries can profit from this trend by investing in battery manufacturing. The African Continental Free Trade Agreement (AfCFTA) enables African countries to create regional supply chains that meet global demand at a lower cost. With the ratification of AfCFTA, African countries will be able to capitalize on anticipated interruptions in global battery flows caused by the US-China trade war and begin creating their own regional supply chains.

Furthermore, to exploit its minerals, African countries can develop legal, regulatory and fiscal mechanisms that will incentivise battery manufacturing within their borders. Chinese firms including Zhejiang Huayou Cobalt, Sinomine Resource Group, Chengxin Lithium Group and Canmax Technologies have spent more than $1 billion over the past two years to acquire and develop lithium projects in Zimbabwe. The country outlawed the export of raw lithium ore to prevent artisanal miners from mining and smuggling the material, instead allowing only lithium concentrates to be exported. The country currently intends for miners to expand beyond the production of concentrates, which are exported out of the nation for further processing, primarily to China. African countries can follow suit in establishing laws and heavy taxes that will reduce the exportation of these mineral outside the borders of Africa without being domestically profitable to the applicable country. This local battery manufacturing can subsequently be used as a backup for energy storage and to augment current electricity generation capacity within countries across Africa.

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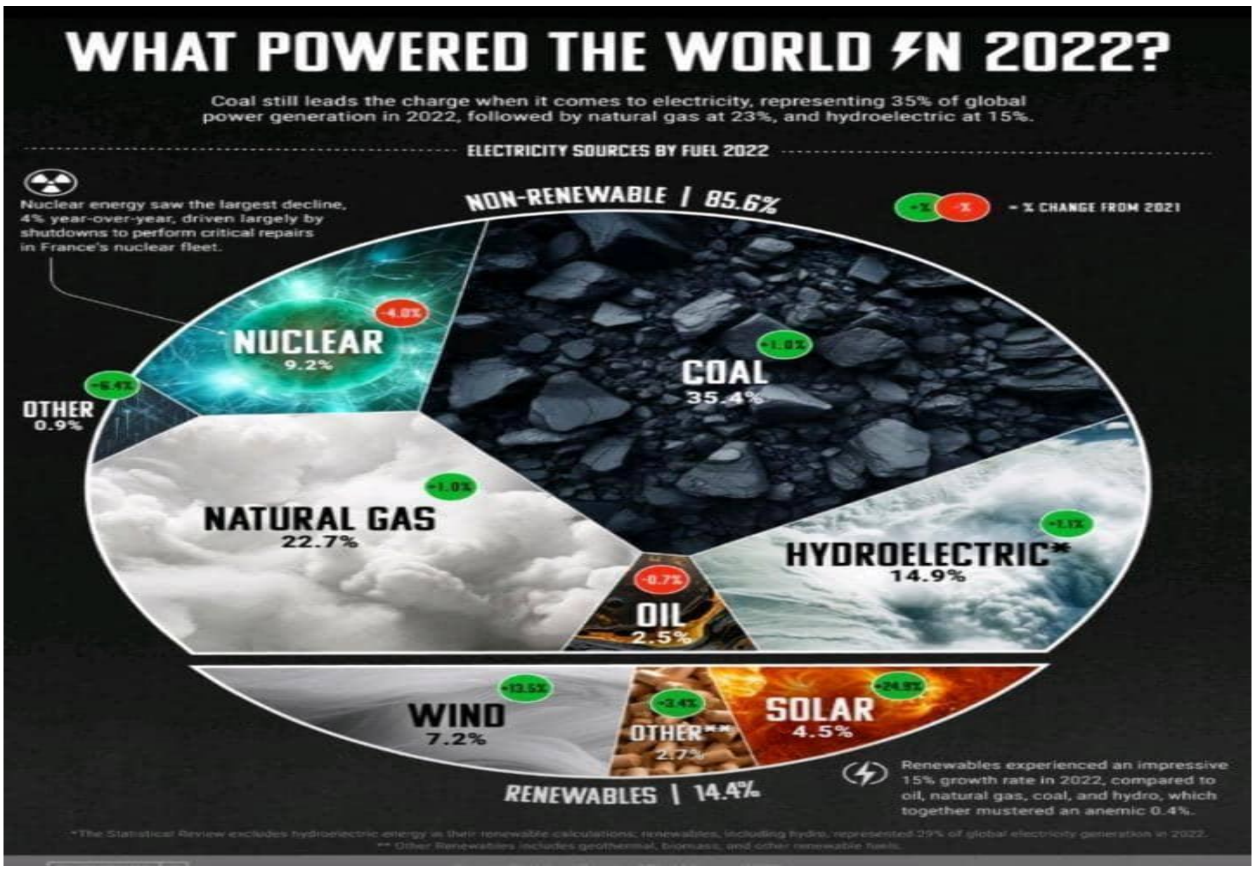
The data intelligence highlights considerations for improving the use of renewables in the global energy mix.



SOURCE: Elements

The picture portrays the energy sources that powered the world in 2022, with non-renewables having a larger share than renewables. This shows how much investment needs to be made by the world to transition to large scale adoption of renewables. The global transition to clean energy is accelerating. Renewable energy output has more than doubled globally over the last decade, and its percentage of total primary energy consumption has increased from 9% in 2011 to 13% in 2021.[92] Despite increases in renewable energy, the consumption of fossil fuels continues to increase to fulfill rising energy demand. Between 2011 and 2021, global energy demand increased by 14%, fueled primarily by emissions-intensive sources.[93]

While global cooperation and coordination are essential, domestic regulatory frameworks must be modified quickly to streamline and accelerate renewable energy projects and spur private sector investment. National/domestic policies and processes must also be in place to reduce market risk and enable and incentivize investments, including streamlining planning, permitting, and regulatory processes and avoiding bottlenecks and red tape.[94] Clear and robust policies, transparent processes, public support, and the availability of modern energy transmission systems are key to accelerating the uptake of wind and solar energy technologies.[95]

Subsidies for fossil fuels are one of the most significant financial impediments to the world's transition to renewable energy. According to the International Monetary Fund (IMF), around $5.9 trillion was spent in 2020 alone on supporting the fossil fuel sector, including explicit subsidies, tax advantages, and health and environmental damages that were not included into the cost of fossil fuels.[96]

Additionally, to secure vital raw materials, components, and labor competencies, countries will need to enhance global supply chains.[97] Promoting recycling and reuse may help minimize demand for key resources, while long-term agreements and

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[92] The Energy transition: A region by region agenda for near term action < https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-energy-transition-a-region-by-region-agenda-for-near-term-action >
[93] Ibid
[94] United Nations < https://www.un.org/en/climatechange/raising-ambition/renewable-energy-transition >
[95] Ibid
[96] Ibid
[97] The Energy transition: A region by region agenda for near term action < https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-energy-transition-a-region-by-region-agenda-for-near-term-action >

relationships with suppliers may provide a hedge against fluctuations in critical supply.[98]

To accelerate the integration of renewables and cleantech into the energy system, old infrastructure will need to be modernized and repurposed, and new assets will need to be developed. Investing in the development and modernization of the power grid will be critical to ensuring that areas with high potential for renewable energy generation are integrated and linked to demand centers.[99]

Furthermore, there must be a streamlining permission processes to expedite renewables and cleantech implementation. Streamlining the permit procedure and reducing the number of required project-approving agencies could help projects move faster.[100] Land access might be made easier by pursuing initiatives that benefit local populations and developing land-efficient solutions like offshore wind. The use of alternative lands, such as wastelands or agrivoltaic land, which is used for both agriculture and solar-photovoltaic-energy generation, as well as out-of-the-box solutions such as floating solar photovoltaics, could help expand the areas suitable for renewables installation.[101]

Socially, to manage economic disruptions that occurs to promote energy affordability and generate equitable possibilities for affected and vulnerable populations, subsidies and other compensatory methods are likely to be necessary to ensure energy affordability for the most disadvantaged users.[102] Regions, particularly those reliant on fossil fuels, will need to diversify their GDP and industrial footprints more quickly. Workers in high-risk industries like fossil mining will require protective measures they can fall back on, like skill programs designed to build a new generation of skills.

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[98] Ibid
[99] Ibid
[100] Ibid
[101] Ibid
[102] Ibid

A more orderly transition will therefore need to be a just transition, one that recognizes the specific challenges that developing countries experience and that responds with collective, global, and unified action, which will require all stakeholders to take decisive, and coordinated action at their various national level. This will amount to a unified global energy transition action.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Improving investment in solar energy in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

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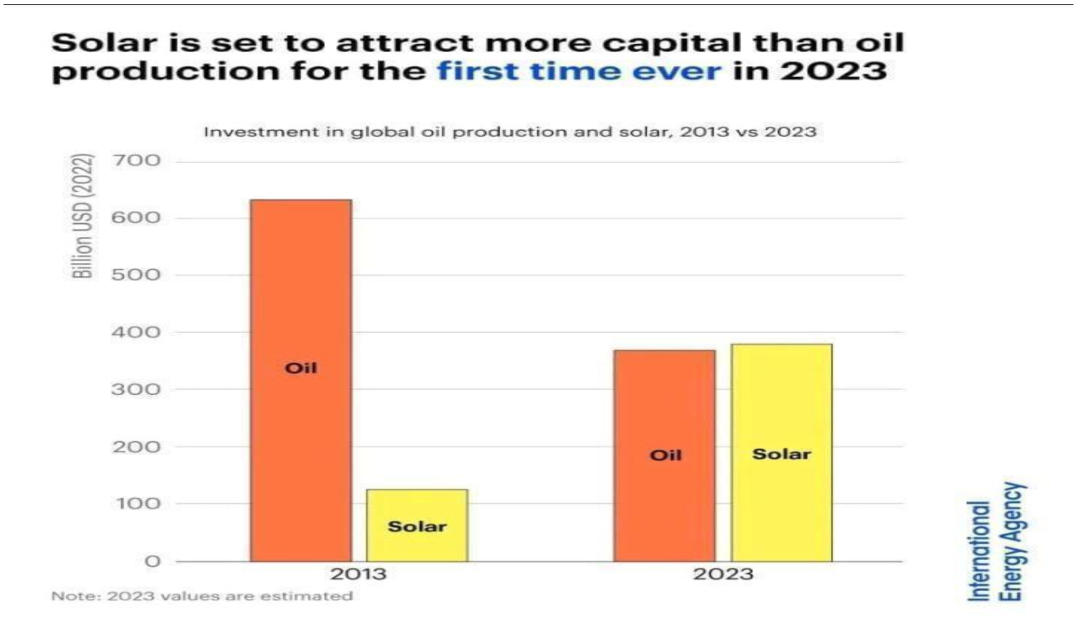

The data intelligence highlights considerations for promoting investments in solar energy across Africa.

The estimation in the graph depicts that solar will attract more global investment in 2023 than oil production. This is a call for African countries to shift their expenditure to investments in solar energy.

It has been opined that the most affordable source of electricity at present is solar. The cost of solar energy equipment has decreased drastically, according to recent research. For example, the weighted average cost of power for large-scale solar photovoltaic (PV) infrastructure decreased by 88 percent between 2010 and 2021. Increased productivity and technical developments are also the reason for this startling decline. However, it is also a product of creative finance structures, in addition to government incentives and enabling laws. However, the Africa region has, to a large extent, not taken advantage of the lower cost of PV technologies. Enabling policies are not being implemented rapidly or effectively, the situation is worsened by the inadequacy of existing regulatory frameworks. They are often out of step with current energy policies and, even where they are aligned, they also suffer from poor implementation. Furthermore, consumer demand for solar energy is affected by the lack of skilled labour and low-quality equipment. It is recommended that there should be quality standards to re-establish consumer confidence in solar technologies. In addition to setting quality standards, there is a need for regional and national quality assurance frameworks through standards and testing laboratories, in addition to the need for closer involvement of the customs authorities to support the enforcement of policy and regulatory frameworks around standards. There should also be programmes in place that will cater to strengthening the technical skills of solar installers.

Furthermore, there should be implementation of a proactive policy of expanding the market, by systematically installing solar power on public-sector infrastructure, which helps reduce greenhouse gas emissions; while contributing to the development of national solar markets.

The lack of data on the solar energy market in West Africa is the first major impediment for private investors. There should be support to promote access to information, market data, and risk assessments, by providing market research and feasibility studies, in addition to a database to host information like the ECOWAS Observatory for Renewable Energy and Energy Efficiency (ECOWREX). Similarly, UNDP's Derisking Renewable Energy Investment (DREI) tool that provides users with a detailed risk map and recommends targeted derisking mechanisms, will be important in promoting investments.

Finally, African countries must promote the positive effects of solar energy for productive uses especially in the agriculture and small industry sectors, to create demand for solar technologies, and set up a guarantee fund to encourage investments, by making it easier for businesses to obtain funding from financial institutions at lower interest rates; through blended finance schemes, to overcome barriers associated with high interest rates for corporations.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Ensuring Cost-Reflective Tariffs for Energy Access in Africa

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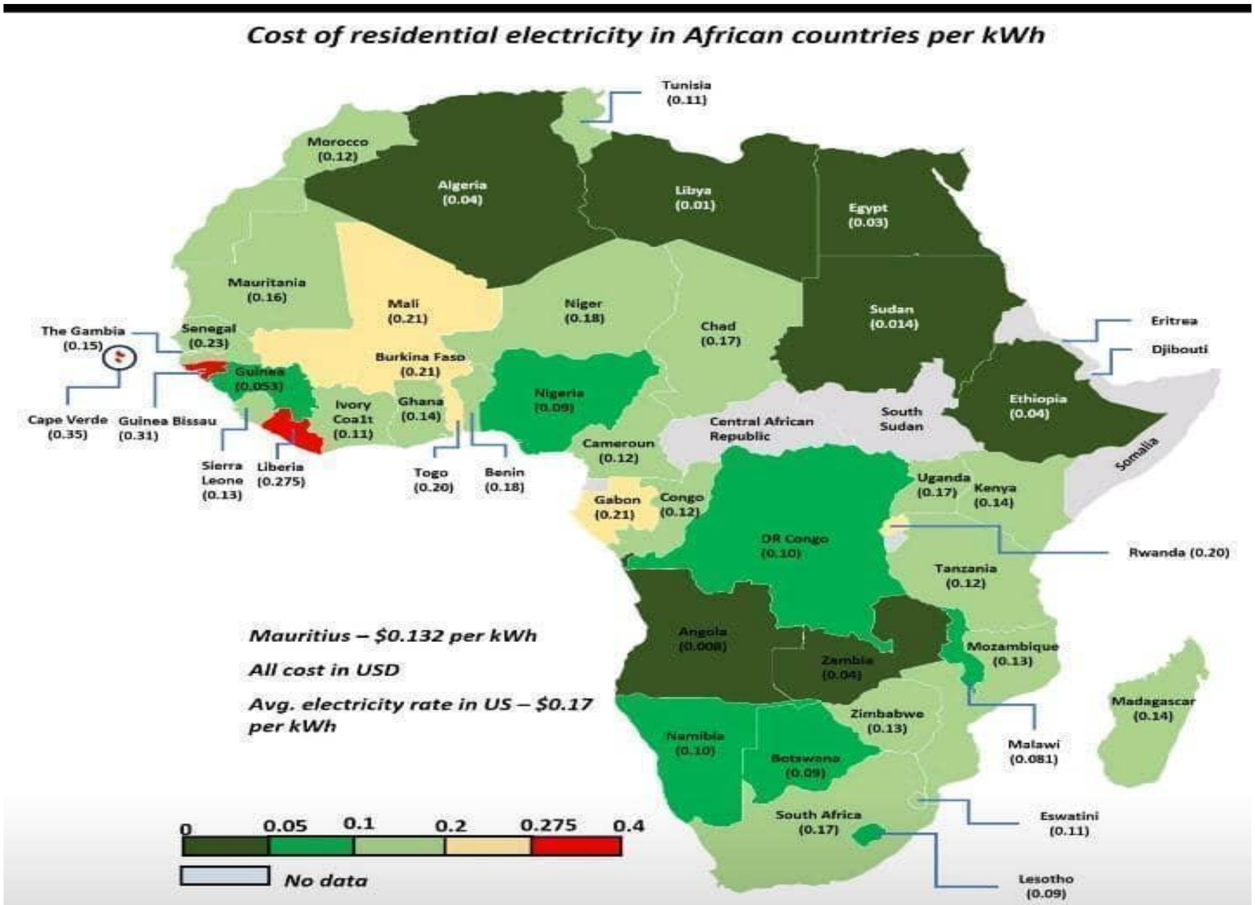

SOURCE: Bayode Akomolafe

The map shows the cost of residential electricity in African countries which is on the average, higher than what is obtainable in the United States, though the supply has been static unstable and electricity utilities faces illiquidity. Thus, many African nations are faced with both a non-cost-reflective tariff and a static electricity supply.

Tariff setting is one of the core processes necessary for the effective functioning of an electricity system.[103] It not only captures the needs and interests of consumers, utilities, and policy makers, it determines the sustainability of the electricity system as a whole. The tariff should provide an opportunity for the utility to earn a reasonable return on its prudently incurred investments for providing reliable electric services and must be fair and affordable for each customer class so that different types of consumers are satisfied with the rate charged for electrical energy consumed.[104]

To start with, tariff setting requires accurate data on utility performance, but most African power authorities have historically had significant difficulties in assuring data transparency and accuracy. To overcome this significant obstacle, African electricity regulators should create strategies to encourage utilities to provide the necessary documentation and report accurate data, such as simple templates for periodic reporting requirements.[105] They should also create effective monitoring and enforcement procedures for accurate data reporting through the use of external independent auditors for data verification.

Similarly, the requirement that the tariff guarantee the potential for cost recovery is one of the core tenets of tariff policy. In other words, the tariff ought to reflect costs. Only a cost-of-service analysis can produce cost-reflective rates. The accuracy of the costs obtained from such studies affect the appropriateness of the tariff determined. However, most African utilities have not been able to carry out thorough cost of service studies (CoSS).[106] There are still questions about the effectiveness of the analysis and the precision of the output costs whenever such investigations are undertaken.

[103] GUIDELINES FOR ADVANCING ECONOMIC AND QUALITY OF SERVICE REGULATION IN AFRICA'S ELECTRICITY SECTOR <https://pubs.naruc.org/pub.cfm?id=1E215369-1866-DAAC-99FB-B7EFFB08159E >
[104] Ibid
[105] Ibid
[106] Ibid

Strategies for adopting a CoSS must be developed by key industry specialists due to its significance for efficient tariff fixing.

Furthermore, the costs of electricity generation, transmission, and distribution in most developing countries, including African countries, is very high due to a number of factors, ranging from aging infrastructure, the need to adopt rapidly advancing, expensive technologies, inadequate technical and managerial capacity, non-prudent procurements, etc.[107] This results in high end-user tariffs, with attendant affordability issues. For instance, due to aging infrastructure, the cost of service is high and volatile due to frequent breakdowns and the need for regular maintenance (or in some cases, replacement). Under these circumstances, it is difficult to achieve a balance between cost and revenue through a cost-reflective tariff. African countries must therefore look for alternative electricity sources like renewable energy which may have lower operational and running costs than many thermal and/or conventional power sources.[108]

[107] Energy for Growth Hub < https://energyforgrowth.org/article/what-will-cost-and-service-reflective-tariffs-mean-for-the-nigerian-electricity-sector/ >

[108] Ibid

Practical considerations for Optimising the Extractive Sector as a Source of Revenue for in Sub-Saharan Africa

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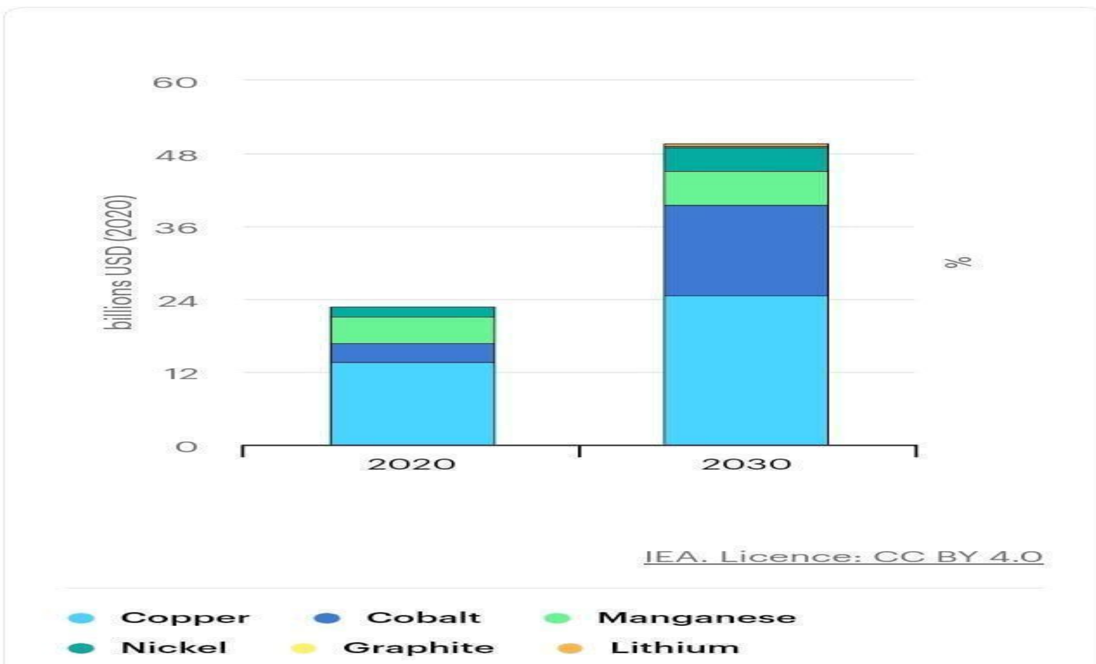
The data intelligence highlights considerations for raising revenue from the extractive sector in Africa.



The data intelligence highlights considerations for revenue realisation from the extractive sector across Africa.

Most of the world's reserves of several transition minerals reside on the African continent. 19% of the world's metal supplies needed to create a typical battery electric vehicle are found in African nations.

In addition to being important for the energy transition, Africa's mineral wealth is also the least concentrated in the world and is yet largely undiscovered. More exploration is probably going to turn up new deposits that will speed up the transition and provide African access to fresh subterranean wealth.

To possess this wealth and revenue, reducing geological risk for businesses will be necessary, for attracting exploration investment across Africa. To accomplish this, African governments may promote geological surveys that provide businesses a preliminary indication of the potential location of deposits. Subsequently, businesses can undertake more extensive exploration to confirm this possibility. But the cost of these surveys is high. Donor support for surveys would uncover new minerals that would supply the energy transition. New surveys are especially needed, as many previous surveys were conducted before the recognition that certain minerals are critical to transition technology. As the African Development Bank's African Mineral Development Centre theory of change advocates, governments should also cooperate on surveys with neighboring countries. Geology does not respect national boundaries; knowledge about minerals on one side of a border can help exploration efforts on the other.

Governments also ought to create value chains, particularly those that aid Africa's own energy transition. There is a sizable potential market in the continent for stationary battery storage for use in mini-grids and two- and three-wheel electric cars. This will make lithium, iron, and phosphate battery chemistry-based African enterprises successful. Although Africa does not currently generate a lot of lithium, African businesses can begin by making batteries, subsequently move up the value chain to make cells and cathodes, and then use their own natural resources to fuel these operations.

No single African country has all the minerals required to produce batteries, particularly lithium. Countries will need to pool mineral supply to achieve the minimum scale and reliability in case supply from one mine stops. Governments in the region will also have to closely collaborate and partner to create an African battery production industry. Recognizing this, the DRC and Zambia have established a “Joint Battery Council.”

The private sector should also play a key role in driving technological innovation in the critical minerals industry. For example, companies could invest in research and development to develop new extraction and processing methods that are more efficient and environmentally friendly. Additionally, companies could adopt new technologies, such as automation and robotics, to improve the efficiency and sustainability of critical minerals extraction and processing. This will help to ensure that the critical minerals industry remains competitive and sustainable in the long term to procure sufficient revenue for the national and global energy transition agenda across SSA.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Increasing Global Grid Investment and Innovation for the Energy Transition

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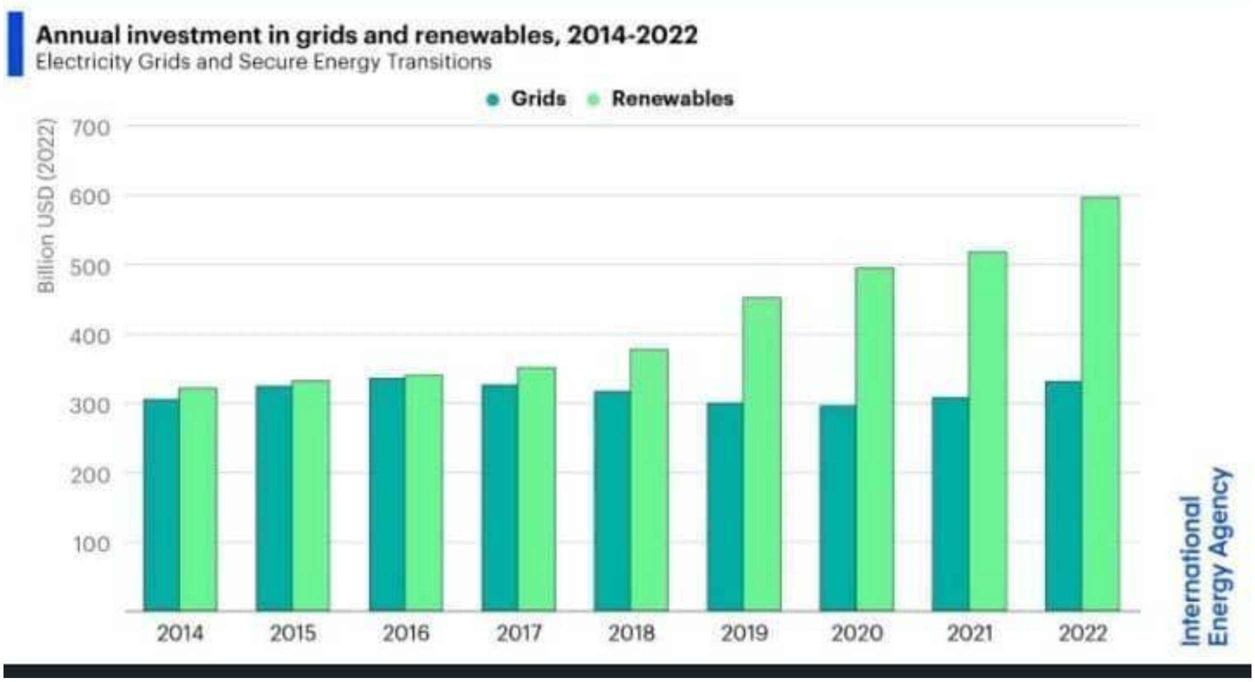
The data intelligence highlights considerations for increasing global grid investment and innovation for energy transition.



The graph shows the annual investment in grids and renewables. However, there is a decline in grid investment from 2019-2022. This will lead to bottlenecks in integrating renewables into grids in the long run.

Grids, the foundation of today's power networks, will become more crucial as the transition to clean energy develops, yet they are currently given insufficient attention. For more than 100 years, grids have been supplying electricity to homes, companies, and industries. Modern energy system transformation is being driven by clean energy transitions, which have also increased the importance of electricity in all types of economies. In order to achieve net zero emissions, nations' grids must be bigger, stronger, and more intelligent. Expanded grids are essential to enabling such levels of diversity as it relates to grid receptivity, as the world ramps up electrolysis-based hydrogen production, deploys more electric vehicles, and installs more electric heating and cooling systems. Grids are essential to decarbonise electricity supply and effectively integrate renewables.

Regulations need to be reviewed and revised to allow the deployment of new grids, alongside better asset utilization. Grid regulation must promote flexibility, in order to adapt quickly to changes in electricity demand and supply. For this, it is necessary to remove administrative obstacles, recognize and reward dependability and good performance, and promote innovation.

The biggest impediments to grid expansion vary by area. While access to capital and high capital costs are major obstacles in many emerging markets and developing economies, particularly across Sub-Saharan Africa, the financial stability of utilities is a major concern in some nations, like India, Indonesia, and Korea. Financial obstacles can be removed by enhancing grid company compensation, promoting targeted grid investment, and raising cost transparency.

Building out grids necessitates secure supply chains and a skilled workforce. Governments can support supply chain expansion by creating firm and transparent project pipelines, standardizing procurement, and technical installations, and building future flexibility by ensuring interoperability of all system elements.

There is also a substantial shortage of skilled personnel throughout the supply chain, in addition to operators and regulatory bodies. It will be critical to develop a talent pipeline, incorporate digital skills into power industry curriculum, and manage the effects of the energy transition and growing automation on workers, through reskilling and on-the-job training.

It is important that grid networking be put at the heart of national energy policy actions, commensurate to renewable energy targets and integration; to fully aid the energy transition agenda across nations and globally.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Reducing Emission Intensity of Electricity Generation in Africa

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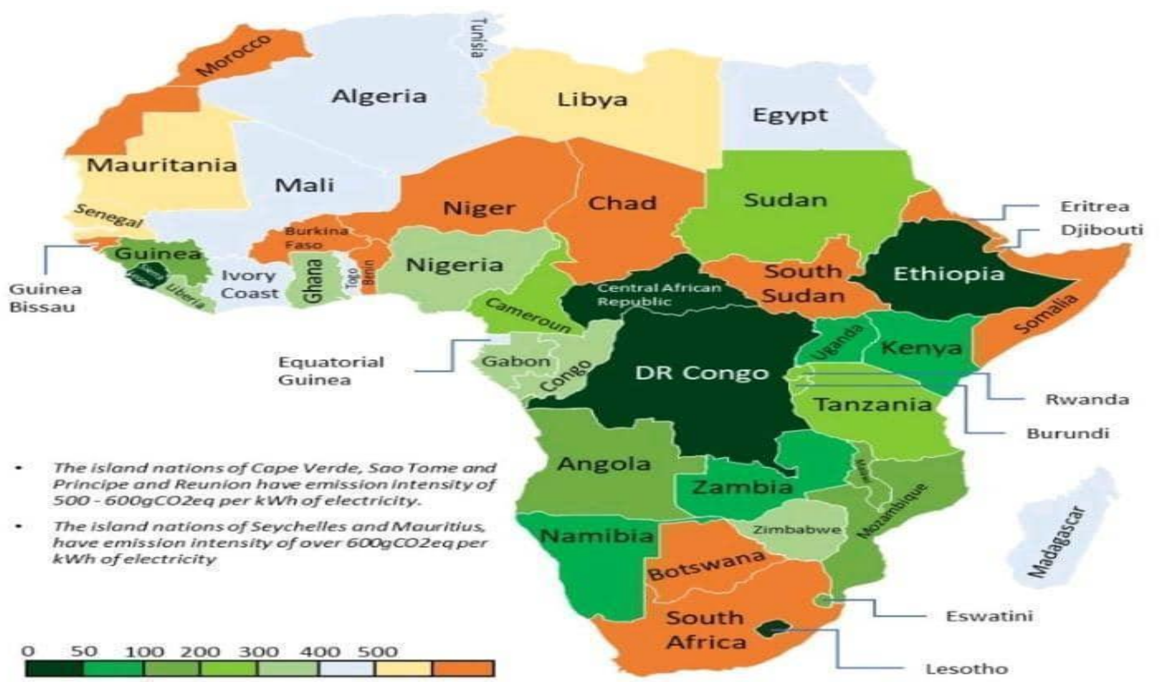
The data intelligence highlights considerations for reducing emission intensity of electricity generation in Africa.



Emissions intensity of electricity generation of African countries (gCO2eq/kWh)

SOURCE: World Bank, EMBER and Statista

Africa carries the heaviest burden of climate change effects despite contributing less than 4% of the GHG emissions. While Africa's carbon footprint is relatively low, rising population, improving standard of living, relative peace, and rising commodity prices, will increase emissions on the continent. To meet the electricity needs of over 500 million people in Africa, electricity generation per capita will need to increase by a minimum of 20 times the current levels.

Also, despite Africa's modest carbon footprint, emissions have been increasing throughout the years. For example, emissions from land usage increased by 20% between 2000 and 2018. In 2018, the agriculture industry emitted 2.2 Gt CO_2eq, accounting for 24% of world emissions, up from 18% in 2000.

The Africa continent does not have an "old economy" that needs to be decarbonized. It can invest right away in the green economy that is needed — an economy that is net positive for the planet and the people. To prevent any increases in emissions, Africa must take the lead and begin decarbonizing. Fortunately, the continent's low carbon footprint, natural treasure endowment, and significant renewable energy potential present a clear path for carrying out the decarbonisation plan. Africa holds the key to accelerating global climate action.

Africa requires a massive increase in energy production and use, which should primarily come from Africa's abundant renewable energy sources, such as solar, hydropower, wind, and geothermal, with a complementary role for sustainable biomass and synthetic fuels (such as green hydrogen) in displacing fossil fuels. To move forward, with the increase of renewable energy manufacturing capacity, clearer roadmaps and long-term energy planning will be critical for winning investor trust in local and regional renewables supply chains, in addition to a myriad of incentives provided within the legal framework.

Regardless of what individual governments can accomplish on a national level, there is a limit to how much can be accomplished in Africa without regional cooperation. Each African country offers unique comparative advantages, ranging from a diverse range of (complementary) critical minerals distributed around the region to manufacturing capability and renewable energy possibilities, in addition to access to important trade routes. All these complementary assets can be part of a well-planned strategy – perhaps an African green deal? – to build an efficient regional industrial ecosystem based on low-carbon technologies.

Furthermore, countries with high emission intensity can also explore natural gas as a transitory energy source, as part of their energy transition plan. According to the International Energy Agency, coal-to-gas switching has saved around 500 million tonnes of CO_2 - an effect equivalent to putting an extra 200 million electric vehicles running on zero-carbon electricity on the road over the same period. Given the time it takes to build up new renewables and to implement energy efficiency improvements, this also represents a potential quick win for emissions reductions. Hence, this calls for a roadmap and national strategy for African countries to implement natural gas as an energy transition fuel.

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Practical considerations for Recovering Electricity Expenditure for Power Utilities across Sub Saharan Africa

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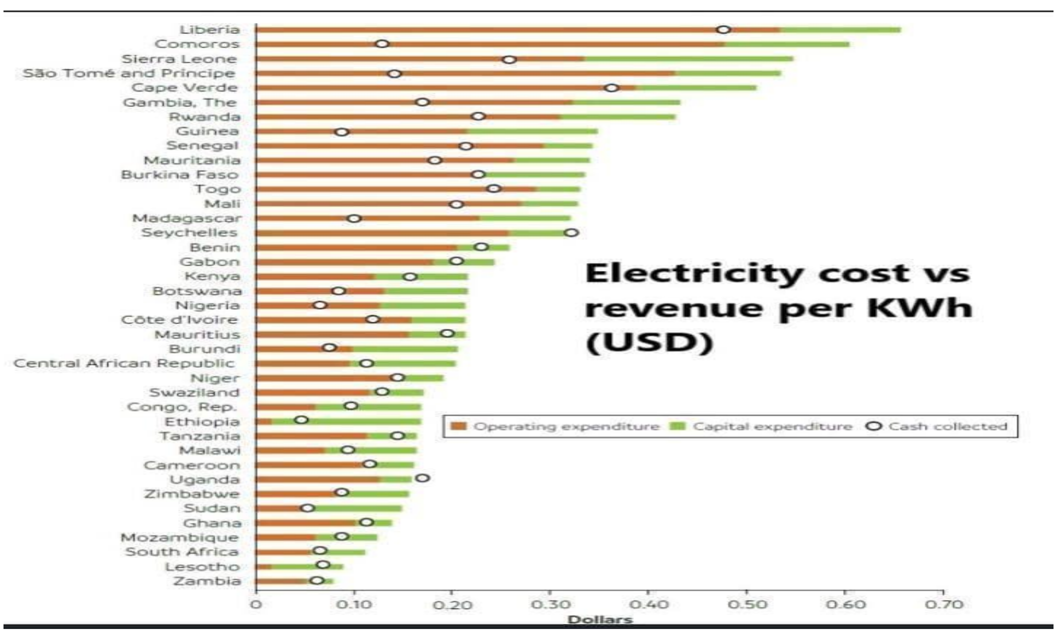
The data intelligence highlights considerations for recovering electricity expenditure for power utilities across Sub Saharan Africa.



SOURCE: World Bank

The data intelligence highlights considerations for the recovery of expenditure by utilities across Sub Saharan Africa.

The graph reveals the operating and capital expenses and the revenue received by electricity utilities across Africa, with a huge disparity. More than half of African utility companies are operating at a deficit, primarily as a result of non-technical losses, as they are unable to pay their operational costs. The only electricity providers that have recovered all of their capital and operating expenses are in Seychelles and Uganda.

The major factor for these losses is electricity theft. Energy theft threatens service delivery and advancements, reduces profit margins, and is a major issue for utility corporations. Meter tampering, theft via unauthorized connections, theft of copper wire and transformer oil, unpaid bills, and the purchase and sale of illicit prepaid vouchers are just a few examples of the different avenues of electricity theft.

Africa's utility inefficiencies cost the continent $4.5 billion a year in lost revenue. Kenya Power had 23.5% of losses in 2021 - Northern Electric Distribution Company in Ghana reports a $3 million monthly deficit and a $300 million outstanding bill; 50% of Liberia's electricity production has been lost due to theft, costing the firm $48 million; and Ethiopian Electric Utility had an annual deficit of about $100 million prior to COVID.

The repercussions of energy theft and non-technical losses are extensive, impacting not just power utilities but also the broader community. Power utilities suffer financial setbacks that make it difficult for them to make infrastructural improvements, service enhancements, and reliable power supply assurances. These losses also impair the utilities' ability to supply customers with reasonably priced electricity and obstruct the development of universal energy access. Furthermore, energy theft tilts the playing field because honest consumers are forced to foot the bill for losses brought on by theft and nonpayment.

Smart meters lower the risk of theft by recording abnormalities, detecting tampering attempts, and enabling remote monitoring. Utilities can improve billing accuracy and revenue collection by utilizing cutting-edge technologies, such as Internet of Things (IoT) devices and data analytics, to detect and immediately respond to theft.

Reducing energy theft requires active community engagement. In order to inform customers about the significance of paying for the electricity they use, power companies can set up outreach initiatives. Transparent and easily comprehensible billing information can enable customers to make well-informed decisions and help lower non-payment rates. Power utilities can incentivize customers to report energy theft and work together to address the problem by building trust and a sense of ownership.

Increasing options for payment can improve billing precision and rates of collection. Convenience and accessibility for customers can be improved by providing flexible payment plans, prepaid billing systems, mobile payment platforms, and agent networks. Power utilities can address the unique requirements and preferences of various consumer categories by expanding their payment options, which will ultimately lower non-payment and promote an accountable culture.

In addition, deploying data analytics can yield insightful information about trends in consumption, anomalies, and possible theft cases. Advanced analytics techniques can be used by power companies to prioritize investigations, identify high-risk locations, and effectively allocate resources. With the use of predictive analytics, it is possible to spot patterns and trends and take proactive steps to reduce losses and increase billing accuracy.

The abovementioned measures cannot be utilized in isolation. To reduce non-technical losses and procure revenue, a comprehensive understanding of the entire electricity supply cycle is necessary for utilities. Once this is clearly mapped, effective measures can be identified and implemented to mitigate recurring non-technical losses.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Transition from Coal to Clean Energy in South Africa.

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

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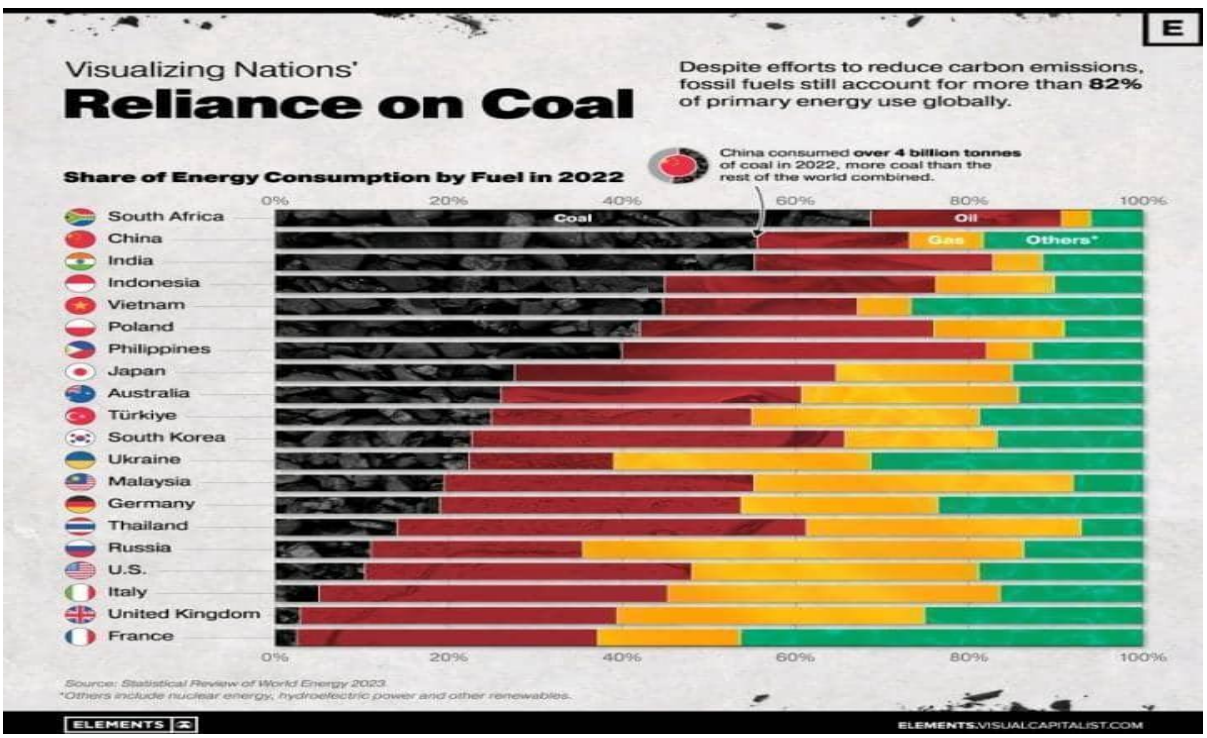


SOURCE: ELEMENT

The image shows the list of countries with heavy reliance on coal as a power source, with South Africa leading the list. Within Africa, South Africa is the

largest greenhouse gas emitter. Eskom, South Africa's utility, plans to close more than 20% of its current coal-fired power capacity by 2030, and the majority of the remaining capacity by 2050, and replace it with renewable energy sources. A just transition entails a shift away from fossil fuels, with the benefits shared by all. The change will enhance environmental and health conditions, while also creating new and better jobs. Importantly, affected communities will be able to undergo the change at a low cost and benefit from a stronger climate-resilient economy. However, with millions of livelihoods linked to the coal value chain, achieving a just transition will be difficult and must be done carefully.

South Africa must divide the energy sector into parts and deal with power supply differently in each segment. Solar and other forms of electricity generation, for example, can credibly and dependably meet the power needs of families and business outlets. Eskom can therefore focus on baseline energy and ensure that its power supply is stable and cost-effective, thus relieving it of around 40% of national demand, which comes from residential and commercial outlets.

The electricity generation sector must also be liberalized speedily. Solar energy choices are now available for households, and the majority of small and medium-sized businesses and commercial firms, given advancements in generation technology. This has the potential to create a significant number of jobs in the production and service/maintenance sectors of the industry, for example, the production of solar panels, cabling, and other related accessories. To optimize impact, Eskom and the Industrial Development Corporation of South Africa (IDC) must work together to ensure policy consistency and coordination in the construction of 3 to 5 manufacturing outlets for the production of solar panels and associated fittings. This is an essential component of an integrated energy policy. Technically, such components must be manufactured prior to the policy transition. If not, there may be a significant and unneeded strain on the balance of payment as a result of a fast increase in imported commodities.

For South Africa to expand further, careful coordination and sufficient funding of manufacturing operations are essential. When the renewable sector's manufacturing of solar panels and all connected accessories are increased, the country has the ability to generate significant growth and employment.

Also, the financial sector, especially the banking system needs to provide the required asset financing facilities to enable willing households, manufacturing enterprises, farming and commercial firms to install solar and other generation and storage facilities.

Furthermore, South Africa can increase investment in green hydrogen. This strongly aligns with Germany's and the EU's geopolitical objectives, as their hydrogen programs consider South Africa a target country for manufacturing and exporting hydrogen, although, a hydrogen economy is projected to materialise only around 2050, as the technologies for producing and transporting hydrogen are still in prototypical stage and are currently subject to subsidized research.

Finally, there should be promotion of green job creation to assist workers in transitioning out of the coal value chain. The spread of renewable energy will produce jobs, but problems will include mismatches in work location and required qualifications, in addition to education and training. Addressing these issues is critical for assisting workers displaced by the decarbonization transition and preparing the younger generation for the future.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Combating Plastic Waste to Foster the Energy Transition

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for combating plastic waste to foster energy transition.

SOURCE: Organisation for Economic Co-operation and Development

The graph reveals the level of global plastic waste recycling which is less than 10 % contributing to pollution and climate change. An astounding 8 million tons of plastic enter the ocean annually, posing a threat to marine life and degrading natural environments. This amount is anticipated to increase because,

according to a recent Pew Charitable Trust estimate, 90 million tons of plastic may find their way into the world's aquatic ecosystems by 2030, if waste management practices remain the same. A major instance is the current situation at the urban areas of Sierra Leone, including the capital city of Freetown, grappling with a significant plastic waste problem that has extended to the sea, leading to alarming consequences for marine life. According to a 2019 country brief titled, Plastic Waste Inputs from Land into the Ocean, Sierra Leone is a renowned net importer of plastic and in that year alone, nine million kilograms of plastic entered the country as imports. Unlike other materials, plastic does not biodegrade. It can take up to 1000 years to break down, so when it is discarded, it builds up in the environment until it reaches a crisis point. This pollution chokes marine wildlife, damages the soil and poisons groundwater, and can also cause serious health impacts apart from its contribution to climate change.

Policy shifts can reduce plastic waste and pollution by incentivizing changes in both business and consumer behavior, in addition to plastic design, alternatives and recycling. Among the most popular and effective legal tools employed by governments are bans and limits on single-use plastic products, which outrightly forbid their manufacture, distribution, or use. The fact that ban laws are flexible enough to grant exclusions for medical supplies and other essential uses, while simultaneously encouraging the use of substitute products like cloth or paper bags, has contributed to their success in part.

Governments can also impose taxes to deter the production or use of single-use plastics, or offer tax breaks, subsidies and other fiscal incentives to encourage alternatives to single-use plastic products. Portugal and Denmark, in particular, have effectively increased the usage of recycled and reusable products through the employment of the highlighted economic mechanisms. Certain companies (like supermarkets or plastic manufacturers) or certain goods (like plastic coffee cup lids or soda bottles) may be subject to taxes and incentives.

Furthermore, product regulations, certifications, and standards for labeling can be developed to inform the public about the dangers plastics pose to human health and safety during use and manufacture, and also about the environmental effects of plastics. Standards for material composition, reusability, recoverability (to guarantee the product may be recycled), biodegradability, and compostability can all be established by legislation pertaining to single- use plastic items. This strategy can encourage consumers to select sustainable goods.

Also, programs known as Extended Producer Responsibility (EPR) can ensure that producers of single-use plastic products continue to be accountable for the entirety of the product(s) life cycles. By making manufacturers accountable for single-use plastics throughout the collection, recovery, recycling, or reuse of products, these legislative measures help ensure more environmentally friendly designs. For instance, an EPR system implemented in 1991 in Germany mandated the payment of a license fee that was contingent on the quantity and quality of packaging manufacturers annually placed into the market.

Finally, cold plasma pyrolysis can be used to convert plastics into hydrogen, methane and ethylene. Hydrogen and methane produce small amounts of soot and carbon dioxide when burned, making them a cleaner source of energy than fossil fuels. The ethylene produced can be used to create more plastic products and contribute to a circular economy - where waste materials are recycled into new, marketable products and added back into the economy. Although this is subject to more research and development, it further engenders the energy transition agenda in nations.

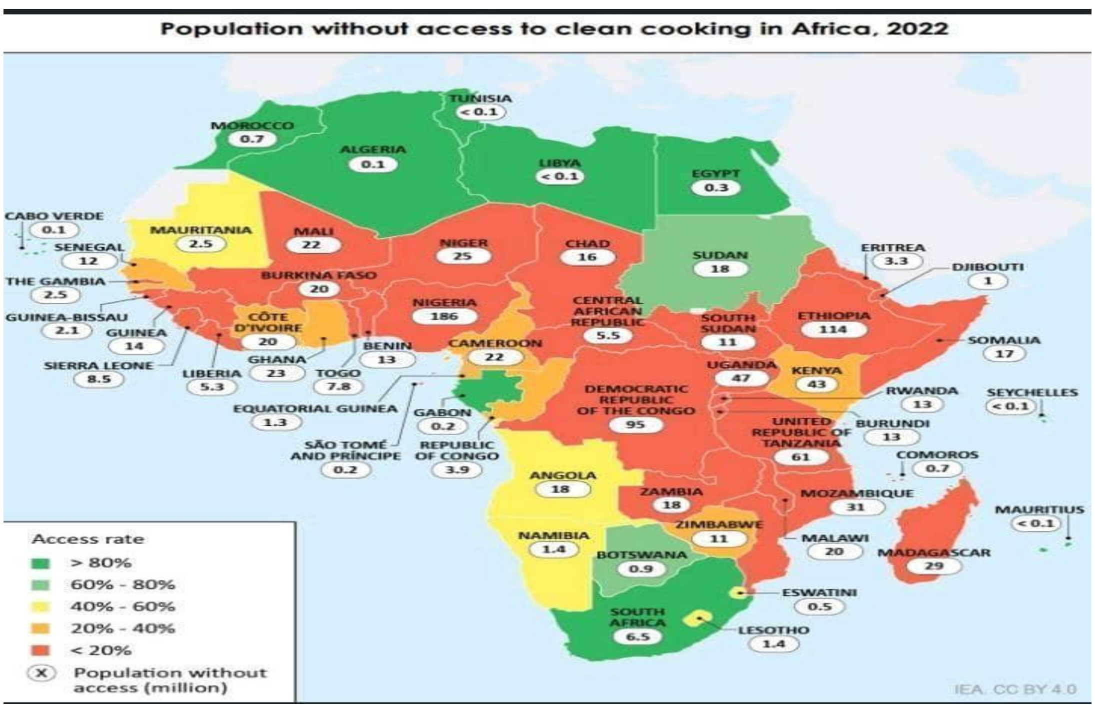
The adoption of the above referenced mechanisms can promote sustainable production and consumption of plastics from product design to environmentally sound waste management, through resource efficiency and circular economy approaches.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Improving Access to Clean Cooking in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for improving access to clean cooking in Africa.



SOURCE: International Energy Agency

The map shows the population without access to clean cooking in Africa in 2022, with majority of countries having access rate of less than 20%. Clean cooking refers to using purer fuels and energy-efficient modern stoves for domestic use. Over the last decade, in a growing number of developing countries, there has been a welcome shift towards the use of cleaner and more sustainable cooking technologies and fuels, away from the traditional practice of cooking over smoky open fires. In Sub-Saharan Africa (SSA), however, over 82% of the population (~700 million people) remain dependent on solid fuels such as charcoal, dung, fuelwood, and other biomass for cooking purposes—and this number is projected to increase to 900 million by 2030.

The lack of widespread access to clean fuels and cooking technologies has been shown not only to endanger health and exacerbate gender inequality, but also to harm the world's fragile climate through deforestation caused by unsustainable wood harvesting and the use of polluting fuels in inefficient stoves. These activities emit greenhouse gases and climatic pollutants including black carbon, the second-largest contributor to climate change after carbon dioxide.

Affordability is one of the known barriers towards adopting clean cooking technology in Africa. However, subsidies can help bridge the affordability gap by reducing the upfront and recurring costs of clean cooking systems; such subsidies have been instrumental in expanding clean cooking in South Africa. The South African government focused on creating regulation to ensure safe devices, in addition to funding cookstove and fuel initiatives in areas where electricity is not available, to further propagate clean cooking. China's coal-to-electricity program, in which a ban on household coal use was implemented alongside subsidies for new technologies, demonstrates policy mechanisms that jointly consider clean fuel adoption and disincentives for the use of polluting fuels.

Despite noteworthy actions in the area of clean cooking initiatives, there is a considerable need to intensify awareness, especially in rural areas. Rural regions barely have access to conventional information channels like tv and social media, which could result in low awareness in these areas. Thus, there is a need for the government to invest in a substantial amount of in-person and radio awareness.

Furthermore, empowerment and mentorship programs for women entrepreneurs in the clean cooking value chain have proven effective in promoting a more gender-inclusive workforce. Better representation of women in energy sector policy and decision-making and more active participation of women entrepreneurs in the clean cooking value chain are important ways to advance gender equity and ensure that efforts to expand access meet the needs of cookstove users.

Finally, there is a need to involve a wide array of actors and stakeholders. Local and national governments, research institutes, international aid organisations, financial institutions, and civil society organisations all have a role to play in the transition. In order to be effective, there is a need to coordinate and strengthen their efforts in capacity-building, awareness creation, facilitating dialogue and scaling up finance to enable access for both retailers and consumers. Donor organisations could engage with governments and the private sector to provide technical assistance for institutional capacity building and the establishment of technical standards for cookstoves, financing research and development of efficient technologies that benefit human health and the environment.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for adopting CNG and LNG as Alternative Fuels in Africa

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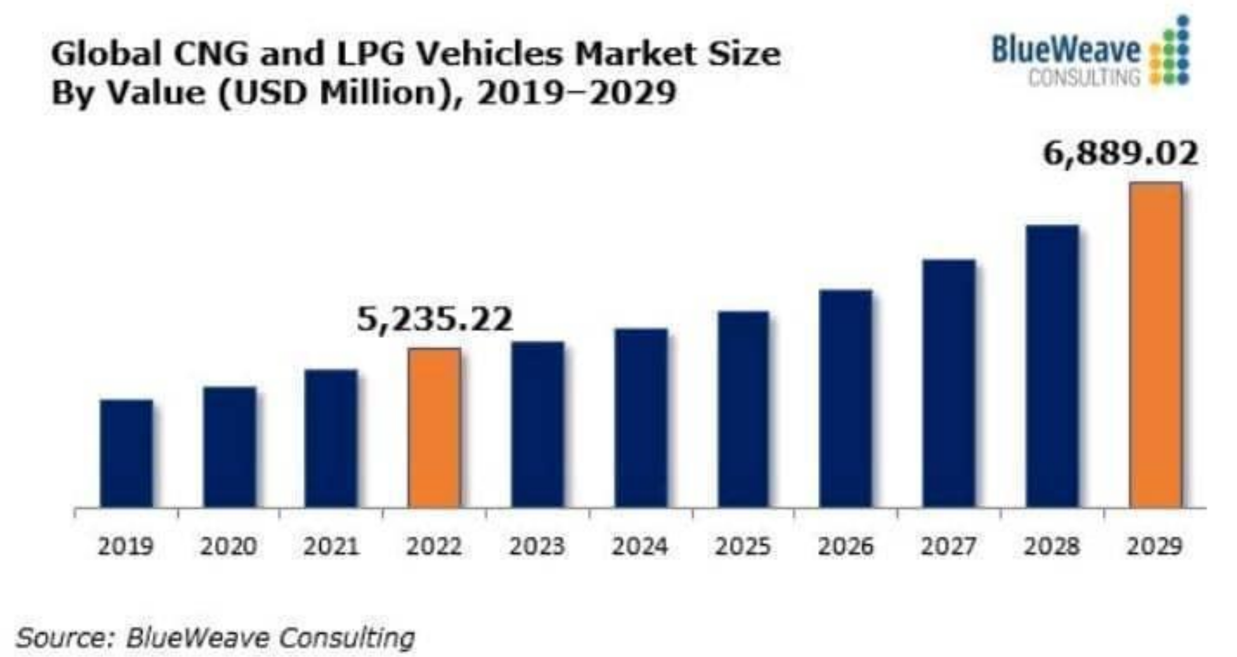

SOURCE: BlueWeave Consulting

Road transport in Africa accounts for nearly 13% of global CO2 emissions, and with recent increases in oil import prices, governments are stepping up efforts to develop cleaner engines that run on alternative fuels such as batteries, compressed natural gas (CNG), liquified petroleum gas (LPG), and a variety of biofuels. Due to the region's declining air quality and increasing air pollution, governments are encouraging end users to convert their conventional fuel vehicles to bio-fuel vehicles such as CNG and LPG fuel, as these fuels are environmentally friendly and emit less carbon dioxide. Switching to CNG can help mitigate greenhouse gas emissions. CNG has been proven to be less expensive than competing fuels in terms of fuel cost and efficiency. The difference varies between 35% and 75% when compared to diesel and gasoline, 20% when compared to electric vehicles, and 60% when compared to gasoline-electric hybrid vehicles.

In addition, companies from Middle East are investing in Africa to boost the CNG fuel station infrastructure. For instance, in August 2022, companies from Iran invested USD 2.5 billion to boost natural gas supply in South Africa. In addition, Nigerian companies announced their plans to work with the Nigerian government to build 10,000 fuel stations for CNG. Considering these prime factors, demand for compressed natural gas is anticipated to witness the highest growth potential.

For the adoption of CNG, the areas that require more attention are the development of emissions regulations, the adoption of safety standards and the periodic testing of CNG cylinders, guidelines and audits of conversion workshops and vehicle inspection, quality control maintenance program, and the certification of conversion kits, which should be integrated into extant legal frameworks relevant to regulation of gas in African countries.

It is therefore recommended that countries adopt strict standards for cylinders to ensure their safety and integrity. Cylinders must undergo periodic testing, such as hydrostatic testing, to verify their structural integrity and compliance with safety specifications.

Furthermore, it is critical to promote safety education and awareness among customers, distributors, and industry professionals. To educate users about potential hazards and best practices, training programs and campaigns on safe handling, installation, and use of the gases should be implemented. Also, safety labels and instructions on cylinders and appliances can assist consumers in understanding proper usage and taking necessary precautions.

Regular inspections and audits by regulatory bodies should be mandated to ensure compliance with safety standards. These inspections should focus on facilities, distribution networks, and consumer premises to identify and rectify potential safety hazards. A well-regulated LPG & CNG sector will attract investment and create employment opportunities, however, the relevant regulations and safety standards should be in place beforehand, to realise the accruable benefits to the region.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Achieving the $100 Billion Climate Finance Pledge to Combat Climate Change in Developing Nations

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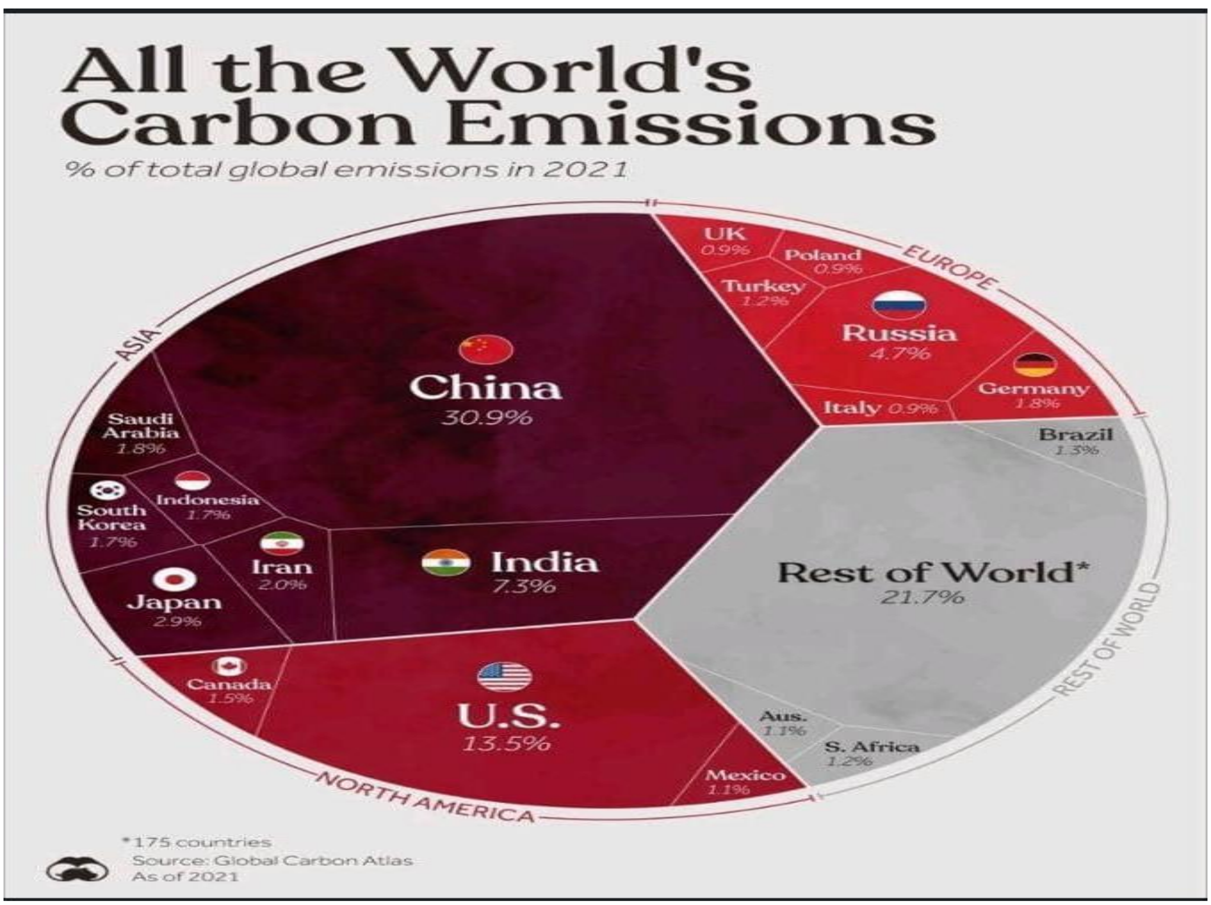
The data intelligence highlights considerations for achieving the $100 billion climate finance pledge to combat climate change in developing nations.



SOURCE: Global Carbon Atlas

The chart above shows that majority of the global carbon emissions come from industrialized and developed nations. According to former National Aeronautics and Space Administration (NASA) scientist James Hansen, industrialization in Europe, North America, Australia, and Japan was responsible for 77 percent of global emissions between 1751-2006. Rich industrialized nations still account for more than one third of emissions, even though China is the country with the highest share at present In contrast, less than 4% of the world's emissions currently emanates from Africa and other developing nations.

According to Oxfam's Climate Policy Lead Nafkote Dabi, 'Wealthy countries bear a disproportionate amount of the blame for the climate crisis. They have a dual responsibility to reduce emissions at home and to assist developing countries with the costs of rebuilding homes and replanting crops after storms, in addition to switching from dirty energy sources to cleaner, lower-carbon ones."

At the Conference of Parties (COP)15 in 2009, developed countries committed to a collective goal of mobilising USD 100 billion per year by 2020 to support climate action in developing countries. Developed countries' commitment to mobilise $100 billion a year by 2020 to support developing countries on climate action is both an intensely important symbol of trust and foundational to progress on climate action by developing countries. Although donors collectively fell short of the goal in 2020, there is however an opportunity to step up and deliver. Fulfilling the $100 billion pledge involves more than just adding up the numbers; it also involves assessing the structure and influence of climate finance, in addition to fostering ambition for 2025 and beyond. Developing nations have significantly higher needs than $100 billion on an annual basis. Therefore, climate finance needs to keep expanding over time and contribute to hastening the overall shift in financial flows required to give life to aspects of the Paris Agreement via a number of strategies.

The private sector and the official sector must work together to greatly expand the mobilisation of private finance. Current developments highlight the enormous potential that exists for the private sector to mobilize and direct funding, and to make climate investments in developing nations, including energy transitions. Through blended finance, private capital can be mobilized and investments that would not otherwise materialize can be made. Nevertheless, the amount of private capital being raised currently is simply too insignificant; and will need to grow significantly. Specifically, inadequacies in the policy and regulatory framework, a dearth of well-prepared, bankable projects, insufficient risk mitigation mechanisms, and a lack of financial channels linking deep sources of funding with investments are barriers impeding private finance for sustainable infrastructure and climate that should be investigated.

All parties should pursue innovative solutions to scale up and leverage climate finance. Strong private philanthropic donations are one option to mobilize concessional financing since they have the potential to cover needs that other donors might not be open to. Voluntary carbon markets are another means of raising debt-free capital. There is potential to raise financing in the many tens of billions of dollars, which could be directed toward objectives like expediting the phase-out of coal and restoring damaged land and forests. However, mechanisms must be put in place to ensure the quality and integrity of such finance.

Additionally, assisting nations in creating and putting into practice domestic policies that might hasten the large-scale mobilization of funds and enable them to execute Nationally Determined Contributions (NDCs) in a manner consistent with recipient nations' national development goals is pertinent. This is a fundamental element of bilateral climate finance for many developed nations. Developed countries should collaborate with partner nations to help promote investment-friendly business climates, including sound governance and transparency.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for Adopting Nuclear Energy in Africa's Energy Mix

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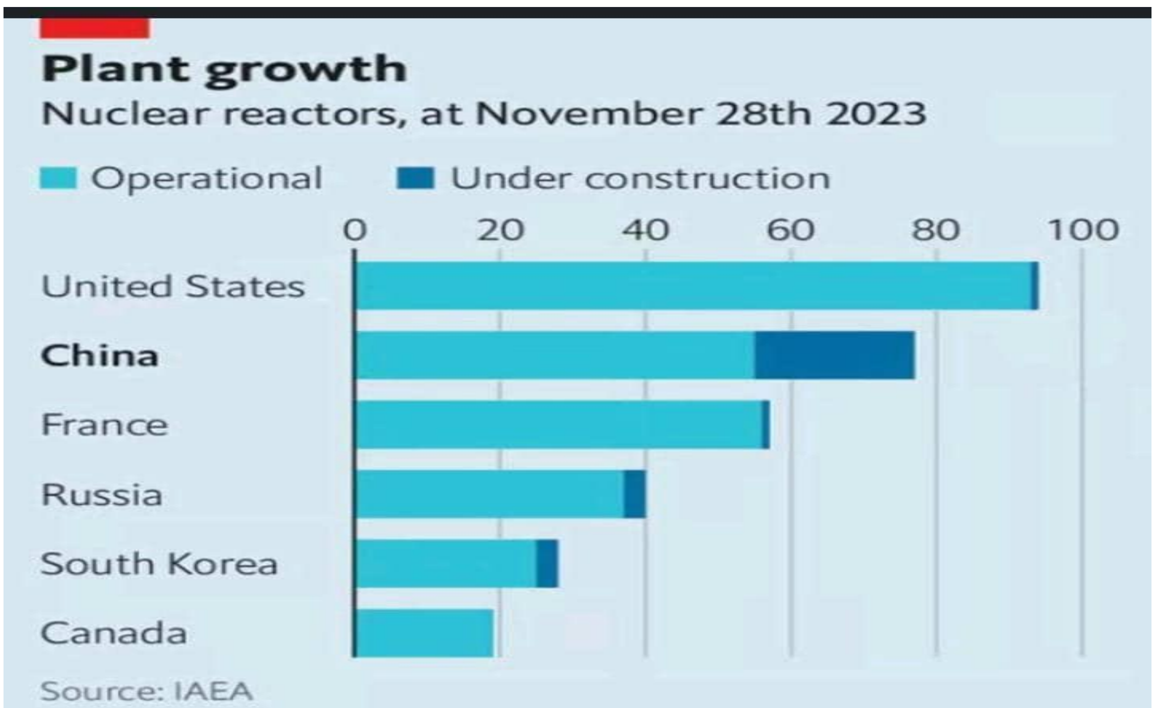

SOURCE: International Atomic Energy Agency

One of the highlights of the recently concluded Conference of Parties (COP) 28 is the adoption of nuclear energy in the global energy mix. The graph, however, shows the status of nuclear reactors globally as of November 28, 2023; of which no African country is featured. The need to look at nuclear energy as a major component of Africa's future energy mix is imperative, as it does not emit greenhouse gases during operation. The continent presently has only one nuclear power station, which is located in Cape Town, South Africa, although other African countries like Ghana, Uganda, Rwanda, etc., hope to establish nuclear power facilities. There are, however, international treaties and procedures that states must follow and adhere to.

The decision to implement nuclear power requires expert and public input in the early stages of the development of the policy. African governments, through a national advisory and consultative process should seek expert views and consult the general population, in addition to individuals, agencies and organizations, which represent various interest groups. Prominent and experienced technical, financial and policy experts with balanced views should be drawn into this process as advisors to the government, and moderators and coordinators of public discussion forums.

Any African country aspiring to embark on a civil nuclear power program needs to develop a robust legislative and regulatory framework. The Forum of Nuclear Regulatory Bodies in Africa (FNRBA) was established in 2009 to improve, strengthen, and unify broad nuclear development challenges. This is a step in the right direction for African countries, as nuclear technology is highly legislated and regulated. The International Atomic Energy Agency (IAEA) is mandated by the United Nations to guide and advise countries wanting to introduce nuclear power into their energy mix. Thus, in order to be ready for this technology, African governments need to develop legislation and infrastructure that will enable effective regulation of the industry and each country is required to have a regulatory body with sovereign powers of regulation and enforcement.

The issues of nuclear project safety, cost, and environmental management of nuclear waste are well known to the public and the proponents of nuclear power will need to demonstrate that these issues are properly addressed and their impacts on the development programme are considered. Hence, the public should also be included in the environmental assessment process for the particular location and project, particularly individuals who live in the region surrounding the potential site. However, after the valid public concerns have been resolved to the satisfaction of the government and regulatory permissions for the project have been given, a legislative structure should be in place to safeguard the project from unnecessarily disrupting usage of the public input process.

In addition, nuclear power projects have a long duration of development and implementation, and it is necessary for African government to provide assurances through policy and legislation that the long-term interests of the investors are not adversely affected by political changes.

Furthermore, the financing of a nuclear power plant is the most challenging element of the realization of the project. The major reason for the difficulty in financing is a high capital cost of nuclear plants, in particular reactor units with larger outputs. As a result, there has been no nuclear project financed in recent years without the direct or indirect involvement of the government of either the country offering the technology or the country receiving it. The means of financial involvement of the government may include direct supply of funds to the project, guarantee of loans from export credit agencies and commercial banks, guarantee of long term power purchase agreements, etc.

Finally, development of adequate local knowledge and expertise for the development of the nuclear power plant is part of the basic infrastructure, and in the long run is the most economical option for African countries.

Nuclear energy has the potential to help African countries achieve developmental outcomes, specifically electrification and increased access to energy, by taking into consideration the highlighted legal, regulatory and policy mechanisms for increased adoption.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Keeping 1.5C alive as Recommended by the International Energy Agency

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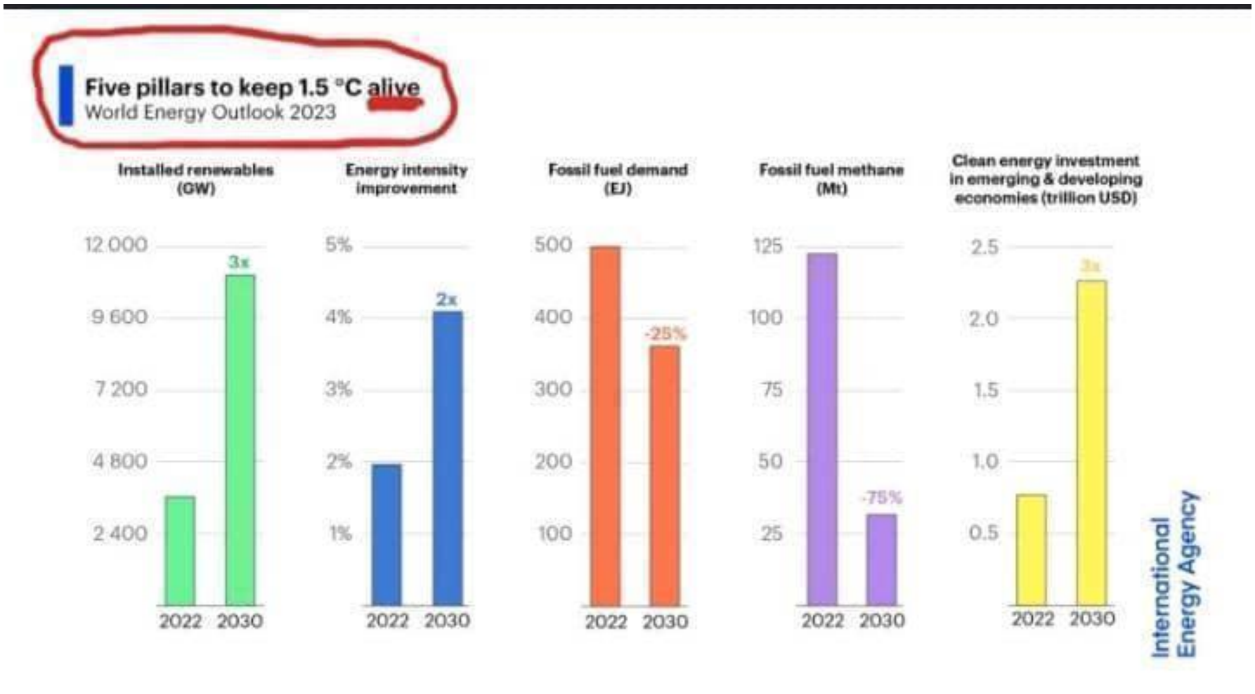

SOURCE: International Atomic Energy Agency

The IEA's recent World Energy Outlook 2023 shows that keeping the door open to 1.5 ºC requires agreement and action on five interdependent measures.[109] Those central

[109] What does COP28 need to do to keep 1.5C alive ? < https://www.iea.org/commentaries/what-does-cop28-need-to-do-to-keep-1-5-c-within-reach-these-are-the-iea-s-five-criteria-for-success >

pillars for action between now and 2030 as depicted on the graph above are: to triple global renewable power capacity; double the rate of energy efficiency improvements; cutting methane emissions from operations by 75%; establish large-scale financing mechanisms to triple clean energy investment in emerging and developing economies; and decline in the use of fossil fuels. [110]These pillars are lofty initiatives that will demand legal, regulatory and policy approaches to be delivered.

It is however important to note that none of the five pillars work without the others. And achieving them will also require a host of accompanying measures, such as expanding electricity grids**,** scaling up low-emissions fuels, and building more nuclear plants.[111]

To increase installed renewables, renewable energy technology should be a global public good - meaning available to all, and not just to the wealthy. It will be essential to remove roadblocks to knowledge sharing and technological transfer, including intellectual property rights barriers.[112] A robust supply of renewable energy components and raw materials is also essential. More widespread access to all the key components and materials - from the minerals needed to produce wind turbines and electricity networks, to electric vehicles - will be key which will take significant international coordination to expand and diversify manufacturing capacity globally. [113] Energy efficiency and intensity are critical tools for financial viability and energy security as energy demand and the pursuit of clean energy options continue to intensify.[114] Energy efficiency building blocks should include regulatory actions (standards) to raise the bar of new equipment and construction efficiency; and integrated planning to prioritize energy efficiency in national economic and environmental policies across countries.[115]

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[110] Ibid
[111] Ibid
[112] Five Ways to jumpstart the RE Transition < https://www.un.org/en/climatechange/raising-ambition/renewable-energy-transition >
[113] Ibid
[114] World Energy Outlook 2023 < https://iea.blob.core.windows.net/assets/42b23c45-78bc-4482-b0f9-eb826ae2da3d/WorldEnergyOutlook2023.pdf >
[115] Ibid

Fossil-fuel subsidies are one of the biggest financial barriers hampering the world's shift to renewable energy and encouraging fossil fuel demand. Fossil fuel subsidies are both inefficient and inequitable. Shifting subsidies from fossil fuels to renewable energy will only cuts emissions, it also contributes to the sustainable economic growth, job creation, better public health, and more equality, particularly for the poor and most vulnerable communities around the world.[116]

Methane emissions could be reduced very quickly if countries and companies were to adopt a set of tried and tested measures and policy tools related to leak detection and repair requirements, technology standards, and a ban on non-emergency flaring and venting.[117] In the oil and gas sector, these measures would cut methane emissions from operations by half. There is a role for governments in implementing and enforcing policies and regulations to incentivise or require early company action, but oil, gas and coal companies carry primary responsibility for methane abatement and should move quickly towards a zero tolerance approach to methane emissions without waiting until legislation compels them to do so.[118] Banks, investors and insurers have an opportunity to add to the pressure for more rapid action by incorporating methane abatement into their engagement with the hydrocarbon industries with the aim of promoting strict performance standards, verifiable methane reductions, and transparent and comparable disclosures on measured emissions.[119] There is also scope for consumers to work with suppliers to create a market for certified low-emissions fuels and to provide economic incentives for methane abatement.

Finally, to increase financing mechanisms to increase clean energy investments will need to involve investment in human and institutional capacity and strong energy sector governance to help generate a pipeline of well-structured programmes and projects.[120] Also, there should be an enhanced international support, including significantly more concessional finance and technical assistance to mitigate country

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[116] Five Ways to jumpstart the RE Transition < https://www.un.org/en/climatechange/raising-ambition/renewable-energy-transition >

[117] World Energy Outlook 2023 < https://iea.blob.core.windows.net/assets/42b23c45-78bc-4482-b0f9-eb826ae2da3d/WorldEnergyOutlook2023.pdf >

[118] Ibid

[119] Ibid

[120] Ibid

and project risks and to act as an anchor for new instruments and platforms capable of attracting domestic and international investment capital at scale.[121] Bilateral and multilateral development banks have an important role to play in advising on policy frameworks, financing and helping to develop early-stage projects, and using concessional capital to mobilise larger multiples of private capital.[122]

[121] Ibid
[122] Ibid

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Battery Energy Storage Systems in Africa

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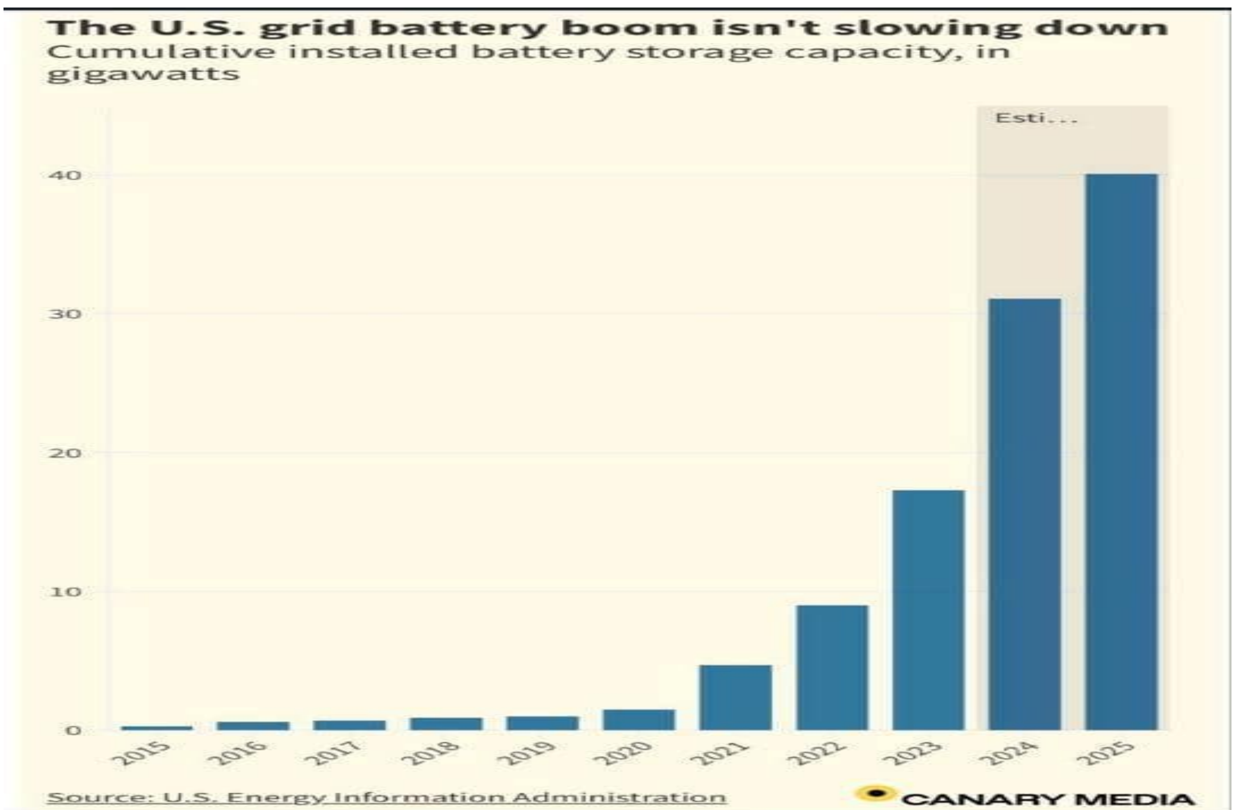
The data intelligence highlights considerations for promoting battery energy storage systems in Africa.



SOURCE: U.S Energy Information Administration

The graph shows the increase in capacity of United States grid battery storage and its forecast till 2025, due to the favorable extant legal framework. African countries can use US as a case study to encourage BESS investment and utilization via their respective legal and regulatory frameworks.

Attractive costs for solar and wind power and cutting-edge innovations are making clean energy a compelling proposition in Sub-Saharan Africa, which faces the world's largest gaps in electricity access. However, solar and wind power are variable by nature, making it essential to find effective ways to store the electricity they produce, for use when it is needed the most. Energy storage – batteries in particular can help to solve the problem. Batteries are critical to supporting Sub-Saharan Africa's energy access goals. Batteries play a role in both an off-grid and weak-grid context, by enabling the use of decentralized energy technologies, such as solar home systems (SHS), and improving the reliability of the grid. Through their impact on energy access, batteries unlock significant improvements in health, education and productivity.

A first step will be to increase partnerships between stakeholders across African countries and internationally. Given the fragmented or immature nature of each market, these coalitions will be essential to: inform the development of regulation and standards by policy-makers; ensure the creation of sustainable business models and market incentives that align with policy ambitions; and increase awareness of the most effective policies and industry techniques. In all markets, strong government leadership will be a major success factor in promulgating legal and financial frameworks and mechanisms favourable to battery energy storage systems in Africa.

Furthermore, utility-scale BESS requirements may include determining appropriate project deployment sites, establishing safety standards to prevent hazards (such as fire, thermal runways, explosive, chemical, and toxic leaks, etc), and addressing asset end-of-life issues. This will necessitate the development of a regulatory agency armed with the technical know-how and standards for renewable energy technology.

Also, there may be a need for market restructuring in Africa. Many African nations still maintain vertically integrated monopolies today. In terms of electricity, this means that utilities handle the generation, transmission, distribution, and retail tasks. This restricts BESS's capacity to compete in the electricity market, which comprises of a large number of independent power producers. For instance, the United Kingdom (UK) model is a perfect platform to quickly deploy BESS capacity into the electricity system, as a result of the UK's unbundled energy industry and wholesale market.

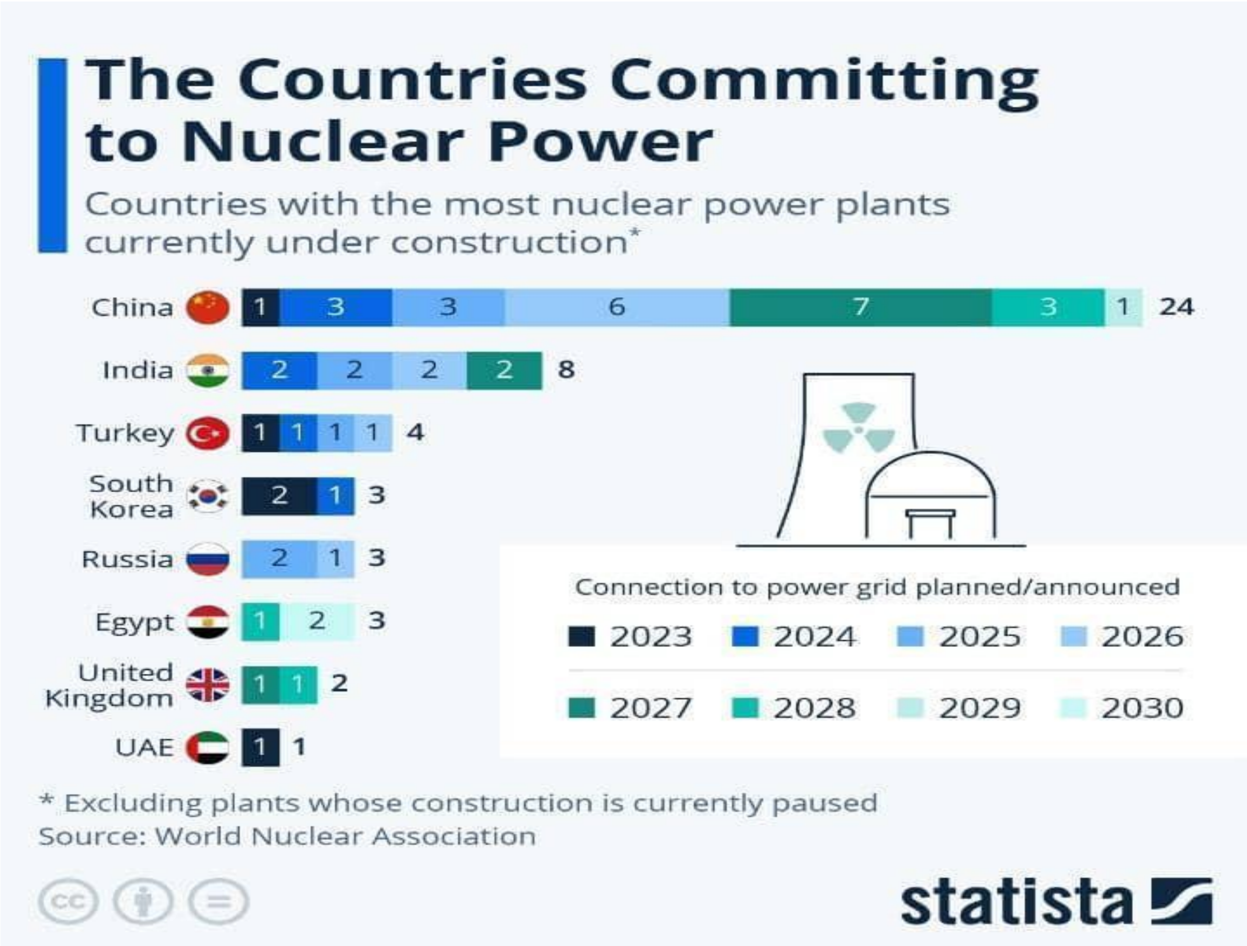
Finally, there are limited incentives and goals in place in Africa to promote investments in BESS technologies. Energy storage procurement goals for utilities are one of the quickest ways to promote energy storage, as was undertaken in California, (United States of America). The financial incentives available to industrial, commercial, and household clients to construct and use energy storage systems is a major area of concern for developed European nations. Although the U.S. Storage Act, which would have offered a 30% tax credit for installed energy storage, was not passed, it is still a great tool that can be adopted by African governments; in promoting BESS in the region.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Nuclear Energy as an Energy Source in Africa's Energy Mix

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for promoting nuclear energy as an Energy Source in Africa's Energy Mix.



SOURCE: STATISTA

The graph reveals countries' commitments to nuclear power in terms of construction of power plants, where Egypt is the only African country. The need to consider nuclear energy as a major component of Africa's future energy mix is imperative, as it does not emit greenhouse gases during operation. Many African countries have shown interest in nuclear energy in later years such as the Revised Energy Policy of Uganda for 2023 which promotes nuclear energy alongside renewables, targeting a 45% contribution from nuclear power to achieve a total capacity of 52,841 MW by 2040. This is similar to Kenya that presently stands at Phase 2 of the International Atomic Energy Agency's (IAEA) milestone approach, positioning itself for the construction of its inaugural nuclear power plant (NPP) by 2031, with construction slated to commence by 2027.

However, expert and public participation is crucial throughout the early phases of policy formation for implementing nuclear power. African governments, via a national advisory and consultative process, should solicit expert opinion and consult the general public, alongside agencies, and organizations representing diverse interest groups. Experts from technical, financial, and policy fields with diverse perspectives should serve as government advisers and moderators for public debate platforms.

In order to further nuclear energy development, African governments must take a strategic approach to engaging with nuclear reactor manufacturers. Maintaining competitive tension throughout the procurement process is critical for guaranteeing a thorough selection of the most qualified manufacturer(s). This entails asking different manufacturers to bid for projects and evaluating submissions based on technical knowledge, experience, and cost concerns.

Before commencing a nuclear energy project, African countries must establish a clear vision of their energy requirements, available resources, and stakeholder status. This strategic vision is critical in selecting the most appropriate reactor technology for the nation's needs. Additionally, recognizing the necessary resources for development and operation is critical.

Furthermore, the public is aware of the concerns surrounding nuclear project safety, cost, and environmental management of radioactive waste; thus, proponents of nuclear power will need to show that these concerns are appropriately addressed and that their effects on the development program are taken into account. Therefore, the public, especially those who reside in areas surrounding possible sites, should be included in the environmental assessment process for the specific location and project.

In addition, nuclear power projects have a long duration of development and implementation, and it is necessary for African governments to provide assurances through policy and legislation that the long-term interests of the investors are not adversely affected by political changes.

Finally, collaboration on a regional scale is strongly encouraged for the advancement of nuclear energy projects in Africa. Regional cooperation allows countries to pool resources, share knowledge and expertise, and collectively address the challenges associated with building and operating nuclear reactors. Establishing a common regulatory framework through collaboration ensures standardized safety and security measures across the region.

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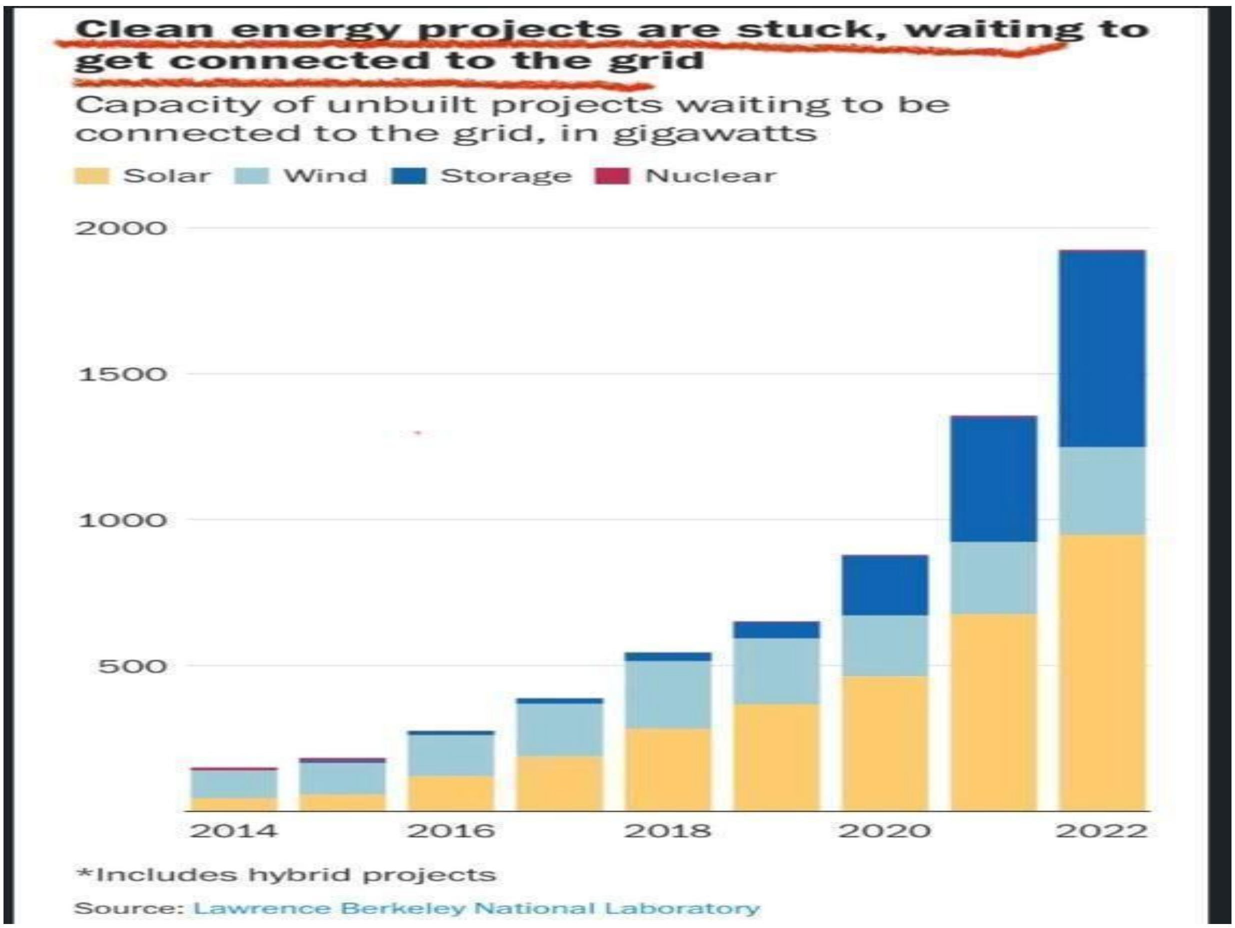
Practical Considerations for Integrating Clean Energy Projects to Grids

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for integrating clean energy projects to grids.



SOURCE: Lawrence Berkeley National Laboratory

The chart shows the increased number of clean energy projects waiting to be connected to the grid year on year. Renewable energy projects, such as solar power plants, wind farms, and hydropower installations, play a vital role in transiting to a clean and sustainable energy future. To maximize their impact and ensure a reliable energy supply, it is essential for these projects to be seamlessly integrated into the existing power grid. Connecting renewable energy projects to the grid allows for the effective integration of clean energy into existing power infrastructure. However, this process raises technological concerns, legal restrictions, and requires collaboration between project developers and grid operators. Before a power project can be operational, the grid operator must examine its connections with the power grid to determine transmission infrastructure modifications required to support the project and apportion those upgrade costs to developers. Most interconnection queues have massive backlogs, and the assessment procedure might result in years of delays.

Renewable energy integration/connection will involve renovations and adjustments to the current grid infrastructure. Transmission and distribution infrastructure must be improved to handle greater capacity, allow for bidirectional power flow, and connect remote renewable energy sources. These infrastructure improvements need considerable expenditures/investments and careful planning to assure grid dependability and resilience.

Also, to effectively integrate renewable energy, grid management and control techniques must be agile and adaptable. There will be need for advanced algorithms and real-time monitoring systems to allow grid operators to optimize electricity flow, balance supply and demand, and minimize possible grid instabilities.

Furthermore, grid integration is premised on the notion that market participants have sufficient information to make efficient generation siting and technology decisions on projects. However, there has been continued concern that inadequate access to information is contributing to high volumes of interconnection requests, high project withdrawal rates, interconnection processing delays, and an overall inequitable system. Regulations can be developed and enforced to spur improved access to and quality of interconnection data with the industry. There can also be orders made to require regulators to make a significant amount of information on interconnection study models and modeling assumptions ("study data") available to interconnection customers. This information can either be available publicly or, upon request through nondisclosure agreements.

Grid interconnection standards and regulations vary across jurisdictions. They are typically defined by regulatory authorities and grid operators to govern the technical, safety, and contractual aspects of grid connection. Permitting procedures coupled with comprehensive interconnection standards are necessary. A comprehensive set of requirements nationwide will reduce uncertainty and ambiguity for all stakeholders and ensure that state-of-the-art equipment/project is installed.

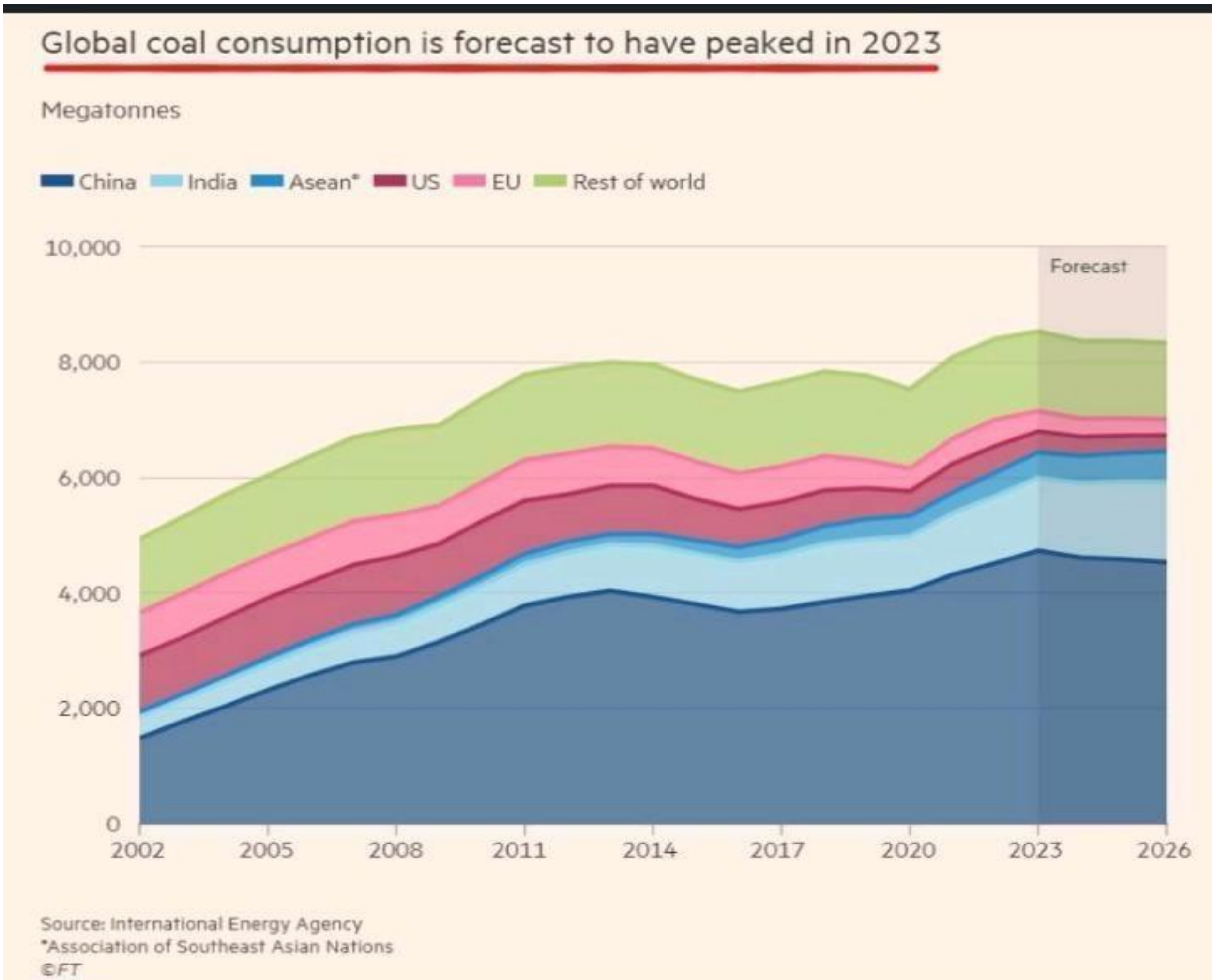
Connecting renewable energy projects to the grid can be challenging. Grid capacity limits, grid access restrictions, difficult administrative processes, and financial concerns are all examples of such challenges. However, measures such as grid expansion and improvements, faster regulatory procedures, and supporting policies may assist to overcome some of these issues and make grid connection easier and seamless for renewable energy projects.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for abating Global Coal Consumption

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for abating global consumption.



SOURCE: IEA

To avert the worst consequences of the climate crisis, the world must handle a major carbon emitter. Coal, the world's greatest source of power, accounts for 30% of total global carbon dioxide (CO2) emissions. To stay below the critical 1.5ºC global warming level(s), coal use must be reduced by 80% between 2018 and 2030. Every future pathway for the global energy sector that avoids severe impacts from climate change involves early and significant reductions in coal-related emissions.

A massive scale up of clean sources of power generation, accompanied by system-wide improvements in energy efficiency, is key to unlocking reductions in coal use for power and emissions from existing assets. Ceasing the addition of new, unabated coal-fired assets to power networks is crucial for reducing emissions from coal. The International Energy Agency (IEA) reports that over the past ten years, the number of new project approvals has decreased significantly. However, there is a chance that the current energy crisis will encourage a renewed willingness to approve coal-fired power plants, especially considering the findings of the IEA, that approximately half of the 100 financial institutions that have supported coal-related projects since 2010 have not committed to restricting such financing, and another 20% have only made weak pledges.

In the absence of an outright ban on coal plants, controlling their impact on the climate can provide a means to phase out coal usage. This may also include pressuring national governments to enforce implementation of existing regulations or establishing new regulations to curtail its usage. In 2010, Tokyo introduced a cap-and-trade scheme to achieve efficiency improvements in buildings and introduced mechanisms to reward the procurement of renewable energy, which has reduced coal consumption and cut several million tonnes of emissions.

For individuals working in the coal power industry and the attendant communities, the transition to clean energy can have significant social and economic impacts. Coal-industry jobs are mostly outside city jurisdictions, but where they are within municipal boundaries, nations must help to ensure a just transition for affected workers. This may involve converting fossil-fuel infrastructure to renewable energy-based infrastructure. In Germany, for example, the Prosper-Haniel coal mine is being converted into a 200MW pumped storage hydroelectric reservoir; in addition to investing in training and compensation programmes to help equip workers for a new role in a low-carbon industry.

For residential and building sectors, nations can consider regulating emissions with building codes that will incentivise public and private building owners to supply buildings with renewable electricity. New York City, for instance, will require existing large buildings to meet strict emissions limits from 2024 – and the limits are set to be stricter over time. In the case of emerging markets and low-income countries, the international community can provide financial and technical assistance (e.g., the know-how needed to build grids that work with intermittent power sources, such as wind and solar) and limit financing of new coal plants. Cleaner alternatives like natural gas can also help bridge the energy transition towards a greener future. Carbon capture and storage technology may be a viable solution to ease the transition away from coal, but it is currently the least cost-competitive, in comparison with other low-carbon energy sources such as solar and wind.

Finally, stricter environmental policies, carbon taxes, and affordable energy substitutes are crucial. For example, a carbon pricing schemes helped the United Kingdom reduce its dependence on coal by 12.4 percentage points from 2013 to 2018. In Spain, government subsidies favoring renewable electricity generation helped reduce coal dependence between 2005 and 2010.

It is clear that there is no one single approach to driving coal emissions into decline. Factoring the reduced deployment and use of coal in various sectors of the economy will be a step in the right direction, in abating the consumption of coal, which may serve as a multi-approach solution; tailored to each country's climate goals.

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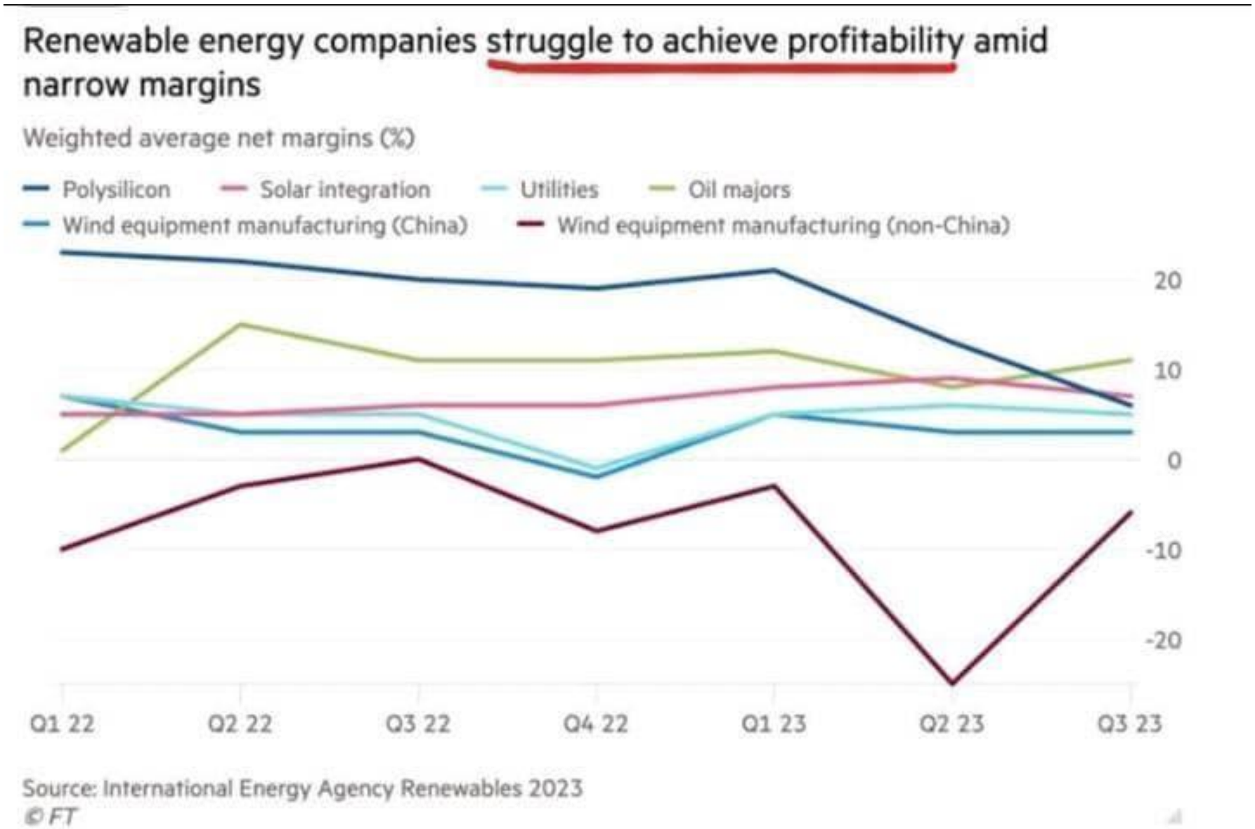
Practical Considerations for Promoting Financial Profitability of Renewable Energy Companies

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for promoting financial profitability of renewable energy profits.



SOURCE: International Energy Agency

The chart shows the struggle of renewable energy companies to make profits in commercial operations. Despite a strong push from governments and international organisations for companies and consumers to support a global green transition, energy companies have been struggling to make a profit from solar, wind and other energy projects in the face of several challenges.[123] However, by deploying various legal, regulatory and financial schemes, countries can stimulate the profitability of renewable energy projects. The law for the transition of electric power was promulgated by the German government in early 1991 to promote the development of renewable energy for the purpose of being able to provide high standard subsidies and preferential loans in conducting and supplying electricity.[124] National governments can exemplify this mechanism suitable to each country.

Individuals and corporations investing in renewable energy projects may be eligible for investment tax credits (ITCs). This can be applied to tax liabilities, hence reducing their tax burden. By decreasing the upfront expenses and boosting the return on investment, ITCs offer a favorable climate for the viability of renewable energy businesses.[125] For example, the United States provides a federal investment tax credit for solar energy projects, which is a credit against income tax equivalent to a percentage of the investment's value. This campaign has greatly contributed to the increase of solar installations around the country.

Furthermore, employing the use of production tax credits by national governments can help to increase revenues and reduce expenditure of renewable energy companies. Production Tax Credits (PTCs) are subsidies given to renewable energy producers based on how much power they produce. These credits are generally

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[123] Energy Firms grapple with Profits < https://finance.yahoo.com/news/green-energy-firms-grapple-profit-210000399.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAANm7_qAwQpplqMrmSe6LMBJYRWaxZCUxicYkT83YFtqMKw9sDyQtPyrP8-YRqLeZiuUmyrHPiyWX8H-kIK2YPMzEFDkIhPZsM8ijIYuGLxYJwBJuZEoIryu6k-tCUHWsnxwZFIv1_bTcOrs040vh-84uMckJLcPgc0nHMyUxXVU_ >

[124] Policies and laws in the application of renewable energy Indonesia: A reviews < https://www.aimspress.com/article/doi/10.3934/energy.2022002?viewType=HTML >

[125] Energy Firms grapple with Profits < https://finance.yahoo.com/news/green-energy-firms-grapple-profit-210000399.html?guccounter=1&guce_referrer=aHR0cHM6Ly93d3cuZ29vZ2xlLmNvbS8&guce_referrer_sig=AQAAANm7_qAwQpplqMrmSe6LMBJYRWaxZCUxicYkT83YFtqMKw9sDyQtPyrP8-YRqLeZiuUmyrHPiyWX8H-kIK2YPMzEFDkIhPZsM8ijIYuGLxYJwBJuZEoIryu6k-tCUHWsnxwZFIv1_bTcOrs040vh-84uMckJLcPgc0nHMyUxXVU_ >

granted per kilowatt-hour of renewable energy generated, guaranteeing a steady cash stream throughout the project's life. PTCs lower investment risks while increasing the profitability of renewable energy projects. For example, the federal output tax credit has significantly boosted wind energy output in the United States. This incentive has played an important role in increasing wind generating capacity around the country.

Also, governments can provide grants and subsidies towards certain renewable energy projects. Grants and subsidies are direct financial contributions made by governments to help develop and implement renewable energy technology.[126] These revenues can be used to pay a wide range of expenses, including research and development, equipment procurement, and project installation costs. Grants and subsidies help renewable energy companies become more profitable while also boosting innovation and market competitiveness. For example, the European Union's Horizon Europe program provides subsidies for renewable energy research and development initiatives. These funds encourage innovative ideas and assist in bringing new technology to market. By implementing various government incentives and subsidies, countries can stimulate the profitability of renewable energy projects.

Increasing financial profitability for renewable energy companies involves a combination of strategic planning, operational efficiency, and market positioning, all of which can be made effective via the tools of legal, regulatory and financial instruments.

[126] Ibid

Practical Considerations for Combating Water-Related Climate Change Risks in Africa

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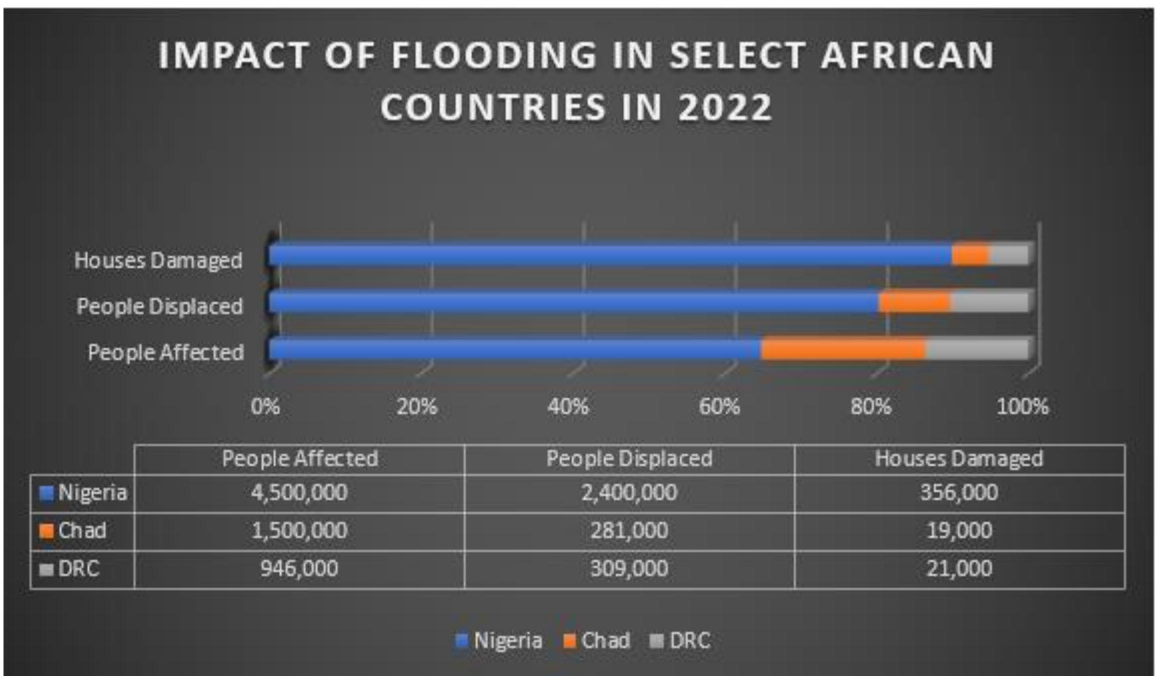
The data intelligence highlights considerations for combating water-related climate change risks in Africa.



SOURCE: Electricity Lawyer. ***Statistics is derived from the United Nations Office for the Coordination of Humanitarian Affairs (OCHA)***

The graph reveals the effect of climate change on water resources in form of flooding and its impact in select African countries, Nigeria, Chad and Democratic Republic of Congo. Flood impacts have become more severe in recent years, due to climate change; with the above- mentioned countries being the most severely impacted African countries in 2022.

As climate change imposes a new reality, the political, legal and institutional frameworks need to be assessed and adjusted to allow for climate change adaptation, especially to water-related risks such as flooding and water shortage, which have resulted in significant damage to homes, displacements, and fatalities.

The common causes of flooding throughout the highlighted regions are inadequate planning and design of rural-urban communities, inadequate land use policy framework, absence of flood data, improperly planned or clogged drainage systems, faulty dams, inadequate river defenses, deforestation and land reclamation along coastal areas. Furthermore, it is imperative that proactive flood mitigation strategies consider the threat posed by climate change in addition to the highlighted challenges.

It is important to prioritize pre-flooding preparations and to invest in early flood warning systems that are accurate and up to date with technology. Real-time flood forecasting and warning systems must be included as a key element of the flood risk management strategy, because flood risks are rising as a result of climate change. Doing so will ensure impact mitigation, by providing accurate warnings and real-time forecasts ahead of impending flooding.

Additionally, flood risks are directly and indirectly increased by deforestation. Indirectly, cutting down trees reduces their ability to absorb carbon dioxide from the atmosphere, which raises the risk of global warming, rising sea levels, overflowing riverbanks, and flooding. Policies that promote reforestation while discouraging deforestation should be developed by national governments. Also, governments should see to the repositioning of their current land use policy frameworks and ensure strict enforcement to prevent indiscriminate erection of residential buildings, offices, schools, hospitals and other infrastructure in areas prone to flooding.

There is also a need for human capital development by training and equipping personnel with technical competency and capacity to operate forecast/warning systems, i.e. read, interpret, correctly forecast, review and improve on system operation. Engagement of stakeholders through efficient dissemination of information to citizens; encouraging them to abide by regulations pertaining to flood forecasts/warnings, flooding patterns, and domesticating flood risk management measures in their immediate environment will help to reduce consequential impacts on individuals.

Finally, national governments can encourage increased studies on water related climate risk management via investment in research and development. This will aid in developing and executing sustainable development strategies that uncover latent causes and produce more modern mitigation techniques. They can also promote, implement and enforce compulsory flood insurance policies, as a non-structural response approach, covering infrastructure and properties such as buildings, vehicles, etc. This will help mitigate the impact of the losses suffered post-disaster.

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Practical Considerations for Increasing Clean Energy Jobs

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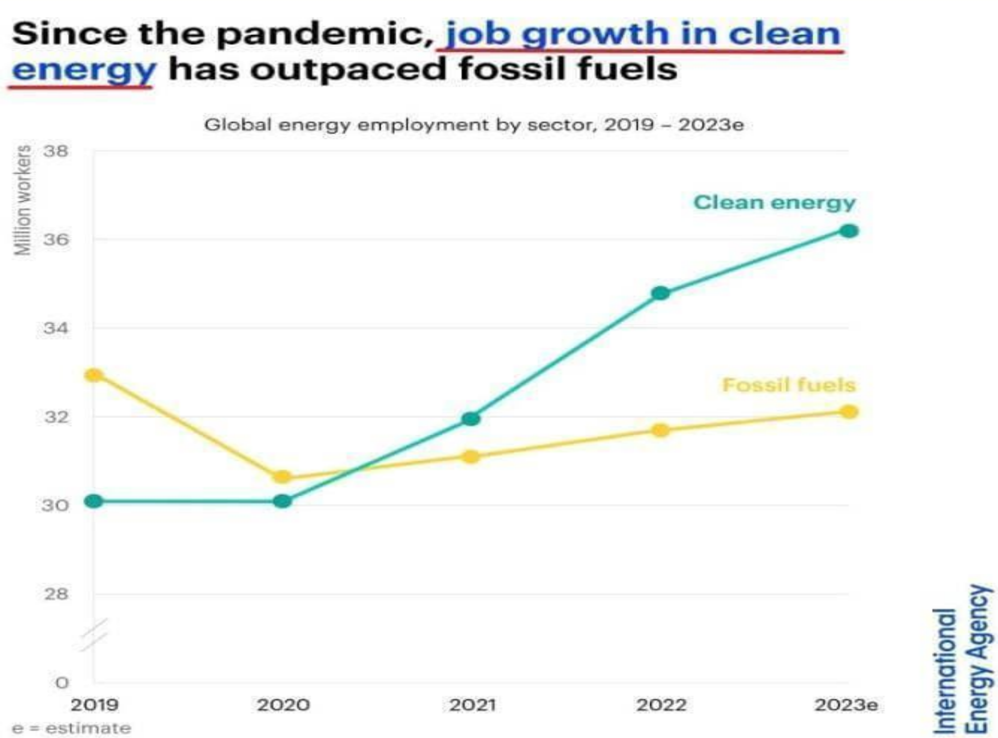
The data intelligence highlights considerations for increasing clean energy jobs.



SOURCE: International Energy Agency (IEA)
The graph portrays the growth of energy jobs globally from 2019 to 2023 in both fossil fuel and clean energy sectors. As governments and businesses continue to prioritise clean energy to achieve sustainability and economic growth, the demand for clean energy jobs is expected to further increase, creating a positive cycle of job creation and environmental progress.[127]

According to a report by the International Renewable Energy Agency (IRENA), the renewable energy sector employed 11.5 million people worldwide in 2019, with the potential to reach 42 million jobs by 2050.

Furthermore, the clean energy industry offers a wide range of job opportunities across various skill levels and sectors. From manufacturing and installation to research and development, clean energy jobs span a diverse range of professions, providing employment opportunities for individuals with different backgrounds and expertise.[128] Several key factors will however propel an increased demand for clean energy jobs. Increased government actions targeted at lowering carbon emissions and boosting renewable energy will have a substantial impact on increasing demand for clean energy employment. For example, more subsidies, tax breaks, and regulatory measures will encourage investment in renewable energy projects, resulting in an increased demand for trained people in the clean energy sector.[129]

Furthermore, there should be an increase in public awareness of global energy transition. As public awareness of environmental issues grows, there will be an increasing demand for sustainable and eco-friendly practices across industries. This heightened awareness will lead to a shift in consumer behavior and corporate responsibility, driving the need for skilled professionals who can contribute to the development and implementation of clean energy solutions.[130] Consequently, there

[127] Cybernetic Search, The Growing Demand for Clean Energy Jobs < https://www.cyberneticsearch.com/blog/the-growing-demand-for-clean-energy-jobs/ >
[128] Ibid
[129] Ibid
[130] Ibid

will be an increased need for professionals who can design and manufacture electric vehicles, install charging infrastructure, and develop energy-efficient building designs. Governments should also explicitly integrate industrial and climate policy to encourage innovation and job development in emerging industries like energy services, renewables, and smart technology.[131] This will make companies recognise the importance of sustainability in their operations and adopt clean energy practices/technologies to reduce their environmental impact. Hence, create job opportunities in areas such as energy management, sustainability consulting, and renewable energy project development.

Establishing clear and transparent long-term energy transition policies would assist promote and de-risk private investment in clean energy industries, hence promoting job development. For instance, part of Denmark's decision to phase out oil and gas production in the North Sea by 2050, the government is planning an aid package to ensure local jobs for the existing skillset of oil and gas workers through carbon capture, utilisation and storage (CCUS) and electrification projects while Canada plans to leverage its existing strengths in the oil and gas sector to develop its hydrogen sector, creating up to 350 000 quality, green jobs over the next three decades.[132]

Finally, when analysing the clean energy job market, it becomes evident that there is a diverse array of job opportunities available, each requiring specific skills and expertise. Thus, modernizing and emphasizing energy related curricula should be a priority at all levels of education are an essential way to allow more students and/or youths to become engaged in clean energy careers.[133] For instance, Lane Community College in Oregon has developed a two-year online degree in energy management focused on large-building energy efficiency solutions.

The clean energy sector offers a wide range of career opportunities across various disciplines. From engineering and project management roles in renewable energy

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[131] IEA, Recommendations of the Global Commission on People-Centred Clean Energy Transitions < https://www.iea.org/reports/recommendations-of-the-global-commission-on-people-centred-clean-energy-transitions/recommendation-1 >
[132] Ibid
[133] Ibid

projects to research and development positions focused on sustainable technologies, the job market is diverse and dynamic. Governmental policies and mechanisms will be an integral tool in developing these opportunities.

Practical Considerations for Encouraging End-Of-Life Strategies for Electric Vehicle Batteries

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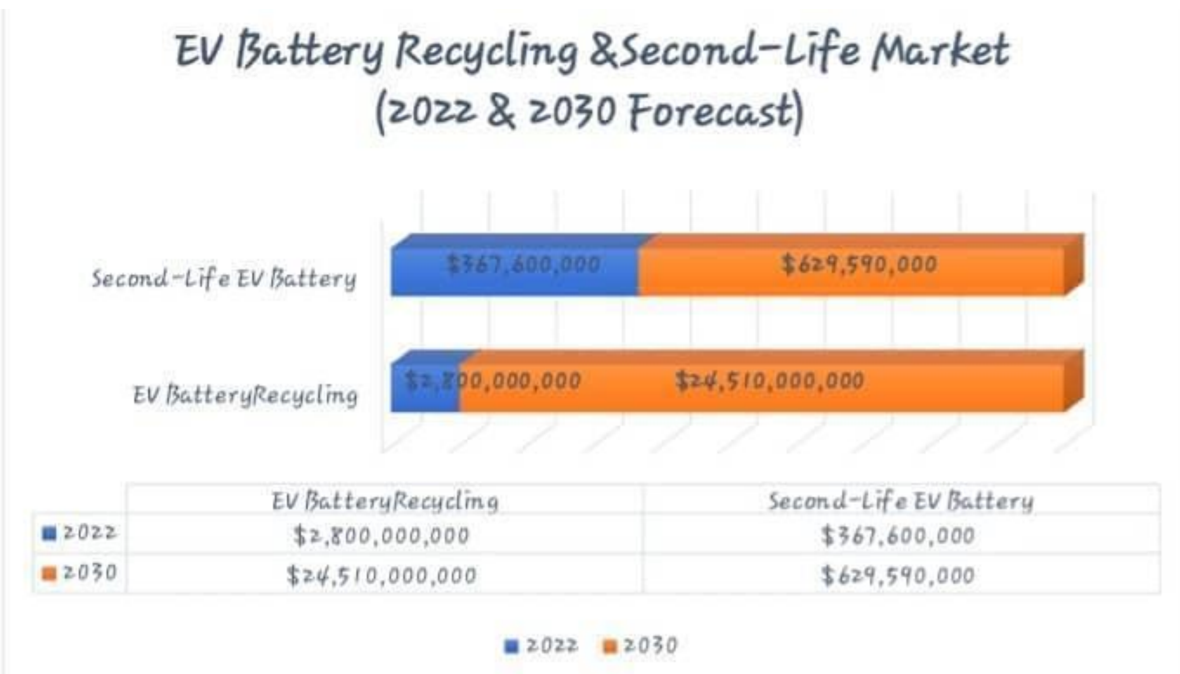
The data intelligence highlights considerations for encouraging end-of-life strategies for electric vehicle batteries.



SOURCE: Electricity Lawyer (Statistics are sourced from the U.S Market Report and Precedence Research)

The graph portrays the market for Electric Vehicles (EVs) batteries based on their end-of-life strategies, which includes recycling and repurposing (second life use) in 2022 and a 2030 forecast. The increased adoption of EVs raises important questions about the availability and sustainability of

the raw materials used for the batteries, mostly lithium-ion batteries that will be powering the vehicles. Without a standardized system, the materials used in these batteries will quickly end up in landfills. Irregular disposal of spent batteries can also lead to fire hazards and the leaching of toxic substances into the environment. These materials are not only hazardous, but they are also valuable. If they are lost due to improper disposal, manufacturers will be forced to keep extracting new materials from the ground. Hence, there is a need for governments to adopt policy measures that can encourage manufacturers and end users to take cognizance of end -of-life strategies for electric vehicle batteries.

When EV batteries are no longer suitable for use, they can be repurposed or recycled. The batteries can be repurposed for second-life applications, which involve using the batteries for energy storage applications such as stationary storage for renewable energy, backup power for buildings, or charging stations for EVs. The recycling process involves disassembling the batteries, separating the components, and recovering the valuable materials. These materials can subsequently be used to manufacture new batteries or other products.

To incorporate these end-of-life strategies, governments can provide incentives for vehicles and battery manufacturers to recycle their batteries. This might include tax advantages or subsidies for recycling plants, and also stipulate legal, regulatory and technical standards for automakers to employ recycled materials in battery manufacture. An extended producer responsibility can also be incorporated for manufacturers, to ensure the adoption of an end-of-life strategy for the batteries produced.

Many worldwide initiatives have been put forward to establish a circular economy for the end-of- life of lithium-ion batteries derived from electric vehicles. The Global Battery Alliance (GBA), for example, has helped to design a Battery Passport. The Battery Passport is a system that improves battery traceability. It is a digital representation of each battery that includes a digital ID. It comprises information on the battery's health and manufacture to help determine if it is appropriate for reuse. The Battery Passport data is useful for deciding if a battery should be repurposed or discarded after its initial usage, and it gives trustworthy and complete information regarding battery health before purchase and testing. Governments can incorporate such measures to encourage more investment and adoption of these end-of-life strategies.

Furthermore, governments should invest in research and development efforts to enhance recycling processes and lower the cost of battery recycling. This may involve creating new recycling methods, refining the recycling process, or discovering new applications for recovered battery components.

There is also a need to educate consumers about the importance of EV battery recycling and how batteries can be properly disposed, as this will encourage consumers to recycle their batteries instead of throwing them away.

Overall, encouraging EV battery end-of-life strategies is critical to the long-term viability of the EV industry. By promoting appropriate battery disposal, educating customers, providing incentives, supporting research and development, governments can assist to reduce the environmental effect of EV battery disposal.

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Practical Considerations for Encouraging Gender Inclusion in the Renewable Energy Sector

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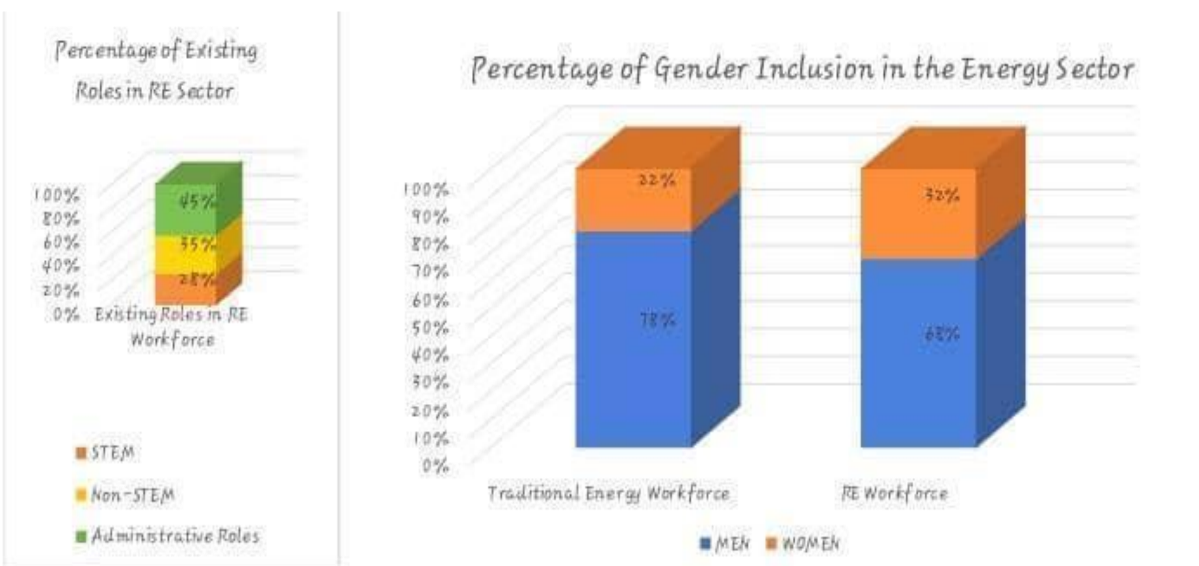
The data intelligence highlights considerations for encouraging gender inclusion in the renewable energy sector.



SOURCE: Electricity Lawyer (Statistics are derived from the Global Women's Network for Energy Transition)

The chart illustrates the level of gender inclusivity within the energy sector, indicating a minimal participation of women despite relatively higher representation in the renewable energy (RE) sector. Nonetheless, this remains constrained by the prevailing roles within the RE sector, which often lack sufficient training opportunities for women. There is substantial evidence that women and children are disproportionately affected by a lack of access to energy, and modern energy infrastructure typically reaches women last.[134] To increase women's participation in the energy sector, it is necessary to not only understand the evidence for it, but also the barriers women face in joining and remaining.[135]

Governments can mainstream gender in energy sector frameworks by integrating women's experiences, capacities, expertise, and preferences into energy policies and programs. This can be achieved through gender audits and by ensuring the integration of women along the off-grid renewable energy value chain.[136]

Also, vocational training programs by organisations can help with recognizing the role that women can play as renewable energy technicians. One such example is the Vocational Training and Education for Clean Energy (VOCTEC) Program, an initiative implemented by Arizona State University with the support of USAID and IRENA.[137] The training curriculum is designed to consider cultural aspects of trainees and increase social awareness and gender inclusion in order to achieve maximum impact and participation among women. Governments can further tailor training and skills development programmes, including raising awareness of career opportunities, adapting curricula, making technical training programmes more versatile, and strengthening mentoring and outreach within the public sector.[138]

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134 Strengthening Women's Role in RE Sector < https://sdg.iisd.org/news/irena-reports-that-strengthening-womens-roles-in-renewable-energy-is-key-to-achieving-multiple-sdgs/ >

135 Making the Case for Women in the Energy Sector < https://www.usaid.gov/sites/default/files/2022-05/IUCN-USAID-Making_case_women_energy_sector.pdf >

136 Strengthening Women's Role in RE Sector < https://sdg.iisd.org/news/irena-reports-that-strengthening-womens-roles-in-renewable-energy-is-key-to-achieving-multiple-sdgs/ >

137 Making the Case for Women in the Energy Sector < https://www.usaid.gov/sites/default/files/2022-05/IUCN-USAID-Making_case_women_energy_sector.pdf >

138 Global Women's Network for Energy Transition < https://www.globalwomennet.org/wp-content/uploads/2020/02/Gwnet-study.pdf >

Human resource policies can cultivate a supportive environment that allows for women to better balance their professional and family lives.[139] Examples of interventions include establishing flexible working hours, allowing for parental/family leave to take care of sick or unwell family members and/ or providing caregiving support or paying wages sufficient for employees to find the caregiving support they need. This will help to attract and retain talent for opportunities in professional advancement in the energy sector in diverse roles.

Finally, national governments and energy companies can pursue promoting networking face-to-face and electronically among women in sustainable energy and support organisations that facilitate such networking; featuring achievements of women in energy in mainstream and specialised media; supporting and designing workshops or conference events specifically targeted at women in sustainable energy; or insisting on inclusiveness in panels at conferences and seminars, in selection committees for industry awards and the like[140].

From legal standards set by governments to recruitment and human resources policies, to opportunities through training and supportive associations, these are measures all stakeholders can engage to recognize the value of women in the energy sector and working to actively recruit and retain them in line with the energy transition agenda.

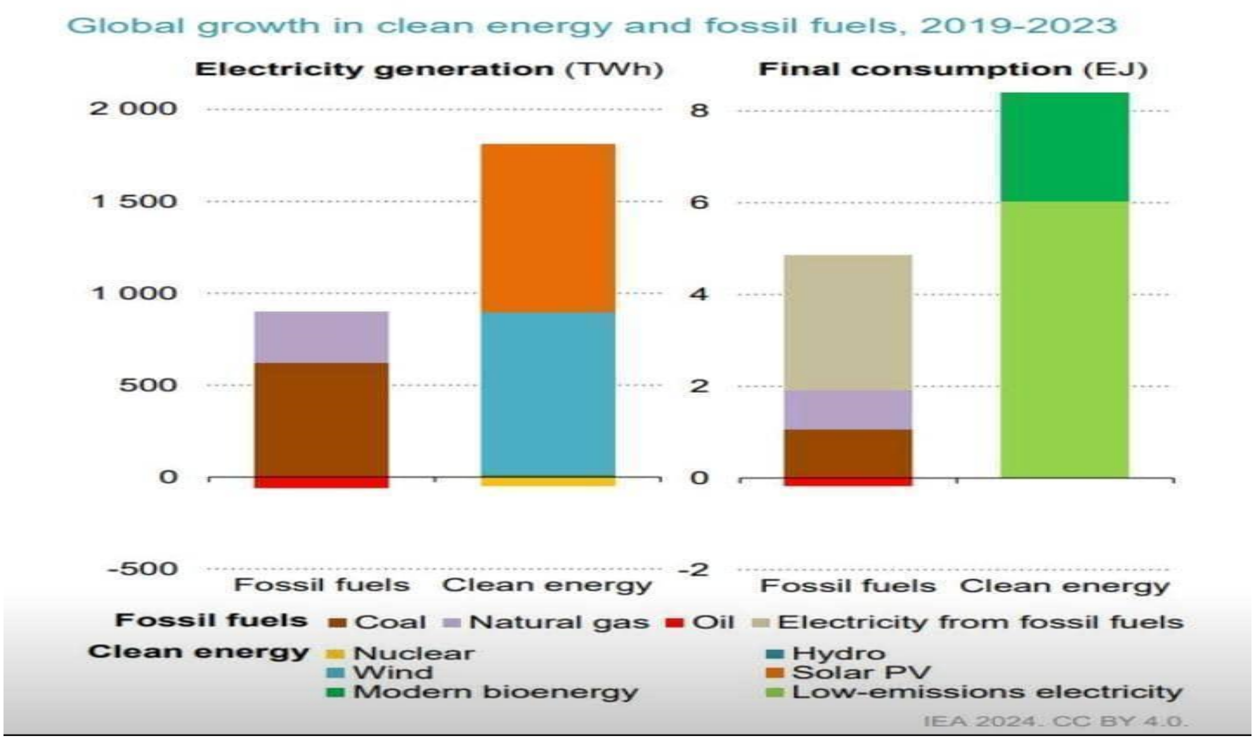
[139] Making the Case for Women in the Energy Sector < https://www.usaid.gov/sites/default/files/2022-05/IUCN-USAID-Making_case_women_energy_sector.pdf >

[140] Global Women's Network for Energy Transition < https://www.globalwomennet.org/wp-content/uploads/2020/02/Gwnet-study.pdf >

Practical Considerations for Encouraging Modern Bioenergy in the Energy Mix of Countries

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for encouraging modern bioenergy in the energy mix of countries.



SOURCE: International Energy Agency

The chart shows the global growth in clean energy and fossil fuels from 2019-2023. Low emissions electricity and modern bioenergy emerge higher than fossil fuels in the final energy consumption. The consumption of modern bioenergy is a novel development in the energy mix of countries which requires increased efforts to yield viable energy solutions.

Bioenergy is a term used to describe renewable energy that comes from biological sources like organic matter or biomass that may be transformed into useful energy forms. It is a type of energy that uses plant life, agricultural waste, and Other organic materials to generate heat, electricity, and liquid fuels. Modern bioenergy is an important source of renewable energy - its contribution to final energy demand across all sectors is currently five times higher than wind and solar PV combined, even when the traditional use of biomass is excluded. Modern bioenergy is the largest source of renewable energy globally today, accounting for 55% of renewable energy and over 6% of global energy supply. More efforts are needed to accelerate modern bioenergy deployment to get on track with energy transition goals.

Bioenergy power generation has significant supply chain and infrastructural challenges, particularly when using bulk biomass sources like residues and garbage. Agricultural and forestry residue-based feedstock are seasonal, therefore the feedstock market price may change widely. Also, financing bioenergy generation can be challenging, due to potential technology and contractual risks; coupled with market uncertainties. Investors may be concerned about the long-term economic supply of sustainable biomass feedstock, making financing difficult for biomass generation. Despite the introduction of Bioenergy with Carbon Capture and Storage (BECCS), infrastructural upgrades and operational expenditures are necessary for the BECCS plants in order to capture, move, and store CO2 - and even with very high investments, project profitability remains unclear, hence BECCS is unlikely to be financially feasible without supporting policies.

A legislative framework supporting bioenergy generation should be carefully constructed to avoid conflicting with climate change aims or putting sustainability at risk. Because of the scarcity of feedstock, governments should not encourage the use of biomass for electricity generation alone. Policies should focus on maximizing the synergies and co-benefits of bioenergy generation, including waste management.

Bioenergy power production is often included within renewable generation support schemes and could benefit from widespread supporting policies, including (feed in tariffs) FITs, renewable portfolio standards and power purchase agreements. FITs can tackle the high cost of bioenergy generation and possibly provide an assured electricity income. They offer a long-term agreement that guarantees a price per unit of output and feed-in-premiums, which offer a premium tariff and wholesale electricity prices. Such mechanisms have been widely used to promote bioenergy generation in Germany, Japan, and the United Kingdom. In Germany, the FIT scheme provides a higher rate for bioenergy plants.

Finally, national governments can ensure enabling conditions for investment in research and development. According to International Energy Agency studies, advanced biofuels can provide infrastructure-compatible, low-carbon fuels, with higher land use efficiency and a better greenhouse gas balance than some first-generation biofuels. Analysis also reveals that biomass, including wood, will play an increasingly important role in heat and power production. Investments in more research on bioenergy can unlock advanced innovations; to mitigate the challenges of adopting bioenergy as a viable energy source.

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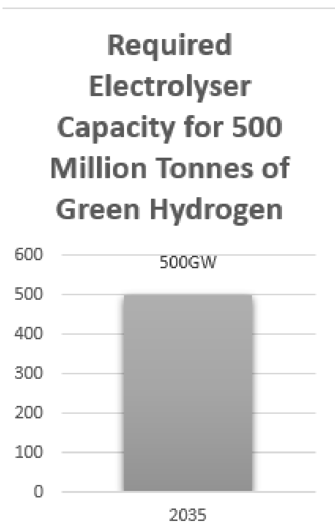
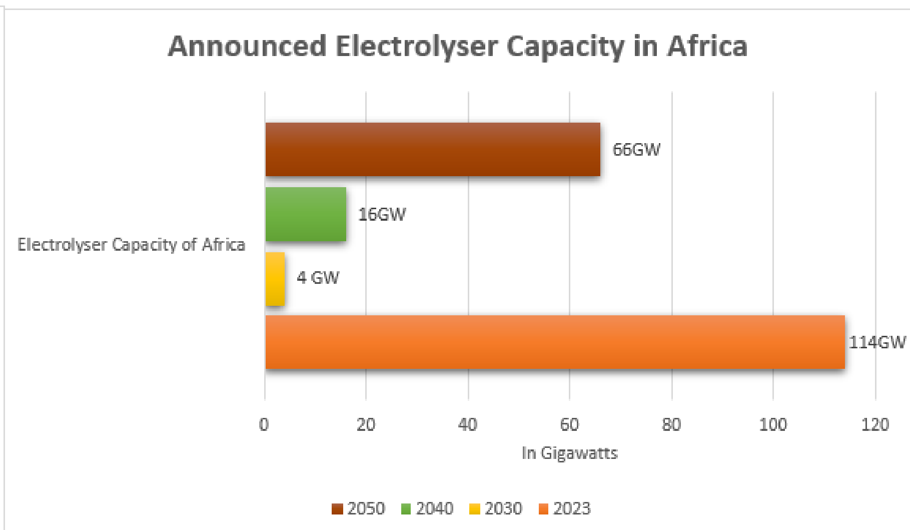
The data intelligence highlights considerations for encouraging investments of green hydrogen electroysers in Africa.





SOURCE: Electricity Lawyer (Statistics from DNV Hydrogen Forecast to 2050)

The graph depicts the capacity of electrolysers announced in Africa from 2023 - 2050 for the production of green hydrogen. Africa has a goal of producing 50 million tonnes of hydrogen by 2035, but the capacity of electrolysers announced cannot produce the amount of green hydrogen targeted. Achieving this capacity will require about 500GW of electrolyser capacity as 4-5 GW of electrolyser capacity is needed to produce a target of 0.5 million tonnes. However, as of 2023, Africa's total announced electrolyser pipeline capacity reached 114 gigawatts (GW). There is need for Africa to engage in more productive efforts towards investing in green hydrogen and its infrastructure, to meet up with the 2035 target.

The upfront capital cost of establishing green hydrogen electrolyser facilities can be prohibitive, particularly for countries with limited financial resources and infrastructure like countries in Africa. This includes the cost of electrolyser equipment, renewable energy installations, and associated infrastructure, such as storage and distribution systems. Also, developing a local supply chain for electrolyser components and materials may be challenging in Africa, due to limited manufacturing capacity and reliance on imports.

Encouraging investment in green hydrogen electrolysers in Africa requires a multifaceted approach that addresses various challenges and leverages opportunities.

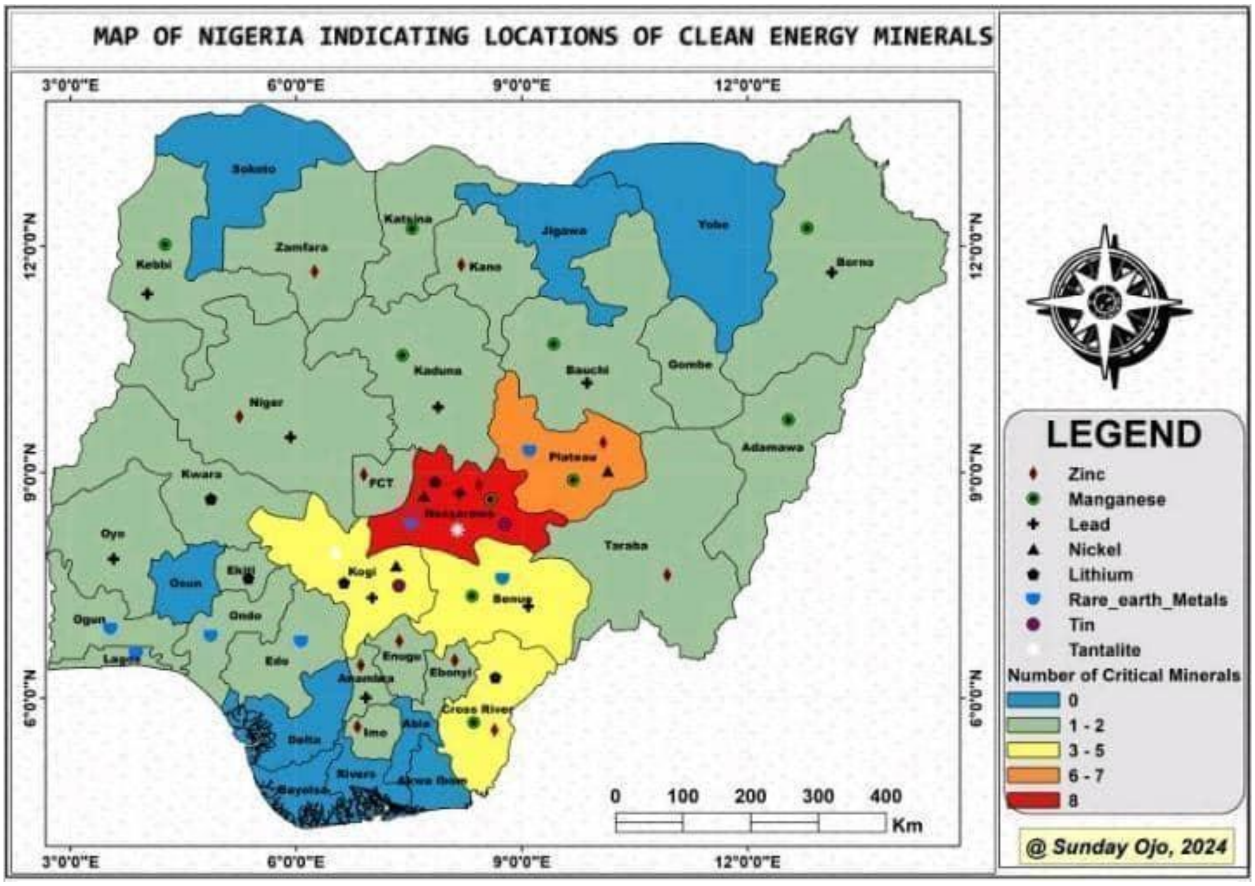
Governments should develop policies and regulations that incentivize the production of green hydrogen electrolysers. This can include offering tax incentives, subsidies, and grants for companies involved in electrolyser manufacturing. Additionally, clear and transparent regulatory frameworks can provide certainty for investors and encourage long-term commitments.

Also, allocating funding for research and development initiatives focused on improving electrolyser technology, increasing efficiency, and reducing production costs can yield more positive investments in Africa. Collaboration between governments, research institutions, and private companies can accelerate innovation in this area.

It is equally important that countries in Africa develop industrial zones or clusters dedicated to green hydrogen electrolyser production, to attract manufacturers and streamline supply chains. They can also invest in infrastructure such as transportation networks and utilities to support growth of the manufacturing sector across the continent. Governments can invest in vocational training programs and education initiatives to develop a skilled workforce capable of manufacturing and maintaining electrolyser systems. This can help create job opportunities and contribute to the growth of the local manufacturing industry.

Finally, demand for green hydrogen electrolysers should be created by promoting their use in various sectors such as transportation, industry, and energy storage. Government procurement programs, incentives for renewable hydrogen adoption, and public awareness campaigns can stimulate this market growth.

The data intelligence highlights considerations for utilising critical minerals to drive the energy transition in Nigeria.



SOURCE: SUNDAY OJO

The global quest for a cleaner energy system has escalated the demand for critical energy transition minerals such as lithium, cobalt, nickel and copper. These minerals play a

crucial role in renewable energy technologies such as solar photovoltaic cells, wind energy, battery storage and electric vehicles. For example, the demand for copper in clean energy systems is forecasted to increase from 23% of total demand across all applications to over 42% by 2050, according to UNCTAD calculations; based on data from the International Energy Agency. The graph depicting the surplus of these mineral in Nigeria, provides the avenue for the country to reposition itself to take advantage of the opportunities that these minerals present, to drive economic prosperity for its populace and take part in the global energy transition.

The mineral intensity of clean energy technologies offers opportunities and challenges for developing economies, particularly resource-rich developing countries like Nigeria, to diversity, upgrade, and capture value in new emerging value chains. However, leveraging this opportunity require African countries to improve their manufacturing capacity and scale up production and export through the building of domestic and regional linkages and value chains. Attaining this feat, however, requires active and proactive industrial policies.

First, stakeholders in Nigeria need to identify the transformative potential of critical minerals and gradually integrate, upgrade, and diversify into various value chains based on their critical mineral endowments and current technological capabilities and paths. These policies must aim at mitigating the 'dark side of the energy transition': local pollution of soil, air, and water; the disposal of toxic residuals; intensive use of water and energy, work and environmental risks, child labour and sexual abuse, and corruption and armed conflict.

Second, at the core of the policy to drive this structural transformation, Nigerian government needs to set both 'ex-ante' and 'ex-post' conditionalities which direct, incentivise and regulate the use of critical minerals. This may involve linking extraction and processing of critical minerals to sustainable industrialisation in the country. Conditionalities include selection, incentives and disciplining mechanisms. They can operate ex ante when they define the specific conditions under which investments can be made, for example, which types of companies can invest, the risk-reward conditions of the investment, the business model to be followed, which social and environmental standards should be followed, etc. Given that many of the companies with capabilities in processing and developing critical minerals are international, and often backed up by the national government, ex-ante conditionalities can be used to trigger a 'race to the top'.

Furthermore, one technology that Nigeria may use to maximize its critical mineral resources for economic growth and the energy transition is nanotechnology. Nanoparticles and nanofluids, which are useful for both domestic use and exports, may be efficiently produced using nanotechnology. Selling the raw minerals will not result in as much profit as processing them. Thus, the government should create nanotechnology research centres and facilitate collaboration between industry and academics through research sponsorship.

In conclusion, the creation of a national critical mineral corridor can be fueled by the introduction and implementation of policies and technologies such as nanotechnology for the energy transition. Nevertheless, for execution or implementation to be effective, there must be significant government commitment via infrastructure development, remuneration, regulations, security, etc.

Practical Considerations for Encouraging Investments in Oil & Gas Exports from Africa to Europe as a Step Towards the Energy Transition

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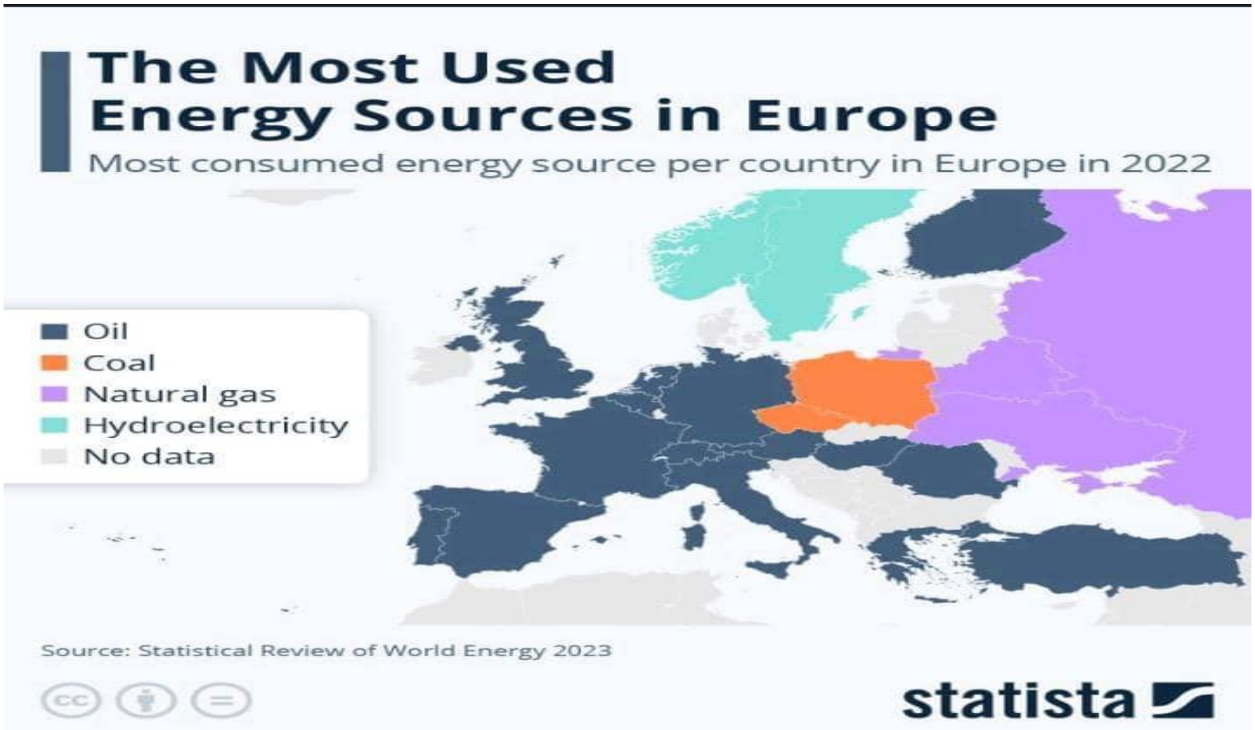
The data intelligence highlights considerations for encouraging investments in oil & gas exports from Africa to Europe as a step towards energy transition.



SOURCE: Statista

The data intelligence highlights considerations for promoting investments in oil & gas exports from Africa to Europe as a step towards the energy transition.

The map shows the most used energy sources in Europe, being predominantly oil and natural gas, which African countries have and produce in surplus. African countries can leverage on this demand to generate profits for the continent to fully transit to the deployment of cleaner energy, especially when African countries simultaneously utilize natural gas as a major energy source in the next few years. This also aligns with the European declaration of adopting natural gas as a transition fuel source.

African oil and gas producing countries stand to potentially benefit from Europe's search for new markets, however, this will require increased investments in the oil and gas sector.

However, for Africa countries to meet their domestic needs and export surplus gas products to Europe, policy considerations and possible collaboration will need to be in place. For instance, Increased investment in natural gas infrastructure is necessary. Good governance and political stability are equally necessary for African countries to attract the significant investments required to improve their energy infrastructure. Without key reforms and investments, African countries will be unable to capitalize on the opportunity presented by Europe's demand of natural gas. If African oil and gas producers can create an enabling environment, they will be able to reap a financial windfall from increased gas exports to Europe, which should result in more revenues to also transition to cleaner fuel sources, create local jobs, reduce poverty rates, and support other domestic development goals. Thus, potential partnerships between European and African nations towards energy transition must prioritize guaranteeing energy access through a combination of varied sources and methodologies accessible on the continent.

First, African countries must be clear to pursue good governance and transparency in the use of the windfall reaped from gas export deals with Europe and decarbonization projects, to promote sustainable development, and easily transit to the deployment of cleaner fuel sources.

Also, to avoid fossil fuel lock-in, European countries must collaborate with gas-exporting African countries and pursue policies such as a carbon takeback obligation - agreements placing the responsibility of safe CO2 storage on the producers and importers of fossil fuels, while African countries develop the infrastructure needed to increase gas exports to Europe.

In addition, the regular maintenance of oil and gas pipelines is essential for their smooth and functional operations. A lack of maintenance can result in social and environmental issues including the destruction of vegetation, harm to local wildlife, and increased water and air pollution levels in Africa. There should be an adoption of regulations and standards that mandate regular inspection and maintenance of oil and gas pipelines to ensure compliance with safety and environmental requirements. Failing to meet these regulatory obligations can result in penalties, fines, or legal liabilities for pipeline operators.

Finally, oil and gas pipeline infrastructure requires significant investments and take time to build, develop and operate. Algeria is currently struggling to meet the increased demand for gas from Europe, due to a longstanding lack of investment in its gas infrastructure. Thus, the continent must focus on having a stable regulatory environment, in addition to investment incentives, to mitigate risks and improve the financial viability of projects.

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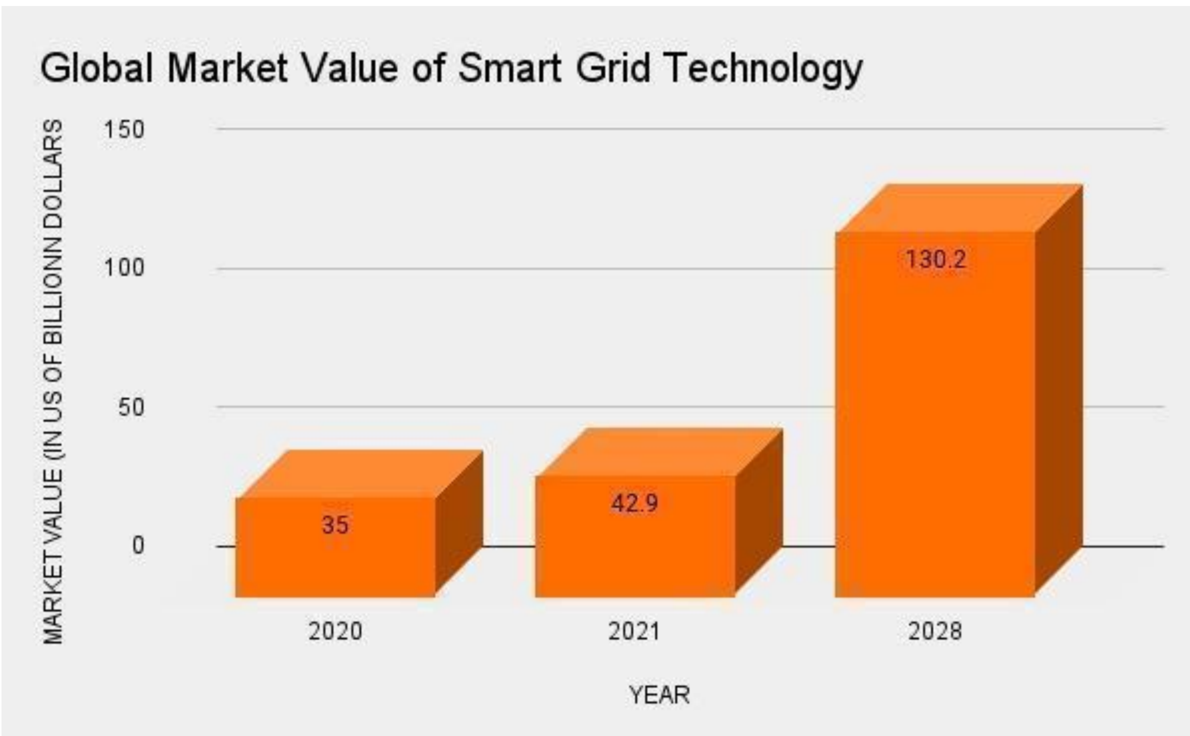
The data intelligence highlights considerations for harnessing smart grid technology in Africa.



SOURCE: Electricity Lawyer (Statistics from Northeast Evidence Hub)

The Sustainable Development Goal 7 cannot be achieved in Africa with the traditional technologies in use for the design of electricity networks. A radical approach will be needed

such as the use of smart grids. Smart grid is a term used to embrace the application of modern electricity supply alternatives with ICT infrastructure to help achieve universal access to energy via modern and flexible electricity supply systems. The global smart grid market was estimated to be US$ 35 billion in 2020, with expected growth for the period 2020-2023 being 21% owing to global demand.

At a global level, it is widely acknowledged that United States and Europe, for example have made progress towards grid modernisation in the last decade specifically to address 21st century industry challenges. In Africa, existing electricity grids are ageing, outdated, and under huge capacity constraints. Africa is well positioned to learn from the developments in the rest of the world. The aim should be to have an economically evolved, technologically enabled, electricity system that is intelligent, interactive, flexible and efficient and will enable Africa's energy use to be sustainable for future generations. While constraints such as lack of good governance, limited investment capital, largely inadequate infrastructure and a gap in well-trained power sector personnel are stifling innovative infrastructure such as smart grids, it will be essential to prioritise specific smart solutions based on clearly defined functionalities that help reduce costs, promote economic growth and improve long-term sustainability. These will include Advanced Metering Infrastructure (AMI), Demand Response (DR), Customer Side System (CSS), Advanced Distribution Automation (ADA), Transmission Enhancement Applications (TEA), Asset / Process Optimisation (AO), Distributed Energy Resources (DER), Information and Communication Integration (ICI), and Wide Area Monitoring and Control (WMC), etc.

The distinct gap in the technical know-how of smart grid technology could impede the deployment of smart grids. To support smart grid engineering, there has to be significant restructuring and training of engineers and technicians in integrated skills regarding the developing and emerging technology area of smart grids in Africa.

Also, cyber-attacks are a global phenomenon that impact nations, companies, organisations, security services, and infrastructure. They can damage hardware and software facilities that control the smart grid. Globally, an estimated US$ 445 billion is spent annually in the war against cybercrimes, with many developing nations like Nigeria budgeting little to nothing to counter cybercrimes. Therefore, smart grid deployment in Africa must be accompanied by well- structured cybersecurity for a secure and resilient system.

Furthermore, poor regulatory policies and implementation in most African nations serve as a barrier to smart grid deployment, as consistency and a well-driven strategy are essential for the sustainable execution of projects. Excellent and consistent regulatory policies will be helpful in the implementation of smart grids, such as agreements on the technical standards required, in addition to regulation for the effective use of systems for assessment of compliance to agreed standards.

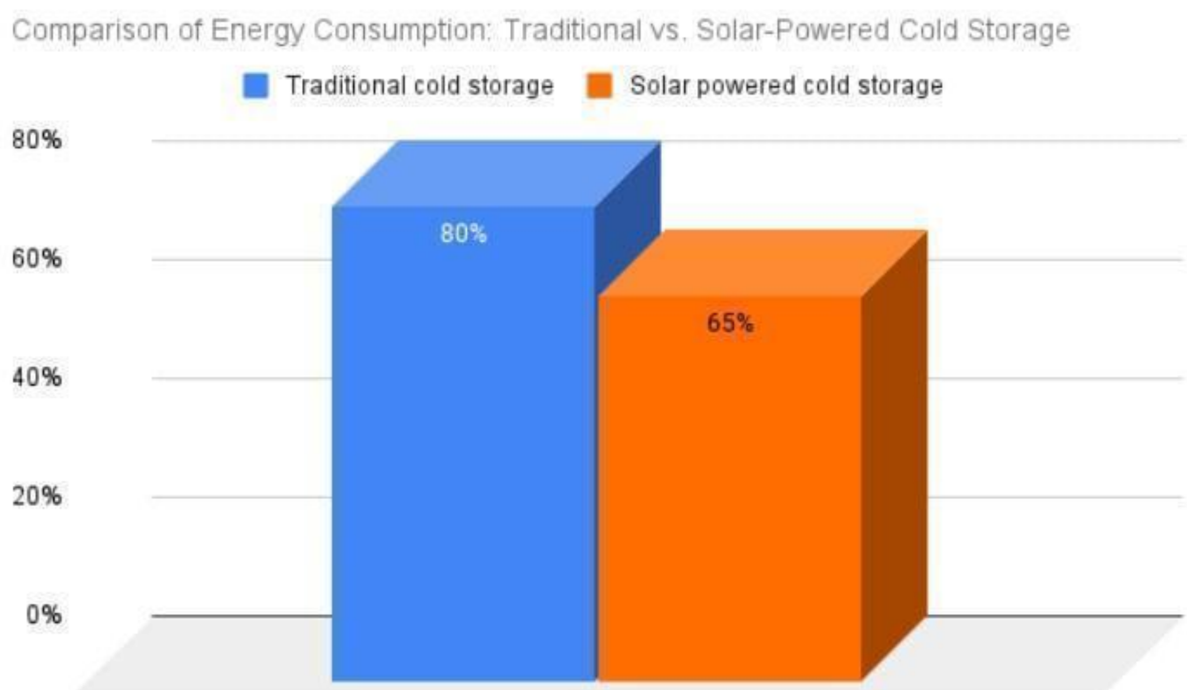
Finally, given the specific needs of Africa, it is obvious that the smart grid approach for the continent cannot simply be a replica of practices in industrialised countries where the starting point, challenges and opportunities vary. Thus, low interruption areas such as smart metering, distributed generation, and ICT can start to implement smart technology, while tending towards a gradual overhaul in avoiding a total breakdown of the power sector.

In conclusion, smart grid integration may enable African countries to leapfrog elements of traditional power systems in terms of both technology and regulation. This could accelerate national and regional electrification timeframes, improve service delivery, minimize costs and reduce environmental impacts.

Practical Considerations for utilising Solar Powered Cold Storage to Combat Post-Harvest Loss in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for utilising solar powered cold storage systems to combat post-harvest loss in Africa.



SOURCE: Electricity Lawyer (Statistics from ESA Solar)

The chart shows the energy consumption of traditional v solar powered cold storage facilities. Conventional cold storage facilities require big, energy-consuming machinery, which drives up industrial operating costs. To put this into perspective, the annual energy consumption of a conventional refrigerator warehouse alone can reach up to 25 kWh per square foot.[141] The cold storage sector as a whole can incur energy expenses of well over $30 billion annually; due to its high energy intensity. Energy expenses related to cold storage can make up as much as 18% of the overall income of a business, with labor costs ranking second[142], creating a major need for an alternative like solar powered cold storage.

Many conventional cold storage systems are heavily reliant on diesel generators and consume copious amounts of diesel in the process of powering the equipment. This contributes to climate change due to the carbon emission level(s) of diesel fuel. Solar powered cold storage provides an alternative to diesel powered equipment achieving the same result without emitting greenhouse gas emissions, and with reduced costs in the long run.[143]

According to the African Postharvest Losses Information System, African countries lose more than 30% of fresh fruits and vegetables, due to inefficient post-harvest management resulting from "lack of knowledge, technology, or storage infrastructure.[144] Hence, utilising solar-powered cold storage systems (SPCSS) will provide adequate storage means for agricultural stakeholders by leveraging clean, sustainable solar energy. There are different target customers and stakeholders who would benefit greatly from SPCSS deployment across regions in Africa. For instance, aggregators collect food produce from multiple locations in large quantities, store, and transport to the market for sale.[145] They leverage cold storage solutions to reduce the risk of spoilage during storage and transportation. The aggregators are an ideal target customer for solar cold storage technologies, given the large number of produce and dairy they store and transport. Also, to effectively transport the produced food without spoilage or loss, cold storage equipped logistics companies are

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[141] Why Energy Efficiency Matters in the Cold Storage Sector" (2023) ESA (13October) <https://esa-solar.com/why-energy-efficiency-matters-in-the-cold-storage-sector/

[142] Ibid

[143] Power Africa, PRODUCTIVE USE COLD STORAGE SYSTEMS IN NIGERIA < https://pdf.usaid.gov/pdf_docs/PA00Z8X7.pdf >

[144] Solar cold storage: A solution to Africa's post-harvest loss < https://fullygreenafrica.com/solar-powered-cold-storage-could-be-the-solution-to-africa-post-harvest-loss/ >

[145] Power Africa, PRODUCTIVE USE COLD STORAGE SYSTEMS IN NIGERIA < https://pdf.usaid.gov/pdf_docs/PA00Z8X7.pdf >

necessary.[146] Logistics companies require refrigerated transport vehicles that will foster the efficient distribution of highly perishable produce.

For sustainable deployment of SPCSS in Africa, there must be an understanding of costs, benefits, and deployment models.[147] When assessing the best deployment model for investing in and implementing SPCSS, users and funders should take due consideration of PAYS (Pay as You Store) rates, operating costs such as fuel requirements, and escalation costs.

There will also be a need for awareness campaigns. Governments and donor funded programs should engage facilitators to undertake awareness creation campaigns; leveraging local knowledge networks to spread information and increase acceptance of SPCSS among potential users, to increase the effectiveness of these solutions.[148]

Furthermore, there should be targeted financing and awareness campaigns for marginalized customers. While SPCSS offers business investment opportunities for women entrepreneurs, farmers, and fishermen, hard-wired energy systems such as cold storage systems, tend to target men, limiting the ability of women to take advantage of benefits from such investments.[149] Governments and donor funded programs can mitigate this imbalance, through strategic awareness campaigns for women. Governments and donor funded programs can also offer specialized financing opportunities specifically for women.

In order to facilitate the effective deployment of cold storage solutions in Africa, it is crucial to ensure that adequate financing, sufficient training on SPCSS selection, use and maintenance, and affordable payment/business options such as Pay-As-You-Store, Lease-To-Own, Ice-As-A-Service are available and accessible tailored to location and business types.[150]

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[146] Ibid

[147] Ibid

[148] Solar cold storage: A solution to Africa's post-harvest loss < https://fullygreenafrica.com/solar-powered-cold-storage-could-be-the-solution-to-africa-post-harvest-loss/ >

[149] Power Africa, PRODUCTIVE USE COLD STORAGE SYSTEMS IN NIGERIA < https://pdf.usaid.gov/pdf_docs/PA00Z8X7.pdf >

[150] Ibid

Africa has a positive outlook for solar-powered cold storage due to the continent's abundant solar resources and a growing demand for energy-efficient cooling solutions, taking into consideration the highlighted recommendations.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Upscaling Hydropower as a Renewable Energy Source across Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory and policy angle to assist decision makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for upscaling hydropower as a renewable energy source across Africa.

SOURCE: Statista

The graph depicts the world's biggest hydropowers and its commensurate electricity generation capacity with no mention of any African country, despite the region's large resource potential.

Hydroelectric technology is a flexible and versatile technology that provides renewable electricity on the national grid and/or off grid schemes.[151] At its minimum capacity, it can supply a single home and at its maximum capacity, it can supply the public and industry clean power.[152] In recent times, wind and solar energy usually grab headlines in global debates on renewable energy and the drive to find cleaner, greener options over fossil fuels. However, the available data is contrary to this position; but points to hydropower. Currently, hydropower generates over three-quarters of the global renewable energy output each year and its CO2 emissions over the entire lifecycle process is usually lower than other RE sources.[153] Hydropower potential across Sub-Saharan Africa is about thrice the wind potential and it accounted for 84% of the non-fossil fuel energy use in Africa.[154]

With seven major rivers — the Nile, Niger, Congo, Senegal, Orange, Limpopo and Zambezi — Africa is well endowed with hydropower potential. However, exploitation of this potential has been hampered historically by a mismatch between demand and supply that has not been overcome by long-distance transmission line infrastructure.[155] It is estimated that only 7% of Africa's hydropower potential has been harnessed, compared to 33% for Europe and 65% globally.[156]

Many other African countries are currently planning or carrying out new hydropower projects in Africa including Angola, Cameroon, Democratic Republic of Congo, and Ethiopia. Interestingly, Tanzania has just recently decided to close five hydropower plants to address an excess of electricity in the national grid.[157]

However, hydropower projects require substantial upfront investment in infrastructure and technology.[158] Securing financing for these projects can be challenging, due to the

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[151] Williams S. Ebhota, P. Y. Tabakov, Power Supply and the Role Hydropower Plays in Sub-Saharan Africa's Modern Energy System and Socioeconomic Wellbeing.

[152] Ibid

[153] Ibid

[154] Ibid

[155] Hydropower in Africa < https://www.projectfinance.law/publications/2008/november/hydropower-in-africa/ >

[156] Ibid

[157] Omono Okonkwo, < https://www.linkedin.com/posts/omono-okonkwo-33371486_energy-nigeria-electricity-activity-7189193822566813696-A4zl/?utm_source=share&utm_medium=member_ios >

[158] Hydropower in Africa < https://www.projectfinance.law/publications/2008/november/hydropower-in-africa/ >

high capital costs, long payback periods, and perceived risks associated with large-scale infrastructure development in Africa. Hydropower also requires investment in transmission and distribution infrastructure to deliver electricity from remote hydropower sites to urban centers and rural communities. The construction of large dams and reservoirs can also have significant environmental impacts, including habitat disruption, biodiversity loss, and alteration of river ecosystems.[159] These impacts can result in conflicts with conservation efforts and affect the livelihoods of local communities dependent on natural resources.

It will be necessary for African countries to promote regional cooperation and integration in hydropower development. This includes sharing technical expertise, coordinating investment plans, and developing cross-border transmission infrastructure to facilitate power trade among neighboring countries.[160] African governments and international organizations will also need to prioritize investments in hydropower infrastructure.[161] This includes building new dams, upgrading existing facilities, and developing transmission lines to deliver electricity from hydropower plants to urban centers and remote regions.

Also, it is recommended that governments conduct thorough Environmental and Social Impact Assessment (ESIA) studies for proposed hydropower projects to assess their potential environmental and social impacts.[162] This includes evaluating effects on ecosystems, local communities, and cultural heritage sites. Mitigation measures should be implemented to minimize adverse effects and ensure sustainable development.

Furthermore, it will be necessary to design hydropower projects with climate resilience in mind, to withstand extreme weather events and changing hydrological conditions.[163] This may involve incorporating climate risk assessments into project planning, diversifying water sources, and adopting management strategies that are adaptive.

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[159] Ibid

[160] AFDB, Hydropower Modernisation Report < https://www.afdb.org/sites/default/files/documents/publications/hydropower_modernisation_report.pdf >

[161] Ibid

[162] Ibid

[163] IEA, < https://www.iea.org/reports/climate-impacts-on-african-hydropower/measures-to-enhance-the-resilience-of-african-hydropower >

Finally, governments can encourage the development of small-scale hydropower projects, particularly in rural and off-grid areas.[164] These projects can provide reliable electricity access to underserved communities, while minimizing environmental and social impacts compared to large-scale dams.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Adopting Carbon Taxation Policies to reduce Greenhouse Gas Emissions in Africa

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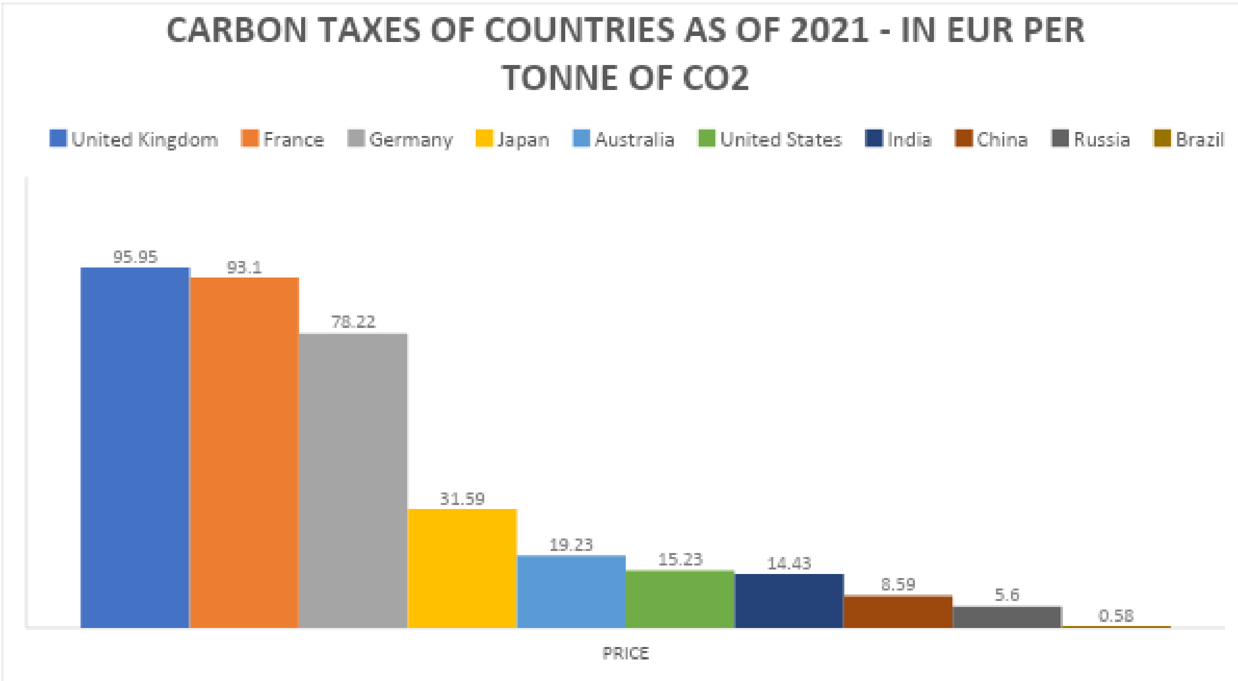
The data intelligence highlights considerations for adopting Carbon tax policies to reduce Greenhouse Gas Emissions in Africa.

[164] Williams S. Ebhota, P. Y. Tabakov, Power Supply and the Role Hydropower Plays in Sub-Saharan Africa's Modern Energy System and Socioeconomic Wellbeing.



SOURCE: Ember

The graph depicts the carbon taxes of countries as of 2021 and there are no African countries listed

Carbon taxation is a policy tool aimed at reducing greenhouse gas emissions by placing a price on carbon emissions. It involves levying a tax on activities that produce carbon dioxide and other greenhouse gases, typically associated with the burning of fossil fuels. The fundamental idea behind carbon taxes is to internalize the environmental costs of carbon emissions, encouraging individuals, businesses, and industries to reduce their carbon footprints by making it more expensive to pollute.[165] Globally, carbon pricing initiatives are gaining momentum, with more countries adopting carbon taxes or emissions trading systems to address climate change. Developed countries in the European Union are aggressively using carbon pricing mechanisms to transition to a green economy and achieve climate neutrality goals.[166] In 2022, the 15 countries in the EU generated approximately $30 billion in revenue from

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[165] Ian,Parry, "WHAT IS CARBON TAXATION?" https://www.imf.org/en/Publications/fandd/issues/2019/06/what-is-carbon-taxation-basics Accessed 2 May 2025

[166] Bob,KOigi, " Is Africa ready for carbon tax?" https://abmagazine.accaglobal.com/global/articles/2021/apr/business/is-africa-ready-for-carbon-tax-.html Accessed 2 May 2024

carbon taxes. France and Canada lead in this regard, accounting for over half of the total amount. Both countries have implemented comprehensive carbon pricing systems that cover a wide range of sectors, including transportation and industry, and they have set relatively high carbon tax rates.[167]

In Africa, the implementation of carbon taxes varies across countries. South Africa stands out as the first African country to adopt a carbon tax policy, which was implemented in June 2019 as part of its mitigation strategy,[168] but there have been no adoptions by any other countries in Africa, although other African countries, particularly in West Africa, are also exploring carbon pricing mechanisms, with a focus on carbon taxes; due to their relative simplicity and ease of implementation. Countries like Senegal, Togo, and Guinea-Bissau are currently studying or planning to implement carbon taxes as part of their climate action efforts.[169]

However, in sub-Saharan Africa, only a few countries are considering carbon taxes, with South Africa leading the way in this regard, While South Africa has taken a significant step in implementing a carbon tax, other African countries are at different stages of considering or studying carbon pricing mechanisms, with a focus on carbon taxes.[170] Despite the potential benefits of carbon taxes for reducing greenhouse gas emissions and mobilizing funds for climate adaptation, the adoption of such policies in Africa faces several challenges and complexities.

One key challenge is the limited coverage of carbon pricing initiatives in developing countries, including those in sub-Saharan Africa.[171] While South Africa has taken a significant step in implementing a carbon tax, many other African nations have not yet adopted similar policies. This lack of uniformity in carbon pricing mechanisms

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[167] Bruno,Venditti " Ranking the Top 15 Countries by Carbon Tax Revenue" https://www.visualcapitalist.com/ranking-the-top-15-countries-by-carbon-tax-revenue/ Accessed 2 May 2024

[168] "South Africa Carbon Pricing And Climate Mitigation Policy" https://www.elibrary.imf.org/view/journals/002/2023/195/article-A003-en.xml Accessed 2 May 2024

[169] "A synthesis Report: Carbon Pricing Approach in West Africa" https://unfccc.int/sites/default/files/resource/Carbon_Pricing_Report_WA_Final_Alt.pdf Accessed 2 May 2024

[170] Ibid n2

[171] What is the case for carbon taxes in developing countries?" https://www.taxdev.org/news-events/what-case-carbon-taxes-developing-countries Accessed 2 May 2024

across the continent hinders the collective effort to address climate change effectively.[172]

Nevertheless, there are several practical considerations for African countries to enhance the adoption of carbon taxes. These include carefully determining the tax rate and design. The tax rate should strike a balance; it must be set at a level that incentivizes emission reductions, without excessively burdening businesses and households[173]. To achieve this balance, it is crucial to consider the African context when establishing tax rates, defining tax bases, and estimating revenue. Additionally, carbon taxes should be integrated with other climate policies, such as carbon budgets, to ensure coherence and prevent businesses from facing duplicate penalties. Furthermore, eliminating fossil fuel subsidies can serve as a complementary measure to reinforce the effectiveness of carbon taxes.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

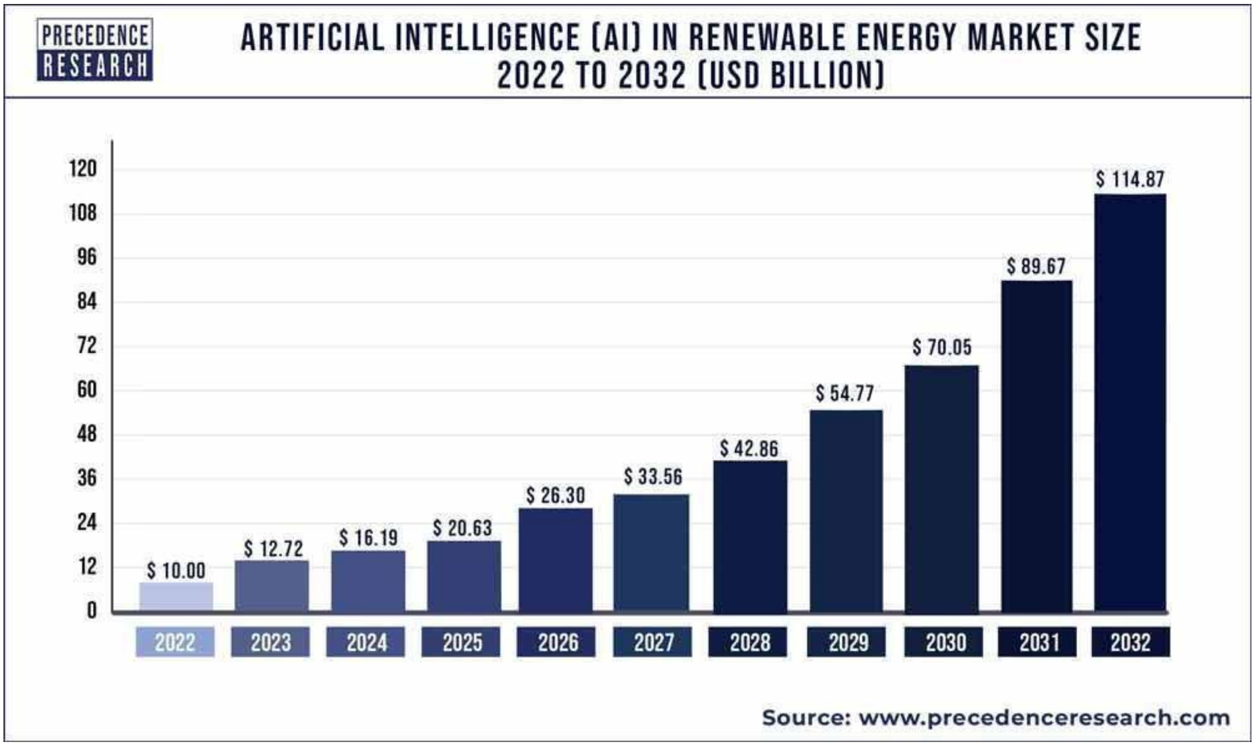
Practical Considerations for Harnessing Artificial Intelligence (AI) for Renewable Energy Grid Integration in the African Renewable Energy Sector

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for harnessing AI for Renewable Energy Grid Integration in the African Renewable Energy Sector

[172] Ibid n7

[173] " ATAF Releases Policy Guidelines for Carbon Tax" https://www.ataftax.org/ataf-releases-policy-guidelines-for-carbon-tax Accessed 2 May 2024



SOURCE: Precedenceresearch

This chart portrays the rise of Artificial Intelligence in the Renewable Energy Market Size globally.

The integration of Artificial Intelligence (AI) into the renewable energy sector has been steadily gaining momentum in recent years, revolutionizing the way energy is produced, managed, and consumed globally. This technological convergence has ushered in a new era of efficiency, optimization, and sustainability, addressing the pressing challenges faced by the renewable energy industry.[174] The rapid growth of renewable energy sources, particularly solar and wind power, has led to the development of complex energy systems that require sophisticated management and optimization. AI technologies have proven to be effective in improving the efficiency and reliability of these systems; by analyzing vast amounts of data, identifying patterns, and making predictions. The integration of AI in renewable energy

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[174] The transformative role of artificial intelligence in smart energy transition for unprecedented energy sustainability in Nigeria > https://www.researchgate.net/publication/378434396_The_transformative_role_of_artificial_intelligence_in_smart_energy_transition_for_unprecedented_energy_sustainability_in_Nigeria Accessed 9 May 2024

systems has been successfully implemented in various countries, including the United States, Europe, and Asia, resulting in significant cost savings, improved grid stability, and enhanced overall performance.[175]

The use of AI in renewable energy grid integration can be traced back to the early 2000s, when researchers and industry players recognized the immense potential of machine learning algorithms to enhance the performance and integration of renewable energy sources, such as solar and wind power.[176] As the global demand for clean energy has intensified, driven by the urgent need to mitigate climate change, countries around the world have increasingly embraced AI-powered solutions to optimize their renewable energy infrastructure. The adoption of AI in renewable energy systems has been widespread globally, with various countries leveraging AI to optimize their energy production and consumption. For instance, in the United States, AI-powered predictive maintenance has been used to reduce downtime and increase the efficiency of wind turbines. In Europe, AI-driven energy management systems have been implemented to optimize energy distribution and consumption. Similarly, in Asia, AI has been used to improve the efficiency of solar panels and wind turbines.

The market for AI in the renewable energy sector has been steadily growing, with a projected value of over $4 billion by 2027, up from an estimated $1.5 billion in 2022, representing a compound annual growth rate of over 18%.[177] This growth is driven by the increasing adoption of AI-powered solutions across various applications, including predictive maintenance, energy storage optimization, and grid management[178]. Looking to the future, the integration of AI in the renewable energy sector is poised to accelerate, as countries and organizations worldwide recognize the transformative potential of this technology. Advancements in areas such as edge computing, 5G connectivity, and the Internet of Things (IoT) are expected to further enhance the capabilities of AI-driven renewable energy solutions, enabling real-time

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175 Review Artificial Intelligence Applications in Renewable Energy Systems Integration > https://www.researchgate.net/publication/380303588_Review_Artificial_Intelligence_Applications_in_Renewable_Energy_Systems_Integration

176 Ibid n1

177 https://www.sap.com/africa/insights/smart-grid-ai-in-energy-technologies.html

178 https://www.kyotutechnology.com/the-role-of-ai-in-optimizing-renewable-energy-production/

decision-making, improved grid resilience, and greater integration of distributed energy resources. [179]

Africa, a continent rich in natural resources, is facing challenges relating to energy efficiency and grid integration. The demand for electricity is surging, due to rapid population growth and urbanization, necessitating innovative solutions for sustainable energy production. Despite the potential benefits of AI in optimizing power generation and distribution systems, Africa lags in harnessing AI for renewable energy integration. The lack of capacity building, skills development, and robust data collection systems pose significant barriers to AI adoption in the African renewable energy sector.[180]

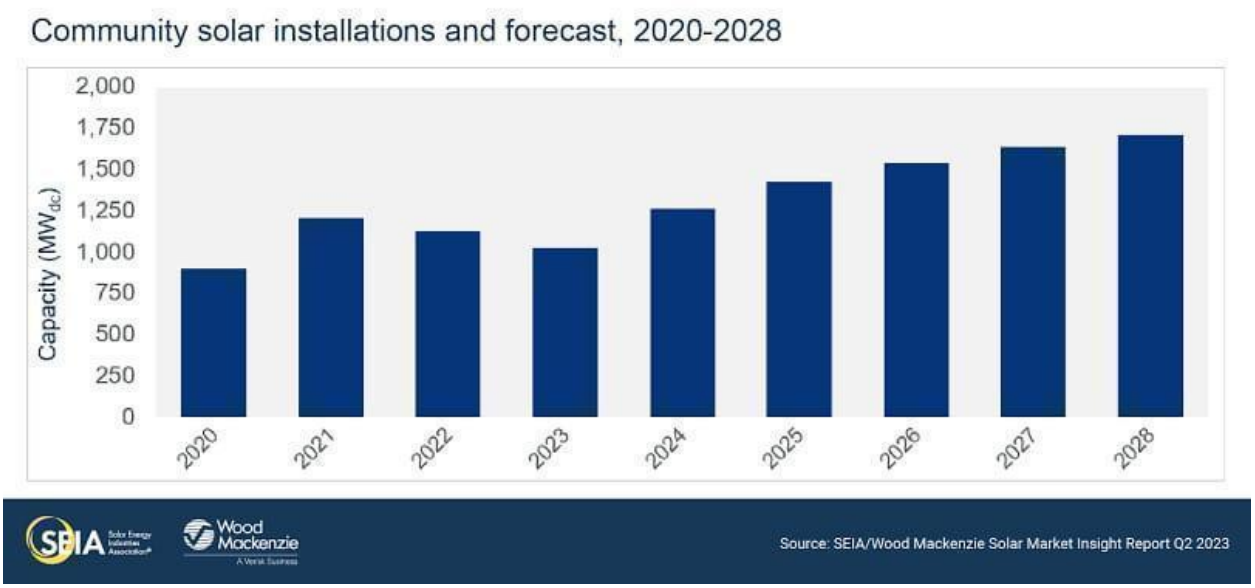
To make the considerations for using AI in the African renewable energy sector a reality, a lot has to be put in place to ensure its widespread adoption and effective use; including robust data collection systems, which are essential for leveraging AI to optimize renewable energy sources like solar and wind. AI algorithms rely on data from various sources, such as smart grids and weather patterns, to provide insights for better planning and resource allocation. Collaboration between governments, private sector companies, and international organizations remains essential for the successful implementation of cost-effective tailored AI systems and solutions in Africa.

[179] https://www.energymrc.ng/transforming-renewable-energy-using-artificial-intelligence/
[180] https://www.linkedin.com/pulse/enhancing-energy-efficiency-africa-harnessing-ai-optimize-ajayi-aaxff/

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Leveraging Community Solar in Bridging the Electrification Gap in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.
The data intelligence highlights considerations for Harnessing Community Solar in Bridging the Electrification gap in Africa



SOURCE: SEIA

This chart illustrates the increasing trend in the integration and installation of community solar projects.

Community solar, a revolutionary concept in the renewable energy sector, has been gaining momentum globally; in response to the pressing need for clean, accessible, and affordable energy. The traditional model of solar energy, where individuals or businesses install solar panels on their rooftops, has been limited by various barriers, including high upfront costs, lack of suitable roof space, and restrictive policies. Community solar, on the other hand, offers a collaborative approach, enabling multiple individuals or organizations to share the benefits of a single solar array, thereby democratizing access to clean energy.

The need for community solar has become more pressing than ever before, as the world grapples with the challenges of climate change, energy poverty, and environmental degradation. The increasing reliance on fossil fuels has led to alarming levels of greenhouse gas emissions, contributing to climate change and its devastating consequences. Moreover, millions of people worldwide lack access to reliable and affordable energy, hindering economic development and social progress. Community solar presents a viable solution to these challenges, offering a clean, renewable, and community-driven approach to energy generation.

One of the primary advantages of community solar is its ability to overcome the barriers associated with traditional solar adoption. By pooling resources and sharing the costs, individuals and organizations can participate in a community solar project, even if they lack the financial means or suitable infrastructure for individual installations. This model also enables renters, low-income households, and those with shaded or unsuitable rooftops to benefit from solar energy, thereby increasing energy equity and accessibility. Furthermore, community solar projects can be designed to serve specific community needs, such as providing energy for local schools, hospitals, or community centers, thereby enhancing the overall quality of life.

Community solar projects also offer a unique opportunity for community engagement and education. By involving local residents in the planning, development, and maintenance of these projects, community solar initiatives can foster a sense of ownership and responsibility, promoting environmental stewardship and sustainability. Additionally, community solar can serve as a catalyst for economic development, creating jobs, stimulating local economies, and attracting investments in clean energy infrastructure.

Community solar has emerged as a significant model for solar energy deployment in the United States, with projects spanning 39 states and Washington, D.C. as of December 2021. The total installed capacity of community solar projects exceeds 3,200 megawatts alternating-current (MW-AC), with the majority of the market concentrated in key states like Florida, Minnesota, New York, and Massachusetts. About 74% of the total market is concentrated in the top four states: Florida (1,636 MW-AC), Minnesota (834 MW-AC), New York (731 MW-AC), and Massachusetts (674 MW-AC).

In the European Union, the Renewable Energy Directive (RED II) introduced the concept of "renewable energy communities" in 2018, which has led to the development of community solar projects in several member states. Germany has seen significant growth in community solar, with over 1,000 projects installed by 2020, totaling more than 200 MW of capacity. The Netherlands has also emerged as a leader in European community solar, with projects like the Zonnepark Rilland, a 54 MW community solar farm completed in 2020.

The adoption of community solar in Africa is still in its early stages compared to other regions, but it is gaining traction as a promising solution to bridge the electrification gap and provide clean, affordable, and reliable electricity to communities across the continent. Africa boasts an abundance of solar resources, with 60% of the world's best solar potential; yet over 80% of the global population lacking access to electricity resides in Sub-Saharan Africa. This stark contrast highlights the significant potential for solar energy to address the electricity access gap.

Nevertheless, household solar solutions, including solar home systems (SHS), have emerged as a promising approach to provide clean energy to African homes. Between 2012 and 2019, the number of SHS deployed in Africa grew from around 0.5 million to over 5 million. Despite this growth, there is still a pressing need for the deployment of community solar to further bridge the electrification gap. To achieve this, there are practical considerations for leveraging community solar in Africa.

Community solar can play a significant role in bridging the electrification gap in Africa, particularly in regions with limited grid infrastructure and high solar potential. To unlock the full potential of community solar, governments must create an enabling policy environment that supports the development of community solar projects. This includes implementing policies such as feed-in tariffs, net metering, and tax incentives to attract investment and drive growth. Additionally, harmonizing standards and quality control measures can help mitigate challenges in customs clearance and import logistics.

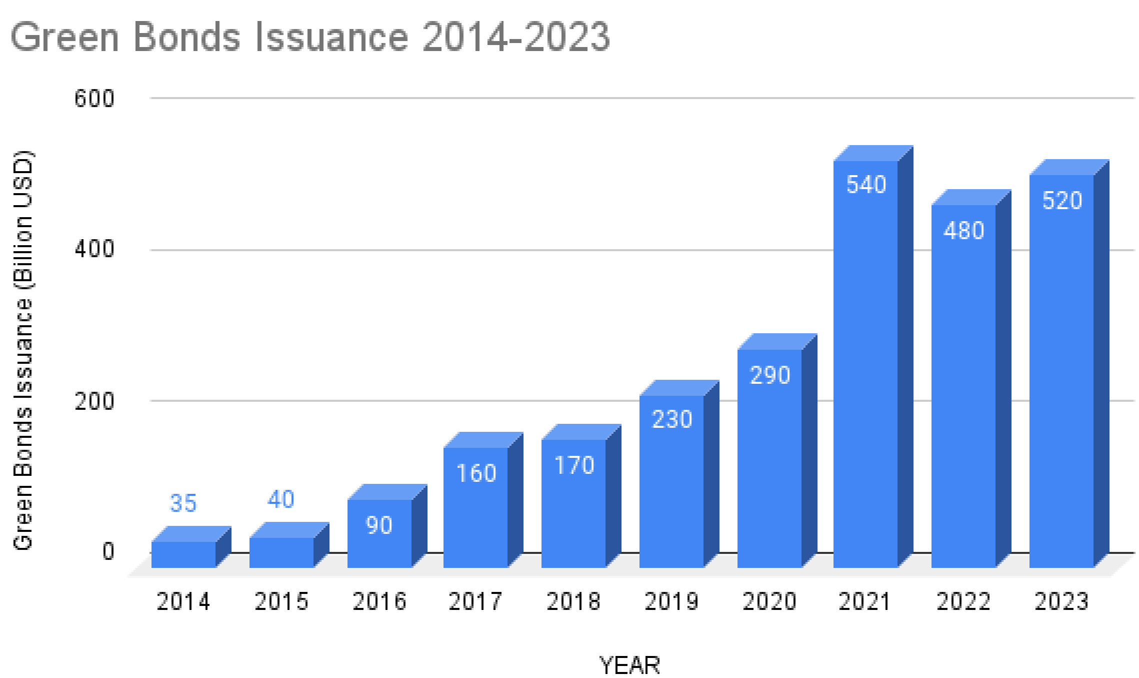
Innovative financing mechanisms are also crucial to improving affordability and accessibility of community solar systems for underserved communities. Lease-to-own models and cash-for-energy programs can provide flexible payment options, while blended finance approaches that combine public, private, and donor funding can help de-risk investments and attract private sector participation in community solar projects. Scalable deployment is another key consideration, as a combination of different solar deployment solutions, from individual solar home systems to larger mini grids, are needed to cater to the diverse settings and energy needs of communities across Africa. Economies of scale can be achieved by developing multiple community solar sites simultaneously, spreading fixed costs over larger volumes of electricity generated and sold. By addressing these practical considerations and leveraging the unique advantages of community solar, African countries can accelerate progress towards universal electricity access and sustainable development goals.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for utilising Green Bonds to support Sustainability and Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for utilising Green Bonds to support Sustainability and Energy Transition in Africa.



SOURCE: Electricity Lawyer (statistics from Bloomberg)

The chart illustrates the green bond issuance worldwide from 2014 to 2023.

Green bonds are debt securities issued by financial, corporate or public entities where the proceeds are used to finance green projects and assets. They are similar to regular "vanilla bonds" in structure and credit rating, with the green label being an additional feature from the investor's perspective and a powerful market signal from the issuers.[181]

The green label refers to the projects and assets associated with the green bond, rather than the broader green credentials of the issuer. Green bonds help investors diversify their investment portfolio and signal an organization's green credentials by investing for environmental purposes. Unlike traditional bonds, green bonds require periodic reporting on environmental, social and economic goals/impacts, unlike traditional bonds, it also has additional steps in the issuance process, such as developing a green bond framework, getting an external review, and allocating proceeds to eligible green projects.[182]

The essence of green bonds lies in their ability to provide a financial mechanism for investments that have positive environmental impacts, such as renewable energy projects and sustainable infrastructure developments. These bonds are structured similarly to traditional bonds in terms of credit rating and structure, with the green label serving as an additional feature that signals the bond's environmental focus to investors.

The adoption of green bonds worldwide has been on the rise, reflecting a growing trend towards sustainable finance and environmental responsibility. Countries and organizations are increasingly turning to green bonds to attract private funding, stimulate financial sector development, and allocate resources to critical green initiatives. The market for green bonds has expanded beyond traditional corporate bonds to include project bonds, asset-backed bonds, and covered bonds, indicating a broadening scope of green financing options. The surge in green bond issuance globally underscores the commitment to addressing environmental challenges and meeting sustainability goals set by international agreements like the Paris Agreement and the UN Sustainable Development Goals.

The global green bonds market has seen substantial growth, with total issuance reaching $521 billion since 2007. The United States leads this market with $118.6 billion

[181] https://asianbondsonline.adb.org/green-bonds/gbfactsheet10.html

[182] Nigeria’s Green Bond Programme https://ng.boell.org/sites/default/files/2022-02/Nigeria%E2%80%99s%20Green%20Bond%20Programme2022Report.pdf

in green bonds, followed by China at $77.5 billion and France. In 2022, Germany emerged as the third-largest issuer with $61.2 billion.[183]

In ASEAN (Association of Southeast Asian Nations) countries, green bond issuance remains low compared to top global issuers. Indonesia is the largest green bond issuer in the region, despite its relatively limited experience with conventional bond issuance compared to Singapore and Thailand. In ASEAN, the majority of green bond proceeds are directed towards green buildings, with Singapore and Malaysia being the forerunners. Additionally, renewable energy projects in Indonesia, Thailand, and the Philippines receive a significant share of green bond investments.[184]

Green bonds have a significant positive impact on the environment, particularly in reducing carbon emissions and increasing renewable energy production:

- Countries with higher green bond issuance are more likely to achieve their sustainability goals, with green bonds substantially impacting both emissions reduction and renewable energy growth, especially after 2015.[185]
- Green bond issuers in the energy, utilities and banking sectors in Europe were much more likely to disclose emissions data and reduced their carbon intensity to a larger extent between 2009-2019 compared to other firms.[186]
- Green bond proceeds are used to finance environmentally sustainable projects and assets across sectors like renewable energy, green buildings, clean transportation, and sustainable water management.[187]

Green bonds have significant potential to support Africa's climate ambitions and drive sustainable development, but the continent's green bond market remains underdeveloped compared to other regions. Several African countries, including Nigeria, South Africa, Seychelles, Morocco and Egypt, have successfully issued green bonds, demonstrating the feasibility of this financing tool. For example, in Nigeria, the

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183 GREEN BONDS THE STATE OF THE MARKET 2018 https://www.climatebonds.net/files/reports/cbi_gbm_final_032019_web.pdf

184 GREEN BONDS FOR FINANCING RENEWABLE ENERGY AND ENERGY EFFICIENCY IN SOUTHEAST ASIA: A REVIEW OF POLICIES https://www.adb.org/sites/default/files/publication/562116/adbi-wp1073.pdf

185 https://www.mdpi.com/2071-1050/15/13/10177

186 https://www.esma.europa.eu/sites/default/files/trv_2021_2-environmental_impact_and_liquidity_of_green_bonds.pdf

187 https://ng.boell.org/sites/default/files/2022-02/Nigeria%E2%80%99s%20Green%20Bond%20Programme2022Report.pdf

first series of a NGN10 billion Green Bond Issuance Programme was issued by a company, with the proceeds used to purchase renewable energy assets required to implement its pipeline of off-grid energy access projects.[188]

The African Development Bank (AfDB) actively supports the development of green bond markets in Africa, providing technical assistance, strengthening financial intermediaries, and acting as a guarantor or anchor investor. In 2022, Africa accounted for less than 1% of over $2 trillion in total global green bond issuance, a share that needs to increase significantly to meet climate and sustainable development goals.[189]

However, barriers such as lack of local demand, high transaction costs, and limited awareness of opportunities have hindered more widespread adoption. To address these challenges, closer cooperation among African countries could be beneficial, with successful issuers sharing experiences and guidelines to assist others. Pooling projects across countries to issue regional green bonds is another potential solution.[190]

International lenders like the World Bank, European Investment Bank, and AfDB are vigorously promoting green financing solutions. They provide guarantees for green bonds to attract private investors and support the funding of Sustainable Development Goals. It is crucial for key stakeholders in Africa to leverage these opportunities. Such support is essential for mobilizing private capital and tackling sustainability challenges in the region.

To effectively utilise green bonds for sustainability and energy transition in Africa, overcoming market and institutional barriers, fostering collaboration among countries, leveraging international support, accessing lower-cost capital, and addressing climate challenges are key.

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[188] Ibid n2

[189] Experts Discuss Market Conditions, Performance and Expectations for Green Bonds and Sustainable Debt Issuance in Africa https://www.afdb.org/en/news-and-events/experts-discuss-market-conditions-performance-and-expectations-green-bonds-and-sustainable-debt-issuance-africa-69661

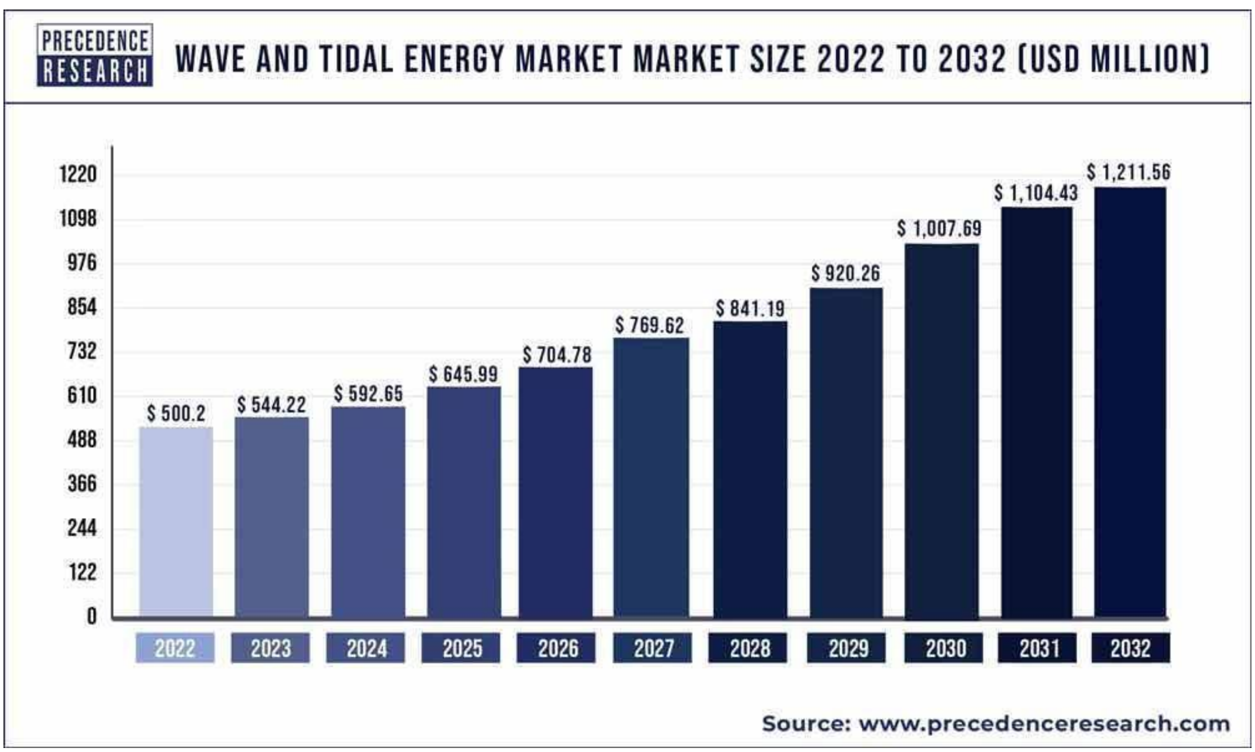
[190] Greening African Finance: Barriers to Issuing Green Bonds and How to Overcome Them https://fbf.eui.eu/greening-african-finance-barriers-to-issuing-green-bonds-and-how-to-overcome-them/

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Integrating Wave and Tidal Energy Systems into Africa's Energy Mix

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for the integration of Wave and Tidal Energy Systems into Africa's Energy Mix



SOURCE: Precedence research

The chart illustrates the Wave and Tidal Energy Market size.

Wave energy harnesses surface wave motion using devices like oscillating water columns and pendular devices, while tidal energy captures kinetic energy from tidal currents with underwater turbines or barrages. Both are renewable but differ in mechanisms and locations, with wave energy often nearshore or offshore and tidal energy in tidal streams or barrages.[191]

The history of wave and tidal energy as an energy source dates back centuries, with early civilizations harnessing the power of waves and tides for various mechanical tasks.[192] Wave energy utilization can be traced back to ancient times, with the development of wave-powered mills and water pumps. Significant advancements in wave energy conversion devices took place during the 20th century, laying the foundation for modern wave energy technologies.[193]

Tidal energy also has a long history, with an early history dating back to the 7th century with the use of tide mills to grind grain. The industrialization era witnessed advancements in tidal energy technology, leading to the emergence of tidal mills and their historical significance.[194]

In the 20th century, engineers developed ways to use tidal movement to generate electricity in areas with significant tidal ranges. The first tidal power plant was the La Rance Tidal Power Station, opened in France in 1966. Since then, the tidal energy industry has seen slow progression due to high costs and potential negative impacts on aquatic wildlife. The largest operational tidal power plant is the Sihwa Lake Tidal Power Station in South Korea, opened in 2011.[195]

Wave and tidal energy are still relatively new and understudied technologies, with more investments and research needed to make them competitive with other

[191] BBC "What's the difference between wave energy and tidal energy?" https://www.sciencefocus.com/science/whats-the-difference-between-wave-energy-and-tidal-energy

[192] " History of wave and tidal Energy" https://green.org/2024/01/30/history-of-wave-and-tidal-energy/

[193] Ibid (" History of wave and tidal Energy" https://green.org/2024/01/30/history-of-wave-and-tidal-energy/)

[194] https://impactful.ninja/the-history-of-tidal-energy/

[195] https://education.nationalgeographic.org/resource/tidal-energy/

renewable energy sources. The future of these energy sources will be heavily influenced by further research, investments, and policy developments.[196]

The global wave and tidal energy market size is projected to grow from $1.28 billion in 2024 to $19.75 billion by 2032, at a compound annual growth rate of 40.75%.[197] Globally, 970 gigawatt-hours (GWh) of electricity in 2022, was generated from marine energy tidal and wave energy, a slight decrease from the previous year.[198] Europe currently dominates the market with a share of 64.29% in 2023. The increasing penetration of renewable energy sources and the potential of wave and tidal energy are leading to its commercialization through the deployment of small arrays.

Government initiatives and technological advancements are fostering market growth. Policies and support mechanisms, such as the partnership between EMEC and PTEC to develop a tidal site in England and the TIGER project funded by Interreg Channel for $46.75 million, are driving the development and commercialization of wave and tidal technologies. The rising grid integration of wave and tidal energy is also contributing to the market's growth by improving reliability and predictability.

India has a potential of around 54 gigawatts (GW) of ocean energy, including 12.45 GW of tidal power and 41.3 GW of wave power, but it is yet to be utilized. The Government of India has taken initiatives to encourage individuals and companies to opt for wave and tidal energy, such as proposing a major tidal wave power project worth Rs.5000 Cr in Gujarat's Gulf of Kutch.[199] The worsening energy crisis and growing environmental concerns have prompted governments, consumers, and manufacturers to focus on alternative sources of energy, putting wave and tidal energy in the spotlight.

The wave and tidal energy landscape in Africa is characterized by significant potential for harnessing renewable energy from the ocean. Countries along the coastal regions, such as Mozambique, Namibia, and Angola, exhibit favorable conditions for multiple energy sources, including wave and tidal power. These regions have expansive continental shelves that provide an ideal platform for floating offshore technologies,

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196 https://regeneration.org/nexus/wave-and-tidal-energy
197 https://www.fortunebusinessinsights.com/industry-reports/wave-and-tidal-energy-market-100584
198 Supra (" History of wave and tidal Energy" https://green.org/2024/01/30/history-of-wave-and-tidal-energy/)
199 https://www.transparencymarketresearch.com/wave-tidal-energy-market.html

such as ocean thermal energy conversion (OTEC) and marine power generation.[200] In West Africa, Ghana has been identified as a promising location for wave energy, with studies suggesting that it can meet the energy needs of the country using cost-effective and reliable technology. However, the potential of wave energy in West Africa is generally considered low, with estimates suggesting values below 1 kW/m, which is slightly above the poorest wave energy record.[201]

The African continent has a diverse range of ocean energy sources, including waves, tides, marine currents, and salinity gradients. These sources have the potential to contribute significantly to the continent's energy needs, particularly in rural areas where decentralized renewable off-grid and mini-grid systems are cost-effective and ideal solutions for electrification.

Despite the potential, the development of wave and tidal energy in Africa faces challenges due to the demanding marine environment and the early-stage nature of the technologies. However, as circumstances align, these resources can contribute to a thriving "Blue Economy" and help address the continent's electricity crisis. The challenges facing the development of wave energy in Africa include the high cost of producing electricity compared to other sources, lack of highly experienced and trained manpower, and the demanding marine environment. Additionally, the lack of technological convergence and the need for complex and expensive maintenance and operation (O&M) procedures further hinder the progress of wave energy projects in the region.[202]

Integrating wave and tidal energy systems into Africa's energy mix requires careful consideration of several practical factors. Firstly, the availability and predictability of these resources vary significantly across different regions of Africa. While some areas like South Africa, Namibia, Mauritius, and Madagascar have high wave energy potential, other regions like Northern Africa have limited potential due to the enclosed Mediterranean and Red Seas. Similarly, tidal energy potential is site-specific, with

[200] https://www.tandfonline.com/doi/full/10.1080/14786451.2023.2204378
[201] Ibid
[202] https://www.power-technology.com/features/featurewave-and-tidal-energy-the-om-challenges-5921035/

some scattered hotspots in Eastern and Western Africa where the semidiurnal tidal amplitude is higher than elsewhere.[203]

The technical maturity and cost-effectiveness of the technologies are also crucial considerations. While offshore wind power is currently the most technically mature offshore renewable technology, other technologies like wave power and ocean thermal energy conversion (OTEC) are still in the early stages of development and face challenges in overcoming the demanding marine environment. The cost-effectiveness of these technologies will also play a significant role in their adoption and integration into Africa's energy mix.[204]

Lastly, policy considerations, such as renewable energy targets, regulations, incentives, and offshore use and zoning regulations, can significantly impact the successful integration of wave and tidal energy systems. Establishing clear and comprehensive regulatory frameworks, offering feed-in tariffs and incentives, and ensuring efficient management of the sector through offshore use and zoning regulations can promote the development and integration of these technologies.

Integrating wave and tidal energy systems into Africa's energy mix requires a careful assessment of resource availability, grid connectivity, technical maturity, cost-effectiveness, and policy considerations. By addressing these practical factors, African countries can harness the potential of these renewable energy sources to contribute to a thriving "Blue Economy" and a more sustainable energy future for the continent.

[203] https://reglobal.org/assessing-the-potential-of-offshore-renewable-energy-in-africa/

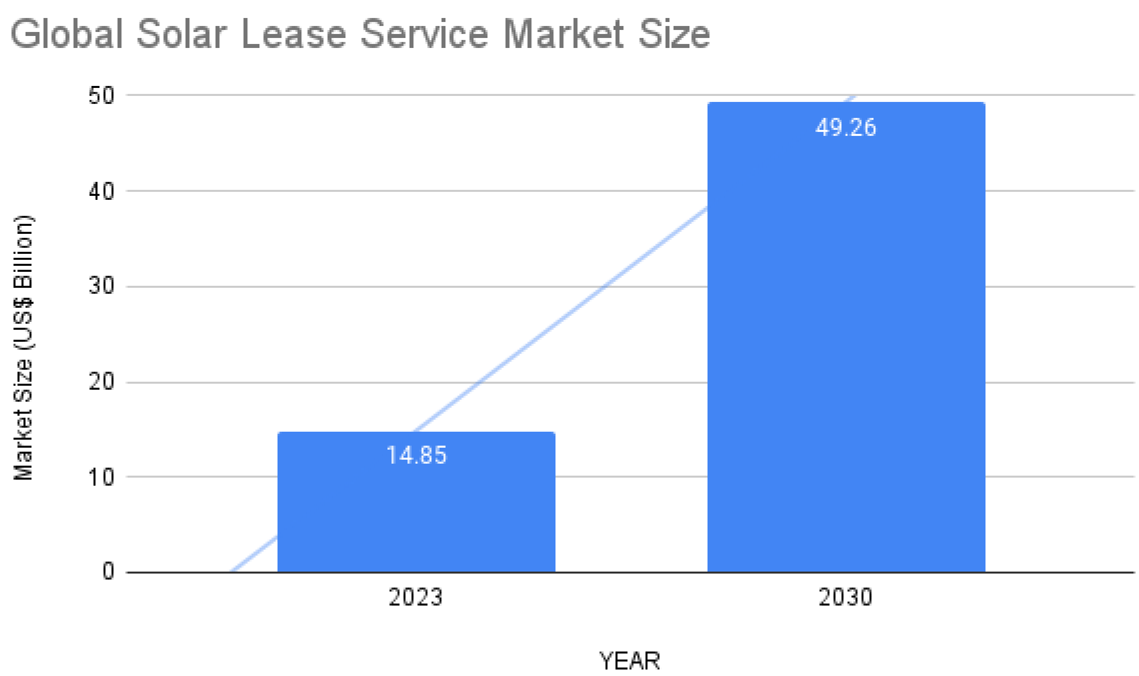
[204]

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Africa's Sustainable Energy Transition through Global Solar Lease Services

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to promote Africa's sustainable Energy Transition through Global Solar Lease Services.



SOURCE: Electricity lawyer (Statistics from Coherent Market Insights)

The chat illustrates the market size of the Global Solar Lease service from 2023 to 2030.

A solar lease is a contract service provided by solar companies to have a solar energy system installed on residential and small commercial buildings with little to no upfront cost[205]. Solar lease services allow consumers to lease solar panels from a solar company rather than purchasing them. A third-party solar provider installs and maintains solar panels on a customer's property, and the customer pays a monthly lease or rental fee for the use of the solar power system[206]. This arrangement allows individuals and organizations to access solar energy without the upfront cost of purchasing and installing solar panels. A substantial decline in the cost of solar PV power plants (80% reduction since 2008) has enabled solar energy to compete with

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205 Solar Lease Service Market (https://www.transparencymarketresearch.com/solar-lease-service-market.html)

206 What is solar leasing? (https://palmetto.com/learning-center/blog/solar-lease-solar-leasing-guide-pros-cons)

other power generation options in some developed markets[207]. For homeowners lacking the financial capacity to purchase a solar home system, third-party ownership (solar leasing or power purchase agreement) has enabled them to avoid high up-front costs[208].

The global solar lease service market is poised for significant growth in the upcoming years, driven by the escalating demand for renewable energy sources and the awareness of environmental sustainability. The market size of solar lease services is estimated to be valued at US$ 14.84 billion in 2023 and is expected to reach US$ 49.26 billion by 2030[209], representing more than a threefold increase. This growth is fueled by increasing awareness of the advantages of solar energy, technological advancements, declining solar equipment costs and government initiatives to promote solar energy usage. Key market drivers include declining solar panel costs, government policies, and rising environmental awareness[210].

One of the key drivers contributing to the growth of the global solar lease service market is the rising demand for clean and renewable energy sources. Solar energy presents an attractive alternative to traditional fossil fuels due to its eco-friendly nature and its potential to reduce carbon emissions. As a result, individuals and businesses are increasingly gravitating towards solar lease services as a cost-effective and sustainable energy solution[211]. Furthermore, the declining solar equipment costs, such as solar panels and inverters, are making solar lease services more accessible and affordable for consumers. Technological advancements and

[207] Bindzi Zogo Emmanuel Cedrick, Wei Long "Why Solar Is Financially More Attractive for a rapid increase of Distributed Solar Power in Developing Countries?" https://www.iiste.org/Journals/index.php/JEDS/article/view/32652

[208] Ibid (Bindzi Zogo Emmanuel Cedrick, Wei Long "Why Solar Is Financially More Attractive for a rapid increase of Distributed Solar Power in Developing Countries?" https://www.iiste.org/Journals/index.php/JEDS/article/view/32652)

[209] Solar Lease Service Market Size and Share Analysis (https://www.coherentmarketinsights.com/industry-reports/solar-lease-service-market)

[210] Ibid (Solar Lease Service Market Size and Share Analysis https://www.coherentmarketinsights.com/industry-reports/solar-lease-service-market)

[211] Supra (Solar Lease Service Market https://www.transparencymarketresearch.com/solar-lease-service-market.html#:~:text=Key%20Drivers%20of%20Global%20Solar,service%20during%20the%20forecast%20period.

economies of scale in the solar industry have led to a significant reduction in the upfront costs associated with solar installations, thereby making solar lease options an appealing choice for a broader consumer base[212].

The steep upward trajectory suggests that the market for solar lease services is expanding rapidly, likely due to increasing demand for renewable energy solutions, financial incentives and the decreasing costs of solar energy. Residential solar leasing has become very popular owing to its flexibility. Solar leasing will allow households to reduce electricity expenses and carbon footprint without high initial installation costs[213].

The key factors hampering the growth of the solar lease market are the disconnect between developers and customers, and complex legal and regulatory requirements. A mismatch between customer requirements and developer offerings can restrain market expansion[214]. Low awareness among people in developing economies is another limitation. The number of service providers of solar lease is less in developing countries. This is expected to restrain the solar lease service market in the near term.[215]

Major players operating in the global solar lease service market include: Sunrun, SunPower Corporation, LONGi Green Energy Technology Co., Tesla (SolarCity), JinkoSolar Holdings Co. Ltd and, Talesun.

Africa's abundant solar resources present a significant opportunity for advancing the continent's sustainable energy transition. Global solar lease services offer a promising solution to overcome financial and infrastructural barriers, facilitating the widespread adoption of renewable energy. The market is expected to continue growing as

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[212] Supra (Solar Lease Service Market https://www.transparencymarketresearch.com/solar-lease-service-market.html#:~:text=Key%20Drivers%20of%20Global%20Solar,service%20during%20the%20forecast%20period

[213] Supra (Solar Lease Service Market Size and Share Analysis https://www.coherentmarketinsights.com/industry-reports/solar-lease-service-market

[214] Supra (Solar Lease Service Market https://www.transparencymarketresearch.com/solar-lease-service-market.html)

[215] Supra (Solar Lease Service Market https://www.transparencymarketresearch.com/solar-lease-service-market.html)

technology improves, costs decrease, and environmental awareness increases. Europe is likely to dominate the global solar lease service market during the forecast period. High investments, especially by governments of countries such as Germany, and technological advancements are projected to drive the market in the region from 2020 to 2030. Asia Pacific is projected to be a high-potential region of the global solar lease service market during the forecast period, led by the rise in concerns about air pollution and carbon emissions in India and China[216].

The global solar lease service market presents substantial growth opportunities as the world shifts towards clean energy solutions. By harnessing Africa's solar potential and implementing effective solar lease models, significant progress can be made towards achieving sustainable development and energy independence in the region.

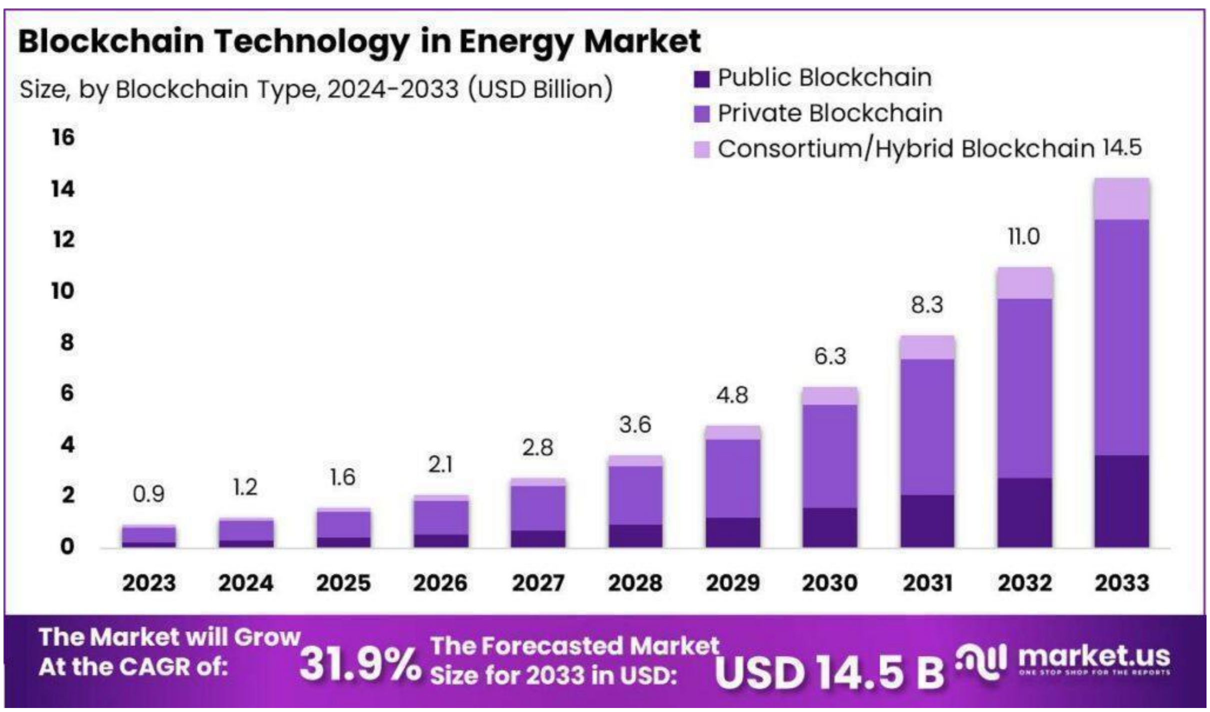
[216] Supra (solar Lease Service Market https://www.transparencymarketresearch.com/solar-lease-service-market.html#:~:text=Europe%20is%20likely%20to%20dominate,region%20from%202020%20to%202030)

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting the use of Blockchain Technology in Africa's Energy Market(s) for effective Grid Management

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for promoting the use of Blockchain technology in Africa's Energy Market(s) for effective Grid Management.



SOURCE: market.us

The chat illustrates the market size of the Global Blockchain Technology in Energy from 2022 to 2032.

The Global Blockchain Technology in Energy Market size is expected to be worth around USD 14.5 Billion By 2033, from USD 0.9 Billion in 2023, growing at a compound annual growth rate (CAGR) of 31.9% during the forecast period from 2024 to 2033[217].

The world is undergoing an energy transformation. As the sun sets on the era of fossil fuels, a new dawn is rising, powered by the clean and sustainable potential of renewable energy. But harvesting sunlight, wind, and geothermal energy is only half the battle. The real challenge lies in efficiently distributing and trading this clean energy across vast distances and complex markets. This is where a game-changer emerges: the revolutionary technology of blockchain. Imagine a system where every unit of renewable energy can be tracked, monitored, and traded with complete transparency and security. This is the promise of blockchain, a distributed ledger technology that acts as a decentralized database, securely recording every transaction without the need for a central authority[218].

Blockchain technology in the energy sector involves the use of a decentralized and digital ledger that records all transactions across a network of computers. This technology provides a transparent, efficient, and secure way of managing data, which can be particularly beneficial in areas such as renewable energy distribution, smart grids, and energy trading[219]. Blockchain technology has the potential to revolutionize the energy industry by providing a secure and transparent platform for transactions and data management. The blockchain can be applied in the energy market for peer-to-peer energy trading, renewable energy certificates, grid management, supply chain management, and smart contracts[220].

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[217] Blockchain Technology in Energy Market https://market.us/report/blockchain-technology-in-energy-market/

[218] Amitav Bhattacharjee, How Blockchain is Revolutionizing Renewable Energy Trading Across the Globe (https://www.linkedin.com/pulse/how-blockchain-revolutionizing-renewable-energy-globe-bhattacharjee-89cxc#:~:text=Despite%20the%20challenges%2C%20Africa's%20embrace,Africa's%20vast%20renewable%20energy%20potential.)

[219] Supra (Blockchain Technology in Energy Market https://market.us/report/blockchain-technology-in-energy-market/)

[220] Blockchain in Energy Market https://www.precedenceresearch.com/blockchain-in-energy-market)

One of the key drivers contributing to the use of Blockchain Technology in energy markets for effective grid management is the increasing share of renewable energy generation to support sustainable initiatives[221] and increasing demand for decentralised and sustainable energy resources to fuel the market growth[222]. The deployment of blockchain technology is expected to accelerate in the energy and utilities sectors, owing to the increased generation of renewable energy to support sustainable initiatives and efforts by oil and gas players to improve operational efficiency and security. Many start-ups are becoming interested in blockchain implementation at the enterprise and consumer levels, contributing to blockchain's growth in the energy utilities market. Dropping reliance on fossil fuels, combined with increasing independence of the local grid from external sources of energy in the long term, is expected to boost blockchain demand in the energy utilities industry[223]. Features such as decentralization and security will drive blockchain technology in energy market growth. Decentralization helps eliminate the third party, and transaction data is stored in multiple computers of chain members. Additionally, all the data records are verified by blockchain members before it is attached to a block, thus securing it cryptographically. Therefore, these features maintain security and transparency, thus driving the market growth and share of blockchain technology in energy markets[224].

Blockchain technology in the energy market faces several challenges, including scalability issues, speed limitations, and the need to balance various blockchain platforms with existing systems. Additionally, differing rules across jurisdictions, compliance issues, and regulatory ambiguity present implementation challenges. To integrate blockchain technology in the energy markets, addressing these issues with creative solutions, cooperative efforts from players, and well-defined rules is crucial.

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221 Ibid (Blockchain In Energy Market https://www.precedenceresearch.com/blockchain-in-energy-market)

222 Supra (Blockchain Technology in Energy Market https://market.us/report/blockchain-technology-in-energy-market/)

223 Supra (Blockchain In Energy Market https://www.precedenceresearch.com/blockchain-in-energy-market)

224 Business Research Insight https://www.businessresearchinsights.com/market-reports/blockchain-technology-in-energy-market-100801)

The scalability of blockchain platforms is crucial for handling the high volume of real-time energy trades, and addressing these challenges is essential, especially in the context of blockchain architectures capable of handling large-scale transactions[225].

The leading players in blockchain in energy market are Microsoft (US), Accenture (Ireland), IBM (US), Infosys (India), and SAP (Germany), Electron (Japan), Power Ledger (Austrialia).

Across the vast and sun-drenched continent of Africa, a revolution is brewing, one powered not just by the sun, but also by the potential of blockchain technology. Africa, a continent brimming with untapped renewable energy potential, presents a unique case. While lacking extensive traditional infrastructure, many African countries are uniquely positioned to "leapfrog" traditional energy systems and embrace the decentralization potential of blockchain. One such example is Kenya, where the "Sun Exchange" platform allows individuals to invest directly in solar energy projects using blockchain technology, bringing clean energy to remote communities that were previously off grid. Despite the challenges, Africa's embrace of blockchain in renewable energy holds immense promise. By fostering decentralized solutions, enhancing market transparency, and promoting inclusivity, blockchain could be the missing piece in unlocking Africa's vast renewable energy potential. This, in turn, could pave the way for a brighter future, one powered by clean energy, empowered communities, and a continent in control of its own energy destiny[226].

Blockchain technology holds significant potential for enhancing grid management in Africa's energy market. Blockchain technology can optimize Demand Response (DR) within Smart Grids by enhancing efficiency, security, and consumer engagement. It enables peer-to-peer (P2P) energy trading and can contribute to overall energy

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[225] Supra ((Blockchain In Energy Market https://www.precedenceresearch.com/blockchain-in-energy-market)

[226] Supra (Amitav Bhattacharjee, How Blockchain is Revolutionizing Renewable Energy Trading Across the Globe (https://www.linkedin.com/pulse/how-blockchain-revolutionizing-renewable-energy-globe-bhattacharjee-89cxc#:~:text=Despite%20the%20challenges%2C%20Africa's%20embrace,Africa's%20vast%20renewable%20energy%20potential.)

efficiency and grid stability[227]. To effectively optimize and control renewable energy systems and their integration with traditional grid systems, blockchain technology can provide decentralized management and control, support for decentralized decision-making, fine-grained and timely data sharing, and maintain data and business privacy. It also supports fast and low-cost electricity market transactions, system operation data security, and prevents malicious cyberattacks[228].

Blockchain technology if properly implemented, can pave the way for a cleaner and brighter future for Africa.

[227] Paraskevas Koukaras, Integrating Blockchain in Smart Grids for Enhanced Demand Response: Challenges, Strategies, and Future Directions https://www.mdpi.com/1996-1073/17/5/1007

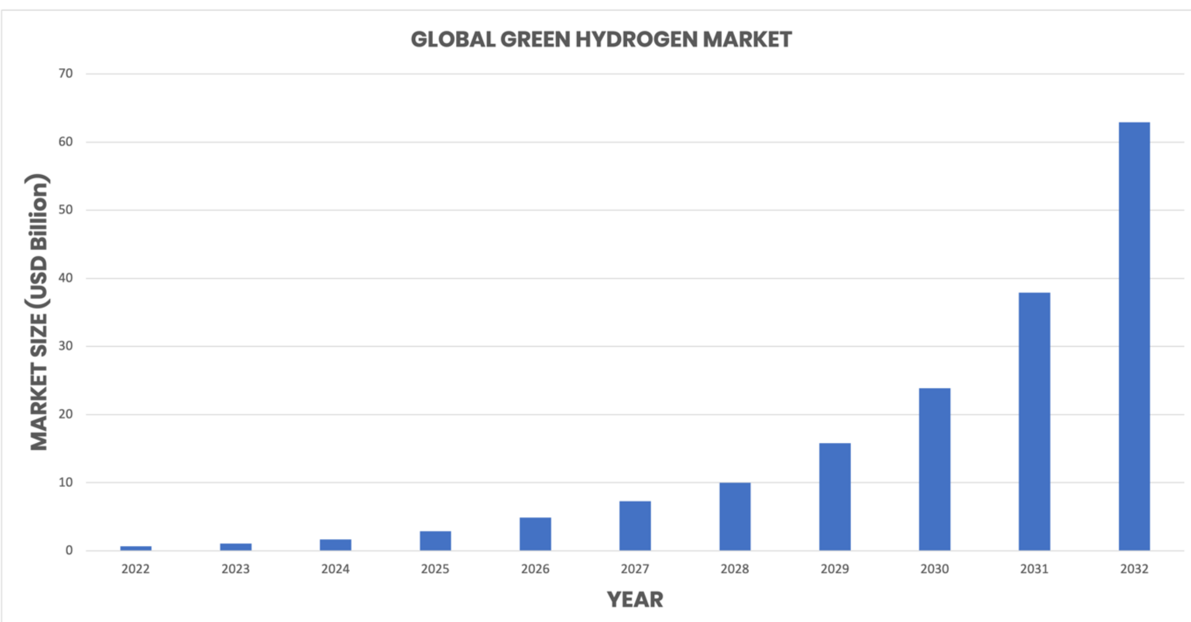
[228] Harshal Patil, Study of blockchain based smart grid for Energy Optimization https://doi.org/10.1016/j.matpr.2020.11.013

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical considerations for promoting Africa's Sustainable Energy Transition using Green Hydrogen

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to empower Africa's sustainable Energy Transition using Green Hydrogen.



SOURCE: Electricity Lawyer (Data sourced from Market. US)

The chat illustrates the market size of the Global Green Hydrogen Market from 2022 to 2032.

Hydrogen is a gas utilized as an energy source that can also be employed as a raw material in the industrial sector. As a primary element occurring naturally, its extraction through traditional methods results in substantial carbon dioxide emissions. In contrast, green hydrogen is derived using cleaner processes that eliminate carbon dioxide emissions. This is accomplished through water electrolysis, a method that disassociates water molecules into their constituent hydrogen and oxygen components. Primarily deployed in energy storage and the powering of wind plants, green hydrogen represents a promising advancement in sustainable energy technologies[229].

The hydrogen produced through water electrolysis (splitting of water), known as green hydrogen, is an environmentally friendly alternative. In this process, hydrogen is extracted, leaving oxygen with no detrimental impact on the environment. Renewable energy sources, like wind and solar power, are used to supply the electricity needed for electrolysis. As a result, green hydrogen is the cleanest form of hydrogen production, as it does not produce carbon dioxide as a by-product. The forecasted increase in renewable energy generation is expected to further drive the growth of the green hydrogen market. Moreover, the implementation of government policies aimed at developing green hydrogen and renewable energy is a key factor propelling this market growth[230].

There is a rise in the market demand for renewable energy sources due to the strict government regulations related to the environment and an increase in the pressure to reduce the consumption of energy from hydrocarbons; to lower carbon emissions. The strict regulation imposed by governments to reduce GHG emissions from power generation facilities is driving the growth of the market. This in turn is projected to drive the growth of the global green hydrogen market.

[229] Decode the Future of Green Hydrogen https://www.chemanalyst.com/industry-report/green-hydrogen-market-323
[230] Green Hydrogen Market https://market.us/report/green-hydrogen-market/

The Green Hydrogen Market size is expected to experience significant growth in the coming years. In 2022, global green hydrogen sales reached USD 0.7 billion; and is anticipated to be worth around USD 62.9 billion by 2032, growing at an astounding compound annual growth rate (CAGR) of 58.6% from 2023-2032[231]. The growth of the green hydrogen market is attributed to several factors, including government initiatives that encourage the use of clean energy sources and advancements in electrolysis technology. These factors play a significant role in driving the expansion of the green hydrogen market.

Based on the end-user industry, the Green Hydrogen market is segmented into various influential industries which are Transportation Fuel, Power & Heating, Refining, and Chemical Feedstock[232]. Energy Storage Feedstock, and transportation are the significant applications of Green Hydrogen, Energy Storage is the dominant application.

There is, indeed, a global race to develop green hydrogen, and for the first time, Africa is on the starting line with developed countries. For many African countries, the question is not how to reduce their carbon footprint, because the continent's overall contribution to global GHG emissions is already low at less than 4 per cent; instead, it is important to examine how the continent can sustainably harness its existing resources to meet the growing demand for energy needed for economic development and to lift citizens out of poverty, while following a sustainable path to a net-zero future. To strike this balance, some African countries are looking towards green hydrogen as a potential technology.

The aim is to reduce reliance on fossil fuels, accelerate access to electricity for millions of Africans by increasing the exploitation of renewable energy resources and meet their global climate commitments[233]. However, the energy sector faces several challenges, including insufficient power generation, inadequate infrastructure, and a

[231] Ibid (Green Hydrogen Market https://market.us/report/green-hydrogen-market/)
[232] Supra (Decode the Future of Green Hydrogen https://www.chemanalyst.com/industry-report/green-hydrogen-market-323)
[233] Bitsat Yohannes and Arona Diedou, Green Hydrogen: A viable option for transforming Africa's energy sector https://www.un.org/africarenewal/magazine/july-2022/green-hydrogen-viable-option-transforming-africas-energy-sector

high level of energy poverty. Significant effort is being made to diversify energy sources, improve energy infrastructure and address challenges by investing in renewable energy and energy-efficient sources and growing private sector investments[234].

Promoting Africa's sustainable energy transition using green hydrogen requires practical considerations such as assessing renewable energy potential, creating collaborative innovation platforms, developing infrastructure, communicating and promoting green hydrogen, establishing policy and regulatory frameworks, attracting investments, and integrating green hydrogen into existing energy systems. By factoring these considerations, Africa can harness the potential of green hydrogen and contribute to a sustainable and low-carbon energy future.

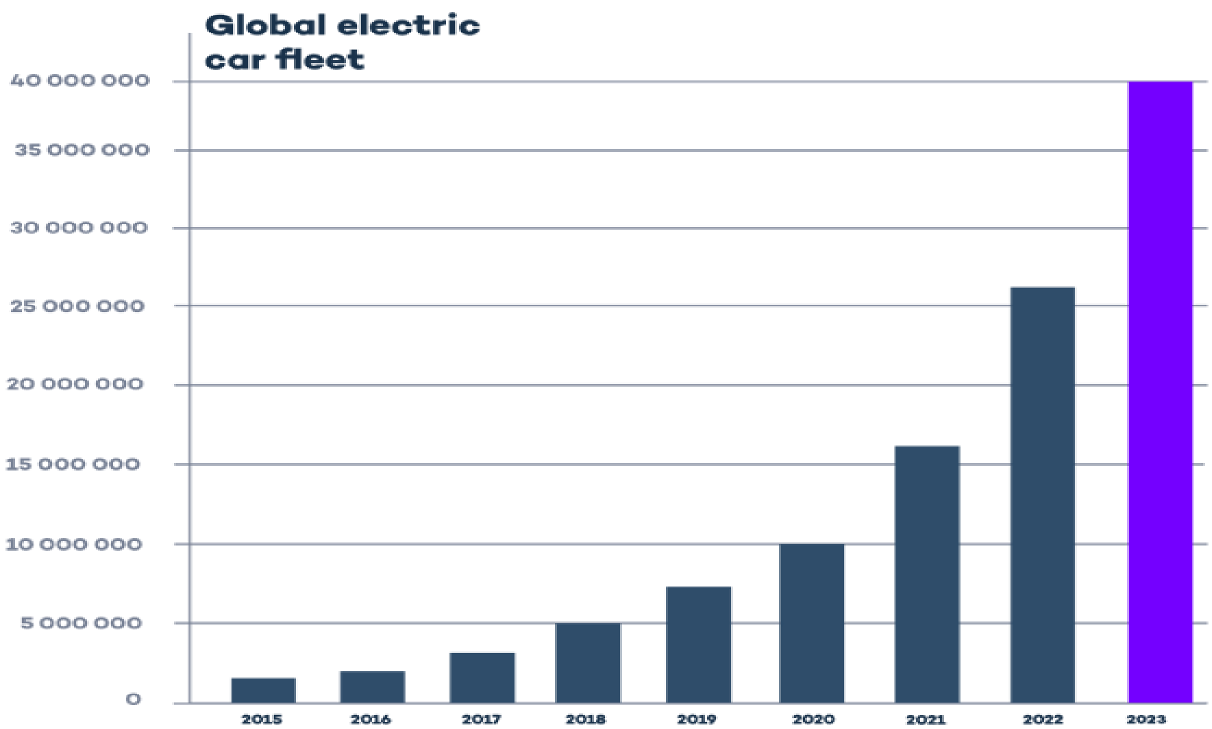
[234] Here's how Nigeria is tackling the barriers to its green energy transition https://www.weforum.org/agenda/2023/05/how-nigeria-is-tackling-barriers-to-its-green-energy-transition/#:~:text=However%2C%20the%20energy%20sector%20faces,high%20level%20of%20energy%20poverty.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting the Adoption of Electric Vehicles for a Just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for promoting the adoption of Electric Vehicles for a Just Energy Transition in Africa



SOURCE: Global EV Outlook 2024 https://www.iea.org/reports/global-ev-outlook-2024

The chart illustrates the upward trend in EV sales.

Electric Vehicles (EVs) are to play a central role in the ambitious objective of zero-emission targets set for 2050 and the industry is gearing up for it[235]. Inspired by the decarbonization challenge, most leading nations now take EV sales seriously, supported by various policies and incentives, which continue to accelerate sales as of 2023[236].

The global EV market share has taken a tremendous leap forward in the past decade and is expected to further accelerate in the coming years. The global EV market size was valued at USD 388.1 billion in 2023 and is expected to reach USD 951.9 billion by 2030 at a Compound Annual Growth Rate (CAGR) of 13.7% during the forecast period 2023-2030. With advancements in technology, increasing environmental consciousness, and supportive government policies, EVs have gained significant traction as a viable and sustainable transportation option. As concerns over climate change and air pollution intensify, consumers and industries are increasingly turning to electric vehicles to reduce their carbon footprint and contribute to a greener future[237].

The year 2021 was a major leap forward for EV sales after COVID-19 negatively affected the global market for all types of cars in the year 2020. Sale of electric vehicles doubled from 2020 to 6.75 million. The number of EVs sold in a week in 2021 was higher than the total number sold in the whole year of 2012. The year 2022 came on strong breaking records. EV sales exceeded 10 million, with 14% of all new cars sold being electric, quite the jump from 9% in 2021 and less than 5% in 2020[238]. According to the IEA, global

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[235] Virta, Here's how EU legislation accelerates the EV revolution <https://www.virta.global/blog/this-is-how-eu-regulation-accelerates-the-electric-vehicle-revolution >

[236] Virta, What is decarbonization, and why do we urgently need it? <https://www.virta.global/blog/decarbonisation>

[237] MarketsandMarkets, Electric Vehicle Market by Component, Vehicle Type, Vehicle Class, Propulsion (BEV, PHEV, FCEV), Vehicle Drive Tyoe (FWD, RWD, AWD), Vehicle Top Speed (<125 mph, >125 mph), Charging Point Type, Vehicle Connectivity, End Use, Region – Global Forecast 2030 <https://www.marketsandmarkets.com/Market-Reports/electric-vehicle-market-209371461.html>

[238] Virta, The Global Electric Vehicle Market Overview in 2024 'Historical EV market data' <https://www.virta.global/global-electric-vehicle-market >

electric car sales reached almost 14 million, which represented a 35% increase from 2022. This growth meant that the global electric fleet rose to 40 million in 2023[239].

Norway, Sweden, the Netherlands and Germany remain the largest European markets, according to the 2024 Global EV Outlook by IEA. France and the United Kingdom come in right after with 25% of all cars sold being electric[240].

Electric vehicles are the key technology to decarbonize road transport, a sector that accounts for around one-sixth of global emissions. Ambitious policies continue to be critical to growth in electric vehicle markets worldwide. If the EV sales growth experienced in recent years is sustained, CO2 emissions from cars can be put on a path in line with the Net Zero emissions scenario by 2050[241].

The growth of renewable energy in Africa is expected to support the development of e-mobility, as electric vehicles can be powered by clean energy sources such as solar and wind power. This contributes to the decentralization of energy systems in Africa, as EVs serve as mobile storage devices that provide opportunities for grid balancing and emergency power supply[242]. Africa's transition to EVs presents both challenges and opportunities. While electric vehicles offer environmental and economic benefits, there are challenges related to infrastructure, costs, energy transition, awareness, and market-related factors that need to be addressed to promote widespread adoption. To effectively harness the use of EVs for a just transition in the energy sector, multiple policies must be put in place. Governments need to prioritize investments in grid upgrades and charging infrastructure to enable EV growth. Targeted subsidies, tax incentives, and financing schemes are needed to make EVs more affordable. Robust regulatory frameworks and incentive policies are essential for overcoming the challenges associated with EV adoption. Fiscal and non-fiscal incentives can play a significant role in accelerating the adoption of EVs for a cleaner energy future[243].

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239 Virta, The Global Electric Vehicle Market Overview in 2024 'Global Electric car market share and size' <https://www.virta.global/global-electric-vehicle-market>

240 Virta, The Global Electric Vehicle Market Overview in 2024 'How's the situation in Europe?' <https://www.virta.global/global-electric-vehicle-market >

241 Electric Vehicles < https://www.iea.org/energy-system/transport/electric-vehicles>

242 A need for a just energy transition with e-mobility <https://wearevuka.com/press-release/a-need-for-a-just-energy-transition-with-e-mobility/>

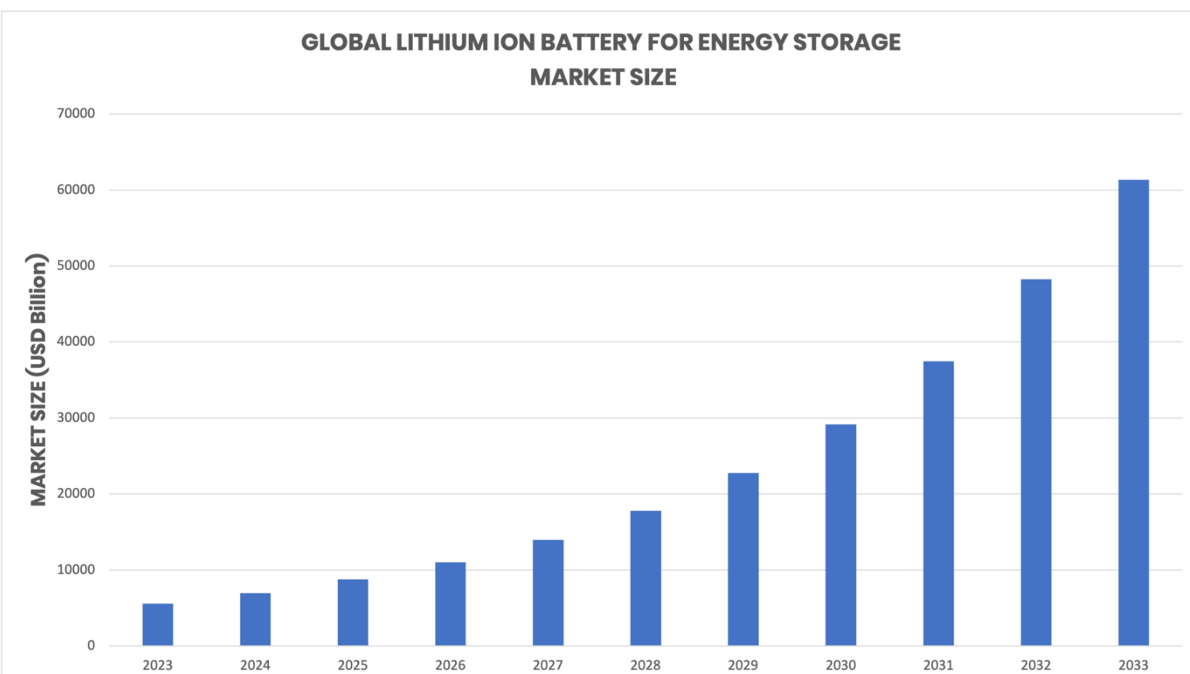
243 Chiara Corradi, Edgardo Sica, Piergiuseppe Morone, what drives electric vehicle adoption? Insights from a systematic review on European transport actors and behaviors <https://www.sciencedirect.com/science/article/abs/pii/S221462962200411X>

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Africa's Sustainable Energy Transition using Lithium-Ion Battery for Energy Storage Systems

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to empower Africa’s sustainable Energy Transition using Lithium-ion batteries for Energy Storage Systems.



SOURCE: Electricity Lawyer

The chat showcases the market size of the Global Lithium-Ion Battery for Energy Storage Market from 2003 to 2033.

Lithium-ion batteries are a type of rechargeable battery that uses the reversible intercalation of Li+ ions into electronically conducting solids to store energy. They offer several advantages compared to other commercial rechargeable batteries, including higher specific energy, higher energy density, higher energy efficiency, longer cycle life, and longer calendar life[244].

The advent of lithium-ion battery technology has significantly catalyzed the evolution of energy storage systems, positioning it as a pivotal component in the global shift towards renewable energy solutions. Characterized by high energy density, longer life cycles, and efficiency in charging and discharging processes, lithium-ion batteries have emerged as the preferred choice for energy storage, underpinning a wide array of applications from residential and commercial to utility-scale projects[245].

The market growth of lithium-ion batteries for energy storage is fundamentally driven by the escalating demand for clean and sustainable energy sources, alongside the global push for electrification and energy security. As governments and corporations intensify their commitment to decarbonisation and green energy initiatives, the deployment of lithium-ion battery-based storage systems is witnessing exponential growth, further bolstered by technological advancements, cost reductions, and supportive regulatory frameworks. The Global Lithium Ion Battery for Energy Storage Systems Market size is expected to be worth around USD 61,337 Million by 2033, from USD 5,575.3 Million in 2023, growing at a Compound Annual Growth Rate (CAGR) of 27.1% during the forecast period from 2023 to 2033[246].

The global market for lithium-ion batteries for energy storage is experiencing significant growth, driven by the increasing demand for energy storage systems (ESS)

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244 Lithium-ion battery <https://en.wikipedia.org/wiki/Lithium-ion_battery>

245 Lithium-Ion Battery for Energy Storage Systems Market <https://market.us/report/lithium-ion-battery-for-energy-storage-systems market/#overview>

246 Ibid Lithium-Ion Battery for Energy Storage Systems Market <https://market.us/report/lithium-ion-battery-for-energy-storage-systems-market/#overview>

across different sectors, in addition to the rising adoption of Electric Vehicles (EV) and solar PV systems. This growth is also supported by the ongoing revolution in renewable energy[247].

However, there are challenges associated with the market, including concerns over the safety and environmental impact of Lithium-Ion batteries[248]. These concerns revolve around the scarcity of finite resources such as lithium, cobalt, and nickel, which raises concerns about long-term availability and geopolitical risks. As demand for these materials continues to soar, securing a stable supply chain becomes increasingly challenging[249].

Despite these challenges, there are significant opportunities in the market. Increasing adoption of batteries in energy access applications will play a critical role in supporting Africa's progress towards achieving full energy access by 2033, enabling off-grid and on-grid electrification. Efforts to reduce costs, improve access to finance, and increase the market value of batteries can create opportunities for market growth. In particular, efforts should focus on supporting the off-grid solar and mini-grid markets, designing electricity market regulations and grid policies to recognize and remunerate the value of battery storage, and reducing batteries' purchase and maintenance costs[250].

Batteries are critical to supporting Sub-Saharan Africa's energy access goals. Access to clean and reliable electricity is one of the greatest challenges to sustainable development in Africa.

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[247] Allied Market Research, Lithium-Ion Battery Energy Storage System Market Size is projected to reach $17.1 billion by 2031 <https://www.openpr.com/news/3446260/lithium-ion-battery-energy-storage-system-market-size>

[248] Supra Lithium-Ion Battery for Energy Storage Systems Market <https://market.us/report/lithium-ion-battery-for-energy-storage-systems market/#overview>

[249] Lithium-ion Battery Technology: Advancement and Challenges <https://www.eco-stor.com/en/resources/blog/lithium-ion-battery-technology-advancements-and-challenges#:~:text=Resource%20Availability,supply%20chain%20becomes%20increasingly%20challenging.>

[250] World Economic Forum, Closing the Loop on Energy Access in Africa < https://www.globalbattery.org/media/publications/wef-closing-loop-energy-access-2021.pdf>

Promoting Africa's sustainable energy transition using lithium-ion batteries for energy storage systems requires several practical considerations such as assessing the techno-economic viability of lithium-ion batteries compared to other battery technologies, addressing their environmental impact through sustainable practices, developing the necessary infrastructure, implementing supportive policies and regulations, ensuring safety and investing in skills development and capacity building in battery technology. By factoring these considerations, Africa can effectively promote the use of lithium-ion batteries for energy storage systems and advance its sustainable energy transition.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Harnessing Africa's Geothermal Energy potential for meeting Energy Demand

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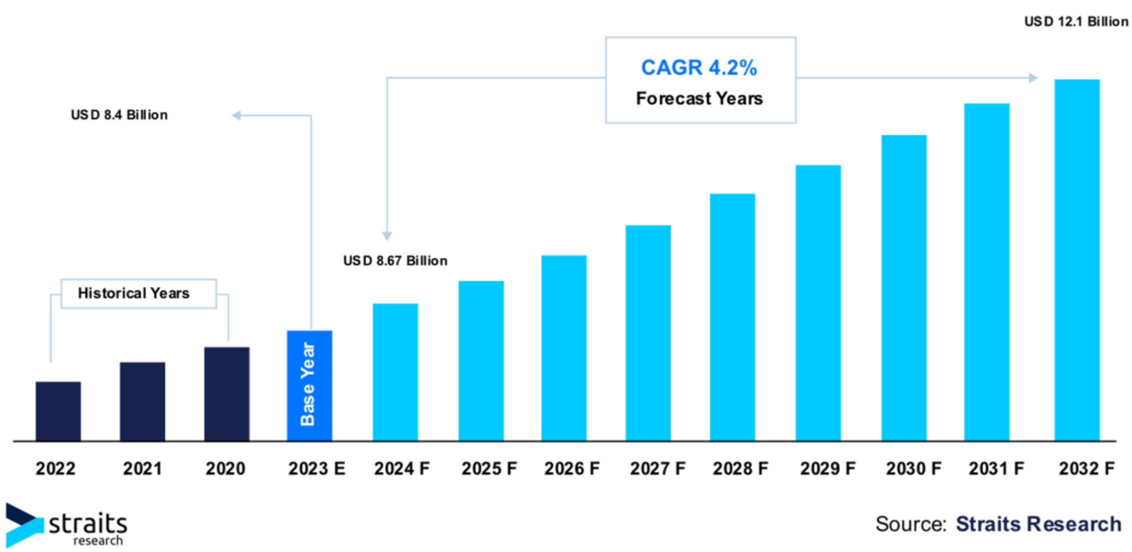
The data intelligence highlights considerations for harnessing Africa's Geothermal Energy potential for meeting Energy Demand across the continent.



SOURCE: Straits Research

The chart illustrates the global market size for Geothermal Energy.

Geothermal energy is heat generated within the Earth that can be harnessed for various applications. It is considered a renewable energy source because the heat is continuously replenished by the decay of radioactive elements and the friction generated along tectonic plate margins.

Geothermal energy can be used for electricity generation, where high-temperature geothermal resources are used to produce steam that drives turbines and generates electricity. As of 2019, worldwide geothermal power capacity amounted to 15.4 gigawatts (GW). Geothermal resources are also used for direct heating and cooling, where geothermal heat pumps utilize the stable temperature of the subsurface to provide heating and cooling for buildings. Hot water from geothermal reservoirs is used for direct use applications such as bathing, space heating, greenhouses, fish farming, and drying materials.[251]

The global geothermal energy market size was estimated at USD 7.45 billion in 2023 and is projected to grow at a Compound Annual Growth Rate (CAGR) of 3.1% from 2024 to 2030, reaching USD 9.22 billion by 2030. In 2021, the market size was valued at $6.6 Billion and is projected to reach $9.4 billion by 2027, growing at a CAGR of 5.9% from 2022 to 2027. Another report estimates the market size to be valued at USD 66.24 billion in 2023 and projected to grow to USD 117.02 billion by 2032, exhibiting a CAGR of 6.61% during the forecast period.

In terms of installed capacity, the geothermal energy market size is expected to grow from 15.68 gigawatts in 2024 to 17.91 gigawatts by 2029, at a CAGR of 2.69%. The global Geothermal Energy market size was valued at USD 5733.42 million in 2022.[252]

The adoption of geothermal energy in Africa is gaining momentum, particularly in countries like Kenya, Ethiopia, and Tanzania. These countries are tapping into their geothermal resources to generate electricity with minimal environmental impact.

Kenya is the largest geothermal energy producer in Africa, generating around 40% of its electricity from geothermal sources. The country has an operating geothermal capacity of 834 MW, with additional capacity under construction. Ethiopia is also investing in geothermal energy, with a projected capacity of at least 10 GW by 2050.

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[251] Geothermal Basics https://www.energy.gov/eere/geothermal/geothermal-basics Accessed 12 July2024

[252] Geothermal Energy Market Size & Share Analysis - Growth Trends & Forecasts (2024 - 2029) Source: https://www.mordorintelligence.com/industry-reports/geothermal-energy-market Accessed 12 July 2024

The country is diversifying its power sector, which is currently 88% hydro-based. Tanzania is exploring its geothermal potential, with several projects underway to harness this resource.[253]

Africa's geothermal energy sector is expected to grow significantly, driven by investments and the need to meet increasing energy demands. By 2050, Africa's geothermal capacity is projected to double, with Kenya and Ethiopia leading this expansion.[254]

However, there are still challenges that exist regarding the adoption of the resource as a clean energy source in various parts of the region. The adoption of geothermal energy in Africa faces several key challenges that have hindered its widespread deployment. One of the primary challenges is the high early-stage risk for financiers. The shortage of technical skills is also a major hindrance, as the region , lacks a robust, skilled, local geothermal workforce and technical capacity. Significant foreign expertise is still required in most cases to fully develop the resources.

Harnessing Africa's geothermal energy potential to meet the continent's growing energy demand requires addressing several practical considerations such as exploration and resource assessment, involving extensive geophysical and geological surveys to identify and assess the viability of geothermal resources across Africa, Infrastructure development, such as building power plants, transmission lines, and distribution networks, which are capital-intensive but crucial for utilizing the geothermal resources, and clear and supportive regulatory environments are essential to attract private investment in geothermal development. Many African countries still lack comprehensive policies and regulations as it relates to geothermal energy development.

By addressing these practical considerations, African countries can unlock their significant geothermal potential and leverage this clean, reliable energy source to meet the continent's growing energy needs.

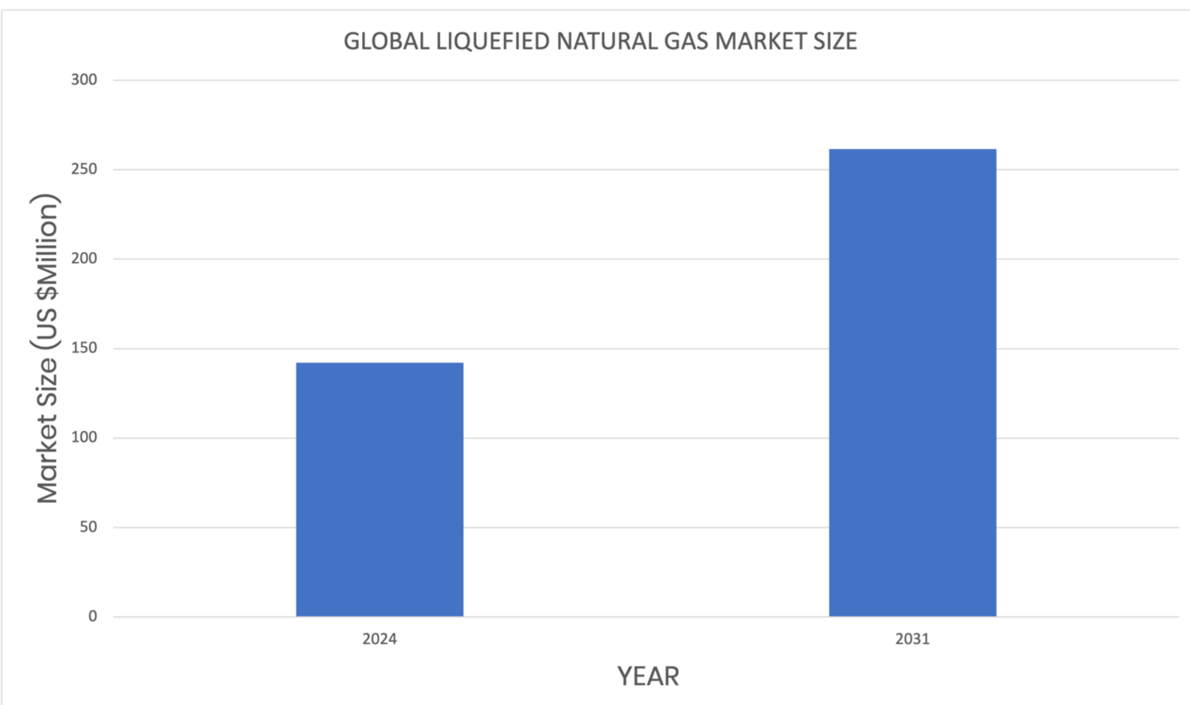
[253] Tech Cabal, Africa's geothermal expansion gathers steam https://techcabal.com/2023/11/08/africas-geothermal-expansion-gathers-steam/
[254] Ibid

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Africa's Sustainable Energy Transition using Liquefied Natural Gas

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to empower Africa's sustainable Energy Transition using Liquefied Natural Gas (LNG).



SOURCE: Electricity Lawyer (Data Sourced from Coherent Market Insight)

The chat illustrates the global liquefied natural gas (LNG) market size from 2024 to 2031.

Liquefied natural gas (LNG) is an odourless and colourless liquid formed by cooling natural gas to -162ºC[255]. The liquefaction process shrinks the volume of gas by 600 times, making it easier to store and ship. When this gas reaches its destination, it is again converted into gas by the regasification process and transported through vessels and pipes to end-use consumers. The main components of natural gas are methane, along with small amounts of hydrocarbons such as ethane, propane, butane, and traces of impurities like water vapour and sulfur compounds. LNG primarily consists of methane in a liquid form[256]. Liquefied natural gas is an emerging fuel due to its cleanest burning nature as compared to petrol, and diesel. Vital drivers such as growing demand for a clean source of energy from several end-use industries, government initiatives to strengthen gas pipeline infrastructure and substantial growth in global natural gas liquefaction capacity are expected to fuel the growth of the global liquefied natural gas market over the forecast period[257].

The global LNG market is witnessing significant growth, driven by robust demand in power generation and transportation fuel sectors, where LNG is favoured for its lower greenhouse gas emissions compared to coal[258]. The liquefied natural gas market is estimated to be valued at USD 142.17Bn in 2024 and is expected to reach USD 261.57Bn by 2031, growing at a compound annual growth rate of (CAGR) of 9.1% from 2024 to 2031[259]. This growth can be attributed to the growing awareness and concerns about climate change and air pollution have led to a shift towards cleaner energy sources.

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[255] Liquefied Natural Gas Market Insights, Analysis Report 2024 – 2033 <https://www.openpr.com/news/3481252/liquefied-natural-gas-market-insights-analysis-report>

[256] Business Research Insights, Liquefied Natural Gas Market Size < https://www.businessresearchinsights.com/market-reports/liquefied-natural-gas-market-110855 >

[257] Fortune Business Insights, Liquefies Natural Gas (LNG) Market Size <https://www.fortunebusinessinsights.com/liquefied-natural-gas-lng-market-105503>

[258] Supra (Liquefied Natural Gas Market Analysis <https://www.coherentmarketinsights.com/market-insight/liquefied-natural-gas-market-985>)

[259] Ibid (Liquefied Natural Gas Market Analysis <https://www.coherentmarketinsights.com/market-insight/liquefied-natural-gas-market-985>)

increasing demand for gas power generation, the rising adoption of LNG-fueled fleets, and supportive government policies promoting the use of natural gas[260]. The liquefied natural gas market is witnessing positive trends over the past few years. There has been substantial investment in the LNG infrastructure like pipelines, shipping, and receiving terminals to facilitate the increasing import and export of LNG across regions[261]. Governments are developing various supportive policies to increase the adoption of CNG and LNG-based vehicles, including providing subsidies and tax exemptions to automobile manufacturers and consumers[262]. The development of LNG infrastructure, including liquefaction and regasification terminals, requires significant upfront investment. The capital costs associated with constructing such facilities can be a restraining factor, particularly for new projects or in regions where financial resources are limited. As a consequence, there will be a declining trend in the market[263]. The LNG oversupply and trade tension are expected to also hamper market growth during the forecast period[264].

Africa is at the cusp of an energy sector transformation driven by natural gas. Its ambitious economic and social goals require accelerated progress in expanding energy capacity. This can be met through investment in clean energy sources, supplemented by a rapid uptake of natural gas as a clean transition fuel. Moving away from fossil fuels towards more sustainable energy sources is fundamental to the global goal of achieving net zero by 2050. Using liquefied natural gas (LNG) as a bridge fuel could make the switch easier, making it a promising lever for accelerating the energy transition. LNG is poised to deliver significant value as a bridge to the new energy economy. Its low-emissions profile relative to coal, transportability and potential as an on-demand backup for renewable power sources position LNG in the right place to accelerate a net zero carbon future. However, key challenges remain

[260] Mordor Intelligence, LNG Market Size & Share Analysis – Growth Trends & Forecasts (2024 – 2029) <https://www.mordorintelligence.com/industry-reports/global-lng-market-industry>

[261] Supra (Liquefied Natural Gas Market Analysis <https://www.coherentmarketinsights.com/market-insight/liquefied-natural-gas-market-985>)

[262] Supra (Mordor Intelligence, LNG Market Size & Share Analysis – Growth Trends & Forecasts (2024 – 2029) <https://www.mordorintelligence.com/industry-reports/global-lng-market-industry>)

[263] Supra (Business Research Insights, Liquefied Natural Gas Market Size < https://www.businessresearchinsights.com/market-reports/liquefied-natural-gas-market-110855 >)

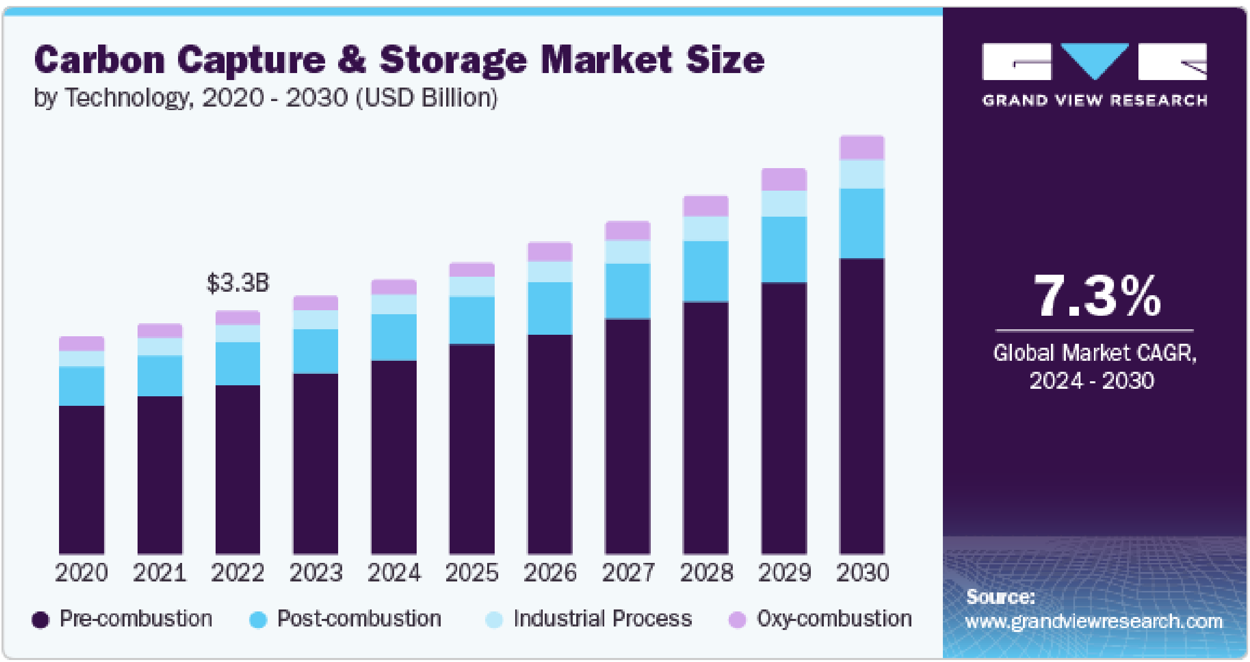
[264] Supra (Mordor Intelligence, LNG Market Size & Share Analysis – Growth Trends & Forecasts (2024 – 2029) <https://www.mordorintelligence.com/industry-reports/global-lng-market-industry>)

that limit the transformative role of gas in Africa. These include limited use of gas in nearly 40 African countries; the need to expand gas infrastructure; development of competitive gas markets, including for liquefied natural gas; development of sound energy plans to steer the introduction of gas in the energy mix; promoting regional integration of the natural gas markets; minimizing flaring and venting of natural gas and tapping the resource to alternative economic uses, including in electricity and clean cooking; and mobilizing private-sector investment and finance.

It is important to note that the adoption of LNG should be part of a comprehensive energy strategy that considers the specific needs, resources, and circumstances of each African country. Additionally, environmental sustainability, social impact, and long-term energy planning should be taken into account to ensure a successful and sustainable energy transition.

Practical Considerations for Promoting the Adoption of Carbon Capture and Storage in Africa

The data intelligence highlights considerations for promoting Carbon Capture and Storage (CCS) adoption in Africa.



The chart illustrates the global market size for carbon capture and storage; estimated at USD 3.47 billion in 2023 and projected to grow at a Compound Annual Growth Rate (CAGR) of 7.3% from 2024 to 2030.

Carbon Capture and Storage (**CCS**) is a process whereby a relatively pure stream of Carbon dioxide (CO_2) from industrial sources is separated, treated and transported to a long-term storage location.[265] In CCS, the CO_2 is captured from a large point source,

[265] Abdulla, Ahmed; Hanna, Ryan; Schell, Kristen R.; Babacan, Oytun; et al. (29 December 2020). "Explaining successful and failed investments in U.S. carbon capture and storage using empirical and expert

such as a chemical plant, coal power plant, cement kiln, or bioenergy plant, and is typically stored in a suitable geological formation. CCS can reduce greenhouse gas emissions[266] and thus mitigate climate change[267]. For example, CCS retrofits for existing power plants can be one of the ways to limit emissions from the electricity sector and meet the Paris Agreement goals[268]. However, as of 2022, only about one thousandth of global CO_2 emissions are captured by CCS, and most of those CCS projects are for natural-gas processing[269]. CCS projects generally aim for 90% capture efficiency,[270] but most of the current installations have failed to meet that goal.[271] Storage of the captured CO_2 is either in deep geological formations or in the form of mineral carbonates. Long-term predictions about submarine or underground storage security are difficult. There is still the risk that some CO_2might leak into the

assessments". *Environmental Research Letters*. **16** (1): 014036. Bibcode:2021ERL....16a4036A. doi:10.1088/1748-9326/abd19e.

[266] IPCC, 2021: Annex VII: Glossary [Matthews, J.B.R., V. Möller, R. van Diemen, J.S. Fuglestvedt, V. Masson-Delmotte, C. Méndez, S. Semenov, A. Reisinger (eds.)]. In Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson-Delmotte, V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, pp. 2215–2256, doi:10.1017/9781009157896.022.

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[268]Ketzer, J. Marcelo; Iglesias, Rodrigo S.; Einloft, Sandra (2012). "Reducing Greenhouse Gas Emissions with CO2 Capture and Geological Storage". *Handbook of Climate Change Mitigation*. pp. 1405–1440. doi:10.1007/978-1-4419-7991-9_37. ISBN 978-1-4419-7990-2.

[269]IPCC, 2022: Summary for Policymakers [P.R. Shukla, J. Skea, A. Reisinger, R. Slade, R. Fradera, M. Pathak, A. Al Khourdajie, M. Belkacemi, R. van Diemen, A. Hasija, G. Lisboa, S. Luz, J. Malley, D. McCollum, S. Some, P. Vyas, (eds.)]. In: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change[P.R. Shukla, J. Skea, R. Slade, A. Al Khourdajie, R. van Diemen, D. McCollum, M. Pathak, S. Some, P. Vyas, R. Fradera, M. Belkacemi, A. Hasija, G. Lisboa, S. Luz, J. Malley, (eds.)]. Cambridge University Press, Cambridge, UK and New York, NY, USA. doi: 10.1017/9781009157926.001.

[270] "The carbon capture crux: Lessons learned". *ieefa.org*. Retrieved 1 October 2022.

[271] A Moseman, 'How efficient is carbon capture and storage?' (21 February 2021) MIT Climate Portal

atmosphere.[272] [273][274] A 2018 evaluation estimates the risk of substantial leakage to be fairly low.[275] [276]As of 2022, around 73% of the CO_2 captured annually is used for enhanced oil recovery (EOR), a process in which CO_2 is injected into partially-depleted oil reservoirs in order to extract more oil and left underground.[277] Since EOR *utilizes* the CO_2 in addition to *storing* it, CCS is also known as Carbon Capture, Utilisation, and Storage (CCUS).[278]

The detrimental effect of carbon emissions on the environment has prompted the global adoption of carbon capture and storage technology, thereby leading to the growth of the market.[279] The CCS market is driven by the growing focus on reducing CO2 emissions globally, with governments implementing regulations and initiatives to encourage CCS adoption. The oil and gas industry is a major application area, as CCS technologies are increasingly used for enhanced oil recovery (EOR) projects. Around 500,000 barrels of oil are produced daily using CO2-EOR. Based on technology, the market is further categorized into post-combustion, pre-combustion, oxy-combustion, and industrial process segments. Among these, the pre-combustion

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[272] A Vaughan, 'Most major carbon capture and storage projects haven't met targets' (1 September 2022) New Scientist

[273] Phelps, Jack J.C.; Blackford, Jerry C.; Holt, Jason T.; Polton, Jeff A. (July 2015). "Modelling large-scale CO2 leakages in the North Sea". *International Journal of Greenhouse Gas Control*. **38**: 210–220. Bibcode:2015IJGGC..38..210P. doi:10.1016/j.ijggc.2014.10.013.

[274] Climatewire, Christa Marshall. "Can Stored Carbon Dioxide Leak?". *Scientific American*. Retrieved 20 May 2022.

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[277] Alcade, Juan; Flude, Stephanie (4 March 2020). "Carbon capture and storage has stalled needlessly – three reasons why fears of CO2 leakage are overblown". *The Conversation*. Retrieved 20 May 2022.

[278] Robertson, Bruce; Mousavian, Milad (1 September 2022). "The carbon capture crux: Lessons learned" (PDF). *Institute for Energy Economics and Financial Analysis*. p. 10. Retrieved 27 June 2024.

[279]https://www.grandviewresearch.com/horizon/outlook/carbon-capture-and-storage-market-size/global

technology accounted for the largest revenue share of over 70.28% in 2023. Pre-combustion CO2 capturing with the usage of water-gas shift reaction (WGSR) and its removal with acid gas removal (AGR) process is commercially carried out across the world at present. However, the major obstacle in the extraction of carbon dioxide[280]from the atmosphere is the high proportion of nitrogen in combustion air. The solution adopted to overcome this challenge is known as the integrated gasification combined cycle (IGCC). The oxy-combustion technology segment is expected to grow at the fastest CAGR of 7.4% over the forecast period 2024-2030. Oxy-fuel combustion involves the combustion of fossil fuels with the help of oxygen instead of air. Combustion carried out under these conditions reduces the production of nitrogen oxides and other by-products that are produced in pre-combustion and post-combustion techniques., Based on application, the market is further categorized into power generation, oil & gas, metal production, cement, and others segments. Among these, the power generation segment accounted for the largest revenue market share of about 68.60% in 2023. The global power sector was responsible for an increase of nearly two-thirds in carbon dioxide emissions in 2022 compared with that of the previous year. Due to high greenhouse gas emission rates, the potential of using carbon capture and storage technology is extremely high in coal-fired power plants. This is anticipated to lead to the growth of the power generation segment of the market in the coming years.[281] The other segments recorded a CAGR of 7.4% over the forecast period. Carbon capture and storage systems are widely used in industries such as pulp and paper, chemicals, and fertilizers. Nitrogen-based fertilizers are widely used worldwide to replenish the soil nutrients used by crops. The fertilizer production process emits a CO2 stream, which is pure and well-suited for capture. Hence, CCS technologies are best suited for the fertilizer industry and are anticipated to witness significant growth in demand over the forecast period.

The adoption of Carbon Capture and Storage (CCS) in Africa holds significant implications for the continent's environmental, economic, and technological landscape. Environmentally, CCS can significantly reduce carbon dioxide emissions from power plants and industrial sources, which is crucial for mitigating climate

[280]https://www.grandviewresearch.com/industry-analysis/carbon-dioxide-market

[281]https://www.grandviewresearch.com/industry-analysis/power-generation-industry

change, while supporting Africa's growing energy demand sustainably[282] [283]. Economically, CCS can drive growth by creating jobs, attracting international investments, and stimulate new industries, contributing to energy security through cleaner use of fossil fuels[284] The technology also promotes advancements by fostering local expertise and innovation, positioning Africa as a leader in CCS technology[285] Moreover, CCS adoption necessitates robust policy and regulatory frameworks, improving governance in energy and environmental sectors. Public awareness and acceptance are essential, requiring efforts to educate communities about CCS benefits and safety. Infrastructure investments for CCS, including pipelines and storage facilities, can enhance overall infrastructure, benefiting multiple sectors. The technology encourages collaboration among governments, the private sector, and international organizations, fostering partnerships and knowledge sharing. Participation in global carbon markets through CCS can provide revenue streams and incentivize low-carbon investments[286].

However, challenges such as high costs, technological complexity, and environmental risks must be managed through careful planning, substantial investment, and international cooperation[287]. Addressing these challenges is essential to ensuring that CCS can contribute effectively to Africa's sustainable development and climate goals.

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[282] Mouli-Castillo J and others, 'the role of carbon capture and storage in meeting net-zero emissions targets: Key considerations for Africa' (2023) 15 Environmental Research Letters 12345.

[283] Global CCS Institute, 'Global Status of CCS 2022' (2022) <https://www.globalccsinstitute.com/resources/global-status-report/> accessed 24 July 2024.

[284] International Energy Agency, 'Africa Energy Outlook 2022' (2022) <https://www.iea.org/reports/africa-energy-outlook-2022> accessed 24 July 2024.

[285] African Development Bank, 'Carbon Capture and Storage in Africa: Opportunities and Challenges' (2021) <https://www.afdb.org/en/documents/document/carbon-capture-and-storage-in-africa-opportunities-and-challenges-2021> accessed 24 July 2024.

[286] Zakkour P and Cook G, 'Carbon Capture and Storage: A Necessary Technology for Decarbonising the Global Economy' (2020) 34 Annual Review of Environment and Resources 243-272.

[287] United Nations Economic Commission for Africa, 'CCS and Africa's Clean Energy Future' (2022) <https://repository.uneca.org/handle/10855/46732> accessed 24 July 2024.

Promoting CCS adoption in Africa requires addressing several practical considerations such as infrastructure development[288], financial incentives such as tax breaks, subsidies, and low interest loans to encourage investments[289], establishment of regulatory frameworks[290], increase in public awareness and engagement about CCS[291], capacity building[292], partnerships and collaborations[293], technology transfers of CCS technologies from developed countries to Africa[294], pilot projects implementation[295], economic viability[296], environmental and social impact assessments[297], and investments in research and development to improve CCS technologies, reduce costs and address technical challenges specific to the African context[298].

288 International Energy Agency, 'Carbon Capture Utilisation and Storage' (IEA, 2023) <https://www.iea.org/topics/carbon-capture-utilisation-and-storage> accessed 24 July 2024.
289 Global CCS Institute, 'Financial Incentives for CCS' (Global CCS Institute, 2022) <https://www.globalccsinstitute.com/resources/financial-incentives/> accessed 24 July 2024.
290 World Bank, 'Regulatory Frameworks for Carbon Capture and Storage' (World Bank, 2021) <https://openknowledge.worldbank.org/handle/10986/35256> accessed 24 July 2024.
291 Carbon Capture and Storage Association, 'Public Engagement' (CCSA, 2020) <https://www.ccsassociation.org/what-is-ccs/public-engagement/> accessed 24 July 2024.

292 United Nations Industrial Development Organization, 'Capacity Building for CCS' (UNIDO, 2019) <https://www.unido.org/resources/capacity-building> accessed 24 July 2024.

293 International Energy Agency, 'Energy Technology Perspectives 2020' (IEA, 2020) <https://www.iea.org/reports/energy-technology-perspectives-2020> accessed 24 July 2024.

294 Global CCS Institute, 'Technology Transfer for CCS' (Global CCS Institute, 2023) <https://www.globalccsinstitute.com/resources/technology-transfer/> accessed 24 July 2024.

295 International Energy Agency, 'CCS Pilot Projects' (IEA, 2022) <https://www.iea.org/reports/ccs-pilot-projects> accessed 24 July 2024.

296 International Energy Agency, 'The Role of CCUS in Energy Transitions' (IEA, 2021) <https://www.iea.org/reports/the-role-of-ccus-in-energy-transitions> accessed 24 July 2024.

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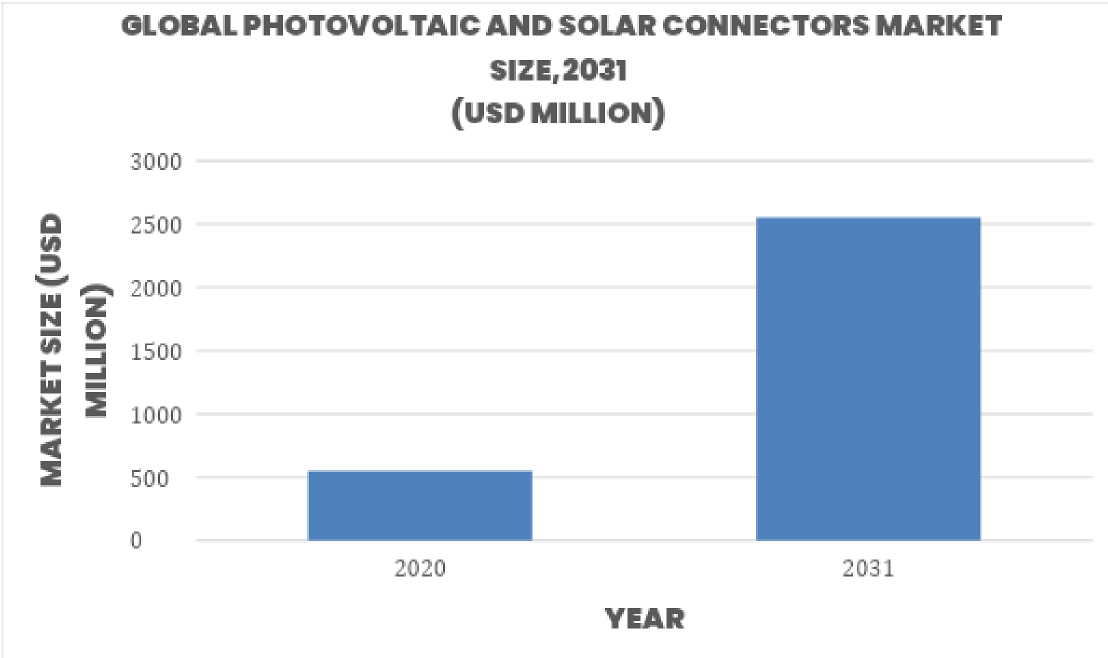
298 Global CCS Institute, 'Research and Development in CCS' (Global CCS Institute, 2023) <https://www.globalccsinstitute.com/resources/research-and-development/> accessed 24 July 2024.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Leveraging Photovoltaic Systems and Solar Connectors for Africa’s Energy Transition

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for leveraging photovoltaic systems and solar connectors for Africa’s energy transition.



Source: **Electricity Lawyer (data sourced from Business Research Insight)**

The chart illustrates the global market size for photovoltaic and solar connectors.

The photovoltaic and solar connectors market growth is underpinned by key factors that highlight the increasing demand for this technology. The global photovoltaic and solar connectors market size was USD 547.1 million in 2020 and is estimated to reach USD 2552.18 million by 2031, at a Compound Annual Growth Rate (CAGR) of 14.6% during the forecast period. This growth is attributed to factors such as the rising energy costs, particularly of fossil fuels like oil and natural gas, which have become a compelling catalyst. The global surge in demand for electricity also acts as a robust driver, propelling the market forward; with this drive attributed to factors such as population expansion, economic development, and urbanization. The photovoltaic and solar connectors market growth is underpinned by key factors that highlight the increasing demand for this technology, such as, the rising energy costs, particularly of fossil fuels like oil and natural gas, as earlier highlighted. The volatile nature of natural gas prices has instigated a shift towards more stable and cost-effective energy sources. Solar power, harnessed through photovoltaic systems and supported by high-quality connectors, emerges as an attractive alternative due to its reliance on the abundant and free source of sunlight. This transition is particularly pronounced among businesses and homeowners seeking affordability and stability in energy consumption. In addition, the global surge in demand for electricity acts as a key driver. As societies continue to evolve, the need for increased electricity generation becomes imperative. Therefore, solar power assumes a pivotal role in meeting this escalating demand. Photovoltaic systems, enabled by efficient connectors, present a sustainable and scalable solution, positioning them as a crucial component in the global energy landscape[299].

The latest trend in the photovoltaic and solar connectors market revolves around the integration and advancement of smart connector technology. This evolving technology is designed to enhance the efficiency and reliability of photovoltaic (PV) systems by incorporating sensors capable of monitoring various parameters such as voltage, current, temperature, and humidity. The collected data plays a crucial role in identifying and troubleshooting issues, optimizing system performance, and ultimately improving safety within PV installations. Smart connectors bring forth several benefits to PV systems, contributing to their growing popularity. Firstly, they significantly improve efficiency by pinpointing and rectifying problems causing power losses, such as loose connections or damaged cables hindering power generation. Secondly, these connectors enhance system reliability by monitoring system health and identifying potential issues before they lead to outages, such as detecting overheating components or high-voltage conditions. Additionally, smart connectors contribute to enhanced safety by monitoring potential hazards like arc faults and ground faults, thereby preventing incidents like fires or electrical shocks and ensuring the overall safety of the PV system. Furthermore, the adoption of smart connectors leads to reduced maintenance costs, as they provide real-time data on system performance, enabling early identification of problems before they escalate into major issues, minimizing downtime and repair expenses. Looking ahead, the future of smart connectors in the photovoltaic and solar connectors market is poised for continued growth and innovation. The ongoing trend involves increased integration with other PV system components, such as inverters and energy storage systems. This

[299] https://www.businessresearchinsights.com/market-reports/photovoltaic-and-solar-connectors-market-110059

integration allows for more advanced monitoring and control capabilities, contributing to a more intelligent and coordinated operation of PV systems. Furthermore, the development of new communication protocols is anticipated, enabling smart connectors to communicate not only with each other but also with other devices on the grid. This advancement is expected to pave the way for more intelligent and interconnected control of PV systems, solidifying the role of smart connectors in shaping the future landscape of solar technology.[300]

Leveraging photovoltaic (PV) systems and solar connectors in Africa's energy transition involves several practical considerations: resource assessment and site selection[301], technology and infrastructure[302], financial and economic factors[303] policy and regulatory framework, capacity building and skill development, environmental and social considerations, technical challenges and solutions, climate resilience, market and economic development, and monitoring and evaluation.[304] Factoring these considerations will allow for a clean and just energy transition on the continent.

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[300] https://www.businessresearchinsights.com/market-reports/photovoltaic-and-solar-connectors-market-110059

[301] IEA, Africa Energy Outlook 2019 (International Energy Agency 2019)

[302] IRENA, Renewable Power Generation Costs in 2019 (International Renewable Energy Agency 2019): BloombergNEF, Africa Solar Market Outlook 2020 (BloombergNEF 2020)

[303] African Development Bank, Financing Renewable Energy in Africa: Challenges and Opportunities (AfDB 2017) : World Bank, Pay-As-You-Go Solar in Africa: Market Insights and Opportunities for Financial Institutions (World Bank 2019)

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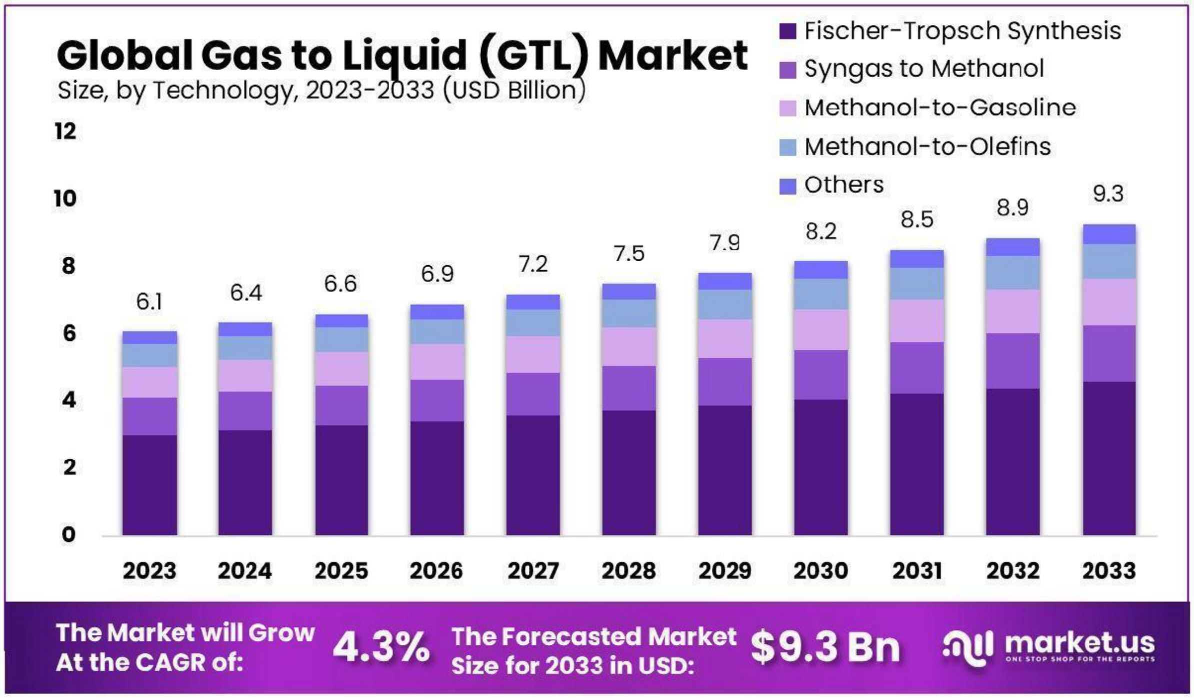
EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for promoting Gas to Liquid Technology for a Just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to promote Gas to Liquid technology for a just energy transition in Africa.



Source: market.us

The chart illustrates the market size of the global gas-to-liquid from 2023 to 2033.

Gas-to-Liquid (GTL) is a process that converts natural gas into liquid hydrocarbons, such as gasoline, diesel, and other valuable chemicals. This conversion is primarily achieved through the Fischer-Tropsch synthesis, which transforms synthesis gas (syngas) — a mixture of hydrogen and carbon monoxide — into liquid fuels[305]. GTL processes enhance fuel performance, reduce emissions, and offer an alternative to crude oil-derived products[306].

[305] Everlasting Valve USA, the gas-to-liquid process explained, https://www.everlastingvalveusa.com/gas-to-liquid-process-explained/

[306] Market.US Global Gas To Liquid (GTL) Market By Technology (Fischer-Tropsch Synthesis, Syngas to Methanol, Methanol-to-Gasoline, Methanol-to-Olefins , Others), By Product(Diesel, Naphtha, Lubricants, Others), By Application(Fuel Oil, Lubricating Oil, Process Oil, Others), By End-Use (Transportation, Chemicals and Petrochemicals, Power Generation, Others), By Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends, and Forecast 2024-2033,, June 2024, https://market.us/report/gas-to-liquid-gtl-market/

The global gas-to-liquid market size is expected to be worth around USD 9.3 Billion by 2033, from USD 6.1 Billion in 2023, growing at a Compound Annual Growth Rate (CAGR) of 4.3% during the forecast period of 2023 to 2033[307]. The market's expansion is driven by a number of factors. A rapid rise in energy demand, as seen in several emerging economies, has fueled the expansion of the gas-to-liquid business. Due to the huge increase in demand for various energy sources, such as crude oil end products, the oil and gas industry has been forced to increase its production capabilities[308].

The gas-to-liquid (GTL) market is significantly propelled by abundant natural gas reserves globally. With major reserves located in regions such as the Middle East, the United States, and Russia, the accessibility of natural gas provides a robust foundation for the GTL industry. This abundance ensures a steady and scalable supply of raw materials for GTL processes, which convert natural gas into liquid fuels such as diesel and naphtha[309]. Environmental concerns and stringent global regulations on emissions are another factor driving the demand for cleaner fuel alternatives, positioning the GTL market for substantial growth. GTL fuels are particularly appealing because they burn cleaner than conventional crude oil-based fuels, producing fewer pollutants such as sulfur oxides and particulates[310]. This factor aligns with global

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[307] Ibid (Market.US Global Gas To Liquid (GTL) Market By Technology (Fischer-Tropsch Synthesis, Syngas to Methanol, Methanol-to-Gasoline, Methanol-to-Olefins , Others), By Product(Diesel, Naphtha, Lubricants, Others), By Application(Fuel Oil, Lubricating Oil, Process Oil, Others), By End-Use (Transportation, Chemicals and Petrochemicals, Power Generation, Others), By Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends, and Forecast 2024-2033,, June 2024, https://market.us/report/gas-to-liquid-gtl-market/)

[308] Anshula Mandaokar, Gas to Liquid (GTL) Market Research Report Information, trends (Driving Factors/Restraining factors/Growth Opportunities) https://www.marketresearchfuture.com/reports/gas-to-liquid-market-5053

[309] Supra (Market.US Global Gas To Liquid (GTL) Market By Technology (Fischer-Tropsch Synthesis, Syngas to Methanol, Methanol-to-Gasoline, Methanol-to-Olefins , Others), By Product(Diesel, Naphtha, Lubricants, Others), By Application(Fuel Oil, Lubricating Oil, Process Oil, Others), By End-Use (Transportation, Chemicals and Petrochemicals, Power Generation, Others), By Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends, and Forecast 2024-2033,, June 2024, https://market.us/report/gas-to-liquid-gtl-market/)

[310] Supra (Market.US Global Gas To Liquid (GTL) Market By Technology (Fischer-Tropsch Synthesis, Syngas to Methanol, Methanol-to-Gasoline, Methanol-to-Olefins , Others), By Product (Diesel, Naphtha, Lubricants, Others), By Application(Fuel Oil, Lubricating Oil, Process Oil, Others), By End-Use

sustainability goals and the increasing consumer and governmental push towards reducing environmental footprints[311]. Government support and favorable policies also play a crucial role in driving the growth of the gas-to-liquid market. Various countries now implement policies to encourage the development and adoption of GTL technology. GTL fuels offer diversification in the transportation fuel sector, and it is predicted to boost the market's growth[312].

The market for gas-to-liquid is highly consolidated, with a few major companies influencing worldwide industry developments. The involvement of numerous companies at various stages is heavily influenced by the GTL production technology as well as capacity[313]. Key Companies in the Gas to Liquid Market include Royal Dutch Shell (Netherlands), Chevron Corporation (US), Sasol Limited (South Africa), Petro SA (South Africa), Velocys PLC (US), ORYX GTL (Qatar), OLTIN YO'L GTL (Uzbekistan), Linc Energy (Australia), Compact GTL (UK), Primus Green Energy (US) and, Gas Techno (US)[314].

As Africa faces significant energy access challenges, with many regions relying on traditional biomass and kerosene. GTL can provide a cleaner alternative, by producing

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(Transportation, Chemicals and Petrochemicals, Power Generation, Others), By Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends, and Forecast 2024-2033,, June 2024, https://market.us/report/gas-to-liquid-gtl-market/)

311 Supra (Market.US Global Gas To Liquid (GTL) Market By Technology (Fischer-Tropsch Synthesis, Syngas to Methanol, Methanol-to-Gasoline, Methanol-to-Olefins , Others), By Product (Diesel, Naphtha, Lubricants, Others), By Application(Fuel Oil, Lubricating Oil, Process Oil, Others), By End-Use (Transportation, Chemicals and Petrochemicals, Power Generation, Others), By Region and Companies - Industry Segment Outlook, Market Assessment, Competition Scenario, Trends, and Forecast 2024-2033,, June 2024, https://market.us/report/gas-to-liquid-gtl-market/)

312 Rajrani Baghel, Gas-to-Liquid (GTL) Market Size & Share by Type (GTL Fuel, GTL Chemicals), End-User (Residential, Industrial, Transportation) - Global Supply & Demand Analysis, Growth Forecasts, Statistics Report 2024-2036, Research Nester, June 2024, https://www.researchnester.com/reports/gas-to-liquid-gtl-market/5101

313 Supra (Anshula Mandaokar, Gas to Liquid (GTL) Market Research Report Information, trends (Driving Factors/Restraining factors/Growth Opportunities) https://www.marketresearchfuture.com/reports/gas-to-liquid-market-5053)

314 Supra (Anshula Mandaokar, Gas to Liquid (GTL) Market Research Report Information, trends (Driving Factors/Restraining factors/Growth Opportunities) https://www.marketresearchfuture.com/reports/gas-to-liquid-market-5053)

liquid fuels that are easier to transport and store compared to natural gas. This can help improve energy access in remote areas where pipeline infrastructure is lacking. Africa, rich in abundance of natural gas resources (holding approximately 7% of the world's reserves) presents an opportunity for countries to leverage GTL technology to enhance energy security and economic development. One of the most notable players in the GTL sector in Africa is Sasol, a South African company that has been a pioneer in this technology[315].

By converting natural gas into liquid fuels, African nations can reduce their reliance on more polluting energy sources like coal and diesel, which are commonly used for domestic energy needs[316]. While GTL technology offers a cleaner alternative to traditional fossil fuels, it is essential to consider its environmental impact. The use of natural gas can significantly reduce greenhouse gas emissions compared to coal and oil. However, there are concerns about methane emissions associated with natural gas extraction and transportation[317]. To address these concerns, many African countries are making commitments to restrict methane emissions and phase out coal, aligning their energy strategies with global climate goals. This dual approach of utilizing GTL while simultaneously investing in renewables can help mitigate environmental impacts, while supporting economic growth.

Promoting Gas to Liquid technology in Africa offers a pathway to a just energy transition that addresses energy poverty, stimulates economic growth, and supports environmental sustainability. By focusing on economic opportunities, effective governance, technological innovation, and environmental considerations, African nations can leverage GTL to enhance energy security and promote sustainable development. This multifaceted approach will be essential for navigating the

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315 EIA, Global gas-to-liquid growth is dominated by two projects in South https://www.eia.gov/todayinenergy/detail.php?id=33192

316 Kwaku Boakye-Adjei, Euractiv, Gas can play a key role in Africa's Energy Transition https://euractiv.com/section/energy-environment/opinion/gas-can-play-a-key-role-in-africas-energy-transition/

317 L. Acha, P. Gaius-Obaseki, O. Onyekweli, The future of African Oil and Gas: Positioning for the Energy Transition https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-future-of-african-oil-and-gas-positioning-for-the-energy-transition

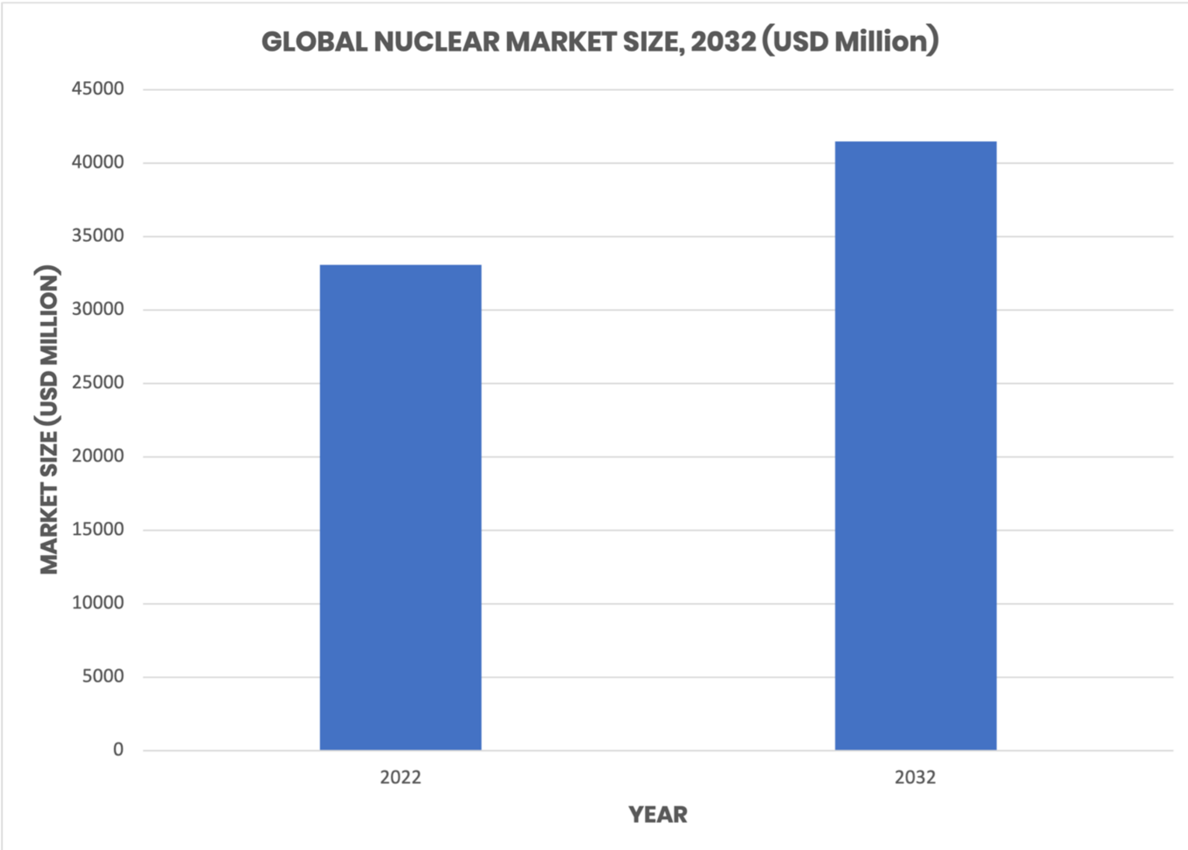
complexities of the energy transition, while ensuring that the benefits are shared equitably across communities.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Africa's Sustainable Energy Transition using Nuclear Energy

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for enabling Africa's sustainable energy transition through the use of nuclear energy.



Source: Electricity Lawyer (data sourced from Business Research Insights)

Nuclear energy is energy released from the nucleus or the core of an atom of protons and neutrons[318]. Nuclear energy can be produced either in nuclear fission (when the nuclei of atoms split into several parts) or by fusion (when nuclei fuse)[319]. Nuclear

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[318] Mordor Intelligence, Nuclear Power Market Size & Share Analysis – Growth Trends and Forecasts (2024 – 2029) https://www.mordorintelligence.com/industry-reports/nuclear-power-market

[319] Andrea Galindo, International Atomic Energy Agency, what is Nuclear Energy? The Science of Nuclear Energy, https://www.iaea.org/newscenter/news/what-is-nuclear-energy-the-science-of-nuclear-power#:~:text=The%20Science%20of%20Nuclear%20Power,-%C3%97&text=Nuclear%20energy%20is%20a%20form,fusion%20%E2%80%93%20when%20nuclei%20fuse%20together.

fission in a nuclear power plant takes place in a controlled environment that produces huge amounts of heat. It is used to generate electricity and then converts that heat into steam[320]. Nuclear energy, derived from nuclear reactions, provides a reliable and low-carbon source of electricity generation, contributing to global efforts to mitigate climate change[321].

The graph illustrates the global nuclear market size from 2022 to 2032.

The global market is expected to expand in the coming years as more countries switch to cleaner energy production methods. The global nuclear energy market size was USD 33080 million in 2022, and it is projected to reach USD 41454.19 million by 2032, with a compound annual growth rate (CAGR) of 2.3% during the forecast period[322].

The rise in the demand for clean energy and the reduction of fossil power stocks are boosting investments in the nuclear power market. Advanced economies are promoting electrification at the same time to decarbonize their industrial, heating, and transportation sectors to drive market growth. The growth of evolving and developing economies is represented by an increase in the power demand. Technological innovations such as small modular reactors, light water reactors, and the increasing demand for clean energy, along with concerns about crude oil consumption, drive investments to meet the growing infrastructure needs without negatively impacting the environment and is expected to further enhance the demand for nuclear energy. The nuclear energy market is majorly driven by the need to reduce carbon emissions from energy generation, growing energy demand, increased focus on improving energy self-sustainability, increased investment in nuclear energy technology, and growing technological advancements in the industry[323]. In addition, the COVID-19

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[320] Business Research Insights, Nuclear Energy Market Report Overview, May 2024, https://www.businessresearchinsights.com/market-reports/nuclear-energy-market-108593

[321] Skyquest, Nuclear Energy Market Insights, https://www.skyquestt.com/report/nuclear-energy-market

[322] Supra (Business Research Insights, Nuclear Energy Market Report Overview, May 2024, https://www.businessresearchinsights.com/market-reports/nuclear-energy-market-108593)

[323] Ibid (Precision Business Insight, Nuclear Energy Market Dynamics, https://www.precisionbusinessinsights.com/market-reports/nuclear-energy-market)

pandemic has accelerated the shift towards renewable energy, as governments and businesses have recognized the importance of building resilient and sustainable energy systems. The Russia-Ukraine war has brought to light the precarious and exposed reliance on certain energy sources, such as gas and oil, ultimately necessitating a significant diversification of countries' energy portfolios in the long term[324].

The nuclear energy market faces several significant restraints that impact its growth and development. Securing funding for nuclear power projects is a major challenge. The high capital costs associated with building and maintaining nuclear power plants can deter investors. Many projects struggle to find financing due to the perceived risks and long payback periods involved in nuclear energy investments[325]. Other restraints include safety concerns and public perception, especially in the aftermath of nuclear accidents such as the Fukushima Daiichi disaster[326] and nuclear waste disposal issues[327].

Nuclear energy is increasingly recognized as a crucial component in Africa's efforts to achieve a sustainable energy transition. As the continent grapples with significant energy challenges, including widespread energy poverty and reliance on fossil fuels, nuclear power offers a viable solution to meet growing energy demand, while addressing climate change. Africa faces a pressing energy crisis, with over 600 million people lacking access to electricity. The continent's energy needs are projected to rise sharply as urbanization and industrialization accelerate. Nuclear energy can provide a stable and reliable source of power, essential for economic development and

[324] Supra (Statista, Nuclear Power – Worldwide, https://www.statista.com/outlook/io/energy/nuclear-power/worldwide)

[325] Supra (Fortune Business Insight, Nuclear Power Plant Equipment Market Size https://www.fortunebusinessinsights.com/nuclear-power-plant-equipment-market-106375)

[326] Supra (Fortune Business Insight, Nuclear Power Plant Equipment Market Size https://www.fortunebusinessinsights.com/nuclear-power-plant-equipment-market-106375)

[327] Supra(Statista, Nuclear Power – Worldwide, https://www.statista.com/outlook/io/energy/nuclear-power/worldwide)

improving living standards, but safety and security considerations also have to be factored.

While Africa has abundant renewable energy resources, such as solar and wind, these sources are often intermittent. Nuclear energy can serve as a baseload power source, complementing renewables and ensuring consistent energy supply. This integration is vital for stabilizing the grid and supporting the overall energy transition, allowing for a more resilient energy system. Nuclear energy also offers a reliable, low-carbon alternative to fossil fuels that can support economic growth, improve energy access, and contribute to environmental sustainability. However, realizing this potential will require overcoming significant challenges, including financing, safety, regulatory, and public acceptance issues. With the right policies, partnerships, and investments, nuclear energy can play a critical role in shaping a sustainable energy future for Africa.

Promoting nuclear energy as part of Africa's sustainable energy transition requires careful consideration of safety, public engagement, financing, infrastructure, waste management, integration with renewables, and regional cooperation. By addressing these practical considerations, African nations can harness the potential of nuclear energy to meet their growing energy needs, whilst also contributing to sustainable development and climate change mitigation.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for the Adoption of Energy as a Service In Africa

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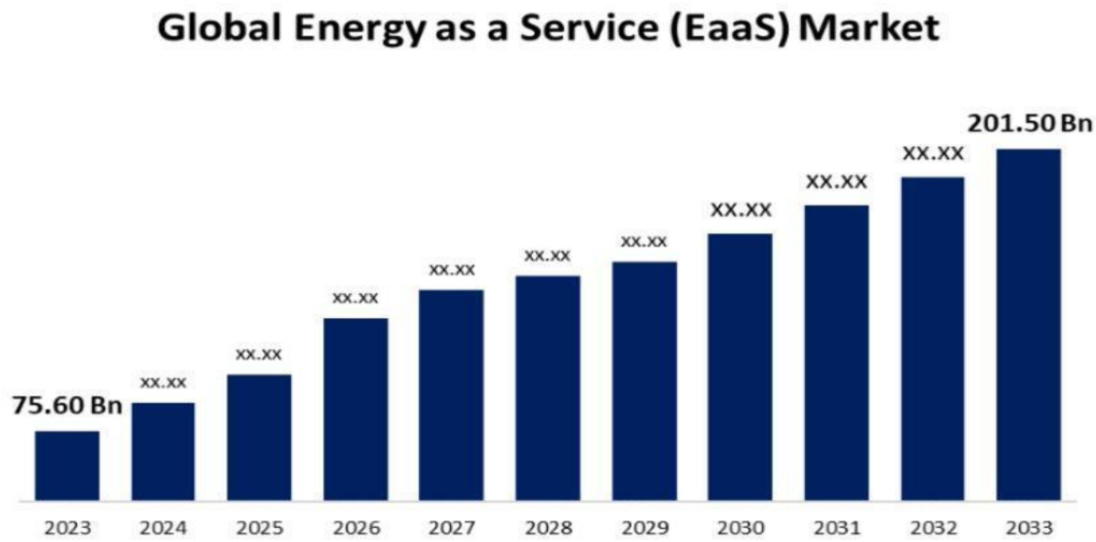
The data intelligence highlights considerations for the adoption of Energy as a Service in Africa.



Source: Spherical Insights (LLP)

The chart illustrates the global market size for Energy as a Service(Eaas).

Energy-as-a-Service (EaaS) is a growing trend in Africa, where energy is provided as a service rather than a product. This model involves a third-party provider offering energy solutions to customers, often through renewable energy sources, energy efficiency measures, and energy storage. In Africa, EaaS has the potential to address energy access challenges, particularly in rural areas where grid connectivity is limited. According to the International Energy Agency (IEA), "Energy-as-a-Service can help accelerate energy access in Africa by providing flexible and affordable energy solutions[328].

Several companies are already offering EaaS solutions in Africa, such as M-KOPA Solar, which provides pay-as-you-go solar energy solutions to households in East Africa[329]. Another example is Africa Energy Solutions, which offers energy efficiency and

[328] International Energy Agency (IEA), "Energy-as-a-Service: A New Way to Accelerate Energy Access in Africa" (2020)

[329] M-KOPA Solar, "About Us" (n.d.)

renewable energy solutions to commercial and industrial customers in South Africa[330]. EaaS offers numerous benefits in Africa, including: increased energy access and affordability[331], improved energy efficiency and reduced energy consumption[332], enhanced energy security and reduced reliance on fossil fuels[333]. However, challenges remain which include; limited infrastructure and grid connectivity in rural areas[334], high upfront costs for energy infrastructure[335], regulatory frameworks that may not support EaaS models[336], etc.

The Global Energy as a Service (EaaS) market size was valued at USD 75.60 Billion in 2023 and the Worldwide Energy as a Service (EaaS) market size is expected to reach USD 201.50 Billion by 2033, according to a research report published by Spherical Insights & Consulting.

The global energy as a service market is segmented into commercial and industrial. Among these, the commercial segment and is witnessing significant growth through the forecast period which includes; the establishment of healthcare, educational institutions, airports, data centers, and others; propelling the market demand in this segment. Prices in the commercial sector are higher than in the industrial sector, allowing for the implementation of energy-efficiency projects with no capital expenditure, which also validates energy savings. The significant number of commercial spaces and high electric consumption are likely to grow the market in the commercial segment.[337]

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[330] Africa Energy Solutions, "Our Services" (n.d.)

[331] World Bank, "Energy-as-a-Service: A Review of the Evidence" (2020)

[332] International Renewable Energy Agency (IRENA), "Energy Efficiency and Renewable Energy: A Synergistic Approach" (2019)

[333] African Development Bank, "Energy Security in Africa: Challenges and Opportunities" (2019)

[334] United Nations Development Programme (UNDP), "Energy Access in Africa: Challenges and Opportunities" (2020)

[335] BloombergNEF, "Energy-as-a-Service: A Cost-Effective Solution for Africa?" (2020)

[336] Energy Research Centre, University of Cape Town, "Regulatory Frameworks for Energy-as-a-Service in Africa" (2020)

[337] https://www.globenewswire.com/news-release/2024/04/12/2862129/0/en/Global-Energy-as-a-Service-Market-Size-To-Exceed-USD-201-50-Billion-By-2033-CAGR-of-10-30.html

Energy as a Service (EaaS) is gaining traction in Africa, driven by the need for affordable, sustainable, and reliable energy solutions. This model, which offers energy as a service rather than a product, is particularly prominent in renewable energy sectors. Companies like M-KOPA and Bboxx are leading the charge by providing pay-as-you-go solar systems to off-grid communities, addressing the upfront cost barrier associated with traditional solar installations[338]. In the commercial and industrial sectors, firms like SolarAfrica are offering EaaS solutions that include solar installations and maintenance, helping businesses reduce energy costs and enhance sustainability[339].

The adoption of EaaS is driven by several factors. Innovative financing solutions, such as pay-as-you-go and leasing, make energy services more accessible by overcoming the challenge of high initial capital costs[340]. Additionally, supportive government policies and incentives, including tax breaks and subsidies for renewable energy projects, align EaaS with national energy access and sustainability goals[341]. However, there are challenges to widespread adoption. Inadequate infrastructure and unreliable grid systems pose significant obstacles, requiring substantial investment to develop both physical and digital infrastructure[342]. Regulatory and market barriers also complicate the deployment of EaaS models, highlighting the need for a clear legal framework to facilitate their success[343]. Overall, while EaaS in Africa is progressing, overcoming infrastructure and regulatory challenges will be crucial for

[338] A Garside and M Collins, 'The Rise of Pay-As-You-Go Solar in Africa: Lessons from M-KOPA and Bboxx' (2018) 43 Energy for Sustainable Development 142

[339] AH Suleiman, 'Adoption of Energy as a Service in Commercial and Industrial Sectors in Africa' (2020) 256 Journal of Cleaner Production 120319

[340] AM Moser and DO Olufemi, 'Financing Energy as a Service: Opportunities and Challenges in Africa' (2019) 15 African Journal of Energy Studies 45

[341] JA Kweku and LD Sarpong, 'Government Policies and Their Impact on Energy as a Service Adoption in Africa' (2020) 138 Energy Policy 111

[342] SM Abu, 'Challenges in Energy as a Service Deployment in Africa: Infrastructure and Grid Reliability' (2021) 44 International Journal of Energy Research 4447

[343] N O Etim, 'Regulatory and Market Challenges for Energy as a Service in Africa' (2022) 29 Journal of Energy Regulation 18

expanding its impact and reaching more communities and businesses across the continent.

The adoption of Energy as a Service (EaaS) in Africa is promising but requires addressing several practical considerations. They include innovative financing models like pay-as-you-go and leasing[344], the development of necessary infrastructure and technology[345], supportive regulatory frameworks[346], and effective customer engagement strategies to build trust and awareness[347]. Additionally, the integration of advanced technologies such as smart grids and IoT devices is crucial for delivering reliable and sustainable energy services. As these elements come together, EaaS has the potential to significantly improve energy access and efficiency across the continent.

EL: Legal, Regulatory & Policy Data Intelligence

Practical Considerations for advancing Sustainable Energy Initiatives in Africa by leveraging Carbon Offsets to achieve Carbon Neutrality

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

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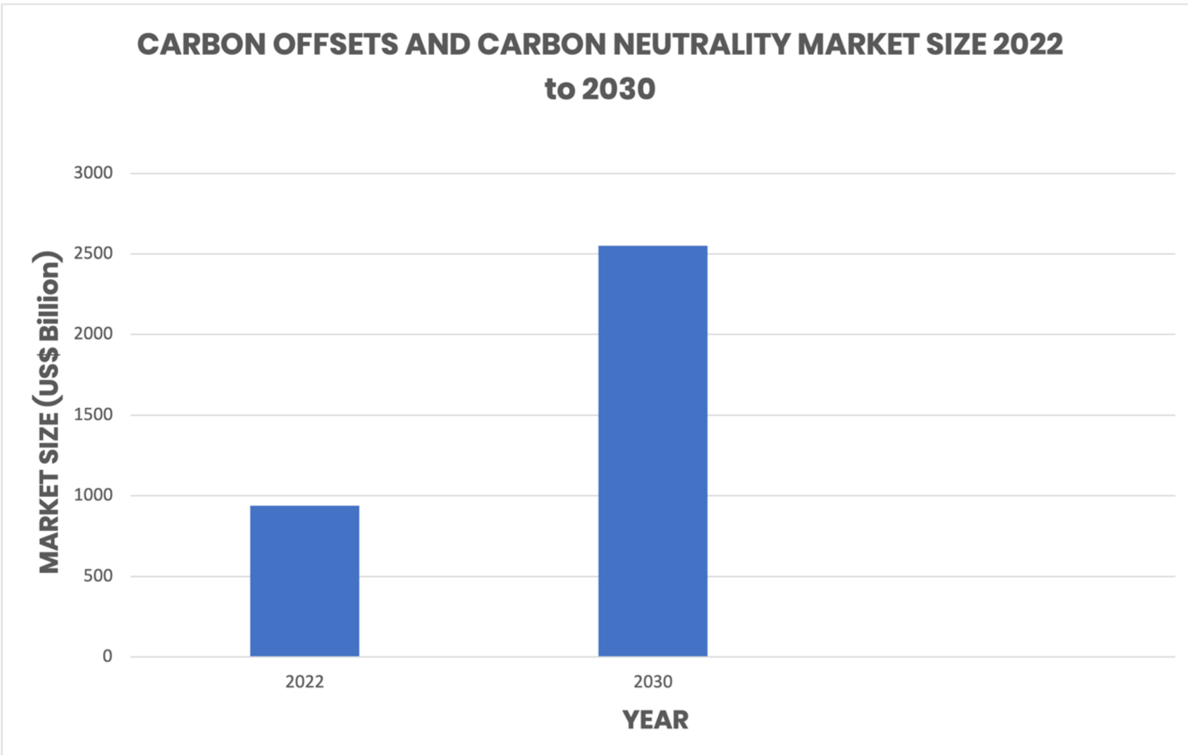
[344] O. Ndungu and A. Agyemang, 'Financing Models for Energy as a Service in Africa: A Review of Pay-As-You-Go and Leasing Models' (2021) 12 Renewable Energy Finance Review 34.

[345] P. Kamau and J. Chukwuma, 'Infrastructure and Technology Requirements for Energy as a Service: Challenges and Opportunities in Africa' (2022) 58 Journal of Energy Systems 102.

[346] R. Muriuki and L. Dlamini, 'Regulatory Considerations for Energy as a Service in Africa: Aligning Policy with Market Needs' (2021) 17 African Energy Policy Journal 67.

[347] A.. Okoro and N. Mthunzi, 'Customer Engagement Strategies for Energy as a Service: Insights from African Markets' (2022) 4 Energy Services Journal 89.

The data intelligence highlights Considerations for advancing Sustainable Energy Initiatives in Africa by leveraging Carbon Offsets to achieve Carbon Neutrality.



SOURCE: Electricity Lawyer (Data Sources from Fortune Business Insights)

The chart showcases the market size of the Global Carbon Offsets from 2022 to 2030.

Carbon neutrality entails achieving a zero carbon footprint by balancing emitted greenhouse gases (GHGs) with equivalent reductions or offsets[348]. Carbon offsets are credits earned by funding projects that reduce or remove GHGs from the atmosphere.

[348] Carbon Offset Guide, Achieving Carbon Neutrality https://offsetguide.org/understanding-carbon-offsets/the-role-of-offsets-in-carbon-management-strategies/achieving-carbon-neutrality/#:~:text=Carbon%20neutrality%20refers%20to%20achieving%20a%20net%20carbon%20footprint%20of%20zero, 29 December, 2020.

These credits can be used to compensate for emissions that cannot be eliminated through direct reduction efforts[349]. This process includes various carbon capture technologies, such as carbon sequestration and the investment in renewable energy that reduces and measures industrial and commercial gases in tons[350].

The growth of this market is associated with the imposed compliance and independent contribution of the end-use industries to neutralize greenhouse emissions[351]. The global carbon offsets market size was valued at USD 938.75 billion in 2022 and is projected to grow from USD 1,067.74 billion in 2023 to USD 2,549.42 billion by 2030, exhibiting a Compound Annual Growth Rate (CAGR) of 13.1% during the forecast period[352].

The demand for carbon credits will significantly grow in the coming decades as companies focus on net zero targets and work towards reducing carbon emissions[353]. The rise in global warming owing to the increasing greenhouse gas emissions has created a potential opportunity for voluntary carbon neutralization projects. Strict government regulations to neutralize carbon emissions by 2050 are a major factor boosting market growth. One factor that could hold back market growth is the lack of standardization and transparency. The absence of uniform standards throughout the voluntary carbon marketplace can result in varying qualities of carbon offsets. This

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[349] Carbon Offset Guide, Achieving Carbon Neutrality https://offsetguide.org/understanding-carbon-offsets/the-role-of-offsets-in-carbon-management-strategies/achieving-carbon-neutrality/#:~:text=Carbon%20neutrality%20refers%20to%20achieving%20a%20net%20carbon%20footprint%20of%20zero, 29 December, 2020.

[350] Fortune Business Insights, Carbon Offsets Market Size, https://www.fortunebusinessinsights.com/carbon-offsets-market-109080#:~:text=The%20global%20carbon%20offsets%20market,13.1%25%20during%20the%20forecast%20period., 12th August, 2024.

[351] Ibid (Fortune Business Insights, Carbon Offsets Market Size, https://www.fortunebusinessinsights.com/carbon-offsets-market-109080#:~:text=The%20global%20carbon%20offsets%20market,13.1%25%20during%20the%20forecast%20period., 12th August, 2024.)

[352] Ibid (Fortune Business Insights, Carbon Offsets Market Size, https://www.fortunebusinessinsights.com/carbon-offsets-market-109080#:~:text=The%20global%20carbon%20offsets%20market,13.1%25%20during%20the%20forecast%20period., 12th August, 2024.)

[353] MarkertsandMarkets, Carbon Offset/Carbon Credit Market, https://www.marketsandmarkets.com/Market-Reports/carbon-offset-credit-market-85350774.html

inconsistency makes it hard for buyers to assess the credibility and effectiveness of various offset tasks, leading to mistrust in the market[354].

As Africa navigates its path towards sustainable development, the transition to renewable energy stands out as a critical element for economic growth and environmental stewardship. Africa, with its vast renewable energy potential and emerging carbon markets, presents unique opportunities and challenges in this endeavour. Despite its relatively low carbon footprint, Africa is one of the continent's most vulnerable to the effects of climate change. According to recent studies, Africa suffers disproportionate risks from climate change, including extreme weather events, droughts, and food poverty. Achieving carbon neutrality—a state where the net carbon emissions are zero—requires innovative strategies. One effective approach is leveraging carbon offsets alongside advancing sustainable energy initiatives. Carbon offset projects in Africa include reforestation, sustainable forest management, solar power, wind energy, biogas digesters, and soil carbon sequestration. By focusing on carbon offset projects in Africa, the environmental difficulties faced by climate change can be solved, and it can also open up huge economic prospects for local communities. These projects not only reduce GHG emissions, but also promote sustainable development and community upliftment[355].

Advancing sustainable energy initiatives in Africa by leveraging carbon offsets requires a multifaceted approach that requires addressing regulatory, technological, and capacity-building challenges. With the right policies, investments, and technological enhancements, Africa can harness its renewable energy potential and

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[354] Business Research Insights, Voluntary Carbon Offsets and Carbon Neutrality Market Size, https://www.businessresearchinsights.com/market-reports/voluntary-carbon-offsets-and-carbon-neutrality-market-115521, 29th August, 2024

[355] TraceX Technology, Carbon Offset Projects in Africa, https://tracextech.com/carbon-offset-projects-in-africa/#:~:text=Did%20you%20know%20that%2C%20despite%20its%20relatively%20low%20carbon%20footprint%2C%20Africa%20is%20one%20of%20the%20continent%20most%20vulnerable%20to%20the%20effects%20of%20climate%20change%3F%20According%20to%20recent%20studies%2C%20Africa%20suffers%20disproportionate%20risks%20from%20climate%20change%2C%20including%20extreme%20weather%20events%2C%20droughts%2C%20and%20food%20poverty 11th April, 2024

carbon markets to achieve carbon neutrality, promote sustainable development, and contribute to global climate goals.

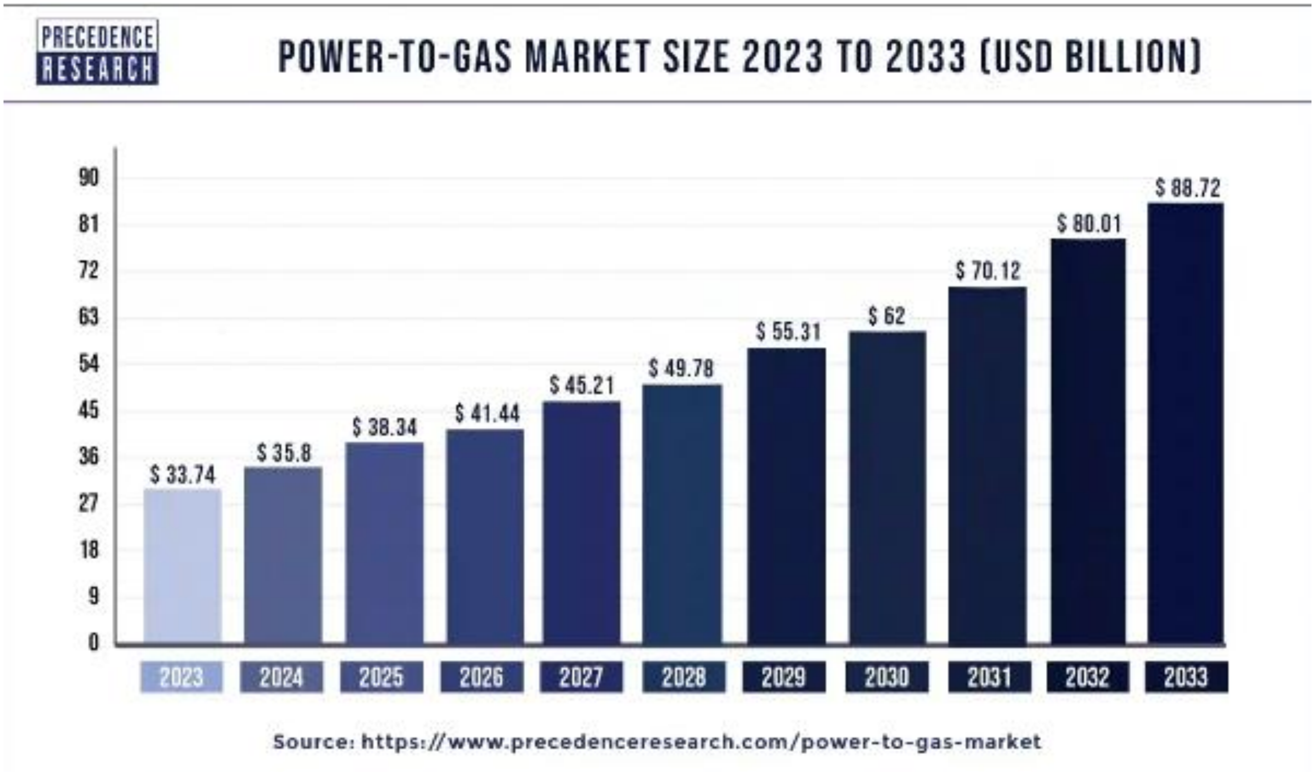
By focusing on high-quality carbon credits and ensuring project integrity, Africa can play a pivotal role in the global effort to mitigate climate change, while fostering economic growth and improving the livelihoods of its communities.

EL: Legal, Regulatory & Policy Data Intelligence

Practical considerations for Promoting the Adoption of Power-to-Gas for a Just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations to empower Africa's sustainable energy using Power-to-Gas technology.



Source: Precedence Research

The chart illustrates the upward trend in the Power-to-Gas market size.

A technique known as "power-to-gas" converts electrical energy into methane or hydrogen syngas (synthetic gas). Businesses use the hydrogen produced by the power-to-gas industry as a chemical or fuel. Energy from renewable resources like wind and solar energy is stored in power-to-gas systems and used for a variety of purposes. These systems utilize stored energy for transportation, heating, and industrial applications. The power-to-gas industry's operations are a positive step towards combining renewable resources with electricity-generating sources[356].

[356] Precedence Research, Power-To-Gas Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/power-to-gas-market#:~:text=The%20global%20power%2Dto%2Dgas,period%20from%202024%20to%202033, April 2024.

The global power-to-gas market size accounted for USD 33.74 million in 2023 and is projected to hit around USD 88.72 million by 2033, growing at a Compound Annual Growth Rate (CAGR) of 10.61% during the forecast period from 2024 to 2033, reflecting robust demand for power-to-gas technologies, as countries strive to reduce greenhouse gas emissions[357]. The rise in the effective use of renewable energy sources and the joint management of power and gas networks are two important factors that are anticipated to promote the growth of the power-to-gas market over the forecast period[358]. Other significant market drivers include the increasing demand for renewable hydrogen, rising electricity demand, and growing environmental concerns[359].

The momentum to reduce greenhouse gas emissions around the world is increasing, alongside the use of hydrogen as a green transportation fuel globally. This, in turn, is creating opportunities for the development of a clean mobility sector[360]. While the Power-to-Gas market presents numerous opportunities, it also faces certain challenges. These challenges include limited hydrogen infrastructure and high initial costs, in addition to the cost of maintenance[361].

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[357] Ibid (Precedence Research, Power-To-Gas Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/power-to-gas-market#:~:text=The%20global%20power%2Dto%2Dgas,period%20from%202024%20to%202033, April 2024.)

[358] Marketsandmarkets, Power-to-gas Market by technology (Electrolysis and Methanation), Capacity (Less than 100 kW, 100-999kW, 1000kW and Above), End-User (Commercial, Utilities, and Industrial), and Region (North America, Europe, Asia Pacific) – Global Forecast to 2024 https://www.marketsandmarkets.com/Market-Reports/power-to-gas-market-200568452.html

[359] Supra (Precedence Research, Power-To-Gas Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/power-to-gas-market#:~:text=The%20global%20power%2Dto%2Dgas,period%20from%202024%20to%202033, April 2024.)

[360] Coherent Market Insight, Power-To-Gas Market Analysis, https://www.coherentmarketinsights.com/market-insight/power-to-gas-market-5750

[361] Supra (Precedence Research, Power-To-Gas Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/power-to-gas-market#:~:text=The%20global%20power%2Dto%2Dgas,period%20from%202024%20to%202033, April 2024.)

Africa faces significant energy challenges, with over 970 million people lacking access to clean cooking fuels and many regions experiencing unreliable electricity supply. The continent's energy mix is heavily reliant on fossil fuels and has the world's lowest levels of per capita use of modern energy, yet there is a growing recognition of the need to transition to cleaner energy sources. As its population and income levels grow, the demand for modern energy is forecasted to expand by a third between 2020 and 2030. Natural gas, while currently contributing only 5% to Africa's energy mix, is seen as a crucial component for providing the baseload power necessary for industrialization and reducing energy poverty[362]. Transitioning to modern energy systems in Africa necessitates substantial investment, estimated at USD 25 billion per year. This investment is crucial for developing infrastructure that supports renewable energy and Power-to-Gas technologies[363].

Power-to-gas technology allows for the conversion of excess renewable energy into hydrogen or synthetic natural gas, which can be stored and used later. This is particularly relevant for Africa, where renewable energy sources like solar and wind are abundant but variable. By integrating Power-to-Gas, countries can enhance energy security and reliability, making it easier to meet domestic energy demand, while reducing reliance on fossil fuels[364]. The adoption of power-to-gas technology in Africa presents a significant opportunity for a just energy transition. By addressing economic, social, and policy considerations, African nations can harness their renewable energy potential, improve energy access, and create a sustainable future for all. This approach not only supports environmental goals, but also fosters economic growth and social equity, ensuring that the benefits of the energy transition are shared by all.

[362] Jason Mitchell, Africa Energy Chamber, Natural gas is key to Africa's industrialization process and to ending the region's massive energy poverty, https://energychamber.org/natural-gas-is-key-to-africas-industrialisation-process-and-to-ending-the-regions-massive-energy-poverty/, September 6, 2023

[363] IEA Africa in an evolving global context, https://www.iea.org/reports/africa-energy-outlook-2022/key-findings

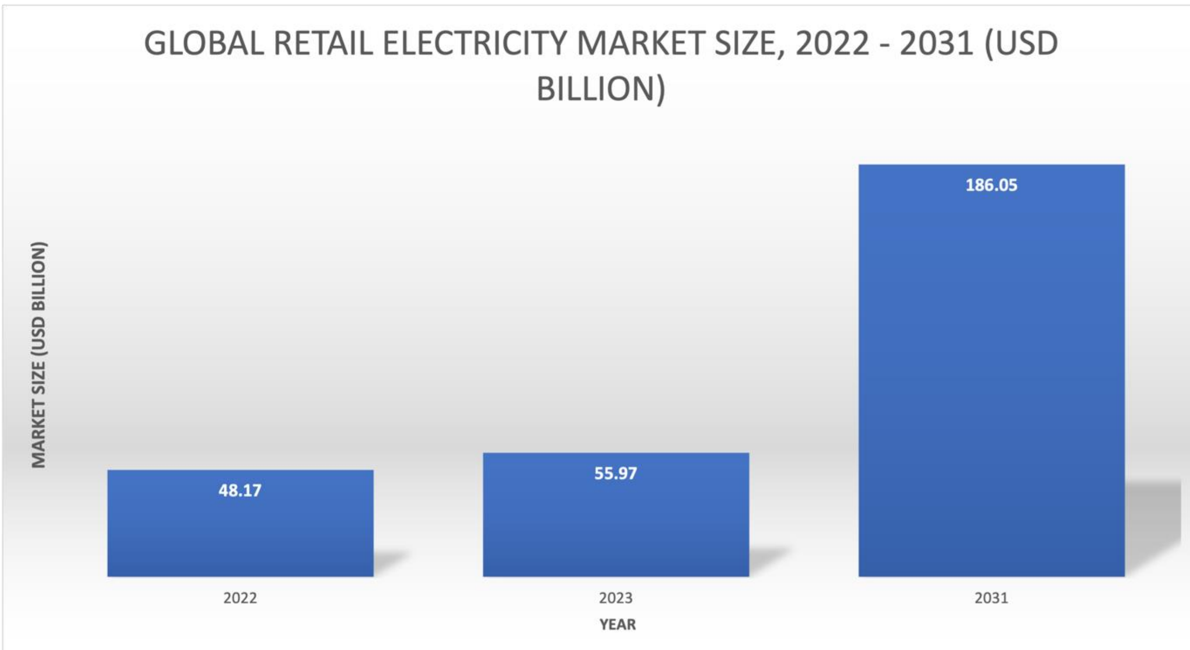
[364] Ibid (IEA Africa in an evolving global context, https://www.iea.org/reports/africa-energy-outlook-2022/key-findings)

EL: Legal, Regulatory & Policy Data Intelligence

Practical considerations for Promoting the Adoption of Retail Electricity for a Just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations to empower Africa's sustainable energy agenda using Retail Electricity.



Source: Electricity Lawyer (data sourced from Skyquest https://www.skyquestt.com/report/retail-electricity-market/market-size)
The chart illustrates the upward trend in the global retail electricity market size.

Retail electricity refers to the sale of electricity to end-users, such as homes, businesses, and industries. It involves buying electricity from wholesale markets or generating it directly, and subsequently selling it to consumers with various pricing plans and customer services[365].
The global retail electricity market has undergone significant changes in recent years, driven by evolving energy policies, technological advancements, and a growing focus

[365] Fortune Business Insights, Retail Electricity Market Size, Share, and Industry Analysis, By End User, and Regional Forecast, 2024-2032, https://www.fortunebusinessinsights.com/retail-electricity-market-109982

on energy sustainability[366]. Global Retail Electricity Market size was valued at USD 48.17 billion in 2022 and is poised to grow from USD 55.97 billion in 2023 to USD 186.05 billion by 2031, growing at a Compound Annual Growth Rate (CAGR) of 16.2% in the forecast period (2024-2031)[367]. The Increasing demand for retail electricity to extend energy access to various unserved and underserved areas is expected to be a key factor driving the global retail electricity market in the coming years[368].

A significant trend in the global retail electricity market is the adoption of smart grid technologies and the integration of digital solutions. Smart meters, advanced analytics, and real-time data monitoring enable consumers to track their energy consumption, optimize usage patterns, and make informed decisions to reduce costs and minimize their environmental footprint. Additionally, digital platforms and mobile applications provide consumers with convenient access to billing information, payment options, and personalized energy-saving recommendations[369].

While the retail electricity market presents numerous opportunities, it also faces certain challenges. Infrastructure limitations, particularly in developing regions, can impede the expansion of retail electricity services. Additionally, regulatory complexities, varying market structures, and policy uncertainties across different countries pose challenges for market participants. Adapting to changing regulations

[366] Supra (SkyQuest Retail Electricity Market Size, Share, Growth Analysis, By Customer Type (Regulated customers and Deregulated customers.), By Application(Energy efficiency solutions, Demand Response programs and smart home technologies.), By Energy Sources(Conventional and Renewable sources of Energy.), By Region - Industry Forecast 2024-2031, https://www.skyquestt.com/report/retail-electricity-market#:~:text=Global%20Retail%20Electricity%20Market%20size,period%20(2024%2D2031)

[367] SkyQuest Retail Electricity Market Size, Share, Growth Analysis, By Customer Type (Regulated customers and Deregulated customers.), By Application(Energy efficiency solutions, Demand Response programs and smart home technologies.), By Energy Sources(Conventional and Renewable sources of Energy.), By Region - Industry Forecast 2024-2031, https://www.skyquestt.com/report/retail-electricity-market#:~:text=Global%20Retail%20Electricity%20Market%20size,period%20(2024%2D2031)., March 2024)

[368] Supra (Retail Electricity Market – Global Industry Analysis, Size, Share, Growth, Trends, and Forecast, 2021 – 2031, https://www.transparencymarketresearch.com/retail-electricity-market.html)

[369] Supra (SkyQuest Retail Electricity Market Size, Share, Growth Analysis, By Customer Type (Regulated customers and Deregulated customers.), By Application(Energy efficiency solutions, Demand Response programs and smart home technologies.), By Energy Sources(Conventional and Renewable sources of Energy.), By Region - Industry Forecast 2024-2031, https://www.skyquestt.com/report/retail-electricity-market#:~:text=Global%20Retail%20Electricity%20Market%20size,period%20(2024%2D2031)., March 2024)

and ensuring compliance, while delivering reliable and affordable electricity services is crucial for sustained growth in this market[370].

A just energy transition in Africa is essential for several reasons. Firstly, the continent is home to approximately 600 million people who live without access to electricity, and 970 million who lack clean cooking fuel[371]. This energy poverty hampers economic development and exacerbates social inequalities. Secondly, Africa's vulnerability to climate change, due to its low adaptive capacity, necessitates a shift towards sustainable energy sources[372].

To promote the adoption of retail electricity for a just energy transition in Africa, a coordinated effort involving governments, private sector actors, and civil society is essential. Policymakers should prioritize the development of supportive regulatory environments and invest in infrastructure improvements. At the same time, businesses and entrepreneurs can drive innovation and offer new solutions to meet the diverse needs of African consumers. By embracing retail electricity models, Africa can transform its energy sector, providing reliable, affordable, and sustainable electricity to its people. This transition not only addresses immediate energy needs but also contributes to long-term economic development and environmental sustainability.

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[370] Supra (SkyQuest Retail Electricity Market Size, Share, Growth Analysis, By Customer Type (Regulated customers and Deregulated customers.), By Application(Energy efficiency solutions, Demand Response programs and smart home technologies.), By Energy Sources(Conventional and Renewable sources of Energy.), By Region - Industry Forecast 2024-2031, https://www.skyquestt.com/report/retail-electricity-market#:~:text=Global%20Retail%20Electricity%20Market%20size,period%20(2024%2D2031)., March 2024)

[371] United Nations Development Program, Just energy transitions as a development priority for Africa, https://www.undp.org/africa/ticad/stories/just-energy-transitions-development-priority-africa#:~:text=600%20million%20lack%20electricity%20and%20970%20million%20lack%20clean%20cooking%20fuel, November 1, 2023

[372] B.E.K. Nsafon, N.N. Same, A.O. Yaku, D. Chaulagain, N.M. Kumar, H. Jeung-Soo, Frontiers, The Justice and Policy implications for clean energy transition in Africa, https://www.frontiersin.org/journals/environmental-science/articles/10.3389/fenvs.2023.1089391/full, 19 January, 2023.

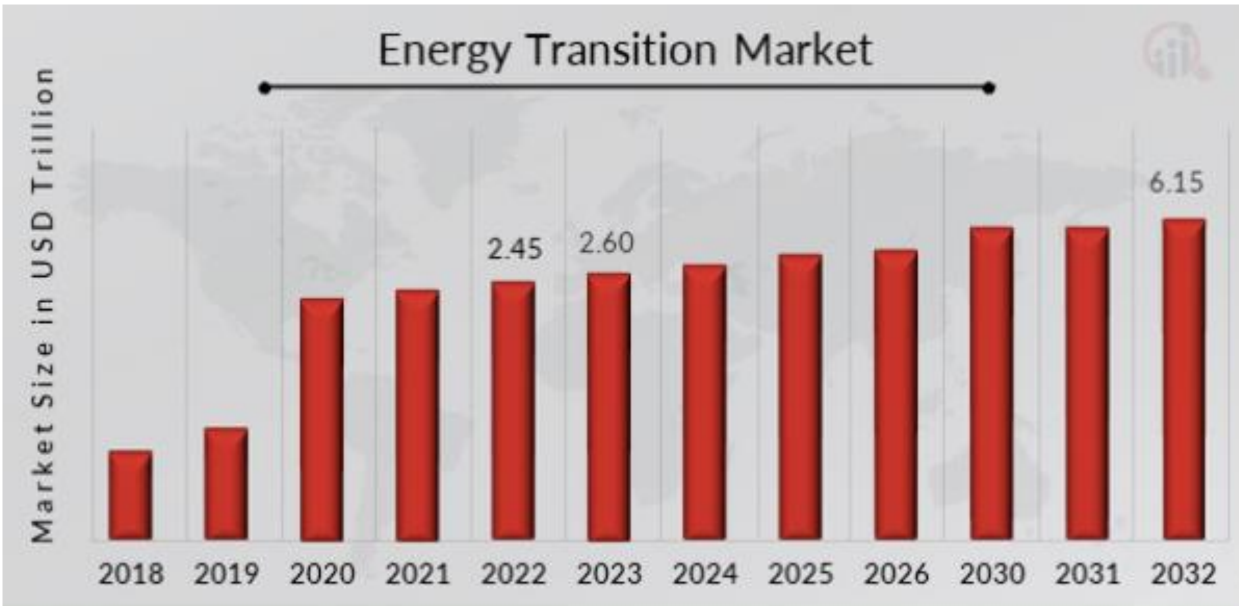
EL: Legal, Regulatory & Policy Data Intelligence

Practical Considerations for Promoting Sustainable Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in

understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for promoting Sustainable Energy Transition in Africa.



Source: Market Research Future

This chart illustrates the upward trend in the energy transition market.

Energy transition refers to the global energy shift from fossil fuel-based energy systems to renewable and sustainable energy production and consumption. It is a global move that requires long-term strategies from the global energy sector to create cleaner and sustainable options via an energy mix that will reduce carbon emissions and decarbonize the environment[373].

The global energy transition market is experiencing significant growth driven by the urgent need to reduce carbon emissions and address climate change. Countries and

[373] Fortune Business Insights, Energy Transition Market Size, Share, and Industry Analysis By Type (Renewable Energy, Energy Efficiency, Electrification, Hydrogen, and Others), By End-Use (Residential, Commercial, and Utility Scale), and Regional Forecast, 2024-2032, https://www.fortunebusinessinsights.com/energy-transition-market-109924,

corporations around the world are making ambitious commitments to boost renewable energy and shift away from fossil fuels. The Energy Transition market was valued at $2.45 trillion in 2022. The industry is projected to grow from $2.60 trillion in 2023 to $6.15 trillion by 2032, exhibiting a compound annual growth rate (CAGR) of 9.00% during the forecast period (2023-2032). The rising awareness of climate change and environmental degradation has emphasized the need to transition to more sustainable and cleaner energy sources. Efforts to reduce carbon emissions and mitigate the impacts of climate change are also contributing to the focus on energy transition. Advancements in renewable energy technologies, such as wind, solar, and energy storage, have made these sources more efficient and accessible, further driving the need for energy transition[374].

One of the major challenges the global energy transition market faces is the high initial costs associated with renewable energy infrastructure development and installation. The high upfront installation costs of renewable technologies like solar panels and wind turbines compared to traditional fossil fuels hampers their widespread adoption[375].

One of the key opportunities lies in further technological developments in energy storage and efficiency. Advancements in battery technologies, renewable integration, and demand response systems can help overcome some of the intermittency issues related to renewable energy sources like wind and solar. Improved and lower-cost energy storage systems will allow greater utilisation of renewable power generated. Likewise, adopting smart grid technologies and enhancing demand response capabilities in the electricity system can help balance supply and demand more effectively[376].

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[374] Market Research Future, Energy Transition Market Research Report: Information By Type (Renewable Energy [Wind Power, Solar Power, Bioenergy, Hydropower, Others], Energy Efficiency, Electrification, Hydrogen, Others), By Application (Residential, Commercial, Utility) and By Region -Global Forecast to 2032, https://www.marketresearchfuture.com/reports/energy-transition-market-13894, September 2024

[375] Coherent Market Insights, Energy Transition Market Size and Share Analysis – Growth Trends and Forecasts (2024-2031), https://www.coherentmarketinsights.com/industry-reports/energy-transition-market, September 2024

[376] Ibid (Coherent Market Insights, Energy Transition Market Size and Share Analysis – Growth Trends and Forecasts (2024-2031), https://www.coherentmarketinsights.com/industry-reports/energy-transition-market, September 2024)

Africa, with a burgeoning population, faces a significant challenge; as a large portion of its population lacks access to electricity. This lack of access leads many to rely on biomass energy sources, particularly charcoal, which not only poses significant health risks, but also contributes to environmental degradation. Despite the heavy reliance on fossil fuels in the continent's energy landscape, Africa holds immense potential for renewable energy. This potential includes abundant solar, wind, and hydroelectric resources that can be harnessed to provide sustainable and clean energy solutions for the continent[377]. By harnessing the continent's vast renewable resources, fostering technological innovations, and implementing supportive policies, Africa can meet its growing energy needs and also drive economic growth, create jobs, and enhance climate resilience. Collaboration among governments, businesses, and communities will be key to navigating the challenges and realizing the full potential of the energy transition[378]. The energy transition in Africa is not just a necessity for sustainable development; it is also an opportunity to create a more resilient and equitable energy future.

EL: Legal, Regulatory & Policy Data Intelligence

Practical Consideration for Promoting the Adoption of Smart Energy for a Just Energy Transition in Africa

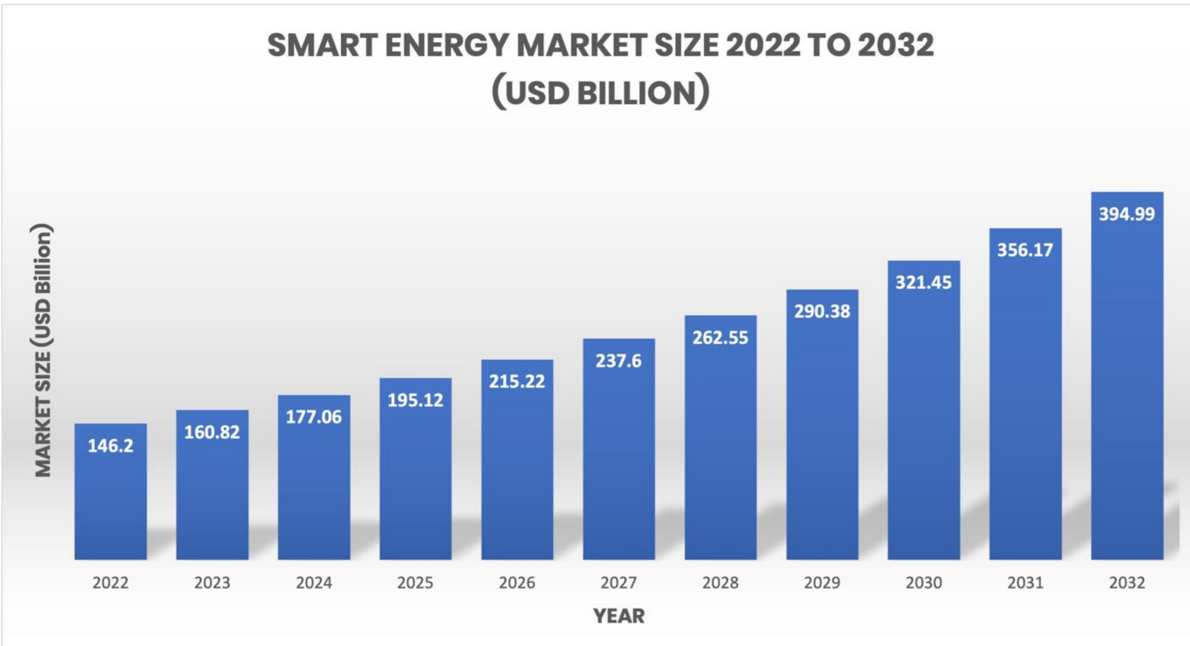
Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in

[377] Pierre-Olivier Rouaud, The Africa Report, Is cleaner green? Africa's Energy Transition Dilemma, https://www.theafricareport.com/91319/africas-energy-transition-dilemma/, May 24, 2021

[378] Irena, The Energy Transition in Africa: Opportunities for International Collaboration with a focus on the G7, https://www.irena.org/Publications/2024/Apr/The-energy-transition-in-Africa-Opportunities-for-international-collaboration-with-a-focus-on-the-G7, April 2024.

understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations to enhance Africa's sustainable energy transition, by implementing smart energy systems.



Source: Electricity Lawyer (data sourced from Precedence Research https://www.precedenceresearch.com/smart-energy-market)

The chart illustrates the upward trend in the global smart energy market size.

Smart energy refers to a sustainable energy management solution that utilizes energy-efficient, renewable and the Internet of Things (IoT) - integrated systems and devices. It involves smart electricity, gas, solar and thermal grids and home energy management systems that use distributed generation systems, meters and modules for one-way or two-way communications. These solutions are used for collecting and storing data that are further transmitted to computers, laptops, smartphones and power line carriers. Smart energy systems enable consumers to monitor and vary their energy demand and reduce emission rates. They also aid in reducing aggregate transmission and commercial energy losses, while preventing disconnection, eliminating inefficiencies in billing and minimizing re-connection costs[379].

The global smart energy market size was exhibited at USD 160.82 billion in 2023 and is projected to be worth around USD 394.99 billion by 2032, registering a Compound annual growth rate (CAGR) of 10.50% during the forecast period from 2023 to 2032[380].

The global smart energy market is witnessing rapid growth driven by increasing energy demand, environmental concerns, and technological advancements[381]. Furthermore, the rising global concern among governments is expected to drive an increased demand for solar (renewable) energy. Governments in various countries are tackling this concern by introducing new rebates and incentive programs specifically designed to encourage the adoption of smart energy technologies, with a focus on smart solar solutions. These initiatives by governments are aimed at encouraging both residential and industrial sectors to invest in and install smart energy technologies[382]. Additionally, the increasing focus on rural electrification and the rising utilization of smart meters for automatic control of electricity, light and energy to minimize wastage, are also contributing to the market growth[383].

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[379] Imarc, Smart Energy Market Report by Component (Hardware and Equipment, Solution and Service), Product (Smart Grid, Digital Oilfield, Smart Solar, Home Energy Management System), End Use Sector (Residential, Industrial, Commercial), and Region 2024-2032, https://www.imarcgroup.com/smart-energy-market

[380] Precedence Research, Smart Energy Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/smart-energy-market

[381] Sky Quest, Smart Energy Market Size, Share, Growth Analysis, By Product(Smart Grid, Digital Oilfield, Smart Solar, and Home Energy Management System), By End user(Residential, commercial, and industrial), By Region - Industry Forecast 2024-2031, https://www.skyquestt.com/report/smart-energy-market

[382] Supra (Grand View Research, Smart Energy Market Size, Share & Trends Analysis Report By Product (Smart Grid, Digital Oilfield, Smart Solar, Home Energy Management System), By Component, By End-user (Industrial, Commercial, Residential), By Region, And Segment Forecasts, 2023 – 2030, https://www.grandviewresearch.com/industry-analysis/smart-energy-market-report#:~:text=Smart%20Energy%20Market%20Size%20%26%20Trends,9.6%25%20from%202023%20to%202030.)

[383] Supra (Imarc, Smart Energy Market Report by Component (Hardware and Equipment, Solution and Service), Product (Smart Grid, Digital Oilfield, Smart Solar, Home Energy Management System), End Use Sector (Residential, Industrial, Commercial), and Region 2024-2032, https://www.imarcgroup.com/smart-energy-market)

Despite the smart energy market presenting numerous opportunities, it also faces certain challenges. One significant factor hindering the market demand for smart energy solutions is interoperability challenges. The diverse array of devices, systems, and technologies within the smart energy ecosystem often face compatibility issues, impeding seamless communication and integration. Interoperability challenges can lead to inefficiencies, increased costs, and operational complexities for both providers and consumers. Another restraint on the market demand is the limited awareness among consumers regarding the benefits and functionalities of smart energy solutions[384].

Smart energy presents a transformative opportunity for Africa to leapfrog traditional energy models and create a more inclusive, sustainable, and resilient energy system. This transition aims to provide equitable access to energy, while addressing environmental sustainability and socio-economic development. A pragmatic approach to energy transition is necessary, considering Africa's unique development realities. Smart energy systems, especially off-grid and decentralized solutions, can bring electricity to underserved and remote communities[385]. Leaders emphasise that the transition should not only focus on renewable energy but also be sensitive to economic and social factors that affect local populations. This means integrating renewable energy solutions with existing economic activities and ensuring that they contribute to job creation and local development[386]. Effective governance and policy frameworks are vital for managing the transition to sustainable energy systems. Policymakers must create environments that support renewable energy investments, while ensuring that these initiatives are environmentally and socially acceptable.

Promoting Smart Energy adoption in Africa requires a multifaceted approach that includes enhancing regional cooperation and integration, leveraging international

[384] Supra (Precedence Research, Smart Energy Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/smart-energy-market)

[385] Otuko M. S., Mathenge V., Research Gate, Towards Energy Security in Africa: Unveiling Policies, Initiatives, and Opportunities, https://www.researchgate.net/publication/383704043_Towards_Energy_Security_in_Africa_Unveiling_Policies_Initiatives_and_Opportunities, September 2024

[386] Mounia Boucetta, Policy Center For The New South, Towards a Just Energy Transition for Africa, https://www.policycenter.ma/publications/towards-just-energy-transition-africa#, September 10, 2024

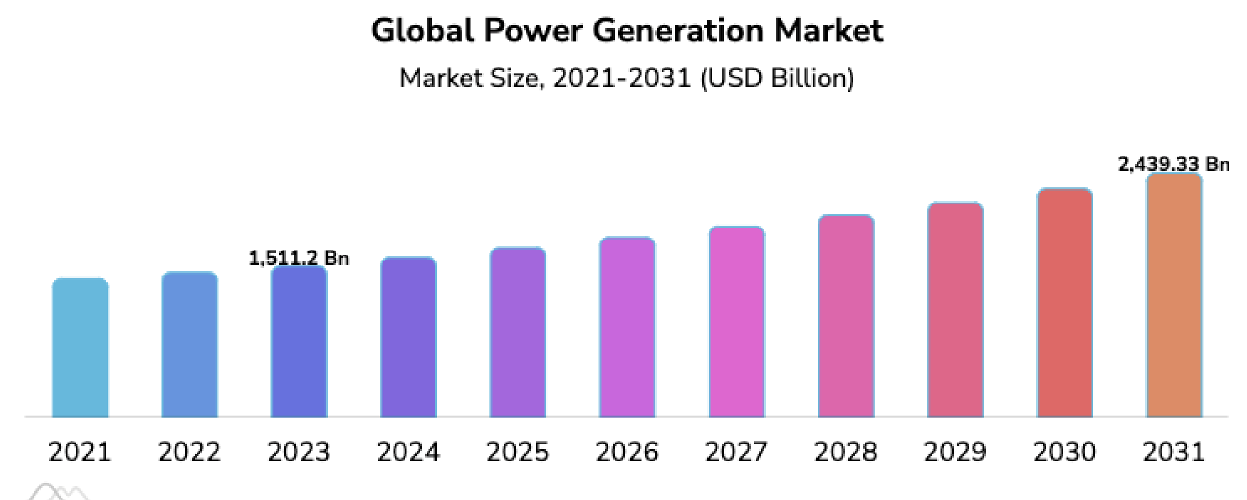
support and financing, infrastructural development and leveraging digital technologies. By addressing these considerations, Africa can move towards a just energy transition that benefits all its citizens, while contributing to global sustainability goals.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting the Adoption of Renewable Energy Technologies for a Just Energy Transition in Africa: Insights from the Global Power Generation Market Size and Trends

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for promoting the adoption of Renewable Energy Technologies for a Just Energy Transition in Africa, leveraging insights from the Global Power Generation Market Size and Trends.



Source: Kings Research[387]

The chart shows the global market growth in Power Generation from 2021 to 2031.

The power generation market refers to the industry segment involved in the generation, production, and distribution of electrical energy. It encompasses a wide range of technologies and methods for generating electricity, such as fossil fuels, nuclear energy, renewable sources like wind and solar, and other emerging technologies[388]. This crucial sector involves the conversion of primary energy into

[387] Kings Research, Power Generation Market Size, Share, Growth & Industry Analysis, By Sources, and Renewable, By End-Use, and Regional Analysis, 2024-2031 https://www.kingsresearch.com/power-generation-market-159, June 2024
[388] NMSC, Power Generation Market, https://www.nextmsc.com/report/power-generation-market

electricity, which can subsequently be distributed to meet the needs of residential, commercial, and industrial consumers[389].

The Global Power Generation market has undergone significant changes in recent years, driven by an increase in population and rapid industrialization[390]. This has pushed nations to expand their power generation capabilities and diversify their energy sources to ensure a stable and reliable electricity supply. Global Power Generation market size was recorded at USD 1,511.20 Billion in 2023, which is estimated to be at USD 1,595.40 Billion in 2024 and projected to reach USD 2,439.33 Billion by 2031, growing at a compound annual growth rate (CAGR) of 6.25% from 2024 to 2031[391].
The power generation market growth is fueled by significant investments in smart grid infrastructure, which promises to enhance the reliability and efficiency of power distribution[392]. Also, government initiatives and policies are encouraging the use of renewable energy sources for power generation to avail their efficiency and reliability[393].

However, the power generation market growth is hindered by factors such as outdated electricity generation infrastructure in developing nations and attendant air pollution, resulting from carbon dioxide emissions; due to the burning of fossil fuels for power production. On the other hand, the growing popularity of smart grid technologies for their high reliability and features, such as advanced monitoring and control systems, is expected to create ample opportunities for the market in the coming years[394].

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[389] Ibid (NMSC, Power Generation Market)

[390] Supra (Kings Research, Power Generation Market Size, Share, Growth & Industry Analysis, By Sources, and Renewable, By End-Use, and Regional Analysis, 2024-2031)

[391] Supra (Kings Research, Power Generation Market Size, Share, Growth & Industry Analysis, By Sources, and Renewable, By End-Use, and Regional Analysis, 2024-2031)

[392] Precedence Research, Power Generation Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/power-generation-market, February 2023

[393] Supra (NMSC, Power Generation Market)

[394] Supra (NMSC, Power Generation Market)

Various market players operating in the power generation market include Enel SpA, GE Renewable, Engie, E.ON SE, Iberdrola S.A, Excelon Corp, Southern Company, AGL Energy[395] etc. These market players continue to adopt various market development strategies including acquisitions and partnerships across various regions to maintain their dominance in the power generation market.

Africa stands at a pivotal moment in its energy transition journey. The transition to renewable energy technologies in Africa is not only a necessity for environmental sustainability, but Is also a critical step towards achieving social equity and economic development. Africa's energy landscape is characterized by significant disparities in access and a heavy reliance on fossil fuels, alongside the lowest rates of energy access globally, with around 600 million people lacking electricity[396]. However, the continent's vast renewable energy potential offers a unique opportunity to address energy access challenges, stimulate economic growth, and mitigate climate change impacts. Africa's vast renewable resources, particularly solar, make it an attractive destination for international investment, with over $34.7 billion invested in the sector from 2011 to 2020[397].

Achieving Africa's energy and climate goals require more than doubling energy investment this decade. This would require over USD 190 billion each year from 2026 to 2030, with two-thirds going to clean energy[398]. This financial strategy is crucial for scaling renewable energy technologies across the continent. Mobilising public and

[395] Supra (Precedence Research, Power Generation Market Size, Share, and Trends 2024 to 2034)

[396] SAIIA, Renewable Energy Technologies in the Global South: Insights from Africa, https://saiia.org.za/research/renewable-energy-technologies-in-the-global-south-insights-from-africa/#:~:text=Africa%20has%20the%20fastest%2Dgrowing,rates%20of%20energy%20access, 26 July, 2024

[397] Rated Power, Solar energy in Sub-Saharan Africa: 5 trends driving the growth, https://ratedpower.com/blog/solar-trends-sub-saharan-africa/#:~:text=Overseas%20companies%20invested%20more%20than, 24 April, 2023

[398] IEA, unlocking more finance remains key to Africa's energy future, https://www.iea.org/reports/africa-energy-outlook-2022/key-findings

private partnerships is essential to support an inclusive energy transition across Africa[399]. Strategic initiatives like the Accelerated Partnership for Renewables in Africa (APRA) aim to increase Africa's renewable energy capacity from 56 GW in 2022 to 300 GW by 2030[400]. These partnerships can enhance access to technology, finance, and expertise, driving the continent's transition to a sustainable energy future.

Promoting the adoption of renewable energy technologies in Africa is essential for achieving a just energy transition that benefits all communities. By leveraging its abundant resources, increasing investment and fostering strategic partnerships, Africa can significantly enhance its power generation capacity. This transition not only supports the continent's climate goals, but also promotes economic development and social equity, ensuring a sustainable future for all.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Advancing a Just Energy Transition in Africa Through the Alternative Fuel Vehicles

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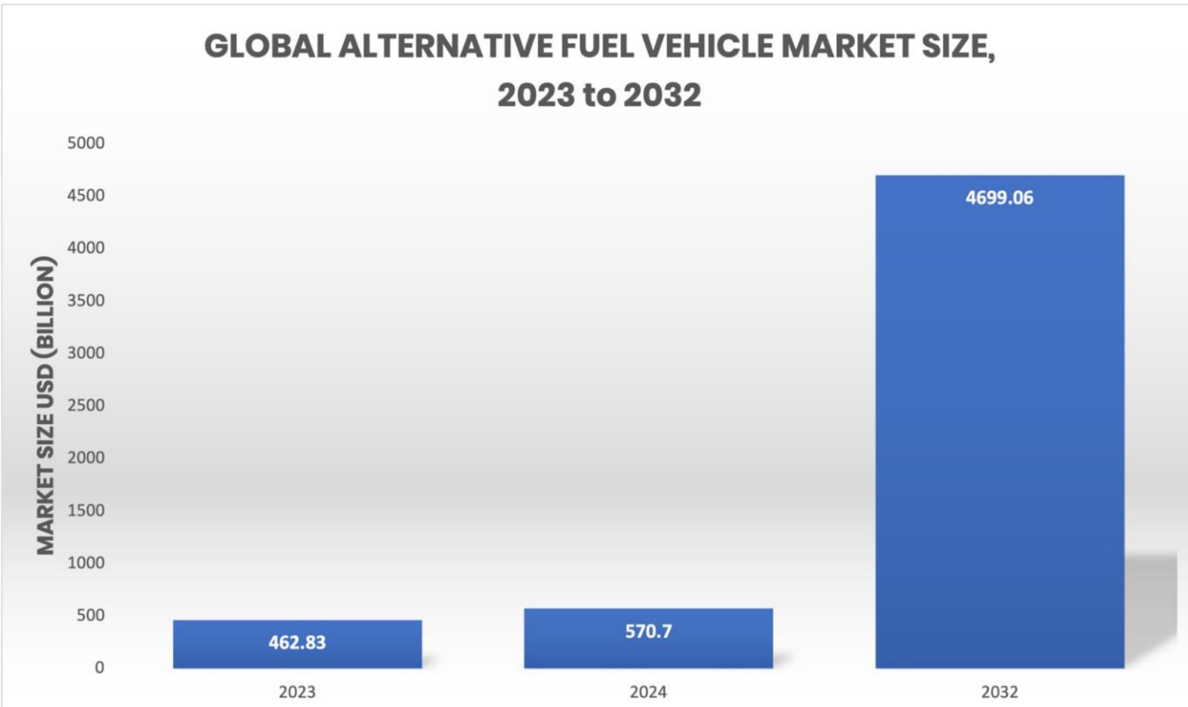
[399] UNDP, Africa's just energy transition a priority as the world moves towards decarbonization, https://www.undp.org/africa/news/africas-just-energy-transition-priority-world-moves-toward-decarbonization#:~:text=Co%2Dorganised%20by%20the%20Tunisia,inclusive%20transition%20across%20the 12 October, 2022

[400] IRENA, Heads of State Accelerate the Partnership for Renewables in Africa at COP28, https://www.irena.org/News/pressreleases/2023/Dec/Heads-of-State-Accelerate-the-Partnership-for-Renewables-in-Africa-at-COP28, 2 December, 2023

understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for advancing a just energy transition in Africa through Alternative Fuel vehicles**.**



SOURCE: Electricity Lawyer (Data Sourced from Fortune Business Insight https://fortunebusinessinsights.com/alternative-fuel-vehicles-market-102518)

The chart shows the global market growth in Alternative fuel vehicles from 2023 to 2032.

Africa is at a critical point as the world works to tackle climate change. The continent, rich in natural resources and potential, is uniquely positioned to lead a Just Energy Transition—one that not only addresses environmental challenges, but also promotes social equity and economic growth. At the heart of this transition lies the promise of alternative fuel vehicles (AFVs), which could transform the landscape of transportation; while fostering sustainable development. Alternative fuel vehicles, which include electric vehicles (EVs), hydrogen fuel cell vehicles, and biofuel-powered vehicles, offer a promising pathway for achieving a sustainable transportation system in Africa.

Alternative fuel vehicles (AFV) refer to motor vehicles that run on alternative fuels instead of traditional petroleum fuels. Alternative fuel vehicles are less expensive, eliminate dependence on oil and are used to conserve fuel and lower vehicle emissions[401]. These alternate fuels are biofuels, such as electricity and solar batteries, ethanol and biodiesel, biogas, LPG, CNG, fuel cells, and hydrogen gas[402].

The global alternative fuel vehicles (AFV) market is expected to be driven by efforts to reduce dependence on fossil fuels, reduce imports of oil, and seek to develop cleaner sources of energy to power vehicles[403]. The AFV market was valued at USD 462.83 billion in 2023. The market is expected to grow from USD 570.70 Billion in 2024 to USD 4699.06 billion by 2032, exhibiting a compound annual growth of 30.2% during the forecast period[404].

The increasing popularity of alternative fuel vehicles worldwide is leading to the adoption of various types of alternative fuel vehicles. The growing reliance on biofuels and the increasing levels of air pollution caused by carbon emissions have prompted the adoption of electric vehicles in global markets. Another contributing factor is the rising fuel prices, which have led to inflation and increased the cost of most everyday goods and services. This has driven the need for sustainable and affordable fuel sources, consequently boosting the demand for alternative fuel vehicles worldwide[405].

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[401] The Business Research Company, Alternative Fuel Vehicles Global Market Report 2024, https://www.thebusinessresearchcompany.com/report/alternative-fuel-vehicles-global-market-report, October 2024

[402] Fortune Business Insights, Alternative Fuel Vehicles Market Size, https://www.fortunebusinessinsights.com/alternative-fuel-vehicles-market-102518, September 2024

[403] Expert Market Research, Global Alternative Fuel Vehicles Market Report and Forecast

[404] Ibid (Fortune Business Insights, Alternative Fuel Vehicles Market Size)

[405] Precedence Research, Alternative Fuel Vehicle Market Size, Share, and Trends 2024 to 2034 https://www.precedenceresearch.com/alternative-fuel-vehicle-market

However, the alternative fuel vehicle market growth is hindered by factors such as the low utilization rate of commercial charging stations and charging costs[406].

The AFVs market is highly competitive and fragmented, with the presence of key players such as the Honda Motor Co., Ltd., Toyota Motor Corporation, Nissan Motor Corporation, Daimler AG, Tesla, BYD Company Ltd., and Ford Motor Company, among others[407]

The adoption of AFVs can significantly reduce the carbon footprint of the transportation sector. Given that transportation is a major contributor to air pollution and greenhouse gas emissions, transitioning to cleaner alternatives is essential for combating climate change and promoting public health[408]. The growth of the AFV market can spur local manufacturing, create jobs, and attract investment. By fostering a green economy, African nations can harness the potential of renewable energy and clean technologies to drive economic development. This includes not only vehicle production, but also the development of supporting infrastructure, such as charging stations and maintenance facilities[409].

To promote a Just Energy Transition in Africa through alternative fuel vehicles, a comprehensive strategy is essential. This strategy should encompass the development of infrastructure for alternative fuel vehicles, ensuring affordability for consumers, crafting supportive policies, increasing public awareness, integrating renewable energy sources, addressing socioeconomic impacts, and fostering collaboration among stakeholders. By addressing these practical aspects, African

[406] Ibid (Fortune Business Insights, Alternative Fuel Vehicles Market Size)

[407] Ibid (Fortune Business Insights, Alternative Fuel Vehicles Market Size)

[408] Brookings, Africa's just energy transition could boost health outcomes, https://www.brookings.edu/articles/africas-just-energy-transition-could-boost-health-outcomes/#:~:text=Below%20is%20a%20viewpoint,region%20in%20the%20coming, March 2022

[409] Electricity Lawyer, Achieving A Just Energy Transition for Africa, https://www.linkedin.com/pulse/achieving-just-energy-transition-africa-electricitylawyer-ztrqf#:~:text=Africa%20possesses%20vast%20natural,such%20as%20oil%20and, October 2023

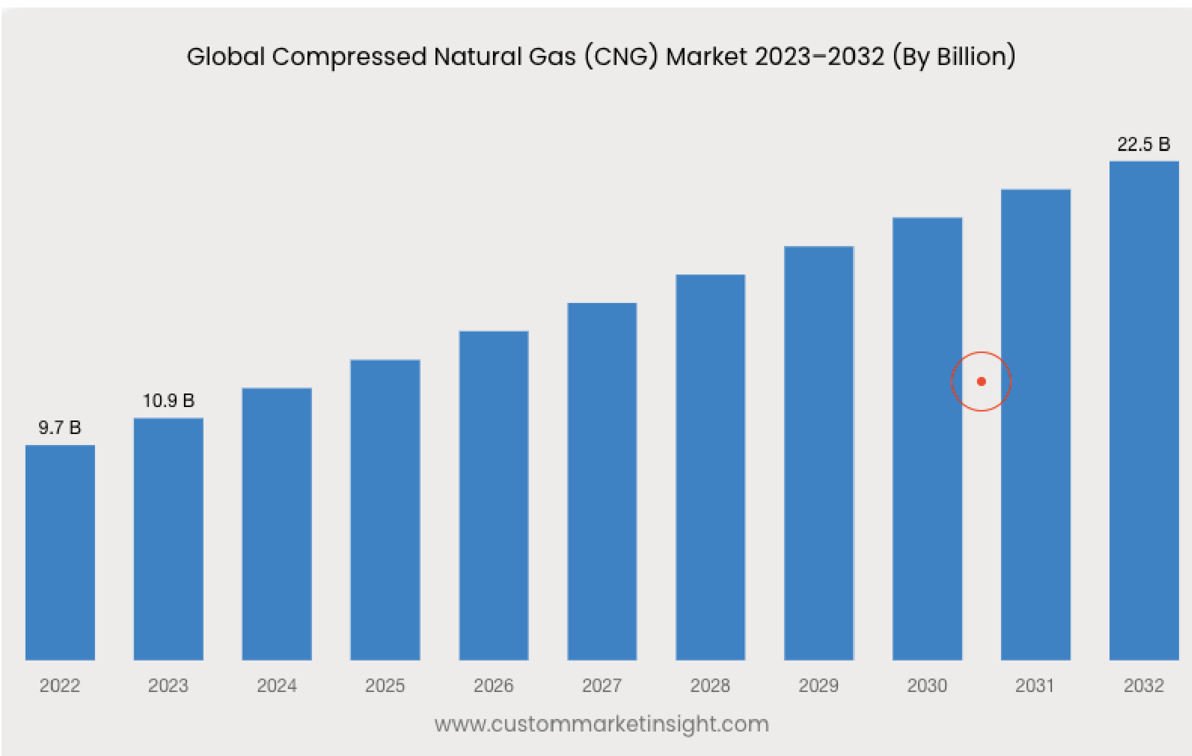
nations can work towards establishing a sustainable and inclusive energy future that benefits all members of society, thereby laying the groundwork for a brighter and more environmentally friendly future. While the path ahead may present challenges, with careful strategic planning and united efforts, Africa has the potential to take the lead in creating a sustainable energy landscape that meets the needs of its people and contributes to the well-being of the planet.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting Africa's Sustainable Energy Transition Using Compressed Natural Gas

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to empower Africa's sustainable Energy Transition using Compressed Natural Gas (CNG).



Source: Custom Market Insights[410]

The chat illustrates the global compressed natural gas (CNG) market size from 2022 to 2032.

[410] Custom Market Insight, Global Compressed Natural Gas (CNG) Market 2023 – 2032 (By Billion), https://www.custommarketinsights.com/press-releases/compressed-natural-gas-cng-market-size/, February 1, 2024

Africa's transition to sustainable energy is a critical component of its development strategy, given the continent's vast natural resources and the pressing need to address energy poverty and climate change. Compressed Natural Gas (CNG) emerges as a viable solution in this context, offering both environmental and economic benefits. Africa is endowed with substantial natural gas reserves, particularly in countries like Nigeria, Egypt, and Mozambique, which positions the continent to leverage CNG for the energy transition[411]. The continent's natural gas reserves are estimated at an upward trajectory of 5,000 billion cubic meters, yet much of this potential remains untapped[412]. By developing these resources, Africa can reduce its dependence on imported oil and stabilize energy projects[413].

Compressed Natural Gas (CNG) is a sustainable alternative fuel derived from associated and non-associated natural gas sources. Associated gas is a byproduct of crude oil production, while non-associated gas is found in unconventional sources; such as shale gas reserves. CNG is primarily used as a fuel for light-duty vehicles, medium-duty buses, heavy-duty buses, medium-duty trucks, and heavy-duty transport trucks, providing an eco-friendly alternative to traditional fossil fuels like gasoline and diesel. CNG is composed primarily of methane, a potent greenhouse gas, but emits fewer carbon emissions and no ozone-depleting substances compared to conventional fuels. The shift towards CNG as a transportation fuel is driven by environmental concerns and the need to reduce carbon footprint[414].

[411] Powergas, Is Compressed Natural Gas (CNG) the Eco-Friendly Solution we need? https://www.powergas.com/is-compressed-natural-gas-the-eco-friendly-solution-we-need#:~:text=Africa%20is%20home%20to,Mozambique%20have%20significant%20CNG

[412] CSIS, Natural Gas can deliver Energy justice and Climate Progress in Africa, https://www.csis.org/analysis/natural-gas-can-deliver-energy-justice-and-climate-progress-africa#:~:text=Upwards%20of%205%2C000%20billion,not%20yet%20approved%20for, November 2023.

[413] Supra (Powergas, Is Compressed Natural Gas (CNG) the Eco-Friendly Solution we need?)

[414] Technavio, Compressed Natural Gas (CNG) Market Analysis APAC, Middle East and Africa, South America, Europe, North America - US, Iran, Qatar, Turkmenistan, Russia - Size and Forecast 2024-2028, https://www.technavio.com/report/compressed-natural-gas-cng-market-industry-analysis, February 2024

The Global Compressed Natural Gas (CNG) market size is set to witness substantial growth from 2023 to 2032, driven by the increasing demand for cleaner energy alternatives, government initiatives promoting sustainable practices, and the growing adoption of CNG as a transportation fuel. The market is projected to achieve a Compound Annual Growth Rate (CAGR) of approximately 9.5% during this period. In 2023, the market was estimated to be valued at USD 10.9 Billion and is expected to reach USD 22.5 Billion by 2032[415]. The primary factor driving market growth is the cost-effectiveness of Compressed Natural Gas.

CNG is gaining popularity due to its environmental advantages, as it produces lower harmful emissions and generates less CO2 per unit of energy. Governments are tightening regulations, and countries are offering subsidies, tax breaks, and grants to encourage the transition, particularly in the transportation sector. The strictness of environmental regulations and the push towards ambitious emission reduction targets are helpful for the growth of the global CNG market. As these policies become more stringent, the adoption of CNG is likely to accelerate, supported by both regulatory pressure and government incentives, making it an increasingly vital component of the global energy mix[416]. Despite the benefits, the CNG market faces challenges such as pressure difficulties in storage cylinders and tanks, in addition to the availability and cost of biomethane from trash firms[417]. Other challenges include the scarcity of CNG stations and the high initial cost associated with developing CNG stations and infrastructure.[418]

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[415] Custom Market Insights, Global Compressed Natural Gas (CNG) Market Size likely to grow at a CAGR of 9.5%by 2033, https://www.custommarketinsights.com/press-releases/compressed-natural-gas-cng-market-size/, February 1, 2024

[416] Data Bridge Market Research, Global Compressed Natural Gas (CNG) Market Size, Share, and Trends Analysis Report – Industry Overview and Forecast to 2031, https://www.databridgemarketresearch.com/reports/global-compressed-natural-gas-cng-market, August 2024

[417] Supra (Technavio, Compressed Natural Gas (CNG) Market Analysis APAC, Middle East and Africa, South America, Europe, North America - US, Iran, Qatar, Turkmenistan, Russia - Size and Forecast 2024-2028)

[418] Supra (Data Bridge Market Research, Global Compressed Natural Gas (CNG) Market Size, Share, and Trends Analysis Report – Industry Overview and Forecast to 2031)

The adoption of CNG can lead to significant economic advantages. It is often cheaper than petrol or diesel, providing cost savings for consumers and businesses[419]. This affordability can stimulate local economies by lowering fuel costs and creating jobs in the energy sector[420]. Additionally, CNG's role in generating electricity and powering vehicles offers a reliable and efficient energy source, helping businesses reduce their environmental footprint. Government policies and incentives are vital in driving CNG adoption. Subsidies for CNG vehicles and refueling infrastructure, tax breaks for businesses, and favorable regulations can create a conducive environment for investment.

Compressed natural gas represents a promising avenue for Africa's sustainable energy transition. By offering a cleaner, more affordable, and accessible energy source, CNG can help bridge the gap between current energy demands and future sustainable solutions. As African countries work to develop their respective energy sectors, a strategic focus on CNG, combined with a commitment to renewable energy, will be crucial in achieving energy access for all; while combating climate change.
In harnessing the potential of CNG, Africa can pave the way for a sustainable energy future, driving economic growth, improving quality of life, and fostering a healthier planet for generations to come.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Integrating Energy-Efficient Lighting Technology for a Just Energy Transition In Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal,

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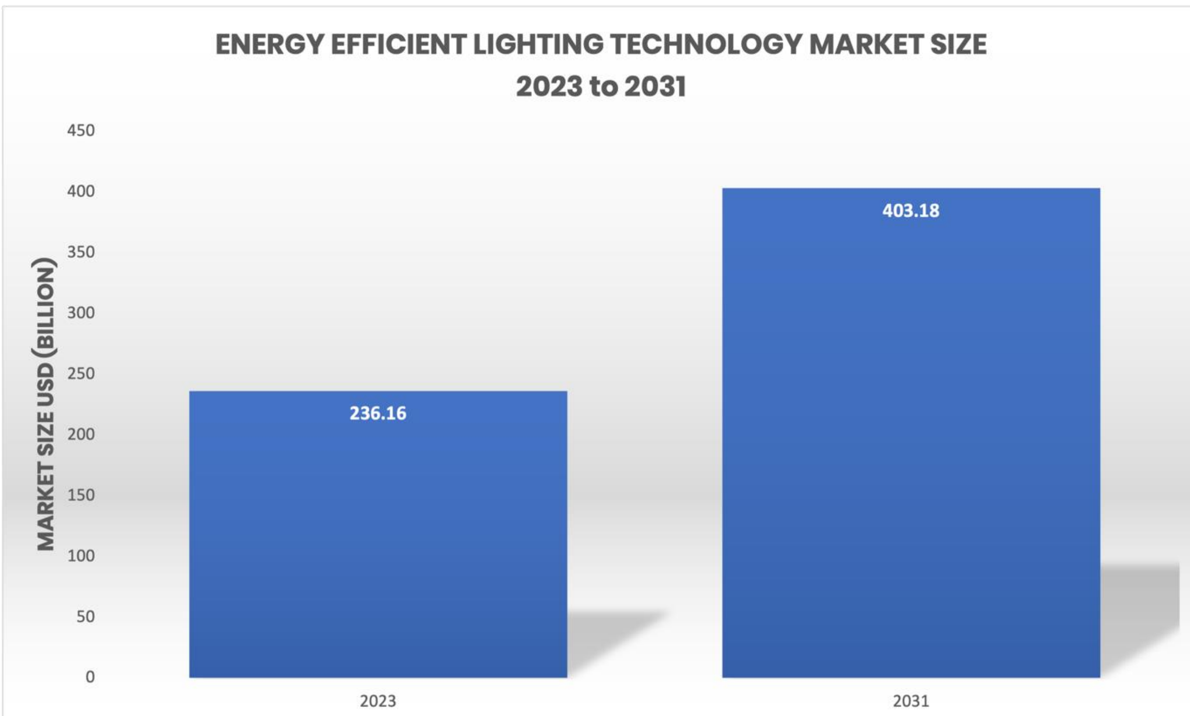
[419] Powergas, Benefits of Compressed Natural Gas (CNG) in Africa, https://www.powergas.com/understanding-the-benefits-of-compressed-natural-gas-in-africa#:~:text=CNG%20is%20often%20cheaper%20than%20petrol%20or, January 2024

[420] Supra (Powergas, Is Compressed Natural Gas (CNG) the Eco-Friendly Solution we need?)

regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to empower Africa's sustainable energy transition using energy-efficient lighting technology.



Source: Electricity Lawyer (Data sourced from Verified Market Research https://www.verifiedmarketresearch.com/product/energy-efficient-lighting-technology-market/)

The chart illustrates the global energy-efficient lighting technology market size from 2023 to 2031.

As Africa strides into the future, the pressing need for a sustainable energy paradigm has never been more urgent. The continent faces a unique set of circumstances: rapid urbanisation, a growing population, and an increasing demand for energy, all against a backdrop of environmental challenges and the impacts of climate change.

Integrating energy-efficient lighting technology emerges as a critical component for Africa's just energy transition, providing solutions that are not only sustainable, but also equitable and inclusive.

Energy-efficient lighting systems are cutting-edge solutions for optimising energy use and improving illumination across a wide range of industries. These creative lighting systems are used in a variety of industries including commercial, residential, industrial, and municipal settings. At the heart of their business is the ability to provide exceptional lighting performance, while reducing energy usage and environmental impact[421]. The different types of products purveyed in the global energy-efficient lighting technology market are incandescent lamps, light emitting diodes (LED), arc lamps, and gas discharge lamps.[422]

The global energy-efficient lighting technology market is set for significant growth from 2023 to 2031, driven by its numerous uses in industries such as commercial, residential, industrial, and municipal sectors, among others. The global energy-efficient lighting technology market is estimated to be valued at USD 236.16 Bn in 2023 and is expected to reach USD 403.18 Bn by 2031 at a compound annual growth rate (CAGR) of 7.86% during the period[423].

The primary factor driving market growth is the critical role that energy-efficient lighting plays in driving energy savings, improving sustainability efforts, and fostering enhanced illumination experiences[424]. Moreover, rapid industrialisation and rapid

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[421] Verified Market Research, Energy Efficient Lighting Technology Market Size By Type (Incandescent Lamp, Light Emitting Diode, Arc Lamp, Gas Discharge Lamps), By Application (Commercial, Residential, Industrial), & Region For 2024-2031, https://www.verifiedmarketresearch.com/product/energy-efficient-lighting-technology-market/, May 2024

[422] Transparency Market Research, Energy Efficient Lighting Technology Market, https://www.transparencymarketresearch.com/energy-efficient-lighting-technology-market.html, April 2020

[423] Ibid (Verified Market Research, Energy Efficient Lighting Technology Market Size By Type (Incandescent Lamp, Light Emitting Diode, Arc Lamp, Gas Discharge Lamps), By Application (Commercial, Residential, Industrial), & Region For 2024-2031)

[424] Ibid (Verified Market Research, Energy Efficient Lighting Technology Market Size By Type (Incandescent Lamp, Light Emitting Diode, Arc Lamp, Gas Discharge Lamps), By Application (Commercial, Residential, Industrial), & Region For 2024-2031)

urbanisation are expected to boost the growth of the market in the forthcoming years. The growing number of real estate residential and commercial projects across the globe and the rising adoption of energy-efficient lighting technology by the government sector to reduce costs are positively impacting the growth of the global energy-efficient lighting technology market[425].

The integration of smart lighting systems and the Internet of Things (IoT) technologies provides huge opportunities for the energy-efficient lighting technology market. Smart lights that can be controlled remotely through mobile apps or voice commands are gaining popularity. These allow adjustment of brightness levels based on occupancy and daylight availability. IoT-enabled lights send usage data to cloud platforms, where it can be analysed for maintenance needs and energy management. This leads to further optimisation of lighting infrastructure[426]. Despite the benefits, the energy-efficient lighting technology market faces challenges, which include high initial capital investments as compared to traditional incandescent or CFL bulbs. While LED lights save considerable energy costs due to their longer lifespan and lower power consumption, their upfront costs tend to be significantly higher. Furthermore, the complete replacement of conventional lighting with new energy-efficient systems in large office buildings or factories involves substantial expenditure[427].

African governments are actively working to phase out inefficient lighting technologies, such as fluorescent lights by 2025, replacing them with LED energy-saving lighting solutions. This transition is part of a broader effort to reduce toxic

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[425] Coherent Market Insights, Energy Efficient Lighting Technology Market Analysis (2024 – 2031), https://www.coherentmarketinsights.com/industry-reports/energy-efficient-lighting-technology-market#:~:text=How%20big%20is%20the%20energy,USD%20403.52%20Bn%20by%202031., Sept 2024

[426] Ibid (Coherent Market Insights, Energy Efficient Lighting Technology Market Analysis (2024 – 2031))

[427] Ibid (Coherent Market Insights, Energy Efficient Lighting Technology Market Analysis (2024 – 2031))

emissions and improve energy efficiency across the continent[428]. The use of efficient lighting technologies can help double the global average annual energy efficiency improvement rate by 2030, contributing to global sustainability goals[429]. Despite the clear challenges, Africa's energy transition faces several challenges. The continent's energy landscape is not uniform, and countries must balance climate change adaptation with economic growth and employment needs[430]. Community involvement is crucial for the success of green energy projects. Engaging local communities ensures that projects are culturally and socially accepted, leading to more sustainable outcomes. Projects like the Kuyasa Clean Development Mechanism in South Africa demonstrate the importance of community-driven initiatives in improving energy efficiency and living conditions[431].

Integrating energy-efficient lighting technology into Africa's just energy transition is not just a matter of improving energy efficiency; it is a pathway to enhancing quality of life, fostering economic development, and addressing climate change. By overcoming existing barriers and implementing targeted strategies, Africa can harness the full potential of energy-efficient lighting to create a sustainable, equitable energy future. This transition will not only illuminate homes and businesses, but also light the way towards a resilient and prosperous continent.

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428 Mercury Working Group, African Countries Lead in Global Effort to Eliminate Toxic Lighting, https://www.zeromercury.org/wp-content/uploads/2021/05/Global-Amendment-Press-Release-FINAL.pdf, May 2021

429 Sustainable Energy for All, Powering education in Kenya: A brighter path through energy efficient lighting in secondary schools, https://www.seforall.org/news/powering-education-in-kenya-a-brighter-path-through-energy-efficient-lighting-in-secondary#:~:text=And%20globally%2C%20increasing%20the,efficiency%20improvement%20rate%20by, May 2024

430 Energy Transition, Africa's energy transition: opportunities and challenges for decent work, https://energytransition.org/2018/11/africas-energy-transition/#:~:text=Africa%E2%80%99s%20energy%20landscape%20is,not%20in%20a%20uniform

431 Dianah Nyamweya, Community Involvement in the success of Green Energy Projects in Africa, https://www.linkedin.com/pulse/community-involvement-success-green-energy-projects-africa-nyamweya-nhbmf#:~:text=Community%20involvement%20ensures%20that,are%20culturally%20and%20socially, May 2024

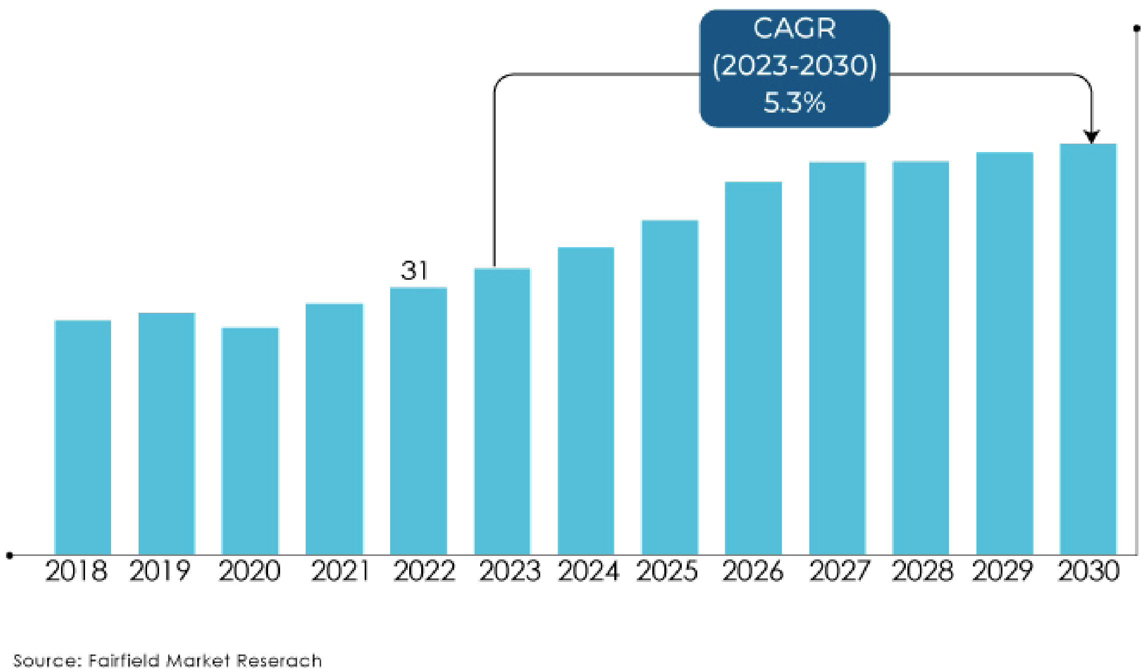
EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Promoting The Adoption Of Wind Power Generation for a Just Energy Transition In Africa.

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in

understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to promote the adoption of wind power generation for a just energy transition in Africa.



Source: Fairfield Market Research

The chart illustrates the global wind power generator market size from 2018 -2030

Wind energy presents a promising solution to Africa's energy crisis. With vast wind resources, particularly in regions like East Africa and along the coast, the continent has the potential to generate a substantial amount of electricity. For instance, Kenya's Lake Turkana Wind Farm, the largest in Africa, produces 310 megawatts of reliable energy, showcasing the viability of wind power in meeting energy demand, while reducing reliance on fossil fuels[432].

Wind energy is regarded as a type of renewable energy; wind energy production is the process of generating electricity using airflow or wind, a phenomenon that naturally occurs in the earth's atmosphere[433]. A wind power generator (WPG), also known as a wind turbine or wind energy converter, is a device that transforms the wind's kinetic energy into electrical energy. It typically comprises a tall tower topped with large blades, known as rotor blades or wind turbine blades. As the wind blows, it propels the blades into rotation, which subsequently drives a generator to produce electricity[434].

The global wind power generator market size is set to witness substantial growth from 2023 to 2030, driven by the global shift towards sustainable energy sources and escalating environmental. The market is projected to achieve a compound Annual Growth Rate (CAGR) of 5.3% during this period. In 2022, the market was estimated to be valued at US$20.7 Bn and is expected to reach USD 31 Bn by 2030[435]

The wind power generation market is experiencing a key trend due to its diverse applications across the renewable energy sector, including electrical, commercial, industrial, and other areas. In addition, rising concerns from governments across emerging nations regarding zero-emission norms are expected to drive market growth.[436] While wind power generators provide many benefits, the market faces

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[432] AOW, Africa's Wind Power Holds Potential to Light Up the Continent, https://aowenergy.com/articles/africas-wind-power-holds-potential-to-light-u#:~:text=The%20study%2C%20which%20mapped%20the,current%20global%20installed%20wind%20capacity., March 5, 2024

[433] Precedence Research, Wind Power Generator Market Size, Share, and Trends 2024 to 2034, https://www.precedenceresearch.com/wind-power-generator-market

[434] Research and Markets, Wind Power Generator Market: Global Industry Analysis, Trends, Market Size, and Forecasts up to 2030, https://www.researchandmarkets.com/reports/5855189/wind-power-generator-market-global-industry?srsltid=AfmBOopP-C5cTgeZV6OnSsKw-TE7UjwtnvFjpquVPd-88y2CyzwhiUbr, July 2023

[435] Fairfield, Wind Power Generator Market, https://www.fairfieldmarketresearch.com/report/wind-power-generator-market, February 2024

[436] Ibid (Allied Market Research, Wind Power Generator Market Expected to Reach $35.4 Billion by 2032—Allied Market Research)

significant challenges that could hinder its growth. One primary concern is the difficulty in identifying adequate sites for wind farms, largely due to the scarcity of available land. This limitation is compounded by a variety of environmental issues, such as the potential impact on local wildlife and ecosystems, which raises apprehensions among conservationists and the public. Additionally, conflicts with other land uses—such as agriculture, residential development, and recreational areas—can further complicate site selection, creating obstacles for developers. These factors collectively pose considerable challenges that may impede the overall growth and adoption of wind energy solutions in the market.

Wind power is becoming increasingly recognized for its cost-effectiveness. With advancements in technology, the cost of generating wind energy continues to decrease, making it a competitive alternative to traditional energy sources. This transition supports the decarbonization of energy generation and aligns with global efforts to achieve net-zero emissions[437].

For wind power to thrive in Africa, capacity building is vital. Training local technicians in the installation and maintenance of wind turbines can create jobs and ensure the sustainability of wind projects. Furthermore, investing in research and development tailored to African contexts can lead to innovative solutions that optimize wind energy generation and distribution.

Integrating wind power generation into Africa's energy landscape is not just an environmental imperative; it is a pathway to achieving a just energy transition. By harnessing the continent's wind resources, African nations can enhance energy access, promote economic development, and contribute to global climate goals. However, realizing this potential requires concerted efforts from governments, private sectors, and communities to create an inclusive, equitable, and sustainable energy

[437] Africa's energy transition gains traction as Siemens Gamesa introduces renewable energy in Djibouti, https://www.siemensgamesa.com/global/en/home/press-releases/200225-siemens-gamesa-djibouti-en.html, February 25, 2020

future. Through collaboration and innovation, wind power can play a transformative role in shaping Africa's energy transition.

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Advancing Africa's Sustainable Energy Transition using Waste to Energy projects

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

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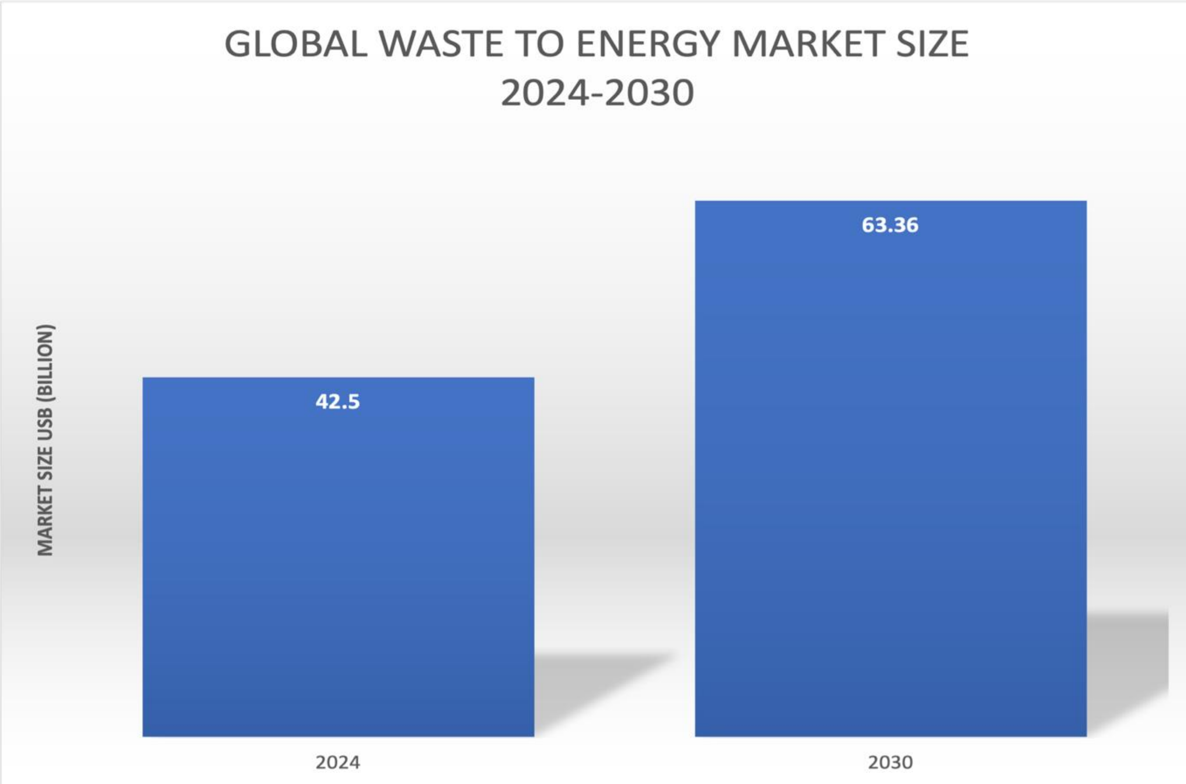

Source: Electricity Lawyer (Data sourced from Grand View Research https://www.grandviewresearch.com/industry-analysis/waste-to-energy-technology-industry)

The chart illustrates the global waste-to-energy market size from 2024 to 2030.

Africa's rapid population growth has intensified challenges in waste management while also increasing the demand for green energy to support cleaner urban development. Utilizing waste-to-energy (WtE) conversion presents a viable solution to these issues, as it helps address energy shortages while promoting sustainable waste management practices. WtE initiatives offer significant benefits, including reducing greenhouse gas emissions, minimizing waste volume in landfills, and contributing to several Sustainable Development Goals (SDGs).

Waste to Energy (WtE), also known as energy from waste, is the process of energy generation from the treatment of waste. Municipal solid wastes, process wastes, and medical and agricultural wastes are used for energy generation. The waste consists of both biomass and non-biomass materials such as paper & paperboard, food waste, plastic, glass, and metal. Waste to Energy also aids in waste management as it reduces the amount of waste ending up in landfills. Waste-to-energy can be achieved by utilisation of chemical (esterification), bio-chemical or thermo-chemical technologies. The energy generated is utilised for applications such as electricity and heat generation, which is predominately achieved by incineration[438]. These new technologies can reduce the original waste volume by 90%, depending on the composition and use of outputs.

The global waste-to-energy market is set for significant growth over the next decade, driven by rising energy demands, stringent environmental regulations, and the need for sustainable waste management solutions. The global waste-to-energy market was valued at USD 42.50 billion in 2024 and is projected to grow at a compound annual growth rate of 8.3% from 2025 to 2030.[439]

Additionally, the continuously rising demand for energy globally due to the increasing population and rapid industrialisation and urbanisation is one of the critical drivers of the global market. WtE has a role to play in achieving the transformation to a

[438] Coherent Market Insights, Waste to Energy Market Analysis, https://www.coherentmarketinsights.com/market-insight/waste-to-energy-market-1226, November 2024

[439] Grand View Research, Waste to Energy Market Size, Share & Trends Analysis, https://www.grandviewresearch.com/industry-analysis/waste-to-energy-technology-industry,

sustainable energy ecosystem acting as an energy source to reduce greenhouse gas (GHG) emissions, a clean demand response option, a design consideration of eco-industrial parks, and sometimes the only option for end-of-life waste treatment. Despite the benefits, the WtE market faces challenges, which include availability and a steady supply of raw materials, choice of technology, and suitable regulatory framework conditions, among others[440].

Some key companies operating in the global Waste-to-Energy market include Hitachi Zosen Inova AG, Suez, Covanta Holding Corporation, China Everbright International Limited, and Veolia. Companies are implementing strategic initiatives, including mergers, acquisitions, and product launches, to expand their market presence and address evolving healthcare demands through waste to energy[441].

In sub-Saharan Africa, only 24% of waste is sent to landfills, leading to severe environmental and health risks. Countries like Angola and Cape Verde are nearing landfill capacity, while nations like Ethiopia and Nigeria face potential economic losses exceeding $2 billion by 2060 without reform. Initiatives like Kenya's 10 MW waste-to-energy plant in Kibera aim to convert waste into energy while providing social and economic benefits to local communities. South Africa, Nigeria, and Morocco are also implementing various waste-to-energy projects, demonstrating the potential of these

[440] Fortune Business Insights, Waste to Energy Market Size, Share & Industry Analysis, https://www.fortunebusinessinsights.com/industry-reports/waste-to-energy-market-100421, October 21, 2024

[441] Supra (Grand View Research, Waste to Energy Market Size, Share & Trends Analysis, https://www.grandviewresearch.com/industry-analysis/waste-to-energy-technology-industry)

technologies to enhance waste management and contribute to sustainable development.[442]

The implementation of WtE projects in Africa can yield substantial socio-economic benefits. These projects can create jobs, stimulate local economies, and provide energy security. For instance, the waste sector in South Africa alone contributes significantly to the economy, providing numerous formal and informal jobs.[443] Moreover, as renewable energy becomes more integrated into the energy mix, it can lead to lower energy costs and improved access to electricity for underserved communities.

Advancing Africa's sustainable energy transition through waste-to-energy projects presents a unique opportunity to address both energy and waste management challenges. By leveraging local resources and fostering community involvement, these projects can contribute significantly to the continent's renewable energy landscape while promoting economic growth and environmental sustainability. As Africa continues to navigate its energy transition, WtE projects will be essential in creating a more sustainable and resilient future.

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442 Electricity Lawyer, Electrify Insight Lens, Electricity Lawyer, Electrify Insight Lens, Legal & Policy Considerations for Promoting Waste-to-Energy Projects in Africa's Energy Transition https://www.linkedin.com/feed/update/urn:li:activity:7251547303952498688

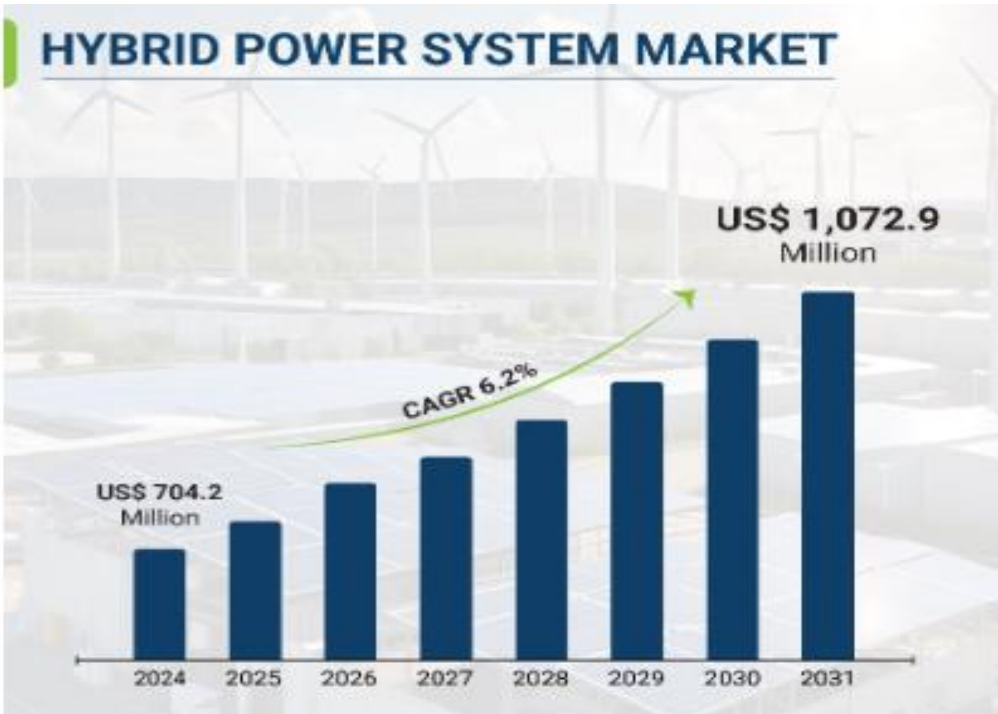
443 IEA Bioenergy, Turning Waste into Energy: A road map for South Africa, https://task36.ieabioenergy.com/news/turning-waste-into-energy-a-roadmap-for-south-africa/

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Integrating Hybrid Power Systems for a Just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations to promote the adoption of hybrid power system for a just energy transition in Africa.



Source: GlobeNewswire https://www.globenewswire.com/news-release/2024/10/09/2960269/0/en/Hybrid-Power-System-Market-to-reach-1-072-9-Million-by-2031-Says-Coherent-Market-Insights-Inc.html#:~:text=Burlingame%2C%20Oct.,published%20by%20Coherent%20Market%20Insights.

This chat shows the global hybrid power system market size from 2024 to 2031.

The call for a just energy transition is particularly significant for Africa, where millions lack reliable access to energy, and communities often depend on traditional, polluting fuels for power. As the continent faces rapid population growth, climate vulnerabilities, and industrialization, a sustainable, inclusive energy strategy is essential. Hybrid power systems – which combine renewable energy sources like solar and wind with backup power systems such as batteries or diesel generators – offer a promising path forward, balancing affordability, reliability, and environmental goals. Leveraging these systems can advance a just transition that prioritizes inclusivity, climate resilience, and economic development.

The hybrid power system is a high-efficiency power generation system designed for the generation and usage of electricity. The hybrid power system is not dependent on the electricity grids and is comprised of more than one power source[444]. Hybrid power systems that integrate renewable energy sources like solar and wind along with battery storage offer a viable way to reduce dependence on fossil fuels. These systems can help off-grid communities meet their energy needs in an environmentally sustainable manner without polluting the air or water. The hybrid approach allows the optimal use of available renewable resources throughout the day and season. It ensures uninterrupted power supply even during gaps in rain or sunlight.[445]

The hybrid power system market is majorly driven by the cost benefits of hybrid systems over conventional diesel generator sets. It provides a reliable and uninterrupted power supply while reducing fuel costs associated with diesel generators. Additionally, the need to lower carbon footprints, along with the support from various governments worldwide in the form of subsidies, is further fueling the demand for hybrid power systems.[446]

The global Hybrid Power System Market Size is set to witness substantial growth from 2024 to 2031, driven by the rising focus of governments worldwide on generating sustainable and reliable power. The market is expected to grow from USD 704.2 Million in 2024 to USD 1,072.9 Million by 2031 at a Compound Annual Growth Rate (CAGR) of 6.2% during the forecast period, owing to rapid industrialisation and a growing need for uninterrupted power supply across various end-use verticals.[447]

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[444] Hybrid Power System Market Size, Share and Global Trend, https://www.fortunebusinessinsights.com/industry-reports/hybrid-power-system-market-101318

[445] Ibid (Coherent Market Insights, Hybrid Power System Market Size and Share Analysis – Growth Trends and Forecast (2024-2031))

[446] Ibid (Coherent Market Insights, Hybrid Power System Market Size and Share Analysis – Growth Trends and Forecast (2024-2031))

[447] GlobeNewswire, Hybrid Power System Market to reach $1,072.9 Million by 2031, Says Coherent Market Insights Inc, https://www.globenewswire.com/news-release/2024/10/09/2960269/0/en/Hybrid-Power-System-Market-to-reach-1-072-9-Million-by-2031-Says-Coherent-Market-Insights-Inc.html#:~:text=Burlingame%2C%20Oct.,published%20by%20Coherent%20Market%20Insights., October 9, 2024

The growing emphasis on the use of clean and renewable energy sources across the globe presents a huge opportunity for the hybrid power system market. The increasing adoption of microgrids is a key trend in the hybrid power system market. Microgrids allow for local distribution of power and increase energy resilience. They help integrate renewable energy resources like solar and wind at a localized level. With growing concerns around power outages and disruptions, microgrids supported by hybrid power systems are emerging as a reliable option. Furthermore, the deployment of hybrid power systems for off-grid applications in rural and remote areas without access to centralized power infrastructure is also gaining traction.[448] While the adoption of hybrid power systems provides many benefits, the market faces significant challenges which could pose a major barrier for widespread adoption, especially in developing countries and remote off-grid areas. One of the major challenges is the high initial investment cost required for the setup and installation of hybrid power systems.[449]

The urgency of addressing climate change cannot be overstated and transitioning to hybrid power systems represents a significant opportunity to reduce carbon emissions. In Africa, where the energy sector is predominantly reliant on fossil fuels, the integration of renewables can dramatically lower greenhouse gas emissions. Countries like DRC, Nigeria and South Africa are already pioneering hybrid solutions, combining solar and wind power with diesel generators, leading to a measurable decrease in carbon intensity and contributing to global climate goals[450] while allowing small businesses to thrive and improving the quality of life for families.

Hybrid power systems have the potential to reshape Africa's energy landscape by delivering sustainable, affordable, and resilient energy solutions. As the continent faces climate change, population growth, and infrastructure challenges, hybrid

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[448] Supra (GlobeNewswire, Hybrid Power System Market to reach $1,072.9 Million by 2031, Says Coherent Market Insights Inc)

[449] Supra (Coherent Market Insights, Hybrid Power System Market Size and Share Analysis – Growth Trends and Forecast (2024-2031))

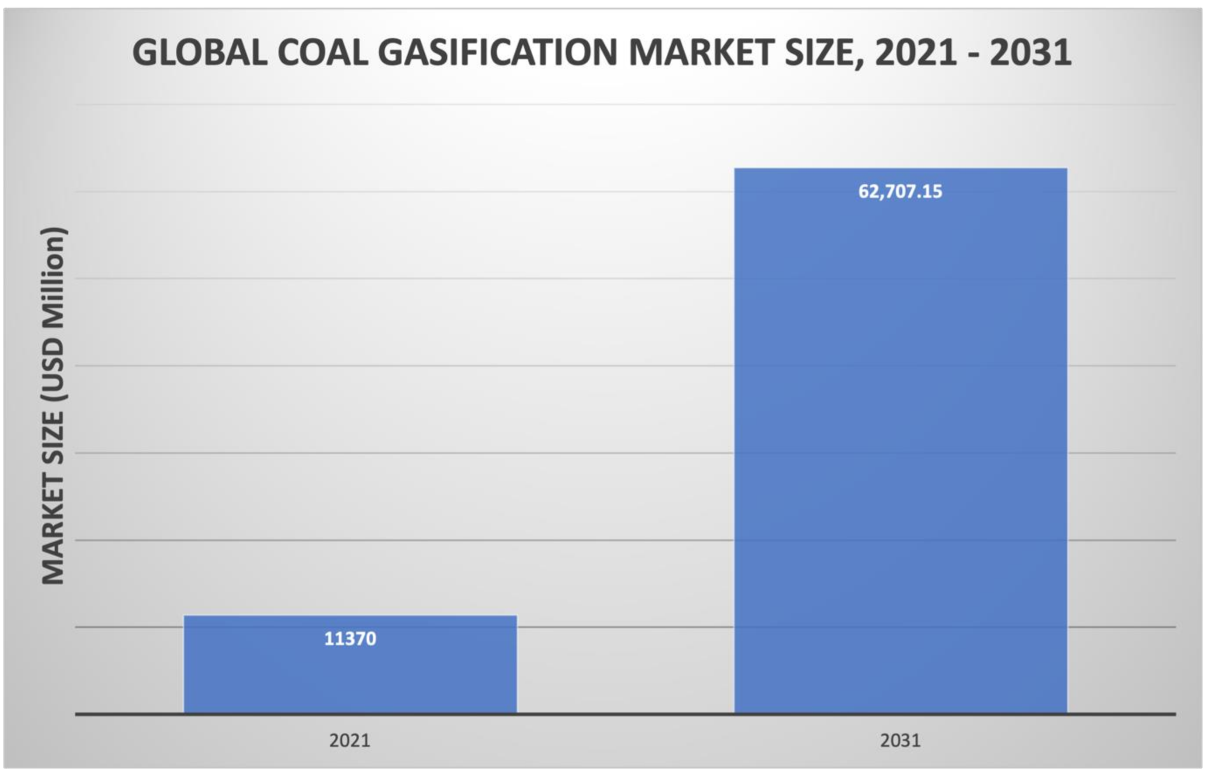
[450] Global Energy Alliance for People and Planet, Powering People and Planet, Impact Report 2023, https://energyalliance.org/wp-content/uploads/2023/12/Powering-People-and-Planet-2023.pdf

systems offer a flexible and scalable pathway for achieving universal energy access. Moreover, hybrid systems can significantly reduce greenhouse gas emissions and reliance on non-renewable resources, helping to mitigate the impacts of climate change. By leveraging local renewable resources, communities can enhance their energy independence and promote sustainable economic development. In this way, hybrid systems serve as a crucial strategy to achieve universal energy access, ensuring that all individuals, regardless of their geographical location or socioeconomic status, can benefit from reliable and clean energy solutions.

Practical Considerations for Leveraging Coal Gasification to enhance Africa's Energy Security and Sustainability

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for leveraging coal gasification to enhance energy security and sustainability across Africa.



SOURCE: Electricity Lawyer (Data Sourced from Business Research Insights https://www.businessresearchinsights.com/market-reports/coal-gasification-market-106678)

The chart illustrates the global market growth in Coal Gasification from 2021 – 2031.

Africa, the world's most energy-deficient continent, faces significant challenges in meeting its growing energy demand, while striving for sustainability. With approximately 600 million people lacking access to electricity, predominantly in sub-Saharan Africa, the continent is in dire need of innovative solutions to address its energy crisis.[451] One promising technology that has emerged as a potential solution is coal gasification. This process, which converts coal into versatile syngas, offers a pathway for African nations to harness their abundant coal resources, bolster energy security, and transition towards more sustainable energy systems.

Coal gasification is a process that converts coal into gas called Syngas (a mixture of carbon monoxide, hydrogen, carbon dioxide, and methane) through the reaction of coal with steam, air or oxygen. The process is carried out in a gasifier. The gasifier is a reactor that is heated to a high temperature, typically between 700 and 1,000 degrees Celsius. The coal is fed into the gasifier, where it is mixed with oxygen or steam. The heat and the oxygen or steam react with the coal to produce syngas.[452] This process reduces the environmental impact by decreasing sulfur dioxide and particulate matter emissions compared to traditional coal combustion. Various gasification technologies, including fixed bed, fluidized bed, and entrained flow, are used for coal gasification. These technologies are employed in electricity generation, hydrogen production, chemical manufacturing (such as methanol, ammonia and urea), and steel production.[453]

The global coal gasification market is predicted to witness expansion over the foreseen period. The increasing focus on clean and efficient energy sources and reducing reliance on fossil fuels & natural gas are the major drivers boosting the coal

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[451] IEA, Africa Energy Outlook 2022 Key Findings, Africa in an evolving global context https://www.iea.org/reports/africa-energy-outlook-2022/key-findings

[452] Business Research Insight, Coal Gasification Market Size, Share, Growth, and Industry Analysis, https://www.businessresearchinsights.com/market-reports/coal-gasification-market-106678, November 4, 2024

[453] Technavio, Coal Gasification Market Analysis APAC, Middle East and Africa, North America, Europe, South America - US, South Africa, China, Australia, Indonesia - Size and Forecast 2024-2028, https://www.technavio.com/report/coal-gasification-market-industry-analysis

gasification market.[454] The global coal gasification market size was USD 11370 million in 2021 and is expected to reach USD 62707.15 million by 2031, exhibiting a CAGR of 18.4% during the forecast period.[455]

The demand for hydrogen gas is expected to be a contributor to the market growth. The coal gasification process has the significant potential to produce hydrogen with reduced emissions and contribute to a more sustainable energy system. Hydrogen is widely used to generate electricity, power vehicles, and power industry and heat, and also reduce dependency on fossil fuels.[456] Coal gasification offers a low-cost feedstock for clean energy and industrial applications, but the environmental impact and the need for pollution control measures are crucial considerations.[457]

Implementing coal gasification technology in Africa has the potential to significantly enhance the continent's energy security in several ways. Many African countries, particularly South Africa, have significant coal reserves. The country alone possesses approximately 242 billion gross tons of coal resources, with 66 billion tons considered recoverable[458]. Coal gasification enables the efficient utilisation of these resources, including low-grade coal that might otherwise be regarded as waste. By converting local coal into syngas, African countries can reduce their reliance on imported fuels, thereby mitigating risks associated with global fuel price volatility and supply disruptions[459]. The syngas produced from coal gasification have various applications, such as electricity generation, chemical production, and serving as a feedstock for

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[454] Precedence Research, Coal Gasification Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/coal-gasification-market

[455] Supra (Business Research Insight, Coal Gasification Market Size, Share, Growth, and Industry Analysis)

[456] Supra (Precedence Research, Coal Gasification Market Size, Share, and Trends 2024 to 2033)

[457] Supra (Technavio, Coal Gasification Market Analysis APAC, Middle East and Africa, North America, Europe, South America - US, South Africa, China, Australia, Indonesia - Size and Forecast 2024-2028

[458] Cliffe Dekker Hofmeyr, The future of underground coal gasification in South Africa, https://www.cliffedekkerhofmeyr.com/news/publications/2015/mining-and-minerals/mining-and-minerals-alert-24-agust-thefuture-of-underground-coal-gasification-in-south-africa.html, August 15, 2015

[459] Supra (Andrew Minchener, Challenges, and opportunities for coal gasification in developing countries)

synthetic fuels[460]. For example, the Majuba Underground Coal Gasification (UCG) Project in Mpumalanga,[461] South Africa, has explored the use of UCG for power generation. Additionally, Mozambique, while currently focused on coal mining and export, has the potential to develop coal conversion plants. These plants could help monetize mining and coal preparation waste, producing liquid fuels for both domestic use and export markets[462].

While coal gasification offers significant benefits for energy security, it also presents opportunities to promote sustainability. When compared to traditional coal combustion, coal gasification is considered a cleaner alternative. It produces fewer pollutants and can be integrated with carbon capture and storage (CCS) technologies to further reduce greenhouse gas emissions[463]. This aligns with global efforts to mitigate climate change and can help African countries meet international environmental commitments. Coal gasification can complement renewable energy sources by providing a reliable backup when solar or wind resources are low. This hybrid approach enhances the stability of the energy grid, while promoting sustainability[464]

Leveraging coal gasification presents a viable pathway for African nations to enhance their energy security and sustainability. By transforming abundant and locally available resources into cleaner energy forms, countries can will not only meet their growing energy needs, but also work towards a more sustainable energy future. The

[460] Supra (Andrew Minchener, Challenges, and opportunities for coal gasification in developing countries)

[461] Lawrence Livermore National Laboratory, Underground coal gasification may provide a secure energy supply and reduce greenhouse gas emissions, https://www.llnl.gov/sites/www/files/2020-05/coalgassification-STR-Apr-07.pdf#:~:text=The%20Majuba%20UCG%20Project,first%20flare%20on%20January

[462] World Coal, Coal Gasification in developing countries, https://www.worldcoal.com/special-reports/05122013/report_on_coal_gasification_321/, December 5, 2013

[463] Sandeep K.R., Shalini V., Abhishek G., Akshoy R. P., Anuj J., and Nawshad H., IOP Science Environmental Impact Assessment of Coal Gasification in Hydrogen Production, https://iopscience.iop.org/article/10.1088/1755-1315/795/1/012029

[464] World Nuclear Association, 'Clean Coal' Technologies, Carbon Capture & Sequestration, https://world-nuclear.org/information-library/energy-and-the-environment/clean-coal-technologies, November 16, 2021

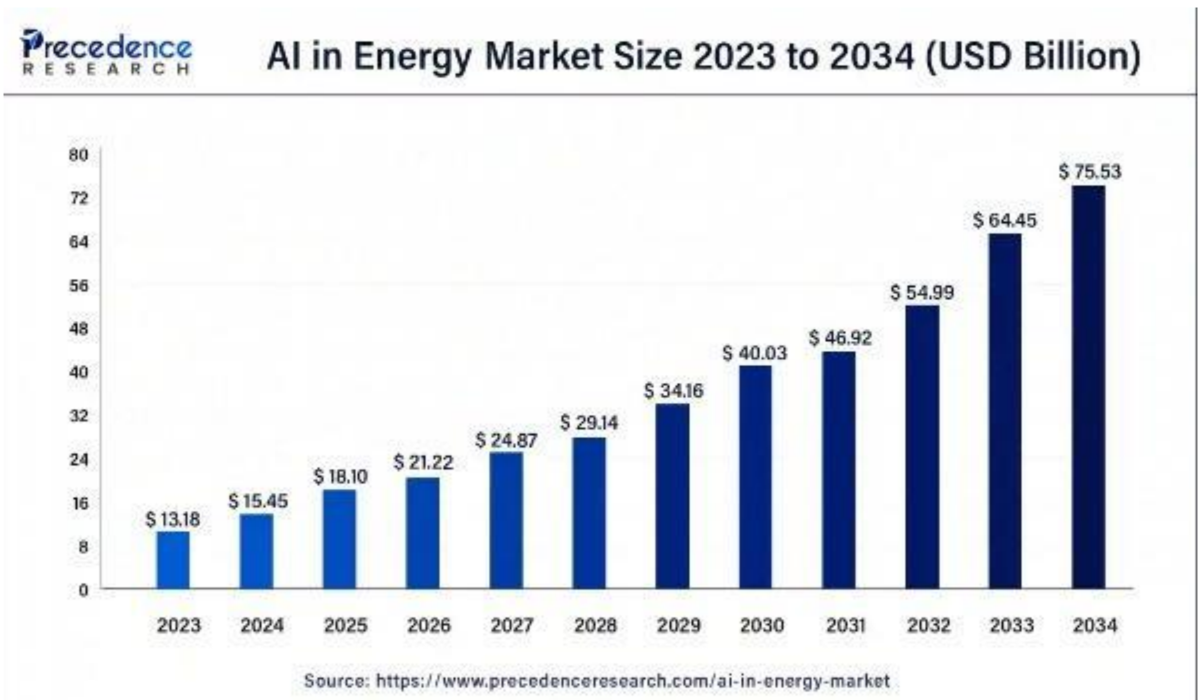
technology offers economic, environmental, and strategic benefits that can support the continent's development goals, while addressing energy challenges. However, successful implementation will require careful planning, substantial investment, and innovation to overcome the associated barriers.

EL: Legal, Regulatory & Policy Data Intelligence

Practical Considerations for Leveraging AI to Enhance Africa's Energy Transition

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights considerations for Leveraging AI to Enhance Africa's Energy Transition



SOURCE: Straits Research

The chart illustrates the global market size for AI in the Energy Market.

The integration of artificial intelligence (AI) into the energy sector is revolutionizing how energy is produced, distributed, and consumed. As of 2023, the global market for AI in energy was valued at approximately $8.75 billion, with projections indicating a remarkable growth trajectory that could witness it reach $75.53 billion by 2034; with a compound annual growth rate (CAGR) of around 30.1% from 2024 to 2030.[465]

[465] Predence Research, 'AI in Energy Market Size, Share and Trends 2024 to 2034' https://www.precedenceresearch.com/ai-in-energy-market Accessed 28th November 2024

Several factors are propelling this growth. One of the primary drivers is the increasing demand for efficiency and sustainability within the energy sector. Companies are adopting AI technologies to optimize energy management and enhance operational efficiencies, motivated by regulatory pressures to reduce carbon footprints and improve environmental sustainability. Additionally, the integration of renewable energy sources such as solar and wind is becoming more critical. AI plays a vital role in managing these resources, by forecasting energy supply based on historical data and weather conditions, which is essential for balancing supply and demand.[466]

Geographically, the adoption of AI in energy varies significantly. North America leads this integration, particularly in the United States, where significant investments from utility companies focus on optimizing energy distribution and supporting transitions to renewable sources. In contrast, the Asia Pacific region accounted for over 40.92% of the market share in 2023, driven by rapid industrialization and urbanization in countries like China and India. Meanwhile, countries in the Middle East and Africa are increasingly utilizing AI to enhance both renewable energy production and traditional oil and gas operations through predictive maintenance.[467]

The implementation of artificial intelligence (AI) in Africa's energy market has shown promising successes, particularly in enhancing energy access and optimizing resource management. Various initiatives across the continent illustrate how AI can address critical energy challenges, despite the existing infrastructural and economic hurdles.

In South Africa, AI-powered smart meters have been deployed to assist vulnerable households in managing their electricity consumption. These smart meters help

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[466] Grand View Reserach 'GVR Report coverAI In Energy Market Size, Share & Trends Report
AI In Energy Market Size, Share & Trends Analysis Report By Type (Solutions, Services), By Application (Renewable Energy Management, Demand Forecasting, Safety Security & Infrastructure), By Region, And Segment Forecasts, 2024 - 2030' https://www.grandviewresearch.com/industry-analysis/ai-energy-market-report Accessed 28th November 2024

[467] Mondaq 'Artificial Intelligence And The Energy Sector: A Legal Perspective' https://www.mondaq.com/nigeria/oil-gas-electricity/1466704/artificial-intelligence-and-the-energy-sector-a-legal-perspective Accessed 28th November 2024

prevent disconnections by providing real-time data on usage, thereby ensuring continued access to energy for those who might otherwise struggle to pay their bills. This application not only improves energy efficiency, but also promotes social equity by supporting marginalized communities.[468]

Despite these successes, challenges remain. The African energy sector still faces significant data gaps, regulatory hurdles, and a shortage of skilled workers proficient in AI and data science. Addressing these issues is crucial for scaling up AI applications across the continent. Investments in local expertise and infrastructure development are necessary to create an environment conducive to AI innovation.

To address these challenges, it is crucial to invest in building robust technical infrastructure across the continent. This includes enhancing connectivity and establishing standardized data collection practices that can facilitate effective AI implementation. Additionally, African governments should prioritize creating clear regulatory frameworks that support AI integration into the energy sector. This involves reducing bureaucratic barriers and providing incentives for investment in AI technologies. Collaborative efforts between public and private sectors can also drive innovation, ensuring that solutions are developed with input from diverse stakeholders.

In conclusion, while the challenges to adopting AI in Africa's energy market are significant, they are not insurmountable. With strategic investments in infrastructure, education, regulatory clarity, and community involvement, Africa can harness the transformative potential of AI to enhance energy access and promote sustainable development across the continent.

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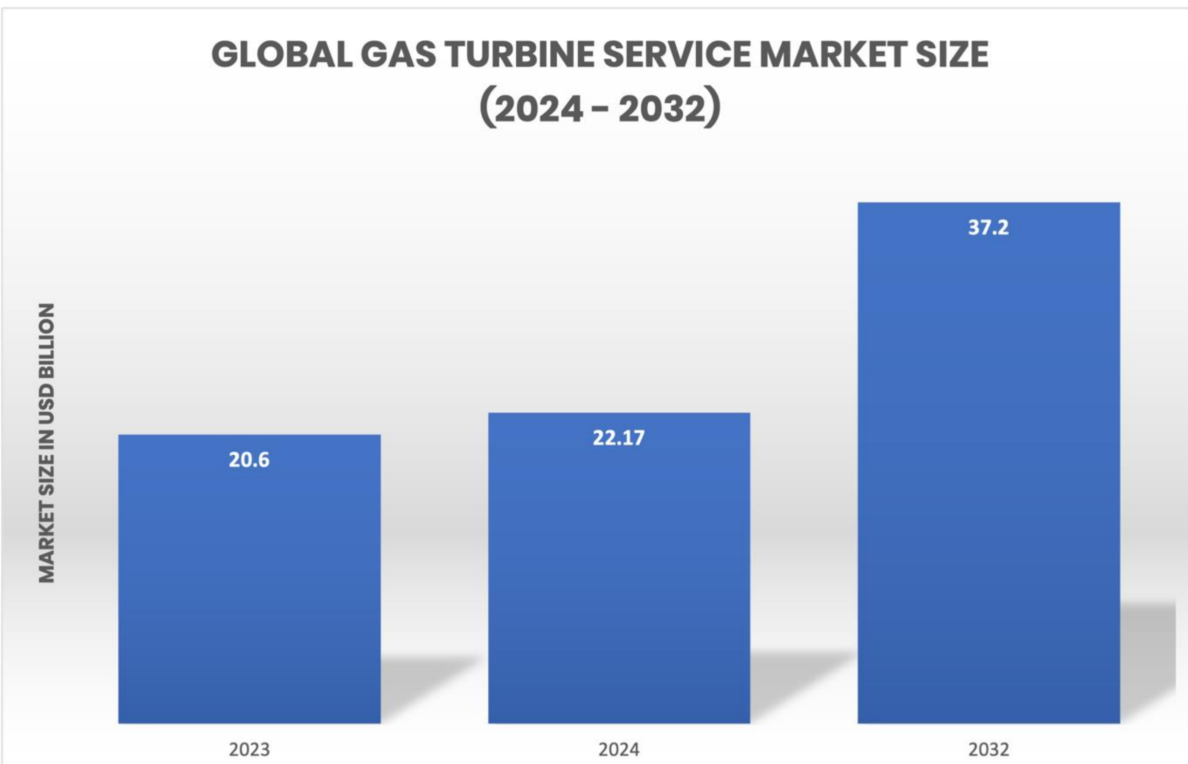
[468] Kenneth C. Ene, Oxford Policy Management 'What role does AI play in improving Africa's energy access?' https://www.opml.co.uk/insights/what-role-does-ai-play-improving-africas-energy-access Accessed 28th November 2024

Practical Considerations for Adopting Gas Turbine Services in support of a just Energy Transition in Africa

Electricity Lawyer is pleased to introduce its Legal, Regulatory, and Policy Data Intelligence which involves an in-depth analysis of energy industry data from a legal, regulatory, and policy angle to assist decision-makers, investors, and stakeholders in understanding the implications of energy market developments and make well-informed decisions.

The data intelligence highlights the considerations for adopting Gas Turbine Services in support of a just energy transition in Africa



SOURCE: Electricity Lawyer (Data Sourced from Market Research Future https://www.marketresearchfuture.com/reports/gas-turbine-services-market-7271)

The chart illustrates the global market size for the Gas Turbine Services Market.

Africa faces a complex energy transition that requires a balanced and equitable approach. The continent has abundant renewable energy potential alongside fossil fuel resources, highlighting the need for a just energy transition that benefits all communities and at the same time addresses climate change. Gas turbine services can support this transition by facilitating the integration of cleaner energy sources and enhancing energy security.

Electricity is the basic need of mankind. Electricity demand is increasing on account of a growing population and electricity consumption per capita. Various governments prefer using relatively cleaner sources like natural gas for the production of electricity[469]. In 2023, the global Gas Turbine Services market size was valued at USD 20.6 Billion. The gas turbine services market industry is projected to grow from USD 22.17 Billion in 2024 to USD 37.2 Billion by 2032, exhibiting a compound annual growth rate (CAGR) of 6.68% during the forecast period (2024 - 2032).[470]

A variety of factors are contributing to the increased growth. One of the primary drivers is the growing demand for electricity, particularly in developing regions, and the requirement for dependable and efficient power generation technologies. Because of its efficiency and reduced emissions as compared to other fossil fuel-based power plants, gas turbines are commonly employed for power generation[471]. Additionally, gas turbines are in high demand because they provide consistent and significant power production, which is essential for large-scale industrial processes and utility grids[472]. Despite the benefits, several factors act as restraints for the market. These include high

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[469] Fortune Business Insight, Gas Turbine Services Market Size, Share & Industry Analysis, https://www.fortunebusinessinsights.com/industry-reports/gas-turbine-services-market-101727,

[470] Market Research Future, Gas Turbine Services Market Research Report Information, https://www.marketresearchfuture.com/reports/gas-turbine-services-market-7271, October 2020

[471] Precedence Research, Gas Turbine Services Market Size, Share, and Trends 2024 to 2033, https://www.precedenceresearch.com/gas-turbine-services-market, June 2024

[472] Ibid (Precedence Research, Gas Turbine Services Market Size, Share and Trends 2024 to 2033.

initial costs, technological advancement and obsolescence, regulatory and environmental concerns, and fluctuating fuel prices[473].

Gas turbines play a significant role in energy production due to their efficiency, flexibility, and environmental benefits. They are versatile machines used in various applications, including powering aircraft, trains, ships, electrical generators, pumps, gas compressors, and tanks[474]. The advantages of gas turbines that make them particularly suitable for addressing Africa's energy challenges include high efficiency, rapid start-up and flexibility, lower emissions, and fuel flexibility[475].

To fully leverage the benefits of gas turbines in Africa's energy transition, comprehensive gas turbine services are essential. These services encompass maintenance, upgrades, and efficiency improvements, all of which play a crucial role in enhancing the performance and reliability of energy production systems. Several successful implementation of gas turbine technologies in Africa demonstrates the potential of these systems to support national energy goals and contribute to regional development. An example is the Kribi Power Plant in Cameroon, with a capacity of 216 MW. This project demonstrates a successful gas-to-power implementation, contributing significantly to the country's energy supply.[476]

The future of gas turbine services in Africa is promising, with numerous technological advancements and emerging technologies set to enhance efficiency, sustainability,

[473] Verified Market Research, Global Gas Turbine Services Market Size By Service Type, By Service Provider, By End-User, By Geographic Scope And Forecast, https://www.verifiedmarketresearch.com/product/gas-turbine-services-market/

[474] ScienceDirect, Gas Turbine Combustion, https://www.sciencedirect.com/topics/engineering/gas-turbine-combustion, 2022

[475] APG, 10 Reasons Industrial Gas Turbines Are A Great Way To Power Your Business, https://alliedpg.com/latest-articles/10-reasons-industrial-gas-turbines-great-way-power-business/

[476] WorldBank, Harnessing African Natural Gas, A New Opportunity for Africa's Energy Agenda, https://openknowledge.worldbank.org/server/api/core/bitstreams/daddf176-2e57-55ee-a273-c614ee7bf012/content#:~:text=countries%20have%20registered%20some,plant%20entered%20service%20in

and reliability. The integration of gas turbine services into Africa's energy landscape holds significant potential for advancing the continents' sustainable development goals, which include affordable and clean energy[477], decent work and economic growth[478], climate action, and industry, innovation and infrastructure.

As Africa continues its pursuit of a sustainable energy transition, gas turbines will play a critical role in providing the infrastructure necessary to support economic growth and development. By embracing these innovations and implementing comprehensive gas turbine services, Africa can ensure a cleaner, more reliable, and sustainable energy future, addressing its unique challenges and leveraging its abundant resources for the benefit of its people and the environment.

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[477] GE Vernova, Reliable, Sustainable and flexible power for South Africa's growing energy needs, https://www.gevernova.com/gas-power/en/ssa/9ha-accelerating-south-africas-energy-transition

[478] Ibid (GE Vernova, Reliable, Sustainable and flexible power for South Africa's growing energy needs)

EL: LEGAL, REGULATORY & POLICY DATA INTELLIGENCE

Practical Considerations for Advancing Africa's Sustainable Energy via E-Fuels

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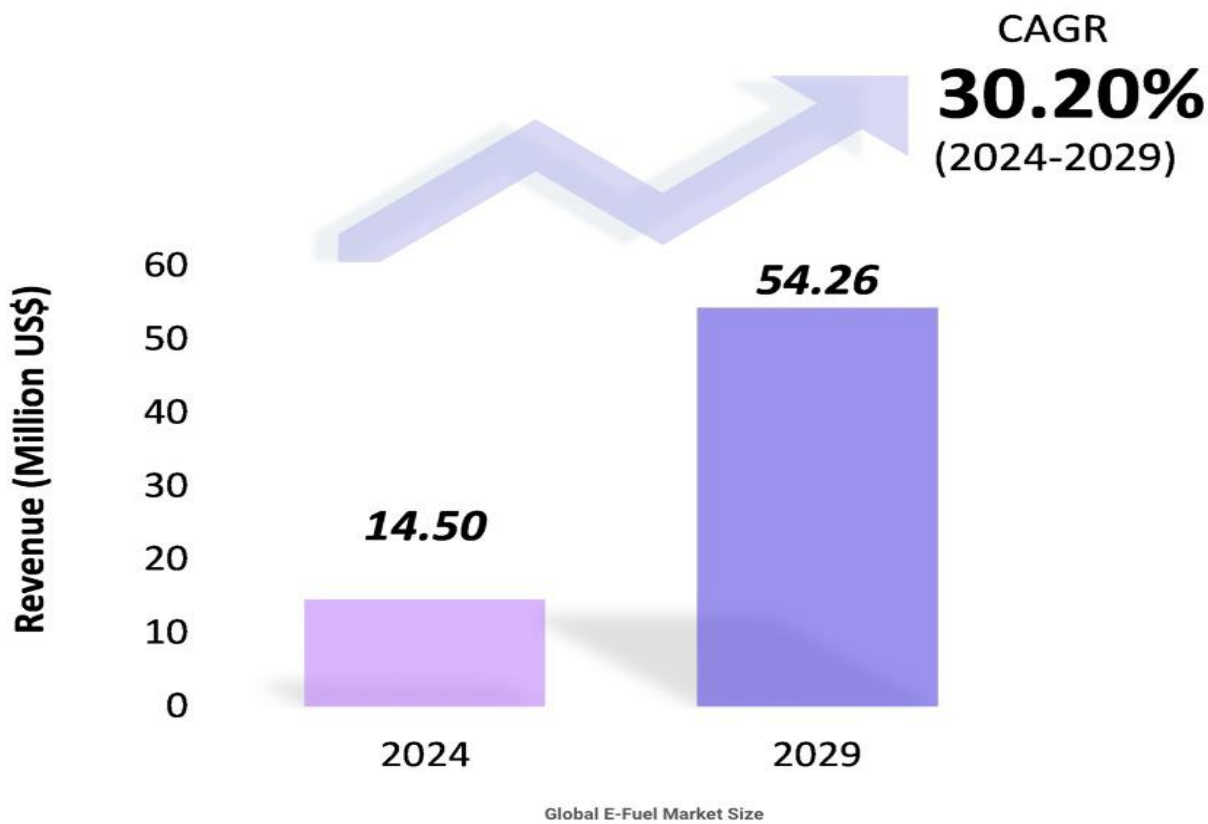
The data intelligence highlights the considerations for advancing Africa's sustainable energy via E-Fuels in support of a just energy transition in Africa.



SOURCE: Electricity Lawyer (Data Sourced from Horizon Market Strategies)
https://horizon-markets.com/energy-and-power/e-fuel-industry/

This chart illustrates the global market size for E-Fuels Service Market.

Africa faces a complex energy transition that requires a balanced and equitable approach. The continent The continent is rich in renewable energy resources, such as solar, wind, and hydropower, making it a potential hub for the production of e-fuels. E-fuels, synthesized using renewable electricity, hydrogen, and captured carbon, offer a sustainable alternative to traditional fossil fuels and play a critical role in decarbonizing sectors like transportation, heavy industry, and power generation.

The e-fuel market is estimated to be at USD 14.50 Mn in 2024 and is anticipated to reach USD 54.26 Mn in 2029, registering a CAGR of 30.20% during the forecast period of 2024-2029[479]. This eco-friendly alternative significantly diminishes the carbon footprint, contributing to sustainable transportation and energy systems. E-fuels primarily find their use in the progressive transportation sector, offering a clean and sustainable solution for automobiles, aviation, and marine transportation[480].

The adoption of e-fuels could address several key challenges in Africa's energy landscape. First, it could reduce reliance on imported fossil fuels, improving energy security and saving foreign exchange reserves. Additionally, e-fuels provide a means of storing excess renewable energy, enhancing the flexibility and reliability of energy systems[481]. Furthermore, they align with global decarbonization targets, positioning African economies to meet their international commitments under the Paris Agreement[482].

Despite these opportunities, advancing e-fuels in Africa requires overcoming significant challenges. High initial investment costs for production infrastructure, the availability of affordable renewable electricity, and the development of a robust

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[479] Horizon Market Strategies 'E-Fuel Market Outlook: Size, Share, Trends & Growth Analysis (2024-2029) (2024)' at https://horizon-markets.com/energy-and-power/e-fuel-industry/

[480] Research and Markets 'E-Fuels Market Global Forecast 2024-2030: Expanding Use of Hydrogen as a Versatile e-Fuel for Power Generation (2024)' at https://www.globenewswire.com/news-release/2024/09/10/2943403/28124/en/E-Fuels-Market-Global-Forecast-2024-2030-Expanding-Use-of-Hydrogen-as-a-Versatile-e-Fuel-for-Power-Generation.html

[481] IEA 'The Role of E-fuels in Decarbonizing Transport' at https://www.iea.org/reports/the-role-of-e-fuels-in-decarbonising-transport

[482] Supra (Research and Markets 'E-Fuels Market Global Forecast 2024-2030: Expanding Use of Hydrogen as a Versatile e-Fuel for Power Generation (2024))'

regulatory framework are critical barriers[483]. Moreover, African governments need to adopt clear policies and incentives to attract private sector investment and international collaboration for technology transfer[484].

Several successful initiatives underscore the potential of e-fuels. For instance, pilot projects in Morocco and South Africa are exploring green hydrogen and e-fuel production for both domestic and export markets. These initiatives demonstrate the feasibility of integrating e-fuels into Africa's energy landscape while driving economic development and job creation[485]. The future of e-fuels in Africa is promising, with emerging technologies and international partnerships offering opportunities to scale production and reduce costs.

In conclusion, as Africa continues its pursuit of a sustainable energy future, e-fuels will play a critical role in providing cleaner energy solutions for various sectors. By embracing innovations in e-fuel technologies and fostering supportive policies, Africa can ensure a more equitable and sustainable energy transition, benefiting its people and contributing to global climate goals.

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483 Ayobami Solomon Oyewo et al 'Power-to-X Economy: Green e-hydrogen, e-fuels, e-chemicals, and e-materials opportunities in Africa (2024) at https://www.sciencedirect.com/science/article/pii/S2352484724005055

484 Ibid Ayobami Solomon Oyewo et al 'Power-to-X Economy: Green e-hydrogen, e-fuels, e-chemicals, and e-materials opportunities in Africa (2024)

485 OSAA's State of Tech Series 'Exploring the Role of Green Hydrogen in Africa's Energy Mix (2022)' at https://www.un.org/osaa/sites/www.un.org.osaa/files/exploringtheroleofgreenhydrogen.pdf

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Practical Policy Considerations for Advancing Africa's Renewable Energy Transition via Solar Thermal Energy

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The data intelligence highlights the Considerations for advancing Africa's Renewable Energy Transition via Solar Thermal Energy.

SOURCE: Verified Market Research
https://www.verifiedmarketresearch.com/product/solar-thermal-fuel-market/?u

The chart illustrates the global market size for Solar Thermal Fuel Market.

The Solar Thermal Fuel market is an emerging sector within the renewable energy landscape, characterized by its innovative approach to absorbing, storing, and releasing solar energy as heat. Although this technology remains largely in the research phase and has not yet been widely commercialized, it holds significant promise for various industrial, household, and commercial applications.

The market is projected to experience steady growth, with estimates indicating a compound annual growth rate (CAGR) of approximately 4.5% to 5.6% from 2021 to 2032. By 2030, the market could reach a valuation of around $33.61 billion. Several factors are driving this growth, including increasing global energy demands and a concerted effort to reduce greenhouse gas emissions. Governments worldwide are implementing renewable energy targets that further stimulate investment in solar technologies.[486]

At the core of this market are solar thermal fuels—chemicals designed to absorb solar radiation and store it for extended periods before releasing it as heat. This capability allows for diverse applications, particularly in heating processes. In industrial settings, stored thermal energy can be utilized for manufacturing processes, while in residential contexts, these systems can provide hot water and space heating. Commercial buildings can also benefit from solar thermal fuels by integrating them into their heating needs.

Regionally, the Asia Pacific area is expected to lead the market due to high installation rates in countries like China, which are driven by rapid urbanization and increasing energy demands. North America and Europe are also significant players in this market; but currently lag behind Asia in terms of installation rates.[487]

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[486] Verified Market Research "Global Solar Thermal Fuel Market Size By Application (Industrial, Household, Commercial), By Competitive Landscape, By Geographic Scope And Forecast" 2024 https://www.verifiedmarketresearch.com/product/solar-thermal-fuel-market/?u Accessed 19 December 2024

[487] Fortune Business Insight "Solar Thermal Market Size, Share & Industry Analysis, By Collector Type (Evacuated Tube Collector, Flat Plate Collector, Unglazed Water Collector, Air Collector), By Type of System (Thermosiphon Solar Heating Systems, Pumped Solar Heating System) By

There have been notable successes in the implementation and research of solar thermal technologies within the African energy market, particularly in countries like Ghana and through initiatives such as the Desert to Power project in the Sahel region. In Ghana, efforts are underway to harness the country's abundant solar thermal energy potential, with the ECOWAS Center for Renewable Energy and Energy Efficiency (ECREE) leading initiatives to install thermal energy systems for domestic and commercial use. This initiative aims to alleviate pressure on the national grid and reduce reliance on fossil fuels.[488]

Despite these successes, challenges remain pervasive across the continent. While investment in renewable energy is increasing, solar and wind still accounted for only about 3% of Africa's electricity generation as of 2018. This indicates a significant gap between potential and actual utilization, driven by factors such as inadequate infrastructure, regulatory hurdles, and limited access to financing for large-scale projects.[489]

To build on these successes and overcome existing barriers, it is essential for African nations to foster supportive regulatory environments that encourage investment in solar technologies. Additionally, enhancing public-private partnerships can facilitate knowledge sharing and resource mobilization necessary for scaling up solar thermal projects. Continued capacity building through training programs will also be vital in

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Application (Domestic Hot Water Systems, Large DHW Systems, Solar Combi Systems, Swimming Pool Heating, Others), and Regional Forecast, 2019-2032" https://www.fortunebusinessinsights.com/industry-reports/solar-thermal-market-101920 Accessed 19 December 2024

[488] Solar Paces "Ghana to Tap its Abundant Solar Thermal Energy Potent" 2017 https://www.solarpaces.org/ghana-tap-abundant-solar-thermal-energy-potential/ Accessed 19 December 2024

[489] IMF "Renewable energy sources, especially solar, are ideal for meeting Africa's electrical power needs" 2020 https://www.imf.org/en/Publications/fandd/issues/2020/03/powering-Africa-with-solar-energy-sy Accessed 18 December 2024

ensuring that local communities can effectively implement and maintain these systems.

In summary, although Solar thermal fuel is an emerging sector in the renewable energy sector and while there have been successful implementations of solar thermal technologies in Africa, particularly in Ghana and through regional initiatives like Desert to Power, significant challenges remain. Addressing these challenges through strategic investments, supportive policies, and capacity building will be crucial for unlocking the full potential of solar energy across the continent.