SBHC for Studies and Research in Energy Sciences
IAFES 2022
مركز سعيد بن هلال لدراسات وأبحاث علوم الطاقة
حدى مؤسسات الوكالة الدولية لأمن الطاقة
A Subsidiary of the "International Agency for Energy Security"
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TURBINE

Energy Security Magazine.. Issued by Saif Bin Helal Center for Studies & Research in Energy Sciences
the Research Arm of the International Agency for Energy Security

3
Third Issue

2024
May

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News of the International Agency for Energy Security (IAFES) and News of Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

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First: Editorial

Artificial Intelligence Mapping the Future's Energy

His Excellency/ Saif Bin Helal Al Shehhi
Founder and CEO

The world has witnessed wars and conflicts since the discovery of oil. Countries were wiped off the world map, and others rose as well to own energy and control the waterways through which the ancient source of energy, oil, was transported.

Today, as we have passed the era of the digital technology revolution and entered the era of artificial intelligence, we establish a new phase through which the world of energy will witness a qualitative shift, reducing time and effort in discoveries, manufacturing, or safe transportation methods from the source to the consumer. With societies' increasing need for clean and renewable energy, which cannot satisfy the markets' needs, there will be an increase in demand for the supply of oil, gas, and electricity, for which artificial intelligence will provide accurate numbers and statistics about the need and alternatives.

Artificial intelligence will contribute to countries' ease of adopting peaceful nuclear energy in terms of utilizing this important resource and reducing expenses. Smart innovation will contribute to reducing the high financial cost of nuclear power plants.

Artificial intelligence will also contribute to building smart networks that reduce waste and save energy, especially in countries that suffer from a shortage of electrical energy and increased loads in the summer.

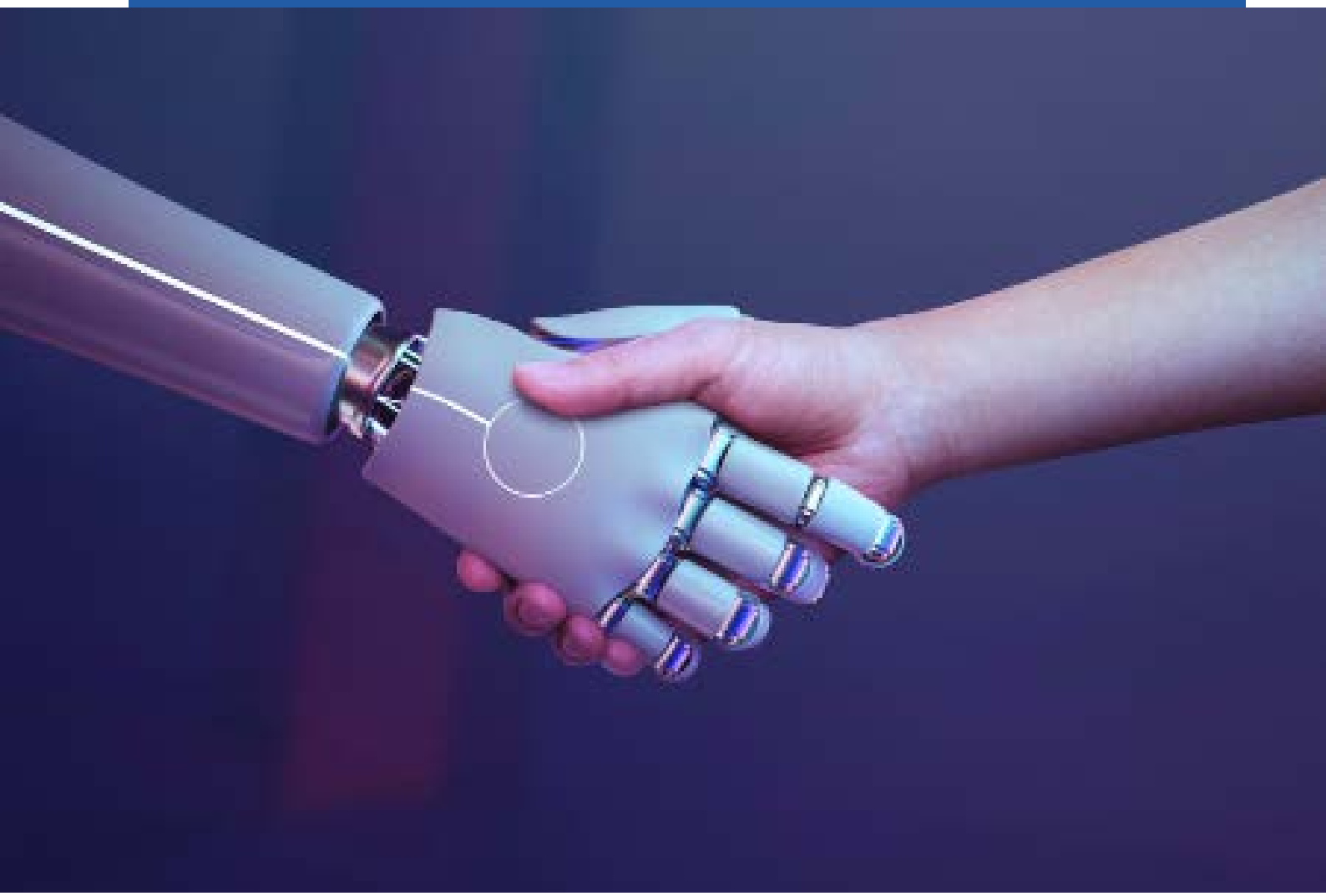
Artificial intelligence also works to predict the state of markets and weather conditions associated with energy transfer. As well, it senses the risks of energy markets, stores prospecting, research, and exploration information, develops maintenance systems, and performs preventive maintenance on energy networks, production stations, and nuclear energy facilities, which requires a high cost of measuring radiation and controlling the security and safety of its facilities.

Harnessing artificial intelligence will also lead us to control the measurement and sensing of radiation and will enable us to measure carbon rates and emissions.

Artificial intelligence will contribute to natural gas energy and predicting exploration reserves and reservoirs, especially since the need for gas will double in the next two decades, as statistics indicate.

Today, we are facing a new era. Whoever reserves a place in it will have a place on the energy map of the future, and whoever neglects artificial intelligence technologies and applications will fall behind and will not have a place on this map that will form the new global energy system and energy security.

Hence our decision to build the first artificial intelligence laboratory in the African Union at Saif Bin Helal Center for Energy Science Studies and Research in the Arab Republic of Egypt in the last quarter of this year.



Second: Articles

1

African Energy and Attempts to "Draw" a New Path

Ms. Nashwa Nashaat
Executive Director of the Center

Diversification and expansion of energy sources are the keys to comprehensive development and the basis of industrialization in Africa. The continent has the potential to focus on renewable energy sources such as hydropower, biomass, and solar energy, in addition to geothermal energy, to provide sufficient electrical energy for citizens. Here we find that African heads of state and government have set a road map to achieve comprehensive and sustainable growth and development by working to implement the seventh goal of the 2030 Sustainable Development Plan, which is "access to affordable, reliable, and sustainable energy for all."

At the same time, African leaders are working to accelerate the adoption of clean energy solutions in line with the African Union's Agenda 2063. For example, African countries, such as Egypt, Ethiopia, Kenya, Morocco, and South Africa, are gradually working to direct renewable energy efforts, and other African countries, such as Cape Verde, Djibouti, and Rwanda, have set ambitious goals for renewable energy. Notably, other African countries are following suit, and renewable energy is gradually being adopted across the continent.

It is noteworthy that the solar energy potential in Africa amounts to 40% of the world's total (665,000 TWh/year), 32% of the world's total wind energy (67,000 TWh/year), and 12% of the world's total hydroelectric energy (330 GW). Thus, Africa is considered a global strategic "reservoir" of energy.

The most important renewable energy projects in Africa can be described as follows:

Green hydrogen project in Namibia: Its cost is about $9.4 billion, and the company implementing it in 2022 has set a 40-year timetable for establishing and operating the project. The project will enter into production in 2026, and the project will begin producing 2 gigawatts of renewable electricity. With expansion in production, the capacity will increase to 5 GW.

Chollet Hydropower Station: On April 12, 2021, Congo and Cameroon signed a concession agreement with China Gezhouba Group to build a $700 million hydroelectric station on the Dja River with an estimated production capacity of 600 MW. The project is expected to be completed in 2025 and will enable the production of electricity in both Congo and Cameroon.

Solar power plants in the Democratic Republic of the Congo: The state-owned electricity company of the Democratic Republic of the Congo has signed power purchase agreements for two solar power plants in the country's copper belt region. The two solar power plants are located in the towns of Kolwezi and Likasi, with a capacity of 100 MW each. The two solar power plants will cost $148 million and $157 million, respectively.

Mogalakwena Solar Power Plant: In 2022, it was agreed to build a 100 MW solar photovoltaic plant at the Mogalakwena mine in South Africa. The solar power plant forms part of the country's broader strategy to integrate renewable energy with mining operations and will contribute to carbon neutrality at the mine while enhancing operational efficiency.

Shumba Solar Project: In 2022, Shumba Energy made investments totaling $950,000 in the company's $80 million, 100 MW solar project in Botswana, with full financing expected by the second quarter of 2022. The project will be the largest in Botswana and is an important step in the company's shift from investing in fossil fuels to renewable energy sources.

Construction of 8 solar plants in Ghana: In 2022, the Government of Ghana announced plans to build eight solar power plants in Ghana.

In Egypt, the Supreme Council of Energy set a huge goal of raising the contribution of renewable energy to meet total demand by 20% by 2030. The Egyptian government is working hard to increase investments in the oil and gas sector while seeking to diversify energy sources. The Egyptian state has intensified its efforts since 2014 to generate and use more renewable energy to overcome the increasing difficulties

surrounding energy. It aims to generate 20% of the country's energy from renewable sources by 2030.

In this context, Egypt has implemented several projects to produce solar energy, including the solar thermal station in Karimat, the Benban solar complex for photovoltaic cells with a capacity of 1,465 megawatts, the photovoltaic station in Kom Ombo with a capacity of 26 megawatts in cooperation with the French Development Agency, distributed photovoltaic cell stations connected to the network with a net metering system with a capacity of 100 megawatts, decentralized photovoltaic cell stations separated from the grid with a capacity of 32 megawatts, and there are also stations under preparation (more than 1170 megawatts).

Egypt has implemented several projects to produce wind energy, including the Zaafarana wind farm (545 MW), the Gabal El-Zeit wind farm (580 MW), a private sector wind station in the Gulf of Suez with a capacity of 250 MW, and stations under preparation (more than 2,400 MW).

Regarding green hydrogen, the Supreme Council of Energy approved in February 2024 the national low-carbon hydrogen strategy, which has a vision that "Egypt will be one of the world's leading countries in the low-carbon hydrogen economy."

However, despite the successful renewable energy projects on the African continent, there are many challenges facing them:

First: The total scope of renewable energy sources in Africa is still very small. Africa's current power generation mix is dominated by fossil fuel generation, and there has been a more recent shift in the renewable energy mix through the acceleration of solar and wind technologies, but it is still small at 1.6%.
Studies indicate that Africa's shift toward renewable energy systems away from fossil fuels could lead to an increase in GDP by an estimated 6.4%, an increase in employment opportunities across the continent by an estimated 3.5%, and an improvement in the well-being index in the continent's countries by about 25.4% by the year 2050.

Second: The worsening electricity crisis in several African countries. In this context, a report entitled "Financing Clean Energy in Africa" issued by the International Energy Agency in November 2023 indicated that more than 40% of Africa's population lives without electricity and 70% without access to clean cooking fuel. According to the International Renewable Energy Agency, population growth and expanding economies are expected to double electricity demand in Africa by 2040.

According to World Bank data, there are approximately 760 million people on the African continent out of 1.373 billion people in 2021 who will not have access to electricity. This means that less than half of Africa's population has access to electricity. Most of these people live in Sub-Saharan Africa, and two-thirds of the networks in Africa are considered unreliable; therefore, we find that the inability to obtain electricity is one of the challenges facing Africa, and it is also one of the most important obstacles to social and economic development. Data indicate that the electrical power generation capacity of most African countries is about 28 gigawatts, and the country of South Africa produces about 39 gigawatts of electricity, which is the highest percentage of any African country.

Third: The decline in the volume of foreign investments in the African continent.

Fourth: High unemployment rates. About 400 million people in Sub-Saharan Africa live in extreme poverty, and the unemployment rate reached 6.7% in 2022.

Fifth: The conflicts that some countries of the continent suffer from.

Within the above, we find that for Africa to succeed in achieving the sustainable development goals related to energy, it will need to double its generation capacity by 2030 and fivefold by 2050. The economic, social, and environmental impacts of meeting this demand will depend on the policies that African governments develop to address **the following challenges:**

1. Ensure universal access to affordable, reliable, and sustainable modern energy by 2030. Sustainable and safe access to electricity in the face of increasing demand is about more than just dividing households into those with and without electricity connections; it is also about an adequate and reliable supply that supports productive uses and creates jobs.

2. Harnessing renewable energy to achieve social and economic development goals as well as mitigate climate change. Countries where fossil fuels currently dominate the electricity mix will need to move toward adopting renewable energy technologies and phasing out fossil fuel-based generation capacity.

Finally, it requires accelerating the transition toward renewable energy, in addition to implementing the sustainable development goals and making these ambitious goals several focal and basic points, namely: political will, creating a legislative, regulatory, and institutional environment conducive to the use of renewable energy, increasing regional integration, and implementing policies to improve the energy sector; To be part of any policy initiative to support the eradication of energy poverty and achieve low-carbon development in African electricity sectors by 2050. To ensure success and sustainability, there must be a fair energy transition that ensures broad social and economic development. As well, building institutional capacity to develop and implement national policies—for universal access to electricity while pursuing low-carbon development of Africa's energy sectors—is a cross-cutting priority at all stages of the energy transition.

The comprehensive transition to renewable energy on the continent requires broader and more concerted initiatives among African countries, as well as gathering expertise when implementing a variety of renewable energy projects, and increasing cooperation between all countries and regional groupings, through technology transfer, exchange of experiences, and strengthening regional markets, and working to implement the recommendations of the COP28 Conference of the Parties, which concluded with an agreement that marks the beginning of the end of the fossil fuel era, by paving the way for a rapid, just and equitable transition, supported by a significant reduction in carbon emissions and increased financing, in a way that ensures that the African energy system is placed on a new path and ensures the shift toward "Green Economy".

2

Stability of Energy Markets and Their Impact on the Economies of the Gulf Countries

Mr. Hussain Al Qemzi
Economic and financial expert - founding partner of Three Capital - United Arab Emirates.

The Gulf Cooperation Council countries—Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates—play a pivotal role in global energy markets thanks to their large oil and gas reserves.

The stability of global energy markets greatly affects the economic landscape of these Gulf countries. There is a clear link between the stability of energy markets and economic outcomes in the Gulf region, in addition to being crucial to the global economy.

Historically, the economies of the Gulf States have been deeply intertwined with energy geopolitics. Since the middle of the twentieth century, these countries have used their oil wealth as a strategic tool for economic prosperity and to find a foothold in regional geopolitics and international alliances.

The stability of oil prices and demand directly affects the economic prosperity of the Gulf countries. World Bank reports indicate that oil price fluctuations could significantly affect the financial positions of these countries and their economic stability more broadly. Due to its heavy dependence on oil revenues. In recent years, there has been a significant shift toward renewable energy in the Gulf countries, driven by the twin goals of reducing dependence on hydrocarbon revenues and addressing global environmental concerns.

Many economic and strategic analyses indicate that the global transition toward greener energy sources will reshape international relations and domestic policies in the Gulf States. These transitions affect not only energy market stability but also geopolitical alliances and security dynamics that have traditionally been influenced by oil diplomacy.

As the global energy scene continues to evolve and these countries deal with international pressures to reduce their carbon footprint and global climate commitments, Gulf countries are increasingly looking toward economic diversification and innovation in energy technologies as strategic priorities. This includes investments in high-tech industries such as tourism, aviation, and financial services, which are less affected by global energy market shocks.

The stability of energy markets remains an essential pillar of economic strategies in Gulf countries. As these countries navigate the complexities of global energy demand, geopolitical shifts, and the transition to renewable resources, so will their resilience, their economic resilience, and their continued prosperity.

Ongoing reforms and investments in various sectors indicate a proactive approach to using conventional and renewable energy resources to achieve a balanced and sustainable economic future. Gulf countries are implementing new technologies or innovative policies to improve their energy independence and reduce their dependence on oil. Examples of this include the atomic energy projects that have begun operating in the UAE and are under implementation in the Kingdom of Saudi Arabia, in addition to solar energy cities such as Masdar City in Abu Dhabi and the sustainable city in Dubai.

The relationship between energy market stability and economic outcomes in the Gulf region highlights the critical need for adaptive strategies that address current needs and future challenges. This ensures the continuity of the countries in this region as major players in the global economy and their regional influence.

The stability of energy markets is an important and sensitive topic that is directly linked to the geopolitical and economic dynamics of the Gulf countries.

3 The carbon footprint of armies, and the impact of armed conflicts on climate change

Mr. Mohammed Hassan Felfel Director of the Climate Change Risk Studies Unit at the Information and Decision Support Center headed by the Egyptian Council of Ministers.

Climate change has been and continues to be one of the issues that most concern the international community due to its devastating consequences in various sectors. Since the increase in carbon emissions is one of the most important causes of climate change, it is important to research the different sources of these emissions. The effects of climate change have increased in severity over the past few years in an unprecedented manner, and it appears that the state of climate deterioration that the world is witnessing recently is what prompted the Secretary-General of the United Nations in July 2023 to express this situation, warning that "the era of global warming has ended, the era of global thermal boiling has begun," commenting on the unprecedented rises in average Earth temperatures over the past years.

The carbon footprint of armies and armed conflicts, due to both defensive and offensive military activities, is one of the most prominent of these sources. Therefore, armed conflicts hurt the issue of climate change, and the high carbon footprint of armies exacerbates the negative repercussions of climate change.

Military Activities Causing Global Carbon Emissions:

The main tasks of the armed forces of any country are to preserve its national security, the unity and integrity of its territory, and to prevent aggression against it. To carry out these tasks, it must carry out a number of accompanying military activities, impose its influence on the scene, and constitute a deterrent to other hostile or non-hostile forces, whether by acquiring military equipment or even military manufacturing and carrying out joint training maneuvers. But despite the importance of these activities, it has been proven that they cause

many problems for ecosystems, not to mention that they cause a rise in the proportion of greenhouse gases in the atmosphere and a subsequent impact on the climate in one way or another. **Perhaps the most prominent of these repercussions are:**

- Direct military activities: These are activities that cause high levels of carbon emissions and may be related to weapons and military equipment that rely on fossil fuels for their operation, such as tanks, airplanes, and warships. Carbon is emitted directly from the fuel that burns in aircraft engines and the fuel storage of tanks, and the jet aircraft that armies possess in large quantities contribute to suffocating the atmosphere, raising temperatures, and high carbon emissions. This is in addition to what countries practice during wars, such as launching missiles and chemical bombs that destroy a wide sector of the environment, affect human health, and cause an increase in the severity and pace of climate change. Perhaps the most prominent examples of this are those witnessed during the First and Second World Wars.

- Indirect military activities: These include activities that do not contribute directly to carbon emissions into the atmosphere, perhaps the most prominent of which are related to military logistical services such as heating and electricity or through military supplies that include the military manufacture of technological weapons, such as advanced missile systems, hypersonic missiles, and microelectronics, as well as reconstruction and reconstruction activities after the destruction caused by wars in the infrastructure.

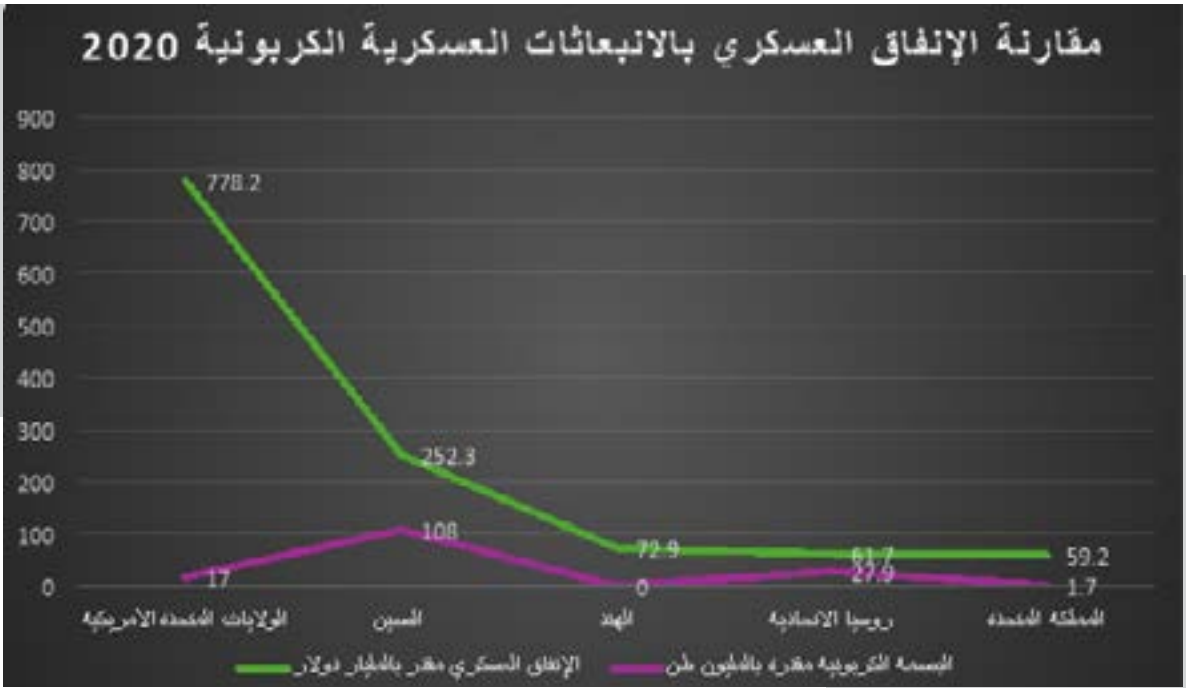
Global Contributions of Militaries to Carbon Emissions:

The military sector is one of the sectors that contributes most to global carbon emissions. This is due to the nature of the work of armies related to wars, weapons, and military equipment, which depend to a large extent on traditional energy and other main causes of the high percentage of greenhouse gases. The contribution of armies to carbon emissions amounted to about 5.5% of total global emissions, or approximately 2,750 million tons of carbon dioxide, according to 2022 statistics. This is estimated to be greater than any emissions released by any single country, with the exception of major powers with generally high greenhouse gas emissions.

The rates of global military spending that were monitored in 2022 increased to about 2,240 billion dollars. According to estimates issued in 2020, the United States was at the forefront of countries in terms of military spending with a total of $778.2 billion, while the amount of reported military greenhouse emissions amounted to about 17 million tons of carbon dioxide, followed by China in second place with a total spending of $252.3 billion. On the other hand, the carbon emissions of its military activities were estimated at about 108 million tons of carbon dioxide gas, surpassing those of the United States of America. Then India ranked third with a volume of military spending amounting to about 72.9 billion dollars in light of the lack of clarity about the size of its military

carbon emissions. The Russian Federation ranked fourth in military spending, with a total of $61.7 billion, and its greenhouse emissions also exceeded those of the United States of America, reaching about 27.9 million tons. In fifth place is the United Kingdom, with a total expenditure of $59.2 billion and about 1.7 million tons of carbon dioxide as military carbon emissions.

As for greenhouse emissions from military personnel, they have been estimated in very large quantities. Since 2020, military personnel in North America and Eurasia have produced an average of 13 tons of greenhouse gases annually, and the practices of military personnel in Asia, Oceania, the Middle East, and North Africa have produced an average of 9 tons of carbon dioxide annually and about 5 tons annually for military personnel in Europe. These activities range from aircraft emissions to mechanical emissions.



Carbon footprint and size of military spending for the top 5 countries in the world: However, despite this data reported within the 2021 UNFCCC, it is believed to be inaccurate; this is due to the tendency of countries not to report their military carbon footprint. The 2015 Paris Agreement recognized that reporting of military carbon emissions is voluntary; therefore, there is no obligation on countries to take this step, and thus the validity and accuracy of the announced data can be questioned, not to mention the amount of data that is not announced or has not been monitored in one way or another.

Armed Conflicts and Their Effects on Climate Change:

Armed conflicts are closely linked to climate and environmental issues; this is due to their various effects that would not only extend to affecting human life but also extend to the environment, whether through the use of chemical and biological weapons or even the use of fossil fuels and the generation of carbon emissions or causing air and water pollution. Wars destroy the sacred things of life, which include humans, the surrounding environment, the atmosphere, and all the factors that shape the structure of the Earth. During periods of war and armed conflict, carbon emissions rates rise due to accompanying military activities, whether using weapons that consume fossil fuels, using modern and advanced military equipment, or adopting "scorched earth" tactics, whereby the conflicting party resorts to destroying the state's natural resources by burning forests, removing cultivated green spaces, and burning oil resources, thus causing more pollution and emissions and higher rates of displacement and asylum on the one hand and putting pressure on the remaining state resources on the other.

The United Nations has estimated the degree to which armed conflicts are linked to climate change through several statistics: At the forefront of these were the consequences of the First Gulf War, which resulted in the burning of approximately 700 oil fields, resulting in plumes of smoke rising approximately 800 miles, in addition to the disposal of approximately 11 million barrels of oil in the Arabian Gulf, and about 300 oil lakes were formed in the desert, resulting in soil and air pollution and affecting the climate, through the doubling of carbon emissions rates resulting from the burning of oil and the rise of suffocating smoke into the atmosphere, not to mention the pollution of seawater and soil with petroleum materials, and to get rid of these fires, an international coalition consisting of firefighters established to extinguish these fires and reduce their impact. The last well was in November 1991, and currently, these areas are still vulnerable to fires, and 90% of the soil in that area is contaminated by these practices.

The Russian-Ukrainian war also caused an increase in the carbon footprint of armies and confirmed the effects of armed conflicts on the climate. It contributed about 150 million tons of carbon dioxide equivalent, which is estimated to be equivalent to emissions from a country such as Belgium. The largest share of these emissions was in the first seven months, which contributed about 100 million tons of carbon dioxide. 9% of those emissions were due to military activities related to the consumption of fossil fuels for equipment and ammunition in the conflict zone, 24% of the emissions were in forest fire areas, and about 15% of emissions resulted from methane leakage due to damage to the Nord Stream gas pipeline. The United Nations indicated that 37% of these emissions will come within the scope of the rehabilitation and reconstruction of infrastructure destroyed as a result of that war. The volume of emissions in building, construction, and reconstruction amounts to 54.7 million tons of carbon dioxide. Therefore, the cost of this conflict will not affect the climate during its existence but rather will cause risks and impacts after its end, especially during the rebuilding phase of destroyed cities and villages.

Although the estimates of the conflict in Ukraine were large and frightening, the indicators of greenhouse gas emissions resulting from the Israeli war on Gaza are also large. One study indicated that the emissions produced as a result of this war exceeded those produced by 20 countries combined in one year. During the first 60 days of the war, about 281,000 tons of carbon dioxide were produced, in addition to the climate cost during that period being equivalent to burning the equivalent of 150,000 tons of coal. It is worth noting that during the analysis of the carbon footprint data for that war, the emissions resulting from bomb explosions and artillery, nor even the percentages of methane gas leaking, were not taken into account. Therefore, it is expected that these emissions will exceed between 5-8 times the previous numbers if the entire military supply chain for participation in this conflict is included. Therefore, it is disastrous for humans, the environment, and the climate, which will result in more carbon emissions, especially during the rebuilding and reconstruction phase of the villages and countries that were destroyed as a result of this conflict. Reconstruction and construction operations are expected to contribute to carbon emissions of approximately 30 million tons of carbon dioxide gas just for the reconstruction of 100,000 destroyed buildings, which is equivalent to the size of the carbon emissions of a country like New Zealand and exceeds the total carbon emissions of about 135 countries, causing more severe and extreme weather episodes.

Required International Movements:

From what was previously discussed regarding the impact of military activities and armed conflicts on the climate by monitoring statistics and the resulting damage to the environment and aggravation of climate conditions, these practices must be dealt with in a way that contributes to reducing these activities. This requires implementing a set of moves toward controlling and balancing the carbon footprint of armies to reduce greenhouse emissions.

It can be said that replacing the voluntary reporting clause on the carbon footprint of armies by the 2015 Paris Agreement and making it a mandatory clause may be one of the proposed solutions. The situation is evaluated annually during the Conference of the Parties until countries acknowledge the danger of military activities to the climate and environment. It is also strongly proposed to add a thematic day within the activities of the Conference of the Parties to the United Nations Framework Convention on Climate Change (COP) on the impact of armed conflicts on the environment and climate change, which includes sessions and panel discussions on the importance of the environmental perspective for resolving these conflicts and finding binding legal solutions for states to include military activities among the main causes of greenhouse emissions.

At the level of investment in new and renewable energy in the military sector, it is necessary to encourage the trend toward using clean energy as an alternative to traditional energy to operate military equipment and weapons. This is to reduce carbon emissions resulting from their operation and to work to limit the use of jet aircraft, which are considered the largest cause of the high carbon footprint of armies. As well as imposing severe penalties on countries that tend to burn forests and cultivated areas during their military operations.

In conclusion, it can be said that finding peaceful solutions to disputes and armed conflicts is the best and most appropriate alternative. This is because the cost of wars and armed conflicts is not only linked to the human and material losses that result from them but also extends to include the high cost of impact on the environment and climate, the resulting huge losses due to climate disasters, and the deterioration of the condition of the planet on which we share a living. This was reflected in the statements of the Deputy Secretary-General of the United Nations during the preparatory conference for the twenty-eighth climate summit, when she said, "We need to overcome geopolitical divisions and rebuild confidence between developed and developing countries." This is what the Executive Secretary of the United Nations Framework Convention on Climate Change also called for, saying: "Let us be united in the knowledge that climate change is the common challenge facing us and that here we will all benefit from solutions, and we will all suffer from failure to address it."

Third: Studies

1 Energy Construction Security in Nigeria

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Overview of Nigeria's Energy Infrastructure:

The world is currently experiencing the most dramatic era of infrastructure demand and expansion across all sectors in human history. This is because infrastructure plays a critical role in explaining the differentials in deficits, demand, and growth. For proper context, infrastructure is a multidimensional concept that needs to be contextualized for clear understanding. This paper attempts to unpack the infrastructure spectrum to discuss energy infrastructure and its construction security in the Nigerian context.

Nigeria, as the economic powerhouse of Africa, boasts a diverse and expansive energy infrastructure that underpins its industrial development, socio-economic progress, and regional influence. With a population exceeding 200 million and a rapidly growing economy, Nigeria's energy demands continue to escalate, necessitating robust infrastructure capable of meeting the nation's energy needs while ensuring security, reliability, and sustainability. Therefore, energy infrastructure and its construction security can be viewed from both professional and academic perspectives.

The professional viewing lens makes Nigeria's energy sector synonymous with its abundant oil and gas reserves, making it a major player in the regional and global energy markets. Nigeria is Africa's largest oil producer and holds the largest natural gas reserves on the continent. Oil has historically been the primary driver of Nigeria's economy, contributing significantly to government revenue, foreign exchange earnings, and employment opportunities.

This further substantiates why Nigeria's energy infrastructure is a vast network of sectors that includes pipelines, refineries, petrochemical plants, power plants, and export terminals, all critical components of the oil and gas value chain. These infrastructures are instrumental in the extraction, processing, and transportation of crude oil and natural gas, facilitating their conversion into various end products for domestic consumption and export.

From an academic perspective, Nigeria's energy infrastructure represents a dynamic and multifaceted field of study encompassing various disciplines, including engineering, economics, environmental science, policy analysis, and international relations. Scholars and researchers delve into the complexities of Nigeria's energy landscape, examining its historical evolution, technological advancements, regulatory frameworks, and socio-economic impacts. Academic research on Nigeria's energy infrastructure explores a wide range of topics, from the environmental consequences of oil and gas exploration to the socio-economic implications of energy access and affordability. Various researchers have been investigating the challenges and opportunities facing Nigeria's energy sector, including issues related to governance, transparency, corruption, and sustainable development.

Therefore, Nigeria's energy infrastructure can be discussed analytically from the convergence of professional and academic perspectives to better understand the energy infrastructure architecture and construction security in Nigeria. The intersection of professional expertise and academic inquiry provides a comprehensive understanding of Nigeria's energy infrastructure, highlighting both its operational intricacies and its broader socio-economic significance. Professionals engaged in the energy sector bring practical insights into the operational realities and challenges facing Nigeria's energy infrastructure, while academics contribute theoretical frameworks, empirical analyses, and critical perspectives that enrich the discourse and inform policy debates.

The Importance of Energy Infrastructure Security for Nigeria:

The security of Nigeria's energy infrastructure is paramount for ensuring the stability of the country's economy, national security, and social well-being. Energy infrastructure security encompasses protection against physical threats, cyberattacks, natural disasters, and other risks that could disrupt energy supply and distribution. A secure energy infrastructure is essential for maintaining uninterrupted energy services, attracting investments, and fostering sustainable economic growth.

Existing Energy Infrastructure Security Challenges in Nigeria:

Despite the significance of energy infrastructure security, Nigeria faces various challenges in this regard within the power sector and the oil and gas sector. For both sectors, these challenges include, but are not limited to, the 4 A's (i.e., availability, accessibility, acceptability, and affordability). These issues affect energy security, as defined by the International Energy Agency

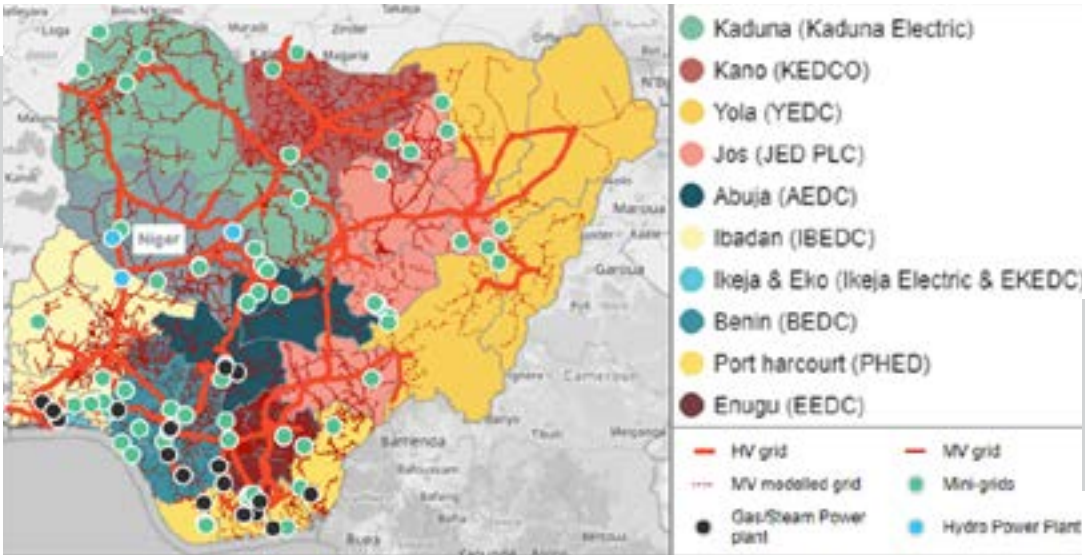
(IEA) as the uninterrupted availability of energy sources at an affordable price. By extension, energy security can be viewed on a short-, mid-, and long-term basis.

Analytically, the challenges peculiar to the power sector in terms of energy security in the electricity value chain in Nigeria are mixed.

This ranges:

1. The slow growth in electricity generation capacity.
2. The inadequate electrical transmission lines and distribution equipment vandalism.
3. The government's interference in the market deregulation process.
4. The poor maintenance of existing electrical facilities.
5. Corruption. This has placed Nigeria in the league of unattractive investment destinations within the global electricity market.

The myriad of mixed challenges prevalent in Nigeria's power sector call for smarter, sustainable, secure, and resilient energy infrastructure and security.



Power sector infrastructure (grid, substations, power plants, etc.) and grid coverage by state

In the oil and gas industry, challenges frustrating Nigeria's energy security topic include:

1. Persistent threats from insurgency, sabotage, and vandalism targeting oil and gas installations and pipelines, leading to oil spillages and environmental pollution.
2. Vulnerabilities to cyberattacks on critical energy infrastructure systems and networks.
3. Inadequate investment in the maintenance and upgrading of aging infrastructure, leading to operational inefficiencies such as gas flares and reliability issues.
4. Regulatory and governance gaps that hinder effective management and protection of energy infrastructure.

If Nigeria must overcome energy security challenges in the oil and gas sector, concerns linked to saboteurs, political opposition, and terrorists using vandals, kidnappers, trade unions, and cartels to frustrate the energy sector and cause energy insecurities must be eliminated.

Lessons Learned and Ways Forward on Energy Construction Security:

It is of tremendous relevance to reflect on in analyzing energy construction security because it is linked to ensuring the availability of reliable energy services for Nigeria's economy. As such, the diversification of energy construction tactics is germane by taking clues from strategies adopted by countries such as Egypt, Japan, South Korea, and Singapore in attaining energy construction security.

A few examples of strategies to adopt include:

1. Embracing the energy mix approach by increasing the number of fuels and technologies used in the energy construction infrastructure and production landscape, such as oil and gas energy, solar, wind, biomass, nuclear, geothermal, and tidal sources.
2. Increasing energy efficiency and conservation.
3. Increasing the number of suppliers for each fuel; and, e.g., developing storage capacity for different fuels (e.g., storage reserves).

Of equal concern is that attaining energy construction security requires a robust, strategic, and deliberate government policy that is free of corruption and strives to address both short- and long-term scenarios and guarantee meeting the present and future energy needs of Nigeria. The inefficiencies of the oil and gas energy sector must be addressed, which can be realized through ending gas flares and utilizing associated and natural gas resources to generate power. For instance, according to the Nigerian Gas Flare Tracker, power generation potential from gas flaring alone amounted to 435.6 thousand gigawatts of power for Nigerians. Similarly, the untapped blue economy resources in Nigeria can contribute to the energy mix, thereby guaranteeing diversified and sustainable energy infrastructure construction security.

Conclusion:

Achieving availability, accessibility, acceptance, and affordability through energy infrastructure and its construction security is essential for Nigeria to thrive and guarantee economic growth and human well-being. Adequate investments in energy infrastructure and construction security are one of the keys to attaining an adequate and sustainable energy mix in a coherent and consistent manner.

To overcome the challenges Nigeria is currently experiencing and the forthcoming ones within the context of energy infrastructure construction security, the diversification of the energy sector must be implemented in a smart and sustainable manner. The lack of competitiveness and corruption concerns in the power sector as well as the oil and gas sector must be tackled. It is only when this menace is purged from the sectors that the laudable policies Nigeria developed nearly three decades ago, but unfortunately were never allowed to work, can be implemented and realized in alignment with energy construction security ethics.

Recommendations:

Energy infrastructure construction security in Nigeria is attainable through adopting a systematic approach to public and private sector engagement in a multidimensional energy sector landscape. Mainstreaming such an approach is aimed at addressing key bottlenecks to investment driven by evidence-based research and development strategies. The following recommendations are made to facilitate sustainable energy infrastructure construction and security in Nigeria:

- Strengthen regulatory oversight:

Implement stringent regulatory frameworks to enforce safety standards, cybersecurity measures, and environmental regulations at all stages of energy infrastructure construction. Ensure compliance, accountability, and risk mitigation.

- Foster Public-Private Partnerships:

Encourage collaboration among government agencies, energy companies, and private security firms. Pool resources, expertise, and intelligence-sharing mechanisms to coordinate efforts and safeguard critical energy infrastructure assets.

- Enhance community engagement: Prioritize engagement with host communities and stakeholders in energy infrastructure projects. Build trust, cooperation, and local ownership to prevent sabotage, vandalism, and social unrest that could threaten infrastructure security.

- Implement comprehensive risk management: Strengthen risk management strategies by integrating physical security measures, cybersecurity protocols, emergency response plans, reduced investment risks, and resilience-building initiatives. Ensure a holistic approach to safeguarding energy infrastructure against various threats and vulnerabilities.

2 Energy Crisis in South Africa

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Abstract:

The persistent energy crisis that the nation and its citizens are currently facing is undoubtedly having a devastating effect on the South African economy. As a result, small companies are shutting down, municipalities are suffering greatly in their operations and capacity to offer services, and other industries and institutions are also being affected. The lack of energy in South Africa is a concern since it cannot sustain further commerce based on the country's already substantial energy-dependent trade operations, even though global markets need diversified economies with a diversity in the products and services offered. By using decentralized and varied generation techniques, the South African government has to step up its efforts to deliver a reliable and secure energy supply. As a result, this study emphasizes the urgency of the present energy crisis and strategies for reducing its impact, particularly in municipal authorities.

Background of the Study:

The South African energy crisis has worsened to almost catastrophic proportions, with far-reaching effects that have resulted in the closing down of several small and medium-sized enterprises and an increase in job losses in the labor force. To decentralize part of the burden of energy generation and distribution to institutions operating at the local level and entrust them with providing services to communities and businesses within a jurisdiction, the government must engage in strong partnerships and "out-of-the-box" approaches. The research presented here is designed to bring attention to the severity of the current energy crisis and

the steps that the government may take to expedite the adoption of new energy-generating strategies that make use of renewable energy sources.

South Africa (SA) provides an abundance of renewable energy resources, including wind and solar electricity. However, due to inadequate infrastructure, the country hasn't been able to properly exploit these renewable energy sources. Instead, the nation's primary source of electricity is still traditional coal-fired power plants, which exacerbates the country's energy issue and strains its electrical supply (Fig. 1). For many years, coal has been South Africa's primary energy source, producing up to 87% of the country's power (Fig. 1).

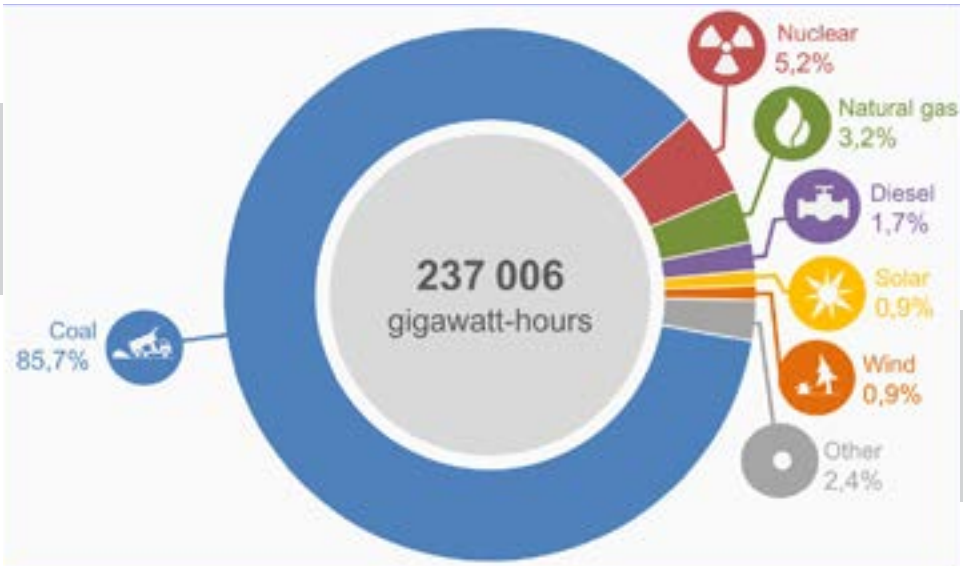

Figure (1): Power station maximum generating capacity

Although it is essential for supplying the country's energy needs, its disadvantages have grown to be a serious issue as a source of greenhouse gas emissions that worsen air pollution and contribute to climate change. SA has become more challenging to meet its increasing energy demands due to its rapidly growing population and greater industrialization. Another issue is the infrastructure for power, which is irrelevant. The increasing unreliability of these infrastructure components is a result of poor maintenance and delayed improvements, which lead to malfunctions and increased power outages. In recent years, SA has been affected by the most serious energy crisis, marked by frequent, continuous failures that can last for up to 10 hours a day or more. Load-shedding, often known as the energy crisis in South Africa, is a prolonged period of widespread countrywide power outages. It started in the latter part of 2007 and is still going on now. According to data released by the supplier, South Africa's electrical crisis in 2023 is worse than it was the year before since there are more power disruptions.

The crisis has mainly caused a devastating effect on economies, resulting in massive harm to the GDP, business closures, employment losses, a lack of investment due to supply instability, a delay in addressing the issue of energy access, and a decrease in credit ratings.

The government is experiencing a growing burden to come up with a solution to the persistent challenge, which has a big impact on social welfare, the growth of the economy, and the overall growth of the country. It is crucial to look at an extensive spectrum of issues, from bad management and corruption to a reliance on coal and insufficient investment in other energy sources, to understand the reasons behind the continuous blackouts and the causes of this energy crisis. The government-owned national power provider, Eskom, is a major cause of the energy crisis in South Africa. It produces a large portion of the electricity produced on the continent of Africa, in addition to producing around 95% of the country's electricity. Since 2007, Eskom has been troubled with mismanagement, which includes poor maintenance processes, inadequate capital, and ineffective operations, all of which have caused shortages of electricity supply in South Africa (Fig. 2). Failures and breakdowns have thus increased in number, seriously disrupting everyday life and economic activity.

Figure (1): Power station maximum generating capacity [https://www.statssa.gov.za/?p=11292]

Furthermore, the energy mix's growth has been hampered by South Africa's excessive reliance on coal. An overreliance on one energy source increases the nation's susceptibility to disruptions in supply. Coal shortages or maintenance issues in coal-fired power plants may seriously impede the flow of energy, making prolonged and frequent blackouts an everyday occurrence for South Africans. Construction project delays made the energy crisis worse.
Development projects have experienced major delays despite the 2019 goal to increase wind power, solar power, and electricity storage capacity. They were supposed to be operating by 2022, but it looks like they won't be completed until early 2024. Not even the beginning has been made in terms of identifying locations and developers for projects that are scheduled for 2023, such as new coal, solar, and wind farms. The rate of activity has slowed down, and the completion date for addressing the energy crisis has risen as a result of these delays.

Energy Action Plan for South Africa to Stop Load Shedding:

1. Repair Eskom while making the current supply more readily available.
2. Facilitate and expedite private sector investment in energy capacity.
3. Look for new capacity from gas, renewable energy, and battery storage as soon as possible.

Figure (2): Eskom's Energy Availability Factor [Source: BusinessTech]

South Africa has suffered several severe consequences as a result of the energy crisis. These include slowing economic growth, making it harder to conduct business in the nation, raising crime rates, and influencing politics in South Africa. According to 2022 University of Johannesburg research, the constant load shedding that has occurred since Level 6 was implemented has considerably decreased "the overall happiness of South Africans". Due to the hardships caused by the energy crisis, a complaint was launched before the Pretoria High Court in 2023 to declare it illegal [https://en.wikipedia.org/wiki/South_African_energy_crisis].

South Africa's New Plan to End Power Cuts:

The most severe energy crisis to hit South Africa in recent history has been marked by frequent, persistent blackouts that can last up to ten hours a day or more. There has been increasing pressure on President Cyril Ramaphosa and the administration to resolve the protracted issue, which has significant effects on the nation's social welfare, economic growth, and general development. To comprehend the reasons behind the ongoing blackouts and the causes of this energy crisis, it is essential to investigate a multitude of problems, from poor management and corruption to a reliance on coal and insufficient investment in other energy sources.

South Africa's strategy to stop load shedding and attain energy security is called the Energy Action Plan. President Cyril Ramaphosa unveiled it in July 2022, outlining a drastic plan of action to restore Eskom rapidly and construct as much new generating capacity as possible to bridge the gap in the supply of energy [energy action plan AUG2023].

There are four main pillars in the plan:

1. Repair Eskom and increase power availability.
2. Encourage and expedite private investment in generating capacity.
3. Obtain new generation capacity from gas, renewable energy, and battery storage as soon as possible.
4. Encourage homes and companies to make rooftop solar investments.

South Africa's Underlying New Target Is to End Load Shedding Permanently:

The draft Integrated Resource Plan for 2023, released by the Department of Mineral Resources and Energy, outlines the department's strategies for resolving South Africa's energy issue and ending load shedding. The updated energy plan of action calls for the construction of more than 100 gigawatts of new generation capacity by 2050 and suggests that a wide variety of fuels and technologies, including solar, wind, nuclear, and coal, be taken into account to accomplish it.

According to the proposal, the subsequent phase, which lasts until 2050, "will require a massive new build program with significant capacity required in just over a decade from now," including the attendant transmission network.

Other notables from the plan are:

- In South Africa, coal still plays a big part in producing power. Investments in clearer and more efficient coal technologies are required, especially considering the nation's wealth of coal resources.

- The government has decided to extend its nuclear program, emphasizing the importance of nuclear power as a clean energy source. To keep up with the rising need for electricity, small-module gas-to-power technology will offer the adaptability needed to support renewable energy sources. While local exploration is being done, opportunities for gas imports should be investigated soon.

- The energy mix may be diversified with the help of solar and wind technologies, and their output is expected to rise quickly.

The strategy also strongly favors delaying the closure of coal-fired power plants in South Africa. The department argues that by doing so, energy security may be ensured for a significantly longer period. reactor might be gradually installed.

Conclusion:

According to the aforementioned reviews of South Africa's energy supply, the nation has a chance to recover from its almost catastrophic energy crises if it can come up with practical plans that would accelerate the insightful solution to its fundamental energy problems. This entails determining that various energy-generating sources must be allowed to become part of the energy supply basket, that more consumers must be brought into the energy supply sector through partnerships with both local and international businesses and institutions, and that energy generation should be decentralized to the municipalities that are home to mines, industries, and other commercial activity.

3 Kenya's Experience in Renewable Energy

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Abstract:

Kenya, a country rich in renewable energy resources, has embarked on an ambitious journey toward sustainable energy development. This analytical research study delves into Kenya's experience in renewable energy, examining the challenges faced, the successes achieved, and the future prospects for further growth and integration of renewable energy sources into the country's energy mix. Through comprehensive analysis and synthesis of existing literature, policy documents, and empirical data, this study aims to provide insights into the factors influencing Kenya's renewable energy landscape, including policy frameworks, technological advancements, investment patterns, socio-economic implications, and environmental impacts. By critically assessing Kenya's renewable energy initiatives, this study seeks to inform policymakers, researchers, and stakeholders about the lessons learned and the opportunities available for advancing renewable energy transition not only in Kenya but also in similar developing contexts worldwide.

Introduction:

Background on Kenya's Energy Sector:

Kenya's energy sector plays a crucial role in the country's socio-economic development. Historically, Kenya has heavily relied on traditional biomass, such as wood and charcoal, for cooking and heating, which has contributed to deforestation and environmental degradation. Additionally, Kenya has faced challenges in electricity generation and access, with a significant portion of the population lacking access to reliable and affordable electricity. To address these challenges and

meet the growing energy demand, Kenya has been diversifying its energy mix and placing increasing emphasis on renewable energy sources.

The Importance of Renewable Energy for Kenya: Renewable energy holds immense importance for Kenya's energy security, economic growth, and environmental sustainability. With abundant renewable energy resources, including solar, wind, geothermal, hydro, and biomass, Kenya has the potential to harness these sources to meet its energy needs while reducing reliance on imported fossil fuels. Renewable energy also offers opportunities for rural electrification, job creation, and poverty alleviation, contributing to inclusive development and improving the quality of life for Kenyan citizens. Moreover, transitioning to renewable energy is crucial for mitigating climate change impacts and reducing greenhouse gas emissions, aligning with Kenya's commitments to international climate agreements.

Challenges in Renewable Energy Development:

1. Financing Constraints and Investment Barriers:

Limited Access to Finance: One of the primary challenges facing renewable energy projects in Kenya is the limited availability of finance, particularly for small-scale and rural projects. Financial institutions may perceive renewable energy projects as risky investments due to factors such as uncertain revenue streams, regulatory uncertainties, and perceived technology risks.

High Initial Capital Costs: Renewable energy projects often require significant upfront capital investment, which can pose a barrier to entry for developers, especially in the absence of favorable financing mechanisms or subsidies. This is particularly challenging for rural electrification projects and decentralized renewable energy solutions.

Lack of Investment Incentives: Inadequate financial incentives and supportive policies may deter private sector investment in renewable energy projects. Uncertain regulatory frameworks, inconsistent policies, and bureaucratic processes can increase perceived investment risks and hinder project financing.

2. Grid Integration Challenges:

Intermittency and Variability: Renewable energy sources such as solar and wind are intermittent and variable, posing challenges to grid stability and reliability. Integrating large amounts of intermittent renewable energy into the grid requires advanced grid management techniques, energy storage solutions, and flexible backup power sources.

Grid Infrastructure Limitations: Kenya's existing grid infrastructure may lack the capacity and flexibility to accommodate high levels of renewable energy penetration. Upgrading and modernizing the grid infrastructure to support bidirectional power flows, smart grid technologies, and distributed generation

are essential for effective grid integration of renewable energy.

3. Institutional Capacity and Governance Issues:

Regulatory and Policy Uncertainty: Inconsistent or outdated regulatory frameworks and policy uncertainties can create barriers to renewable energy development by increasing project risks and delaying investment decisions. Clear, stable, and transparent policies are essential to providing certainty to investors and developers.

- **Inadequate Institutional Capacity:** Weak institutional capacity within government agencies responsible for energy regulation, planning, and implementation can hamper the effective implementation of renewable energy policies and initiatives. Building the capacity of regulatory bodies, fostering inter-agency coordination, and streamlining approval processes are necessary to support renewable energy deployment.

- **Corruption and Governance Challenges:** Corruption, lack of transparency, and governance issues can undermine renewable energy projects by increasing transaction costs, distorting market incentives, and eroding investor confidence. Strengthening anti-corruption measures, enhancing transparency, and promoting good governance practices are essential for creating an enabling environment for renewable energy investment.

4. Socio-Economic and Cultural Considerations:

- **Community Engagement and Acceptance:** Renewable energy projects may face resistance or opposition from local communities due to concerns about land use, environmental impacts, and cultural considerations. Engaging with local communities, consulting stakeholders, and incorporating their feedback into project planning and implementation processes are crucial for building social acceptance and ensuring the success of renewable energy initiatives.

- **Equitable Distribution of Benefits:** Ensuring that the benefits of renewable energy development are distributed equitably among different socio-economic groups and regions is essential for promoting inclusive and sustainable development. Addressing issues of energy access, affordability, and socio-economic disparities can enhance the social acceptability and impact of renewable energy projects.

- **Cultural Sensitivity:** Cultural considerations, such as traditional land tenure systems, customary practices, and indigenous knowledge, may influence the design and implementation of renewable energy projects. Respecting cultural values, engaging with local knowledge holders, and incorporating indigenous perspectives into project planning processes can help mitigate potential conflicts and enhance project outcomes.

Success Stories and Best Practices

1. Case Studies of Successful Renewable Energy Projects:

Lake Turkana Wind Power Project: The Lake Turkana Wind Power Project, located in northern

Kenya, is one of the largest wind power projects in Africa. With a capacity of 310 megawatts (MW), the project has significantly contributed to Kenya's renewable energy generation capacity. Despite facing challenges such as financing constraints and logistical hurdles, the project successfully completed construction and commenced operations in 2019, providing clean and reliable electricity to the national grid.

Olkaria Geothermal Power Plants: The Olkaria geothermal field, located in the Great Rift Valley, is a key success story in Kenya's renewable energy sector. The Olkaria geothermal power plants, operated by KenGen, have a combined capacity of over 700 MW, making Kenya one of the leading geothermal energy producers in Africa. The project demonstrates the potential of geothermal energy as a reliable and sustainable source of electricity, leveraging Kenya's abundant geothermal resources to meet growing energy demand.

2. Public-Private Partnerships and International Collaborations:

Kenya Renewable Energy Association (KEREA): KEREA serves as a platform for collaboration between government, private sector, and civil society organizations to promote renewable energy development in Kenya. Through advocacy, capacity building, and knowledge-sharing initiatives, KEREA facilitates public-private partnerships and fosters international collaborations to drive innovation and investment in renewable energy projects.

Scaling Solar Program: The Scaling Solar program, supported by the International Finance Corporation (IFC) and other international development partners, aims to accelerate the deployment of solar energy in emerging markets, including Kenya. By providing advisory services, financing solutions, and risk mitigation instruments, the program enables private sector participation in utility-scale solar projects, fostering sustainable development and energy access.

3. Community Involvement and Capacity Building Initiatives:

Off-Grid Solar Electrification: Off-grid solar solutions, such as solar home systems and mini-grids, have played a significant role in expanding energy access to rural and underserved communities in Kenya. Organizations like M-KOPA Solar and have implemented innovative pay-as-you-go financing models, allowing households to access affordable and clean energy services while promoting local entrepreneurship and job creation.

Community-Based Renewable Energy Projects: Community-based renewable energy projects, such as micro-hydro and biogas initiatives, empower local communities to participate in energy generation and benefit from renewable resources. Projects like the Gakawa Micro-Hydro Power Plant in central Kenya and the Githembe Biogas Project in western Kenya demonstrate the importance of community ownership, participation, and capacity building in sustainable energy development.

Socio-Economic Impacts of Renewable Energy Deployment:

Renewable energy deployment in Kenya has far-reaching socio-economic implications, contributing to economic growth, improving energy access, and fostering social empowerment. This section examines the key socio-economic impacts of renewable energy deployment in the country.

1. Employment Generation and Economic Growth:

Renewable energy projects, such as solar, wind, hydro, and geothermal installations, create employment opportunities across the value chain, from project development and construction to operation and maintenance. These projects stimulate economic activity in local communities, supporting job creation and income generation.

The renewable energy sector attracts investments, both domestic and foreign, spurring economic growth and diversification. By fostering a conducive environment for renewable energy development, Kenya can leverage its abundant renewable resources to drive sustainable economic development and reduce reliance on imported fossil fuels.

2. Energy Access and Rural Electrification:

Renewable energy technologies, particularly off-grid solutions such as solar home systems and mini-grids, play a crucial role in expanding energy access to rural and underserved communities. These decentralized energy solutions provide clean and reliable electricity to households, schools, healthcare facilities, and businesses, improving quality of life and enabling socio-economic development.

Rural electrification initiatives supported by renewable energy contribute to bridging the energy access gap, empowering rural communities, and unlocking their potential for economic productivity and social development. By prioritizing off-grid electrification and decentralized energy solutions, Kenya can accelerate progress toward universal energy access targets and sustainable development goals.

3. Poverty Alleviation and Social Empowerment:

Access to affordable and reliable energy services enhances livelihoods and reduces poverty, particularly in rural areas where energy poverty is prevalent. Renewable energy technologies offer opportunities for income-generating activities, such as productive use of energy in agriculture, agro-processing, and small-scale enterprises, empowering communities to lift themselves out of poverty.

Renewable energy projects that prioritize community ownership, participation, and benefit-sharing contribute to social empowerment and inclusive development. By involving local communities in decision-making processes, capacity-building initiatives, and revenue-sharing mechanisms, renewable energy initiatives can foster social cohesion, equity, and resilience.

Implications for Renewable Energy Development in Kenya and Beyond:

As of 2019, renewable energy only contributed 74% of the current energy mix, and the rest came from non-renewable sources (Klagge et al., 2020). The energy demand is constantly on the rise as the population increases; therefore, Kenya spends up to half of its annual foreign exchange earnings to import petroleum and oil (Sarkodie & Adom, 2018) to cover the demand. Despite this, Kenya's current energy mix is still dominated by renewable energy sources like bioenergy (64.6% of total primary energy supply), wind and solar (15.2%), hydro (1.3%), and, to a lesser extent, coal (1.9%) and oil products (16.9%) (Hafner, 2019). The overreliance on imported fossil fuels to balance baseline energy demands makes the country highly susceptible to supply and pricing jolts in international markets (Power, 2013).

In recent years, Kenya has prioritized the growth of geothermal and wind projects, with most investments channeled toward their development (Ndiritu et al., 2020). Geothermal energy leads the energy mix with 48.4% among the other renewable sources in Kenya. Exploration reveals that geothermal energy potential in Kenya exceeds 7,000 MW and is capable of meeting all of Kenya's electricity needs over the next 10 years (Simiyu, 2010). In 2019, Kenya was ranked the 9th largest producer of geothermal electricity in the world and number one in Africa (Renkens, 2019). Its geothermal capacity was projected to increase to 1984 MW in 2020 and targeted to exceed 5000 MW by 2030, but due to challenges like the high cost of production and difficulty in obtaining finances for upscaling, this number is likely to rise to approximately 1900 MW by 2030 (Renkens, 2019).

Hydropower currently has a usage of 826 MW, which is about a third of the total energy mix. The total hydropower potential in Kenya stands at 6000 MW for both large and small projects (Kiprop et al., 2018). Large hydropower has a potential of 3000 MW, whereas only 800 MW has been harnessed. Out of the 3000 MW for small and micro hydropower, less than 30 MW, which is about 1% of the potential, has been harnessed, hence the need to exploit the untapped resource (Kiprop et al., 2018). However, interest in hydropower in Kenya has gradually gone down at the expense of geothermal power owing to the draughts experienced due to global warming (Janho, 2020).

Solar energy is the most abundant source of energy in the world and is growing rapidly in Kenya. Kenya has made significant progress in the energy transition, with 89% of electricity generated from renewable sources, with solar power accounting for 1% in 2021. The ideal potential for solar energy in Kenya is 4-6 kWh/m2/day levels of insolation because it is located near the equator, with an average of 5-7 sunshine hours each day. The country has an

approximate solar potential of 15,000 MW.
It is estimated that 120 MW of solar power will be added to the national grid in 2021, raising the total solar power generation to 172 MW. Garissa Solar Power Project is the largest installation in the country with a capacity of 55 MW; Malindi Solar Plant has a capacity of 52 MW; Kesses 1 (55 MW); Cedate (40 MW); and Selenkei has a capacity of 40 MW (George et al., 2019; KEEPS, 2023; KIPPRA, 2022). Despite this increase, the uptake by manufacturing firms is still low. Utilizing solar energy in manufacturing firms is one way to cut down on energy costs.

The cost of power generated from the electricity grid continues to be more volatile and has been rising. Solar energy, therefore, protects manufacturers from unpredictable market fluctuations, thus offering more stable energy options needed for sustainable growth. There is also a huge untapped demand for off-grid solar that will connect communities located far from existing transmission infrastructure. As a result, personnel need to be trained to scale up solar panel installation, solar energy production, and connection for domestic, industrial, and commercial level utilization. This will contribute to the achievement of SDG 7 on access to affordable, reliable, sustainable, and modern energy for all.

Renewable Energy Sources in Kenya:

Wind energy, alongside geothermal and solar, has also grown over the years. The largest wind farm in all of Africa has its home in Kenya. The Lake Turkana wind plant is made up of 365 turbines and produces 310 MW of electricity (Klagge et al., 2020). Wind in Africa has a potential of 109,000 MW, and Kenya has 73% of its area with wind energy coverage with good potential speeds above 6 m/s. The wind energy density is one of the highest in Africa at 346 W per meter square and has the potential to cover the country's power requirements (Agnieszka H. Kazimierczuk, 2019).

Biomass is produced globally every year from agriculture. According to the United Nations Food and Agriculture Organization (FAO), over 9 billion metric tons of crop residues were created in 2017, while over 5 billion cubic meters of forestry waste products were recovered in the same year (Duque-Acevedo et al., 2020). They are deposited on the farm to decay or be burned directly in the atmosphere; these disposal methods have ecological problems (Kwon, Ryu, & Carlsten, 2020; Welfle, Chingaira, & Kassenov, 2020). Garcia-Freites et al., 2020). These huge volumes of biomass can be converted to energy. The Government of Kenya (GoK) has recognized a need for a transition toward modern bioenergy systems using alternative feedstocks for expanding renewable generation (Popp et al., 2014). The focus has been to develop legislation that: prevents the exploitation of forests (GoK, 2005); promotes increased efficiency of clean bioenergy technologies (Garcia-Freites et al., 2020); and encourages the use of residue

feedstocks from Kenya's large agricultural sector and the growth of dedicated biofuel crops (Welfle, Chingaira, & Kassenov, 2020; Okoko et al., 2017). Approximately 22,000 biogas plants have been installed in Kenya, of which 20,000 rely on livestock manure and the rest on crop waste, with support mainly from GIZ. Over 90% of these biogas plants are domestic; others are institutional, while the rest are on flower farms. Therefore, there is a need to train personnel to upscale the production of bioenergy to industrial and commercial levels (Roopnarain & Adeleke, 2017).

Renewable Energy Policies in Kenya:

The formulation of regulations and policies has been a huge step in promoting renewable energy use in Kenya. Renewable energy policies like Vision 2030 aim to turn Kenya into a mid-income, newly industrialized country by the year 2030. It was launched in 2008 and identified "energy" as one of the enablers of socio-economic and political growth (Janho, 2020). It aims to achieve a 100% electrification rate across the country from renewable resources regarding energy and power generation.

The government of Kenya passed the Energy Act (2019) in March of 2019, which outlines the laws of the chain of energy from production to sale and regulates the exploitation of renewable energy sources such as coal and petroleum. Part 6 of the Energy Act deals with renewable energy and facilitates the introduction of net metering. Net-metering gives way for Kenyans to generate their electricity and channel the excess power to the grid during off-peak periods for credit, with solar users being the main benefactors (Bonell).

However, the Energy Act has limited the net-metering system to 1 MW, after which a Purchasing Power Agreement (PPA) should be made with Kenya Power (Janho, 2020). Under the Energy Act, the Rural Electrification Authority (REA) was also dissolved and replaced with the Rural Electrification and Renewable Energy Corporation (REREC). Its purpose is to oversee rural electrification projects and boost domestic research and production of renewable energy technology. The Rural Energy Resource and Advisory Committee (RERAC) was also established in line with this to advise on the licensing and development of renewable energy resources.

The Ministry of Energy in Kenya launched the Feed-In-Tafiff (FIT) policy in 2008, which encouraged foreign investment in the renewable energy sector. The fixed tariff price at an agreed-upon period encouraged foreign and local entities to develop renewable energy projects and, in return, forecasted their costs and profit margins accurately (Ndiritu et al., 2020). Investors in renewable energy are also exempted from value-added tax and import duties for the supply or import of materials and equipment required for the construction of renewable energy projects under Kenya's

amended VAT Act (2014).

The Nuclear Power and Energy Agency (NuPEA) was also established under the Kenya Energy Act to lead the research, development, and distribution of nuclear power. NuPEA proposes policies and laws for the growth of nuclear energy in Kenya and takes part in public awareness campaigns on nuclear programs and benefits. Through these policies, Kenya has attracted international renewable energy investors, and the energy mix has grown to nearly 90% (Janho, 2020).

Despite the huge advancements in renewable technology, there are some challenges when it comes to operation, which leads to technical barriers. Lack of sufficient knowledge causes poor usage and inadequate capacity to maintain the systems. The progress of some renewable energy sources, such as biodiesel and solar, has been hindered by a lack of available experts and skilled manpower (Takase et al., 2021).

Similarly, small and micro hydropower have an unexploited potential of about 2970 MW, while wind aims to reach 2300 MW by 2035 (EPRA, 2020). This calls for skilled personnel training to enable building human capital for the transition, and this training aims to fill that gap. However, given the high percentage of people using renewable energy, there exists a huge training gap because of inadequate experts for maintenance, future installations, and skill transfers from the few available experts for sustainability.

Renewable energy has been identified as a potential energy resource as it is inexhaustible, plentiful, clean, green, and reliable. However, renewable energy generation is perceived as a risky venture because of the high costs associated with the construction of generation plants, hence the unwillingness of the majority of financial institutions to fund investments (Takase et al., 2021).

The solar energy sector is the most affected. Over 75% of bioenergy in Kenya is generated from 'traditional biomass' such as charcoal and firewood, and up to 80% of Kenyan households are dependent on firewood for cooking and heating (Karanja & Gasparatos, 2019). The estimated deficit between demand and supply for fuel wood is approximately 20 million metric tons per year, and this is a catalyst for the increased rate of deforestation and land degradation (Kiplagat, Wang, & Li, 2011).

Conclusion:

As demonstrated by the Kenyan case, success in renewable energy looks to need enablers like explicit political leadership, institutional coordination, and stakeholder engagement on the one hand to drive sustainable energy transitions. The availability of huge renewable energy resources has seen Kenya make huge strides toward the accomplishment of its objectives, including reaching energy security and enabling environmentally sustainable economic development, to name just a few, through strategic investments and partnerships. This shall, therefore, continue to call for investment as well as innovation in renewable sources that will be supportive of maintaining the momentum toward Kenya's vision of a green and prosperous future. On top of that, to a greater extent, the Kenyan case is peculiar in that the nation has achieved its policy objective of effectively integrating clean sources of energy with the energy basket of a developing country.

Some of the factors that are driving this mixture of factors in a journey toward sustainable development include:

Geographical Advantage: Kenya is assumed to have a significant reserve of renewable energy sources in the form of solar, wind, geothermal, and hydroelectric. That lies near the equator, and its geography enjoys equitably stable solar radiation, while the Rift Valley region offers it good potential for geothermal. The additional length of the Kenyan coast and diverse topography in which wind and water resources open great opportunities.

Government Commitment: The vibrancy and will of the political class to develop investments in renewable

energy in Kenya have been on point. The government has put in place intergovernmental frameworks that have positive investment incentives to promote renewable energy. Indeed, the 2009 Kenya Vision 2030 and the Energy Act of 2019 both provide succinct targets for increasing the penetration of renewable energy sources that are renewable into the country's energy mix.

Investment in Infrastructure: The country went all out in a bid to ensure investment in infrastructure that is of aid to renewable energy, especially where it concerns geothermal and wind power installations. For instance, the Olkaria Geothermal Complex is among the best geothermal installations. Regarding power, the Lake Turkana Wind Power Project is the biggest wind farm in the country and produces almost thirty percent of the total renewable energy produced by the country.

Public-Private Partnerships: In its commitment to the development of renewable energy, Kenya has risen to the occasion through public-private partnerships as well. Many bilateral organizations and multilateral agencies have already come to Kenya, having already initiated or already entered into collaboration agreements with the government in respective funding and implementations into the transpositions of renewable energy sources. The partnerships have brought technology transfer, the sharing of knowledge, and financial flows to the initiatives of renewable energies.

Off-Grid Solution: Kenya has made giant strides in the journey of access to energy through an off-grid renewable solution. The Kenyan government has come up with the "Last Mile Connectivity Project," which the government says will ensure all people in remote and unprofitable environments are connected to the national grid by using decentralized renewable energy systems such as solar mini-grids and off-grid solar home systems. Besides, it has gone a long way in improving livelihood and energy poverty in communities.

Job Creation and Economic Growth:

In this particular context, the renewable energy sector has substantially influenced job opportunities and the conglomeration of economies. There is a massive realization of various job opportunities in this line of criterion, in context with the jobs realized in the construction, installation, operation, and maintenance of renewable energy development projects.

Environmental Benefits: The usage of renewable resources in producing energy helped cut down Kenya's overreliance on fossil fuels and, therefore, diluted both environmental damage and emissions of greenhouse gases. Other reduced damages include massive deforestation brought on by the consumption of traditional biomass and strengthening climate change resilience in Kenya.

Challenges: Kenya needs to promise more breakthroughs and success in renewable energy because barriers to regulations, financing, difficulty in grid integration, and constraints being experienced show the attainment of renewable energy. Increasing political commitment, sustaining it, producing policy and investment coherence in policy, and offering capacity building and infrastructure that include innovative technology in energy storage, smart grid technology, and mini-renewable energy grids would help treat rising challenges on this path.

4 Decarbonization: An Innovative Solution for a Greener Future

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Climate stabilization necessitates the reduction of carbon dioxide (CO_2) emissions to zero. This persistent gas remains in the atmosphere for hundreds to thousands of years, continuing to emit CO_2 beyond the absorption capacity of natural carbon sinks such as forests, which will increase atmospheric CO_2 levels, leading to ongoing warming. Therefore, it is imperative to pursue "decarbonized" development.

This goal can be achieved through a series of strategies, including renewable energies, energy efficiency, and carbon capture and storage techniques. Decarbonization has become a crucial element in addressing global climate change because it is the only way to reduce atmospheric carbon dioxide levels and slow global warming.

Background:

Human activities such as electricity production, transportation, building, industrial processes, and agriculture are significant greenhouse gas emitters. Given the urgency of this global issue, the international community has implemented the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. Strengthening these measures, the Paris Agreement was adopted at the United Nations Climate Change Conference (COP21) in December 2015.

The Paris Climate Agreement, adopted in 2015, sets critical objectives to counter global climate change. Foremost among these, the Agreement aims to limit the increase in global temperature to well below 2°C above pre-industrial levels

and to pursue efforts to limit the temperature increase to 1.5°C. This requires a drastic and rapid reduction in greenhouse gas emissions.

Additionally, the Agreement obligates nations to fortify their adaptive capacities to withstand the adverse effects of climate change and to foster climate resilience as well as low-carbon development, ensuring that these efforts do not undermine food production. It further underscores the significance of aligning financial flows with climate-resilient, low-carbon development objectives.

Lastly, the Paris Agreement establishes a framework of transparency and assessment to ensure that countries adhere to their commitments and progressively intensify their efforts in the future. This includes a global stocktake every five years to evaluate collective progress toward achieving the agreement's goals. These measures are crucial for ensuring coordinated and effective global action against climate warming.

The Climate of Morocco:

The impacts of climate change are becoming increasingly evident in Morocco, where alterations in precipitation patterns and drought conditions are observed, along with rising average temperatures and more frequent heatwaves. Floods and rising sea levels further exacerbate the situation across numerous regions. To illustrate, the country's water resources are limited, amounting to approximately 20 billion cubic meters, with an average consumption of 700 cubic meters of water per individual annually. This scenario underscores significant water stress. Moreover, the frequency of years characterized by a rainfall deficit exceeds that of wetter years, particularly during the periods from 1980 to 1985, 1990 to 1995, 2007 to 2010, and 2021 to 2024.

The effects of climate change directly influence the availability of water resources by altering hydrological cycles. These changes impact energy production, particularly hydroelectric power, while also substantially altering energy demand. Indeed, periods of intense heat lead to a significant increase in the need for air conditioning systems, thereby testing existing energy infrastructures.

Morocco is actively committed to reducing its greenhouse gas emissions, with a particular focus on the development of renewable energies and the improvement of energy efficiency. This shift toward less carbon-intensive energy sources is part of a national strategy aimed at decarbonizing various economic sectors, including industry, transportation, and agriculture.

What Is Carbon Decarbonization?

Decarbonization refers to the process aimed at decreasing the amount of carbon dioxide (CO_2) emitted into the atmosphere. It involves reducing CO_2 emissions in the short term while investing in technologies and methods capable of supporting the goal of achieving net zero, or nearly zero, emissions in the long

term. This process is crucial in combating global climate change, as it significantly contributes to reducing the global carbon footprint.

Carbon decarbonization is crucial for combating climate change and achieving sustainability goals on a global scale. This process involves reducing or eliminating CO_2 emissions to limit global warming. Increasingly, countries and companies are making firm commitments to achieve carbon neutrality by 2050, thereby demonstrating their commitment to a more sustainable future.

How to Achieve Carbon Neutrality:

The report from the Intergovernmental Panel on Climate Change (IPCC), which includes contributions from Morocco, has identified a range of technically feasible solutions to achieve carbon neutrality by the end of the century. Officially endorsed by the governments of 194 countries, including Morocco, this document represents the consensus of 830 international experts, including scientists, engineers, and economists from over 80 countries. The strategies outlined in the report are structured around four main pillars.

This requires that high-income countries as well as emerging economies succeed in decarbonizing their electricity production by the middle of the century. Low-income countries, which contribute little to global electricity consumption, will have a few more decades to make this transition, but they will ultimately also need to move toward CO_2 emission-free electricity production.

Morocco's Energy Strategy:

Morocco is implementing an ambitious policy against climate change based on a coherent set of policies. This includes the Climate Change Policy initiated in March 2014, the National Sustainable Development Strategy launched in November 2017, and the Nationally Determined Contribution (NDC) presented upon the ratification of the Paris Agreement on September 21, 2016. These initiatives are part of the 2009 National Energy Strategy, developed through action plans with short- and medium-term goals, and they are supported by a clear vision of the necessary legislative, regulatory, and institutional reforms.

Morocco's National Energy Strategy, launched in 2009, aims to diversify the country's energy sources and reduce its dependence on imported fossil fuels. A key highlight of this strategy was the setting of ambitious targets for renewable energies, with a plan to increase their share to 42% of installed electric power capacity by 2020. To achieve this, Morocco has implemented large-scale projects such as the Noor solar power plant in Ouarzazate, inaugurated in 2016, which is one of the largest in the world. Additionally, a commitment to energy efficiency and regional integration of the energy market are also key components of this strategy. These

measures are part of a long-term vision aimed at ensuring a sustainable energy transition and supporting the country's economic growth. Although significant progress has been made in establishing a sustainable energy model, Morocco continues to strengthen and expand its energy efficiency, considering it an essential tool to accelerate its energy transition.

In Morocco, replacing fossil fuels with electricity is a key component of the national energy strategy aimed at reducing greenhouse gas emissions and promoting sustainable development. In the transport sector, the initiative includes the increasing adoption of electric vehicles and the enhancement of charging infrastructure. For heating, the replacement of traditional systems with more efficient electric solutions is encouraged, especially in urban areas. In the industry, shifting to electrified processes not only helps reduce reliance on fossil fuels but also promotes greater energy efficiency. These efforts contribute to an energy transition that supports Morocco's environmental goals while strengthening its energy security.

Promoting energy efficiency across various sectors plays a key role in reducing greenhouse gas emissions, thereby facilitating electrification and reducing energy bills. By optimizing energy use, industries, residential and commercial buildings, as well as transportation, can achieve significant savings while contributing to environmental protection. This approach not only reduces dependence on fossil fuels but also enhances a country's energy security. Moreover, by reducing energy consumption, the involved sectors decrease their ecological impact, improve their competitiveness, and support national and international sustainable development goals. Thus, energy efficiency proves to be a winning strategy for both the economy and the environment.

Energy efficiency in Morocco varies significantly from sector to sector. The industrial sector in Morocco accounts for 22% of total energy consumption and 13% of CO_2 emissions related to energy, primarily from fossil sources. In this sector, manufacturing companies play a crucial role in improving energy efficiency with dynamic capabilities that positively impact energy practices. As for the building sector, constructing highly energy-efficient housing is a critical priority for implementing Morocco's national strategy on renewable energies and energy efficiency. By optimizing the use of certain building materials and adopting appropriate architectural design principles, it is possible to significantly reduce heating and cooling needs in buildings while improving thermal comfort. Aspects such as optimal building orientation, appropriate window sizing, effective thermal insulation, and good lighting management are regulated by the Moroccan Thermal Regulation for Buildings (RTCM 2014), which sets precise standards to promote energy efficiency in the building sector.

Optimizing land management is a strategic lever for increasing countries' capacity to function as carbon sinks, which is essential for mitigating the effects of climate change. Effective land management involves various agricultural, forestry, and conservation practices that maximize carbon sequestration while supporting biodiversity and ecosystems. From an agricultural perspective, adopting soil conservation techniques such as agroforestry, minimal tillage, crop rotation, and maintaining permanent vegetative cover can significantly increase the amount of organic carbon stored in the soil. These practices also reduce erosion and improve soil fertility, which results in increased productivity and enhanced resilience to extreme weather conditions.

In Morocco, sustainable forest management is critically important within the country's environmental policy framework. The kingdom is actively engaged in reforestation initiatives and the restoration of degraded forest areas to combat deforestation and the effects of climate change. Forestry management adapted to the Moroccan context not only aims to capture carbon dioxide from the atmosphere but also to promote the conservation of the country's rich and unique biodiversity.

These forest management strategies must be carefully tailored to Morocco's specific ecological and climatic conditions. They should also leverage traditional knowledge and meet the needs of local communities, which often rely on forest resources for their livelihoods. Integrating these elements ensures the sustainability and effectiveness of the efforts undertaken, thus contributing to Morocco's ecological and economic resilience in the face of global environmental challenges.

Wetland conservation in Morocco plays a significant role in the country's decarbonization efforts. Wetlands such as the Sidi Moussa-Oualidia lagoon complex, the temporary wetlands of the Sebou Delta, the Ad-Dakhla Bay, the Mehdia-Kenitra wetland area, and others provide essential ecosystem services, including carbon storage and sequestration, which can help mitigate climate change.

Investing in Technology for a Greener Future: To reduce emissions and achieve net-zero or near-zero emissions, countries and organizations must invest in technologies and practices that will assist them in meeting these goals. These technologies and practices may include investments in renewable energy, energy efficiency, carbon capture, and storage, as well as smart electric meters for real-time monitoring of energy consumption.

Carbon capture and storage (CCS) technologies are essential for reducing carbon dioxide emissions from large industrial sources and power plants. The process begins by capturing CO_2 produced either directly from combustion

gases (post-combustion), by intervening before the combustion of fossil fuels (pre-combustion), or even by extracting CO_2 directly from the ambient air (direct air capture). Once captured, the CO_2 is compressed and transported, usually by pipeline, to a storage site where it can be injected into deep geological formations such as depleted oil and gas fields or deep saline aquifers for permanent storage. These technologies are considered vital for achieving carbon neutrality goals, especially in sectors where emission reduction is particularly challenging, such as power generation and heavy industry. However, the development and implementation of CCS must be accompanied by strict regulations and monitoring measures to ensure the effectiveness and safety of long-term CO_2 storage.

Analysis of Moroccan Scenarios for a Sustainable Future:

Morocco has developed several scenarios to orchestrate its transition toward a decarbonized economy. These scenarios aim to significantly reduce greenhouse gas emissions across key sectors of the Moroccan economy. Three main scenarios have been considered:

• The "Business as Usual" (BAU) scenario projects current trends without major changes in policies or technologies. This scenario serves as a benchmark to assess the effectiveness of more ambitious scenarios.

• **The "Accelerated Ambition" (AA) scenario,** which involves increased efforts and stricter policies to accelerate emission reductions. This scenario assumes rapid adoption of clean technologies and vigorous implementation of environmental legislation.

• **The "Green Development" (GD) scenario**, which is the most ambitious, envisages a profound transformation of the economy with substantial investments in renewable energies, energy efficiency, and sustainable technological innovations. This scenario aims not only for carbon neutrality but also for comprehensive sustainable development.

The "Accelerated Ambition" and "Green Development" scenarios aim for more ambitious greenhouse gas reductions than current policies. By 2030, these two scenarios anticipate a reduction in emissions by 25% compared to current levels excluding activities from agriculture, forestry, and other land use (AFOLU). The "Accelerated Ambition" scenario thus exceeds the conditional target of the NDC but does not meet its unconditional target.

The "Green Development" scenario surpasses both the conditional and unconditional targets set by the Nationally Determined Contributions (NDC), achieving a 40% reduction in greenhouse gas (GHG) emissions. By 2050, GHG emissions will see a significant decrease under the "Accelerated Ambition" and "Green Development" scenarios, with reductions of 56% and 74%, respectively, compared to the Business as Usual (BAU) scenario. The decarbonization goals of the "Accelerated Ambition" and "Green Development" scenarios would be primarily achieved by increasing the electrification of end-use sectors and by incorporating more renewable energies, including green hydrogen, into electricity production.

Conclusion:

To successfully decarbonize various sectors such as transportation, electricity production, industry, and residential, it is crucial to adopt appropriate technologies, improve energy efficiency, and expand the electrification of end uses while gradually moving away from fossil fuels. These ambitious measures are essential not only for reducing local pollution but also for stimulating economic growth through innovations that promote sustainable and competitive development. These efforts represent a key step toward achieving the environmental goals of 2050, thus ensuring a greener future for Morocco.

Fourth: Reports on African Affairs

Prepared by the Research and Studies Department at Saif Bin Helal Center

1 How Does the Nigeria-Algeria Gas Pipeline Project Help Europe Solve the Energy Crisis?

Within the current challenges facing global energy security, the Nigeria-Algeria Gas Pipeline Project stands out as a strategic initiative that promises to transform the energy landscape in Europe and Africa. This project comes at a critical time. As the European continent strives to diversify energy sources and reduce dependence on Russian imports, this makes the search for sustainable and reliable alternatives crucial.

With the resumption of work on the trans-Saharan gas pipeline project, which extends thousands of kilometers from the heart of Nigeria to the coast of Algeria, hopes are renewed for the possibility of achieving energy security and supporting economic development on the African continent. This project is not only a step toward energy independence for Europe but also an opportunity for African countries to enhance regional cooperation and achieve common growth.

The importance of the Nigeria-Algeria Gas Pipeline goes beyond the economic aspects to include the strategic dimension. It reflects the strong will of the three partners to embody a regional facility with an international dimension. With the commitment of the African Development Bank and the African Union to support the project, the pipeline demonstrates Africa's ability to achieve economic integration and contribute to global energy security.

This report is a review of recent developments in the Nigeria-Algeria Gas Pipeline Project and aims to shed light on the opportunities and challenges it faces and how this huge project can contribute to meeting the growing demand for energy in Europe and supporting economic development in Africa.

The Importance of the Project:

The Nigeria-Algeria Gas Pipeline is considered one of the most important and strategic projects in Africa, with a length of about 4,000 and about 128 kilometers. About 2,200 kilometers have been completed, and the final cost of the project exceeds more than 13 billion dollars.

The Algerian Minister of Energy said on Saturday, March 2, 2024, during a press conference held on the sidelines of the Gas Exporting Countries Forum: "All parties agree to complete the project. The pipeline extends over a distance of about 4,000 kilometers from Abuja to the coast of Algeria. Work on the pipeline has been completed up to the Kano region, and only 100 kilometers remain to reach the Niger border."

As for Algeria, the pipeline has been completed up to the Ahnet area, leaving only 700 meters to the border with Niger. About 100 kilometers of the project remain in Nigeria and about 700 kilometers from the Algerian side. As for Niger, there are about 1,000 kilometers, representing the Niger strip, and Algeria has a network of pipelines belonging to the Sonatrach complex, which exceeds 2,000 kilometers, which reflects the end of the opening of the gas pipeline between Algeria and Niger.

Representatives of the two countries agreed to complete the project on February 18, 2024, for the pipeline to pass so that gas can flow to Europe. The pipeline extends from the city of Warri in southern Nigeria through Niger to the gas distribution center in the Hassi R'Mel region in Algeria.

Algeria signed a memorandum of understanding in July 2022 with Nigeria and Niger, the aim of which is to conduct a feasibility study and deepen studies to complete the Nigeria-Algeria Gas Pipeline Project. The pipeline starts in Abuja, passes through Niamey, and then heads to Algeria, intending to pave the way for its export to Europe.

The Aim of the Project:

The project aims to transport about 30 billion cubic meters of Nigerian gas every year to Europe through Algeria, and the project is of great importance. Therefore, it receives support from the African Development Bank and the African Union, and the pipeline is considered an opportunity for the development of the three countries, especially the countries through which the pipeline will pass to transport gas. Neighboring countries will also benefit from the pipeline—one of them is Mali—as these countries can transport gas through sub-pipelines for each gas transport.

After it enters into force, the project will allow the supply of gas to the Sahel countries, and the pipeline to Algeria represents an example of the will of the three partners to embody a regional facility with an international dimension. The cost of the pipeline amounts to about 13 billion US dollars, and on September 22, 2021, the Minister of Oil of Nigeria stated that Nigeria is expected to begin construction of the project, and he met with a number of companies and countries in Europe to obtain financing to complete the project.

The year 2022 witnessed the announcement of financing sources in Egypt and Italy, through which the project will be provided with financing so that gas can be pumped from Africa to Europe. Nigeria's Minister of Finance, Zainab Ahmed, stated that Nigeria is looking

for low-cost financing to expand gas projects to meet local needs in addition to exporting them to various countries around the world that need to export gas.

Gas is considered important at this stage as it is considered a clean fossil fuel compared to other types of fuel. Therefore, Nigeria wants to expand gas production, and Nigeria's Oil Minister, Timbre Sylva, confirmed on September 7, 2022, in his participation in the "GASTECH" conference, which was held in Milan, Italy, that Europe seeks to abandon Russian gas, and to achieve this, it requires obtaining alternatives to Moscow. Nigeria is scheduled to take a decision soon regarding infrastructure investments for the gas export pipeline to the African continent, which exceeds $10 billion. The Algerian-Nigerian gas pipeline is gaining great importance as it is an investment supported by the Bank and the African Union. He pointed out that Algeria is contributing to the restructuring of the African Development Fund with about $10 million, which makes Algeria one of Africa's largest contributors to the Fund.

Challenges Facing the Project:

The project faced several challenges. On July 26, 2023, the Republican Guard in Niger witnessed the move to carry out a military coup that resulted in the arrest of President Mohamed Bazoum and his family. The tense security situation following the military coup in Niger led to the disruption of work on the project, especially in light of Europe's hostility to the new leaders in Niger.

Niger is considered a pivotal point in the African geopolitical scene as a result of the active involvement of France, the United States of America, Turkey, Russia, and the UAE, and Niamey plays a major and pivotal role at the intersection of energy resources and geopolitical interests.

A major challenge that has led many to question the feasibility of the project is the problem of the local basic infrastructure in Nigeria, especially concerning the troubled AKK pipeline. An expert at the Lagos-based legal consulting firm Megathos Law Practice, Olufola Wusu, stated that the project faced challenges.

These are as follows:

* The security situation in Niger and neighboring areas poses a great danger and affects the stability of the project before and after construction.

* The pipeline's reliance on the late KK Pipeline, which is self-financed, is due to complexity and uncertainty.

2 A European Plan to Rely on Green Hydrogen Production in North African Countries

The current era is characterized by radical transformations toward sustainability and clean energy, and the importance of green hydrogen is highlighted as an essential component of the global energy future. Green hydrogen production in North Africa is a strategic step not only to enhance the continent's energy independence but also to support Europe in achieving its environmental and energy goals.

With the European Union moving to import millions of tons of green hydrogen, North African countries are seeking to accelerate the pace of development and international cooperation to achieve this goal. These countries possess enormous natural resources and untapped potential that make them candidates to be major centers for green hydrogen production. Which provides promising opportunities for economic development and regional integration.

This report aims to review the efforts made in the field of green hydrogen in countries such as Egypt, Mauritania, Morocco, and Algeria, with a focus on the challenges and opportunities associated with this sector. We will begin by looking at green hydrogen projects in Egypt, which are an ambitious plan to produce millions of tons of green hydrogen, and we will discuss the progress achieved and the challenges facing the implementation of these projects.

African countries are rushing to sign memorandums of understanding and submit offers to finance projects in Africa. African

countries enjoy strong solar and wind energy resources, in addition to available land and gas export pipelines to Europe.

Several countries on the continent of Africa are considered potential centers for the production of green hydrogen, and we will present the experiences of several countries, including Mauritania, Morocco, and Algeria. Despite the advantages enjoyed by the continent of Africa, there is a state of uncertainty regarding the demand for clean, green hydrogen. In addition to several challenges facing the green hydrogen sector and its exports, which have made the announced projects face many challenges, we will now begin presenting green hydrogen projects in Egypt:

"Morocco" Projects in the Green Hydrogen Sector:

The Kingdom of Morocco is considered a potential supplier of cheap hydrogen to Europe due to the country's ability to benefit from solar and wind resources. Due to its proximity to Spain and the availability of a pipeline to transport this clean fuel, Morocco received support from the European Union during the COP28 climate conference worth about 50 million euros through the Green Partnership with Morocco program aimed at decarbonization.

The cost of producing green hydrogen in Morocco will not be much lower than its production in Spain, which will effectively offset the additional cost of building a pipeline. Morocco hopes that the GDP of hydrogen will reach about 4 terawatts per hour, which will be equivalent to 121 thousand tons, and that Morocco will export about 10 terawatts per hour, which is equivalent to 303 thousand tons, by 2030.

The group is working to spend about $1.5 billion of its budget on a green ammonia production plant, and the plant's production capacity is about 200 thousand tons annually. It is expected that the factory will begin production during the year 2026, and $7 billion will be allocated to establish another factory, but it will have some advantages as it will be larger. The production capacity of the project will reach about one million tons annually, and it will begin operation in 2027.

Morocco intends to build a huge hydrogen pipeline linking 11 countries in West Africa. It is planned to be built with a length of 5.6 thousand kilometers and will be operated in parallel with the natural gas pipeline linking Nigeria and Morocco, with a value of about 25 billion dollars.

Total Energy intends to implement a hydrogen production project with investments amounting to about 100 billion dirhams and depends on generating 10 gigawatts of solar and wind energy. As for local companies in Morocco, Falcon Capital intends to implement the "White Dunes" project to produce green hydrogen. The investment cost of the project will reach approximately $2 billion.

Morocco has about eight projects aimed at producing green hydrogen, but so far they are still at an early stage, which leads to a delay in the issuance of incentives for hydrogen production.

Algeria's Projects in the Hydrogen Sector as an Important Supplier for Europe:

Among the global shift toward renewable and clean energy, Algeria is emerging as a major player in the green hydrogen market, aiming to meet an important part of European demand for this promising fuel. By 2040, Algeria aspires to become a major provider of green hydrogen, with ambitious plans to create subsea infrastructure linking it to the European market via Italy and Tunisia.

The value of pilot investments amounts to about 20 million euros from Germany, and cooperation projects with international companies such as the South African "Sasol" and Algeria are laying strong foundations for low-carbon hydrogen production. These steps reflect the country's commitment to developing the clean energy sector and exporting it on a large scale to Europe. Which strengthens its position as a regional center for sustainable energy.

This project aims to explore Algerian efforts in developing the green hydrogen industry and its impact on European energy security, with a focus on strategic plans, international financing, and industrial partnerships that shape the region's energy future.

Algeria has a plan that aims to provide 10% of European demand for green hydrogen by 2040, especially among the country's plans to establish an undersea pipeline whose goal is to transport fuel to Italy via Tunisia, but the agreement to establish the line has not been signed yet.

Germany provided approval to finance a pilot project worth about 20 million euros with a capacity of about 50 megawatts in the city of Arzew, which is located west of Algeria. The financing came as part of a commitment to build the infrastructure for production and export and will be on a large scale for Europe.

The Algerian company Sonatrach plans to cooperate with the South African company Sasol to produce low-carbon hydrogen in Sicily, with a volume of 7,800 tons annually and 25,000 tons of low-carbon gas annually. OPEC stated that Algeria already has about four green hydrogen projects, which will open by the end of 2023.

Mauritania Projects to Produce Green Hydrogen:

European Union countries have made promises to Mauritania regarding projects to produce green hydrogen and its derivatives. Mauritania currently has four projects, and last October saw the European Union launch an initiative aimed at supporting renewable energy and infrastructure projects in Mauritania.

The European Commission proposed the possibility of producing green iron and steel by taking advantage of the potential of green hydrogen and iron ore reserves to export them to the European Union. Mauritania has received several projects proposed by international developers. Despite all of this, Mauritania is still at an early stage.

A Danish company, Go Energy, is planning to build a plant to produce green hydrogen. It will be built in the shape of a crescent, and its production capacity will reach about 35 megawatts by generating 60 gigawatts of renewable energy (sun, wind).

Fifth: Statistical Reports

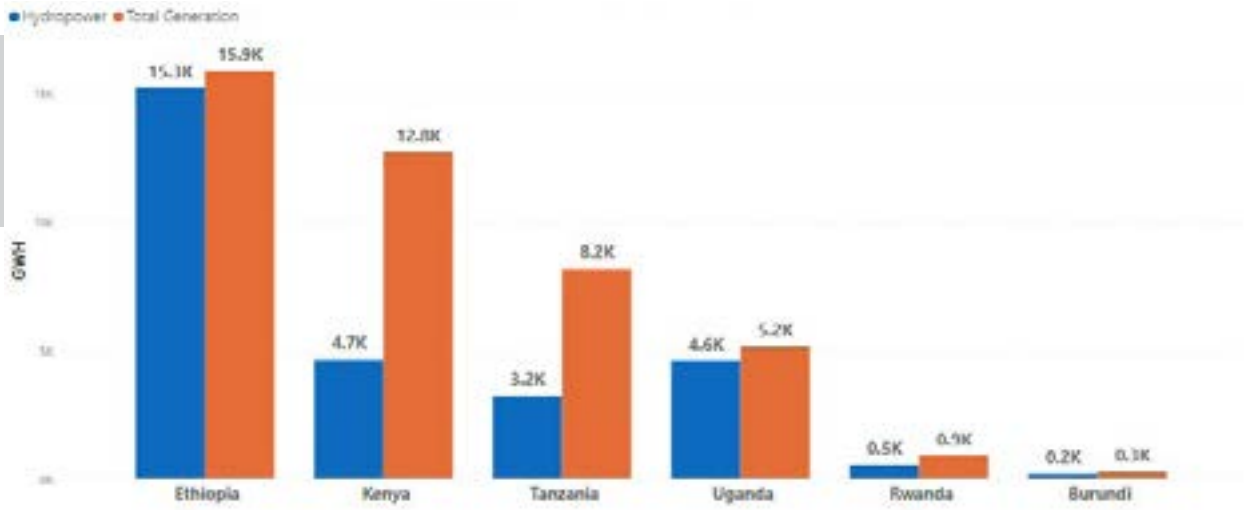
Prepared by the Research and Studies Department at Saif Bin Helal Center

Hydropower in East "Africa" Revives the African Economy

East Africa is characterized by water resources that enable it to be active in the field of hydroelectric power, between the Nile Basin, the lakes of the Great Valley, and many rivers. Hydroelectric projects are one of the most important projects that contribute to achieving sustainable development in East African countries, despite the successive obstacles facing these projects from a lack of funding, weak infrastructure, and lack of expertise. In this descriptive and analytical report, Saif Bin Helal Center provides monitoring of projects in this region, both current and currently being built, discusses their origin, what they produce, and the cost of their production, and reviews the percentage of clean electricity produced from hydroelectric power stations from the total electricity production.

Hydropower Is an Opportunity to Revive the Energy Market:

The region has enormous natural resources that make it ready for hydropower production, and it is clear from the figures shown in the following figure that Ethiopia produces electricity—from 11 dams on its territory—with a capacity of 14 thousand GHz, followed by Kenya and Uganda, and this translates into great economic opportunities; hydropower is currently responsible for more than 80% of electricity generation in the region. In general, hydropower accounts for more than 80% of the total electricity production in that region.



Generated electric power and hydroelectric power

Hydropower Projects in Africa Between Left and Right:

Small businesses succeed in "Tanzania":

Reliance should not necessarily be placed on giant projects; rather, Tanzania's small-scale experience is among the most successful ones. The Tanzanian government signed agreements with the African Development Bank and the French Development Agency in April 2023 for loans totaling $300 million, in addition to a grant from the European Union aimed at supporting development projects, earmarked for funding the Kakono hydroelectric power station, which has a capacity of up to 87.8 megawatts and is located in the Kagera region in the northern part of Tanzania.

The project of the "Rujigi 3" hydroelectric power station in Tanzania, Burundi, Congo, and Rwanda":

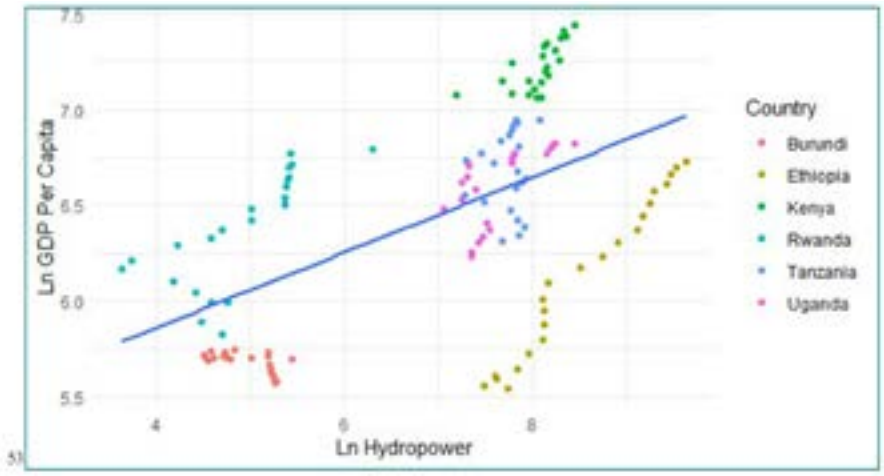
Among the medium-sized projects, Burundi, the Democratic Republic of the Congo, and Rwanda are participating in a joint project for the Rujiji 3 hydroelectric power station, which is part of the Infrastructure Development Program in Africa (PIDA). The project includes the construction of a dam on the Rujigi River between the democratic republics of the Congo and Rwanda, as well as the construction of a power plant with a capacity of 147 MW and a distribution station. It is expected that this project will contribute significantly to increasing the hydroelectric capacity in Burundi and Rwanda's capacity.

The figures and statistics reveal the importance of hydropower in the African continent, according to International Studies and reports, and a study conducted by the World Bank in 2020 confirms that increasing the supply of hydropower leads to an increase in employment opportunities in East African countries by 10%, which leads to an improvement in the standard of living in the countries of the region. Perhaps the most important point of the articles and scientific literature is that one of the most important benefits that have returned to East African countries from hydroelectric projects

is the provision of new job opportunities in the fields of construction, operation, and maintenance, other than indirect employment opportunities. In addition to increasing productivity by supporting productive sectors with the necessary energy after completion, it is also understood that the outcome of all this is to improve the standard of living. In general, hydropower projects are one of the most important projects that contribute to achieving sustainable development in East Africa for several reasons: most notably, the high cost of the projects themselves before they generate a return that covers their cost, in addition to the shortage of technical personnel in the African region as a result of the deterioration of education, as well as environmental impacts such as seismic foci and changing river courses as a result of climate change factors, which threaten the sustainability of projects, and finally—the most miserable element—the permanent fluctuations in political systems in these regions, in addition to social instability. There is no doubt that hydropower has a great impact on sustainable development projects, and both of them have a close relationship. We use the following evidence through measurable indicators such as GDP per capita as a strong indicator of the quality of life and compare it with hydropower projects and what they produce, and identify whether through previous literature or through statistical analysis on the relationship between these variables.

الدولة	الناتج المحلي الإجمالي للفرد	الكهرباء المولدة من المحطات الكهرومائية
بوروندي	264.3648	196.42
إثيوبيا	834.9913	15295.5
كينيا	1705.74	4656.3
رواندا	889.7488	542.81
تنزانيا	1041.751	3233.17
أوغندا	920.5476	4637.76

GDP per capita, and electricity generated from hydroelectric plants



A figure showing the relationship between GDP per capita and hydropower

Gross domestic product per capita, electricity generated from hydroelectric plants:

The previous figure shows the centrifugal relationship between the amount of hydropower produced and GDP per capita in East African countries, where the two variables were tracked from the five selected countries (East African countries) in the period from 2000 to 2021. The estimated regression line in the figure shows the directivity of this relationship in the sample as a whole, and the line comes with a positive slope, indicating that with each increase in the amount of hydropower, GDP per capita increases by estimated less than half of the increase in the amount of hydropower produced.

Based on this, the Pearson test was conducted for the correlation between the two variables, and the test result showed a significant positive correlation between the two variables. To focus on studying the impact of hydropower on GDP per capita, a regression model was estimated based on longitudinal panel data. The results showed that there is a significant positive impact of hydropower on GDP per capita in East African countries; the model shows that with an increase in the amount of hydropower produced by 1%, GDP increases by 39%. Based on a p-value of approximately 0.0, the estimated impact is considered statistically significant, but due to the reliance on a simple model and without fully testing the statistical assumptions of the model, the direction of the impact will be relied on, and it will be recognized that there is a positive impact of hydropower on GDP per capita in South-East African countries following previous studies.

Conclusion:

1. East Africa has the potential to greatly benefit from hydropower projects through the scattered stations and dams, whether under construction or already established.
2. The most important obstacles to hydropower projects are the absence of political stability and political and economic fluctuations.
3. The presence of a statistically significant positive direct relationship between hydropower and GDP per capita; the presence of a positive and significant impact of hydropower on GDP per capita.

Study Supplements:

First: Pearson's Correlation Test:

```
        Pearson's product-moment correlation
        Capita and Hydropower Per data:  GDP
    t = 3.5726, df = 130, p-value = 0.0004964
alternative hypothesis: true correlation is not equal to 0
                :95 percent confidence interval
                    0.1350333 0.4470389
                      :sample estimates
                            cor
                        0.2990066
```

مخرجات لغة R

To confirm the relationship between the two variables, the Pearson correlation test was performed, and the test result shows a statistically significant positive direct correlation. Based on the p-value, the nihilistic assumption that the degree of correlation between the two variables is equal to zero was not accepted.

The Estimated Regression Model:

```
Oneway (individual) effect within Model

Balanced Panel: n = 6, T = 22, N = 132

Residuals:
     Min.   1st Qu.    Median   3rd Qu.      Max.
-0.468887 -0.125950  0.032411  0.122218  0.298338

Coefficients:
                  Estimate Std. Error t-value  Pr(>|t|)
log(Hydropower)   0.392006   0.031686  12.371 < 2.2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Total Sum of Squares:    7.6333
Residual Sum of Squares: 3.4316
R-Squared:      0.55044
Adj. R-Squared: 0.52886
F-statistic: 153.051 on 1 and 125 DF, p-value: < 2.22e-16
```

مخرجات لغة R

The model was based on longitudinal panel data from East African countries in the period from 2000 to 2021. The natural logarithm of all observations was taken before the estimate, and the estimate was made using the fixed effects model as a statistically appropriate model in most cases and to take into account individual differences between countries when estimating.

The results of the model show that there is a significant positive impact of hydropower on GDP per capita in East African countries; the model shows that with an increase in the amount of hydropower produced by 1%, GDP increases by 39%, and depending on the p-value, which is approximately equal to 0.0, the estimated impact is considered statistically significant.

Sixth: In Translation

Prepared by the Research, Studies, and Translation Departments at Saif Bin Helal Center

Energy in "Africa" As Seen by Others

How do foreign countries and institutions see the energy reality on the continent of "Africa"? And what role do they see in drawing the map of the future?

Introduction:

Africa boasts a wealth of natural resources, including vast reserves of both renewable and traditional energy sources. Global estimates indicate that the continent possesses 10% of the world's oil reserves, 40% of its natural gas reserves, and 60% of its hydroelectric potential. Despite these immense capabilities, Africa still suffers from severe energy shortages. The International Energy Agency revealed in its report that nearly 600 million people on the continent lack access to electricity, with almost 900 million relying on unclean energy sources such as firewood and coal for cooking and heating.

Foreign investors, whether countries, development institutions, or investment companies, are aware of these potentials and challenges, which has led to an increase in their interest in investing in the energy sector in Africa in recent years.

The United Nations Conference on Trade and Development revealed in 2021 that the flow of foreign direct investment in the energy sector in Africa will reach 38 billion US dollars, which is an increase of 5% from 2020.

This research aims to analyze the vision of foreign countries in energy investment in Africa, focusing on the motives of foreign countries to invest in the continent's energy sector and mentioning specific examples. The research also analyzes the areas of foreign investment in energy in Africa, **focusing on specific projects:**

- Assess the challenges and opportunities facing foreign investment in energy in Africa, citing real-life examples.

- Explore the role of foreign countries in supporting sustainable development in Africa through energy investment, focusing on specific initiatives.

The importance of this research is highlighted in its attempt to understand the changing dynamics of foreign investment in the energy sector in Africa and try to highlight the point of view of foreign countries and institutions operating on the continent and their goals, as well as trying to discuss the opportunities and challenges of foreign investment in this sector and the mutual benefits between the countries of the continent and investor countries and institutions, which helps decision-makers in the continent to make the right decisions related to accepting or rejecting foreign partnerships based on understanding the reasons and motives of partners to invest.

The first theme: The challenges faced by Africa in the field of energy The continent of Africa is facing enormous challenges in the field of energy, hindering its efforts toward sustainable development and improving the standard of living of its people. These challenges range from underinvestment to rising costs, energy insecurity, and devastating environmental impacts.

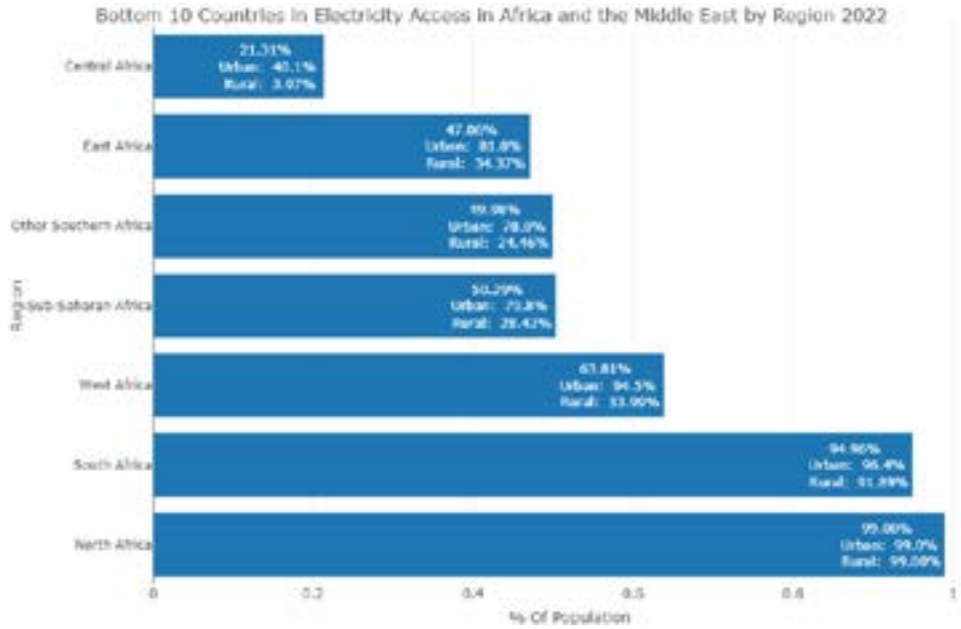
1. Limited access to energy:

Based on the data of the International Energy Agency (IEA) for 2022 The following figure shows the percentage of the population with access to electricity in Africa and the Middle East.

It is clear from the figure that there are a lot of African countries suffering from the problem of access to electricity; there are 27 countries in Africa where the percentage of the population with access to electricity does not exceed 50%, 41 African countries where the percentage does not exceed 80, and only 10 countries where the access to electricity exceeds 90%.

At the level of the Middle East, Yemen, and Syria also suffer from the problem of lack of access to electricity, as it is clear from the data that more than half of the population of Yemen does not have access to electricity, while Syria has only 9%.

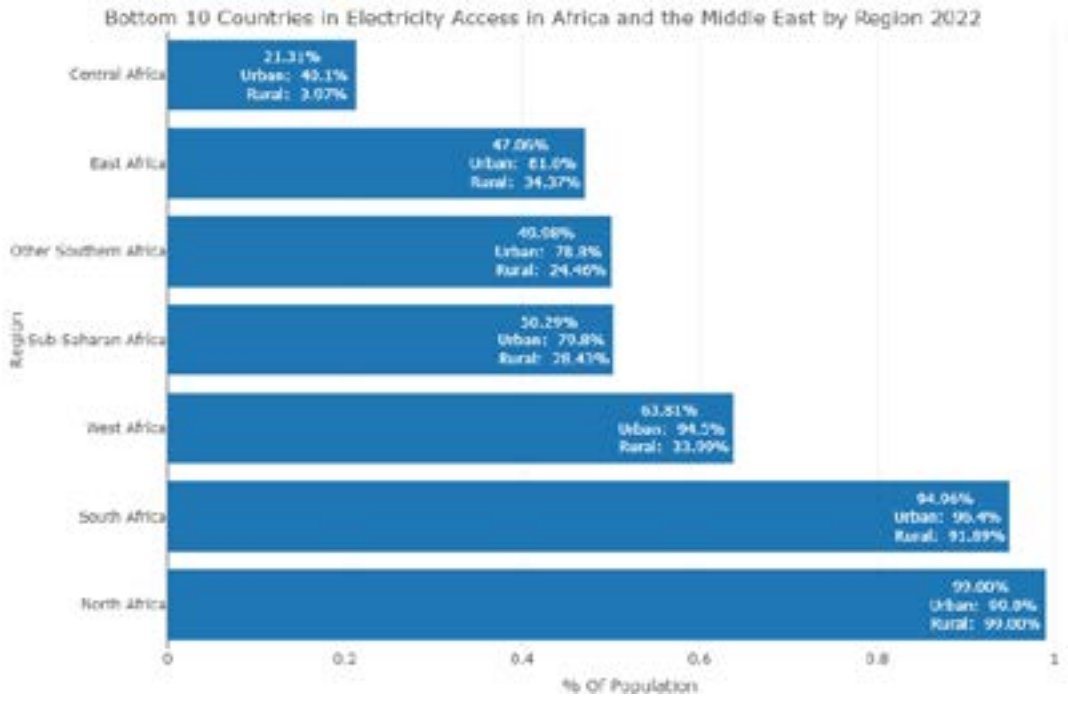
As for the problem of access to electricity at the level of African regions, the following figure shows, based on IEA data, the percentage of the population with access to electricity in each of the African regions.



It is clear from the figure that the North region does not suffer from the problem of access to electricity, but more than half of the population in central and eastern African countries and some southern African countries do not have access to electricity, and more than 70% of the rural population in Sub-Saharan Africa do not have access to electricity, which shows that the problem is significantly concentrated in rural areas.

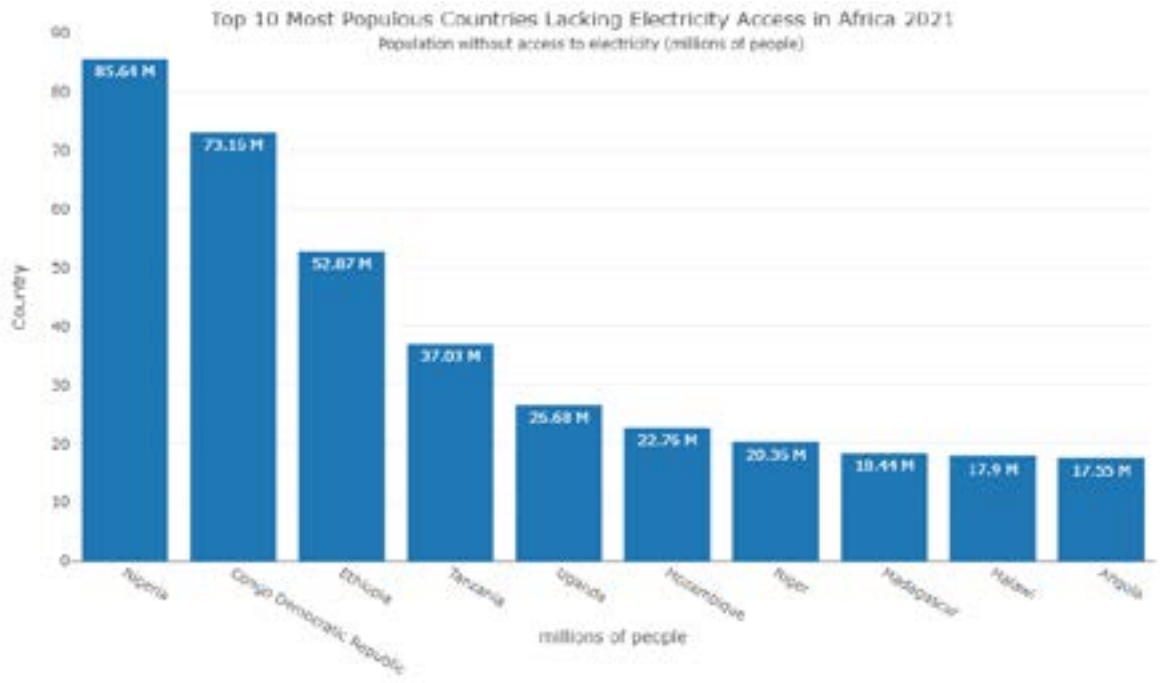
The Central African region is also the darkest in Africa; only 21% of the population has access to electricity; that is, 79% of the population of Central Africa lives in darkness without electricity, and the problem is not only at the level of rural areas; only 40% of urban residents in Central Africa have access to electricity, which is also the lowest level of access to electricity in urban areas in Africa, and rural areas in Central Africa live in complete darkness; only 4% of rural residents in Central Africa have access to electricity.

The following figure, based on data from the International Energy Agency (IEA), shows the 10 most African countries suffering from the problem of access to electricity.



The top of these countries is the Central African Republic, where the percentage of the population with access to electricity does not exceed 6%—that is, almost 94% of the population does not have access to electricity—followed by South Sudan, Chad, and the Democratic Republic of the Congo, and all these countries do not exceed 30% of the population with access to electricity.

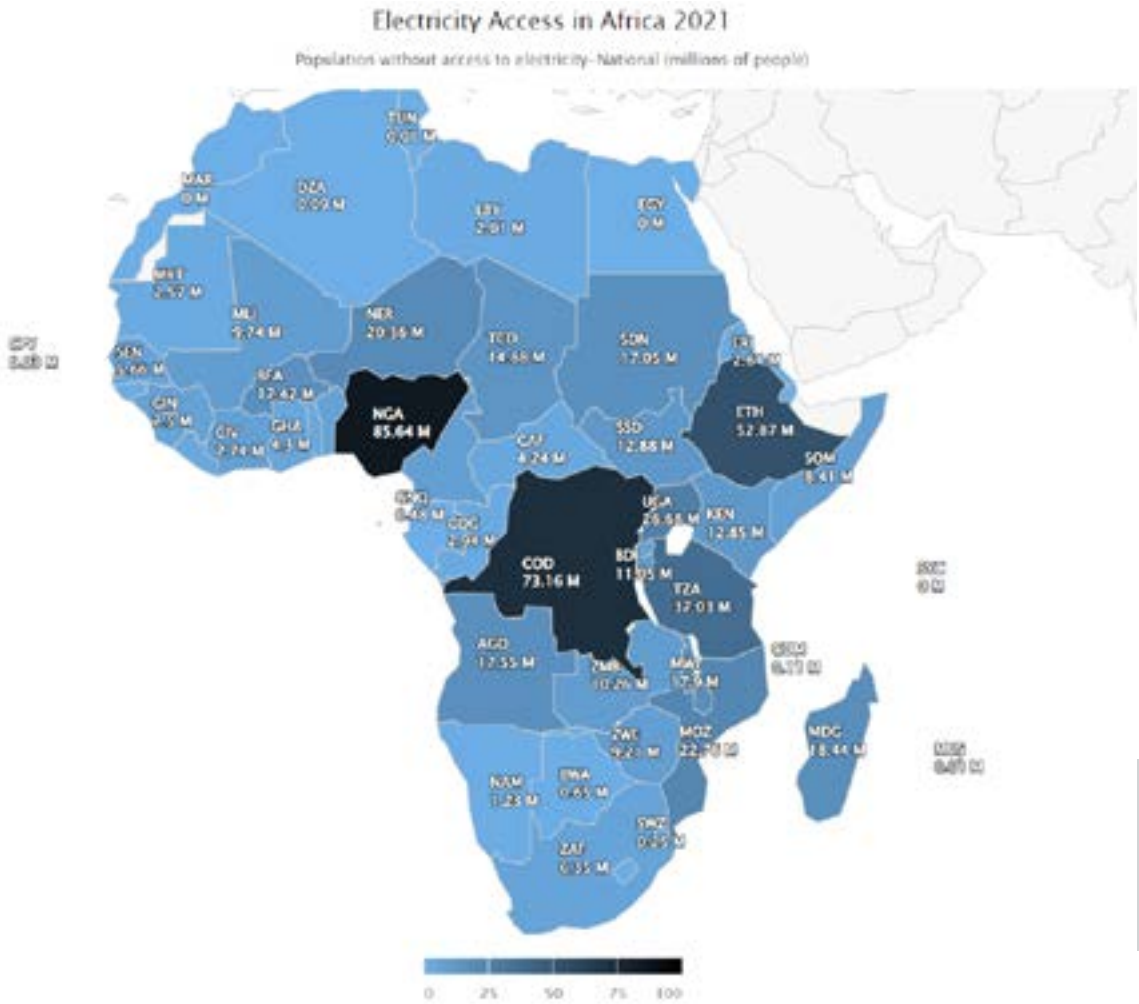
The following figure, based on the 2021 data from the Africa Energy Portal (AEP) website, also shows the top 10 countries in terms of the number of people without access to electricity.



Niger is at the forefront of these countries; 85.6 million people in Niger do not have access to electricity, which is a relatively large number; the total population in most African countries does not exceed 85 million people. But because there is a problem with access to electricity with a population of more than 200 million the scale of suffering from a lack of access to electricity becomes great.

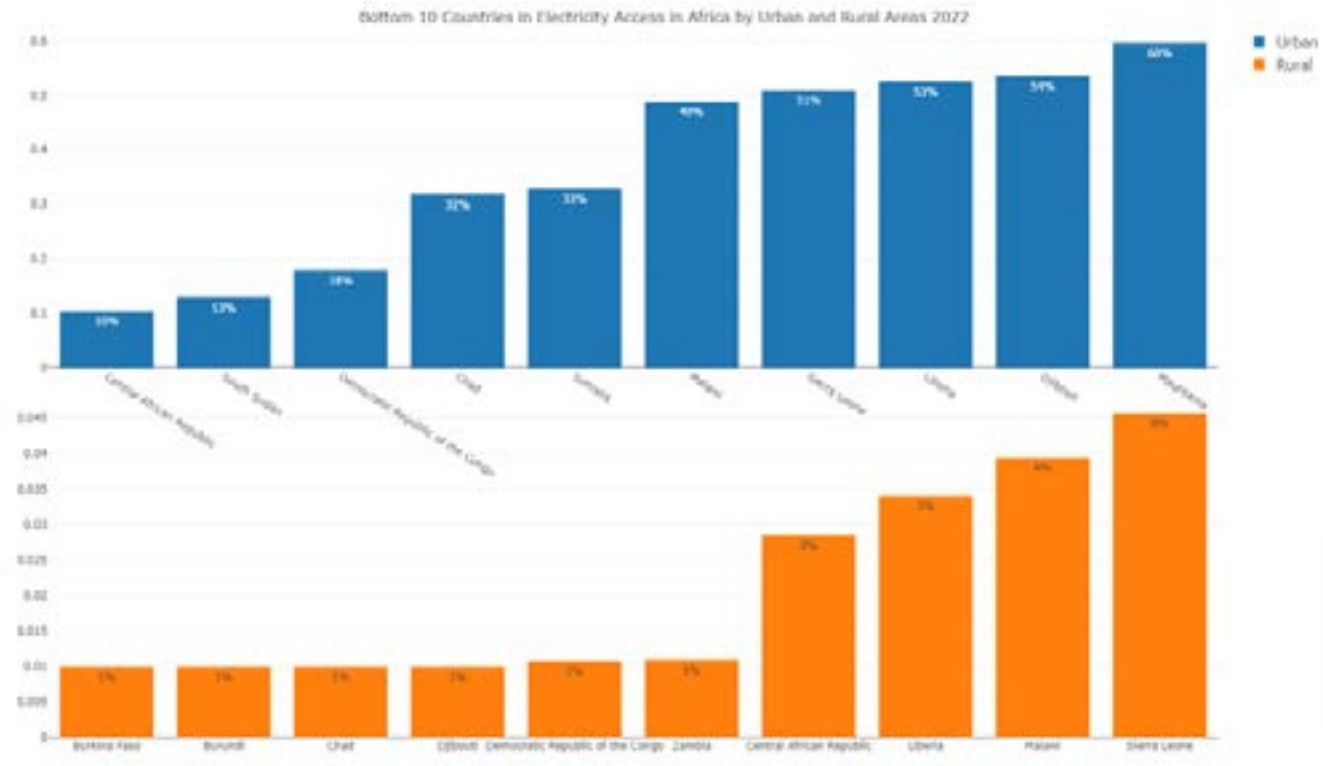
Although the Central African Republic and South Sudan are the two countries with the highest percentage of residents without access to electricity, Niger and the Democratic Republic of the Congo are the two countries with the highest number of people without access to electricity, and this is due to the large difference in population between African countries.

Based on AEP data, the following map shows the variation in the number of people without access to electricity in African countries.



The gradient to black on the map reflects the increasing number of people without access to electricity, and it is also clear that the Central African region contains the largest number of countries in terms of population with access to electricity.

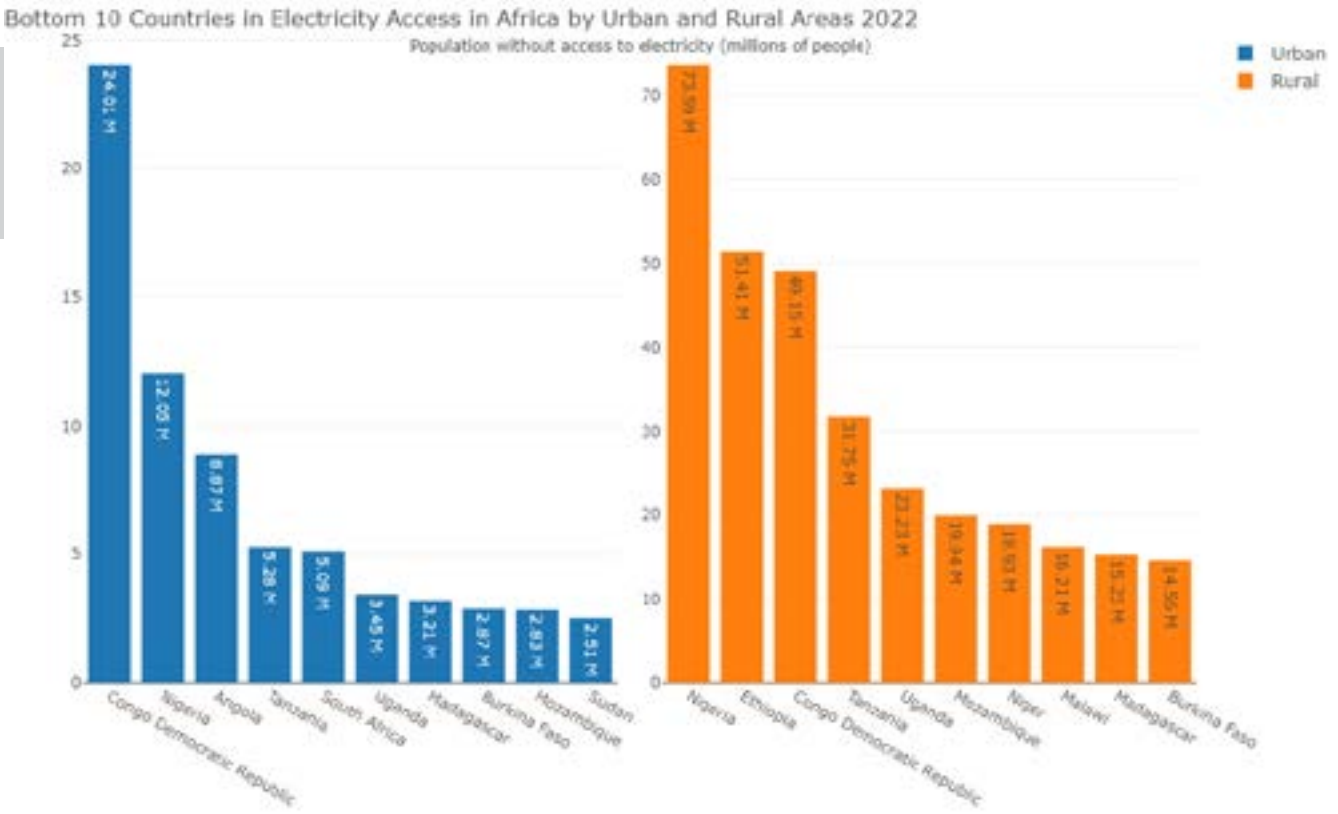
As for the rural and urban areas, the following figure shows the 10 most rural and urban areas suffering from the problem of lack of access to electricity.



The figure shows that the urban areas in the Republic of South Africa and South Sudan are also the most urban areas in Africa suffering from access to electricity, which has a major impact on attracting investments in these areas, as the problem is not limited to the rural level only but also at the urban level, which is supposed to be the center of economic activities, making it a great challenge for economic growth in these two countries.

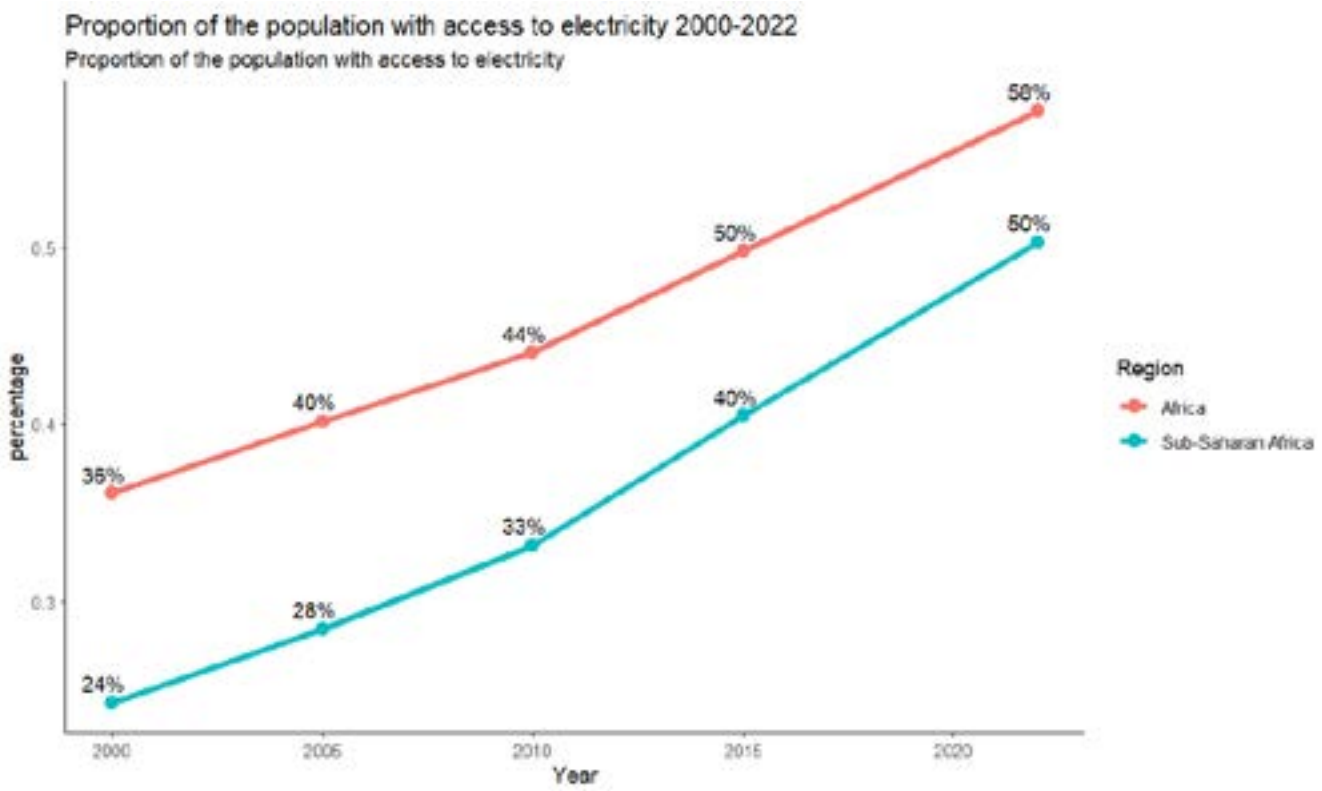
The percentage of access to electricity in the countryside in these countries does not exceed 5%, and 90% of the rural population in 15 African countries do not have access to electricity, which indicates the great suffering suffered by rural people in Africa in accessing electricity. In terms of population, the Democratic Republic of the Congo and Nigeria are the two most populous African countries without access to electricity in urban areas, with 24 million and 12 million people, respectively, living without access to electricity in urban areas in these two countries.

In terms of rural areas, Nigeria is the top country with 73.6 million people without access to electricity, followed by Ethiopia with 51 million people.



Although the electricity situation in many African countries has deteriorated significantly, African countries are making attempts to implement the seventh goal of the United Nations Sustainable Development Goals (commonly known as SDG7), which is to ensure universal access to affordable electricity services, as well as international efforts such as the US government-led international partnership called Energy in Africa to mobilize resources to increase access to electricity and eliminate energy poverty. However, progress is relatively slow in increasing the provision of electricity.

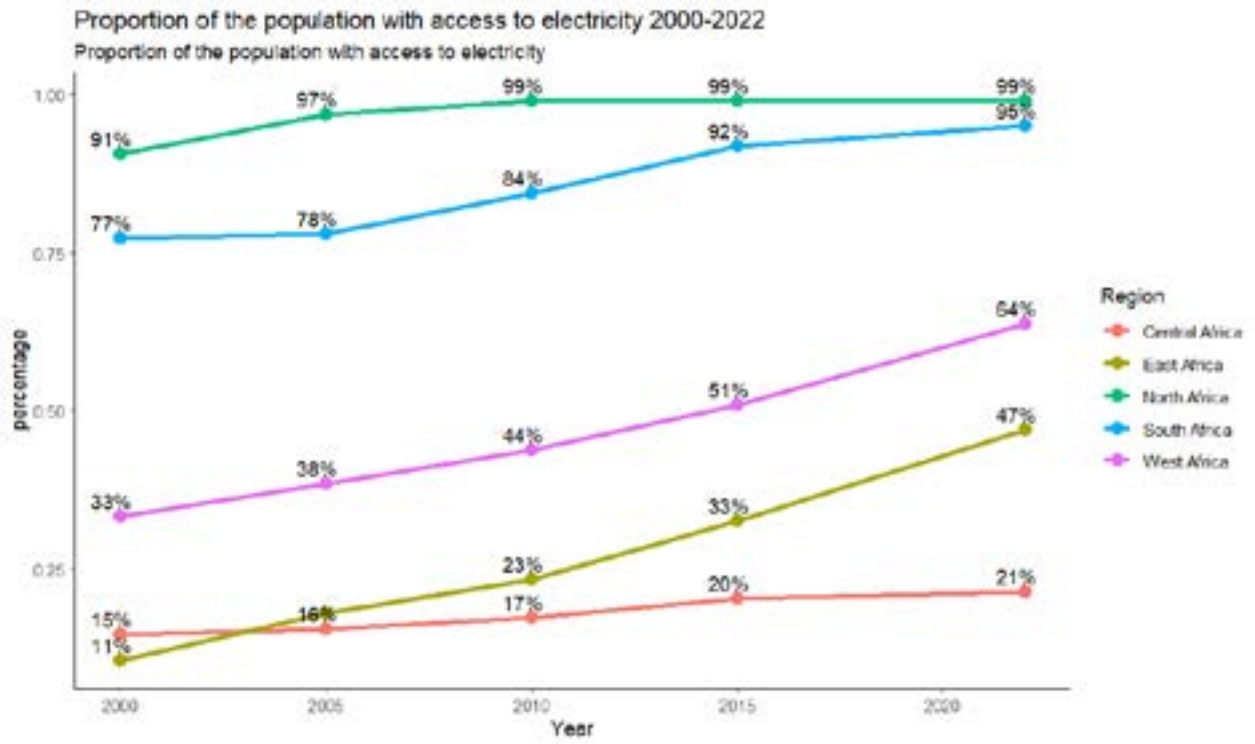
The following figure shows the evolution of the electricity access ratio from 2000 to 2022 in Africa and Sub-Saharan Africa.



Since North African countries do not suffer from the same problem of access to electricity as other African countries, the percentage of access to electricity in the African continent as a whole differs significantly, with the exception of North African countries. Although the percentage of access to electricity in Africa in 2000 was 36%, the percentage of access to electricity in Sub-Saharan Africa was only 24%, and this percentage in Africa 22 years later, in 2022, reached 58%, and in Sub-Saharan Africa, it reached 50%.

Despite the efforts of African countries to increase access to electricity and the continuous improvement in increasing access to electricity, some regions have been progressing more slowly than others.

This figure shows the evolution of the percentage of the population with access to electricity according to different African regions.



The figure shows that this percentage has not increased significantly in the Central African region, where it was 15% in 2000 and then increased to only 21% in 2022, in contrast to the East African region, where the percentage was only 11% in 2000 and then reached 47% in 2022, an increase of 36% over 22 years.

Despite the progress made by some countries (for example, Kenya, Ethiopia, Ghana, Senegal, and Rwanda), the current and planned efforts to provide access to modern energy services hardly exceed population growth. In 2030, it is expected that 530 million people will be without electricity, and almost a billion people will lack access to clean cooking. As a result, the global concentration of the energy-poor population will become more concentrated in Africa, where 90% of those who lack electricity and about 50% of those who lack clean cooking in 2040 will live on the African continent.

2. Lack of investments in renewable energy projects:

The lack of investments in energy projects in Africa is due to several factors, most notably:

- Low energy awareness:

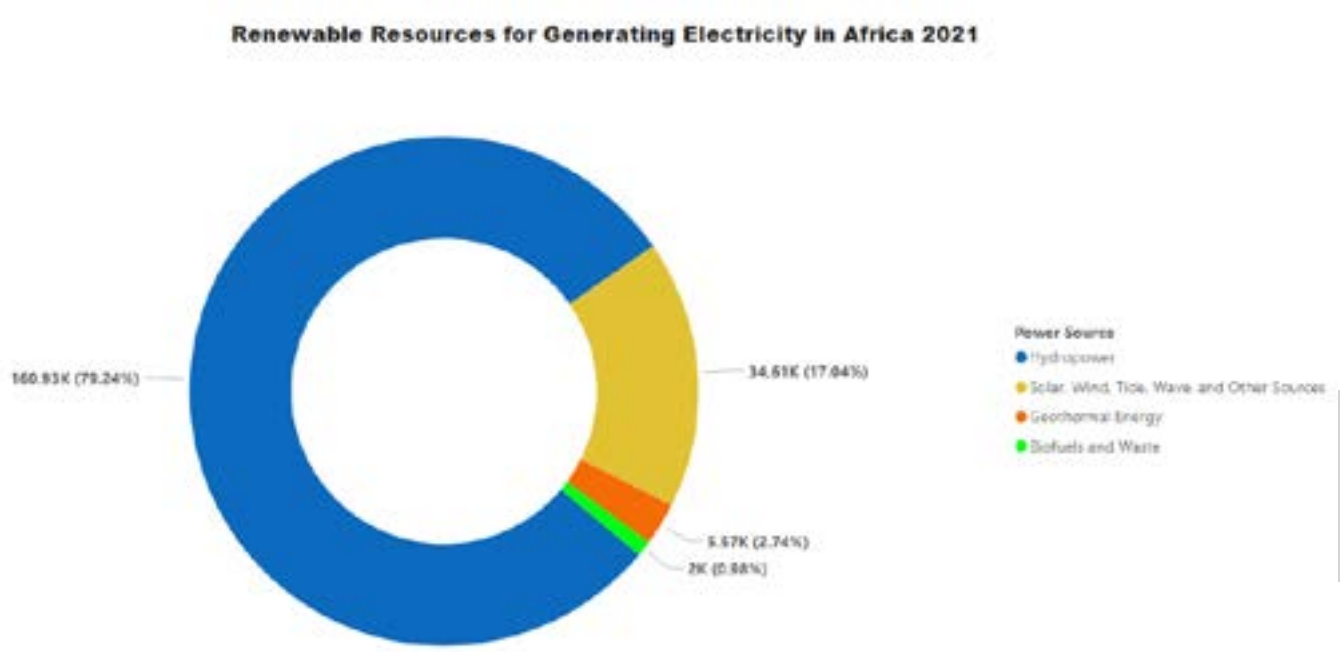
According to a 2022 World Bank study, only 50% of Africans are aware of the advantages of renewable energy, although electricity is the cornerstone

of modern energy systems in Africa, which is increasingly moving toward renewable energy sources. Africa has 60% of the best solar energy resources in the world, while its contribution to installed solar PV energy still does not exceed 1%, and by 2030, solar PV, which is already the cheapest energy source in many regions of Africa, will surpass all other energy sources on the continent.

- Lack of funding: Energy investments in Africa account for only 2% of total energy investments, according to the International Energy Agency.

- Political instability: Armed conflicts in countries such as Libya, Sudan, South Sudan, and the Central African Republic have delayed the implementation of renewable energy projects.

Renewable sources contributed almost 20% to the electricity generated in 2021.

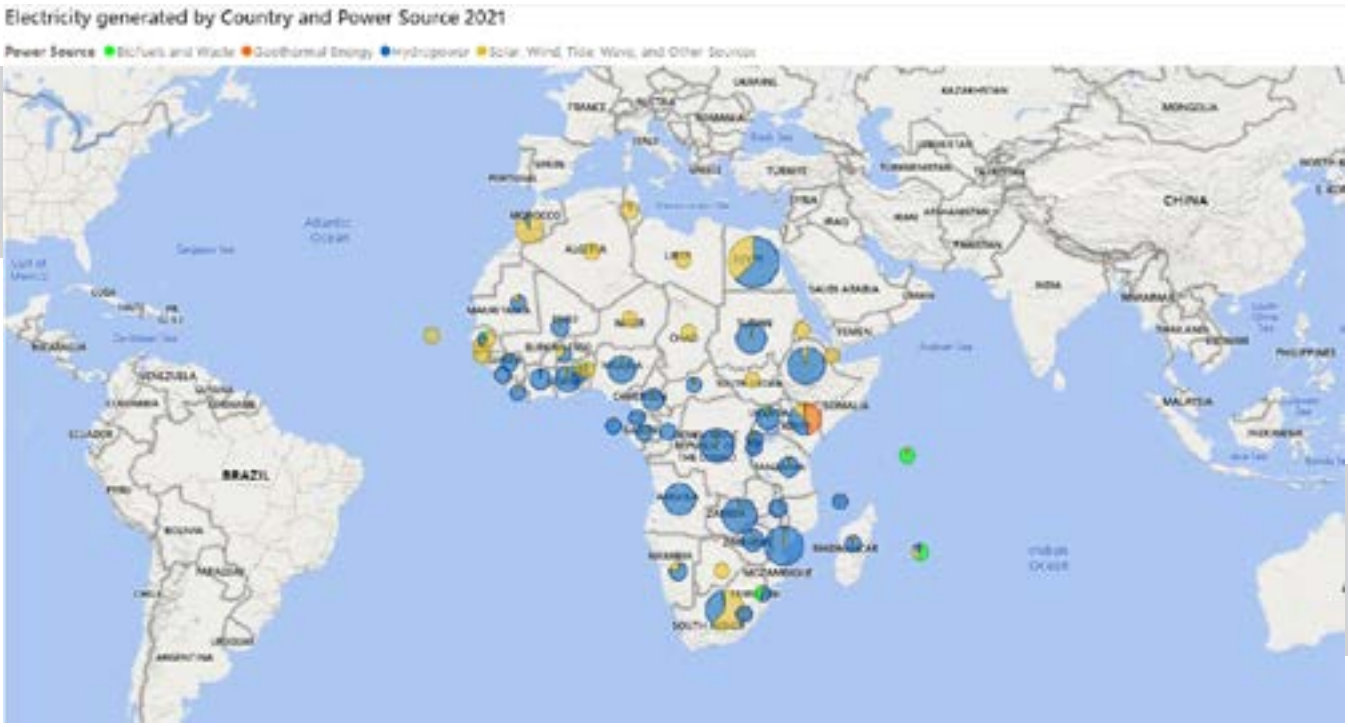


In the previous figure, renewable sources of electricity generation have been divided into four basic sources, and the figure shows that hydropower is the most important renewable source of electricity in Africa.

To clarify this, figure 5 was developed, which shows the volume of electricity generated in 2021 from renewable sources only; the size of the bubbles expresses the volume of electricity generated, and each bubble was divided into 4 colors expressing the renewable sources that have been relied on in each country.

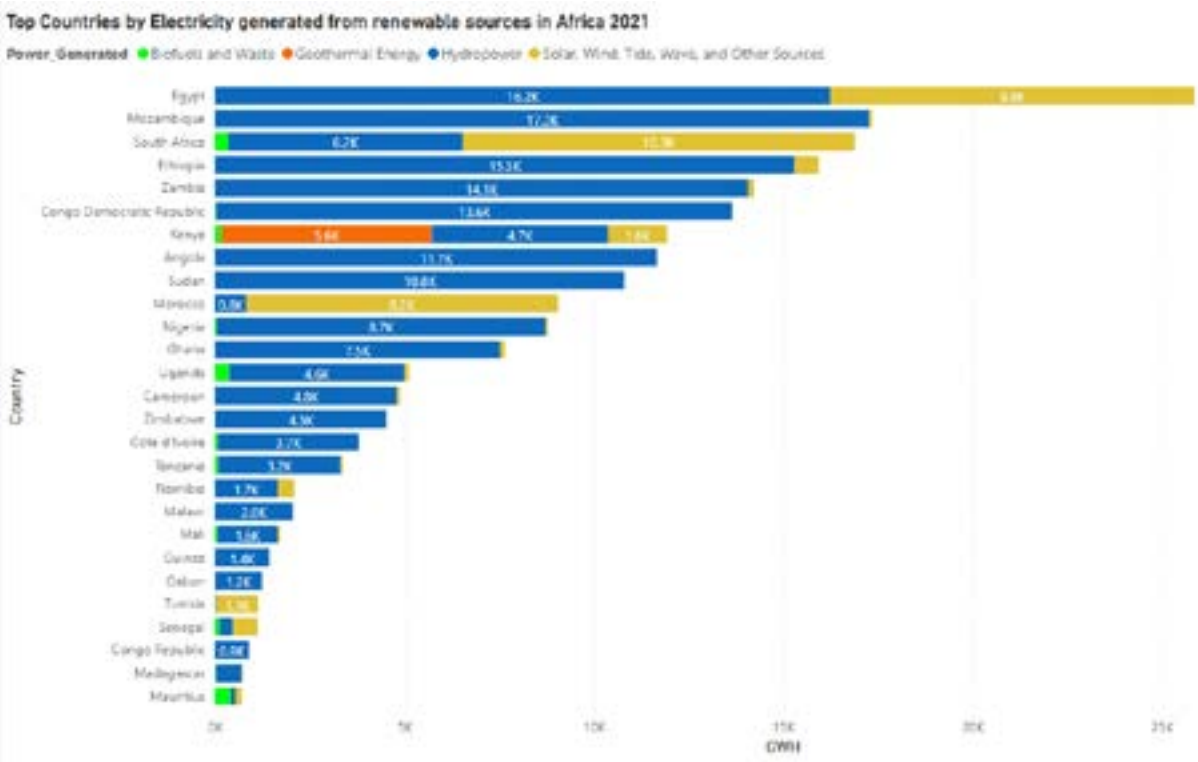
The following figure shows that many African countries rely heavily on hydropower for electricity generation, such as Angola, Congo, Sudan, and other countries, due to the availability of rivers and water bodies in many African countries, and therefore water is a convenient and available source for electricity generation in Africa.

Wind, sun, and other sources are also major renewable sources of electricity generation in some African countries, as a result of the expansion of the Sahara in many of these countries. Countries that do not rely on hydropower and rely heavily on wind, solar, and other renewable energy sources for electricity generation include: Libya, Algeria, Morocco, Niger, and Chad.

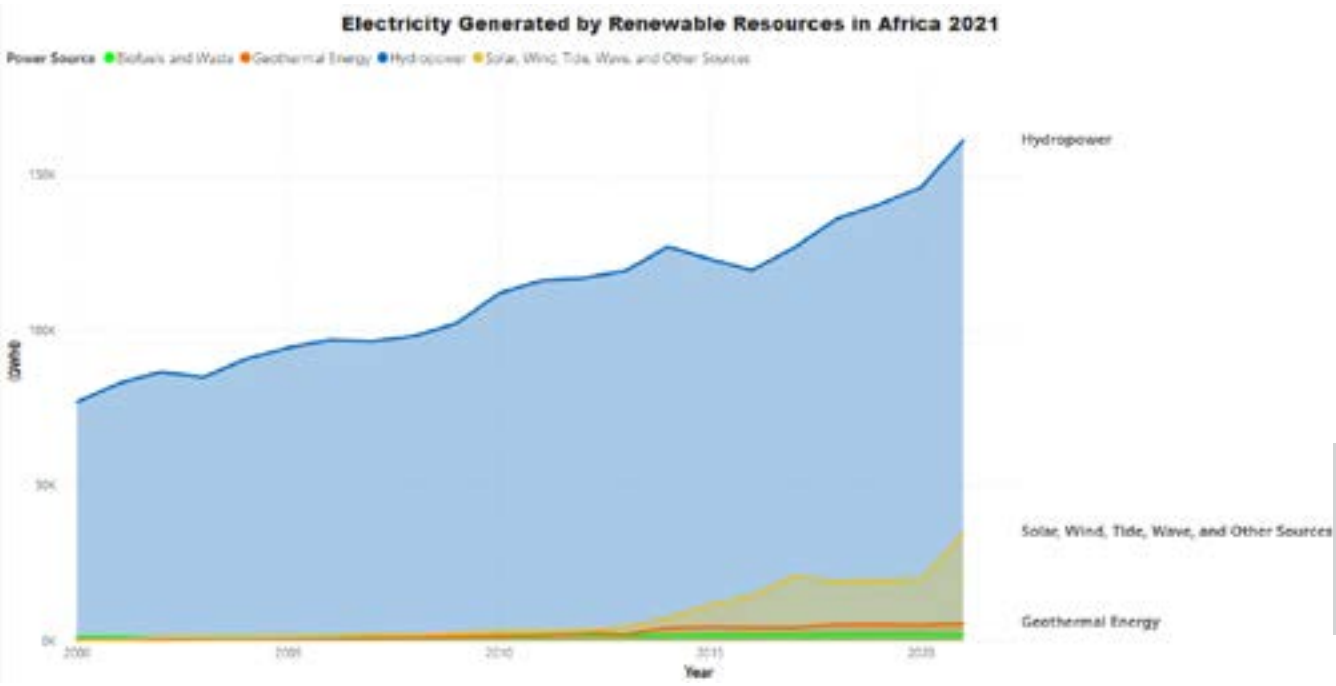


There are also some countries that rely on these two types of renewable sources for electricity production, such as Egypt and South Africa.

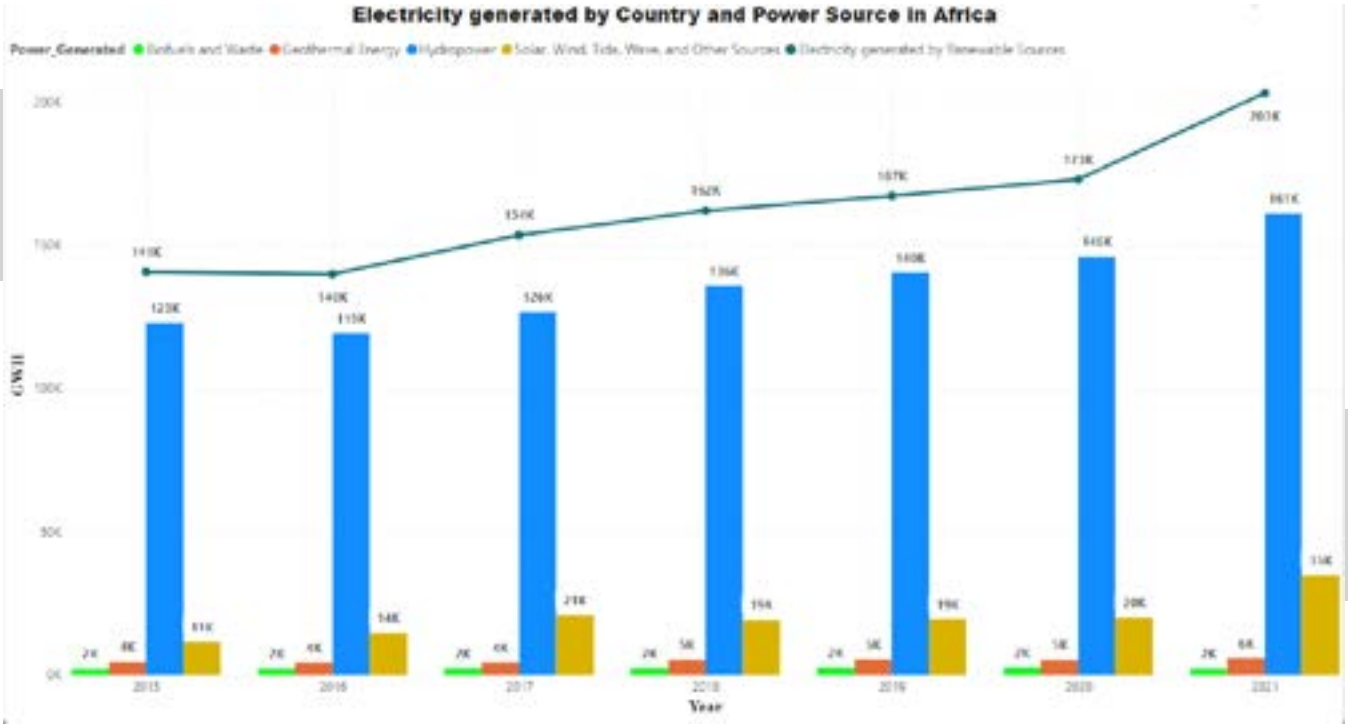
Geothermal energy is not available in Africa except in the country of Kenya. Electricity generation from biofuels and waste is also not very widespread in Africa, but it contributes a small percentage to electricity production in countries like South Africa, and the Republic of Mauritius, Uganda, and South Africa) are the largest countries generating electricity from biofuels and waste in Africa.



In the previous figure, the African countries were ranked in descending order by the amount of electricity generated from renewable sources for the year 2021. The figure shows that Egypt is the largest African country producing electricity from renewable sources. The figure shows that Egypt relies on hydropower, solar energy, wind, and others as renewable sources to generate electricity.



The previous figure shows the development of renewable components of electricity generation in Africa from 2000 to 2001, and it is clear from the figure that Africa was almost completely dependent on hydropower as a renewable source of electricity generation even after 2010, and the formation of a mix of renewable sources for electricity production began. Hydropower still dominates this mix until 2021, but it is clear from the figure that the proportion of electricity generated from the sun, wind, and other sources began to increase after about 2013.



The previous figure shows the amount of electricity generated from renewable sources in Africa from 2015 to 2021, with the display of renewable energy components that were used to generate electricity every year. It is clear from the figure that wind, sun, and other sources generated 11 thousand GWH of electricity in 2015, while the total volume of electricity generated from renewable sources was 141 thousand GWH, accounting for only about 7%, while this percentage increased to reach about 17% in 2021. This shows the increasing importance of these renewable sources over recent years.

3. Lack of Investment in Energy Infrastructure:

- Lack of electricity grids: 40% of Africa's population lacks access to electricity, according to the World Bank.

- Lack of pipelines: many African countries are experiencing a shortage of pipelines for the transportation of natural gas.

The energy sector in Africa suffers from a significant shortage of pipelines, which is a major obstacle to the efficient and effective distribution of energy.

The World Bank estimates that Africa needs investments of up to 130 billion US dollars a year to develop energy infrastructure, mainly pipelines, which are one of the most important factors hindering the flow of investments in this sector.

Energy Insecurity:

Energy insecurity in Africa faces enormous challenges, as most of the continent's countries lack the necessary infrastructure to generate and distribute energy efficiently, leading to frequent power outages and low quality. In addition, there is a high dependence on fossil fuels, which constitutes an environmental burden and increases dependence on external countries.

The African Development Bank estimates that between USD 130 billion and USD 170 billion are needed for infrastructure development each year, leaving a gap of about USD 100 billion.

According to the International Energy Agency, 600 million people in Africa do not have access to electricity, which is equivalent to 43% of the continent's population.

According to disclosures to the Reuters news agency in 2022, Africa as a whole generated 39% of its electricity needs from gas, 29% from coal, 8% from other fossil fuels, 17% from hydropower, and 4% from renewable sources, although power outages cost African countries between 2% and 4% of their GDP.

Challenges:

1. Lack of investments: African countries allocate only about 2% of their GDP to the energy sector, which is much lower than the global average of 3%.

2. Dependence on fossil fuels: the cost of generating energy from fossil fuels is relatively high, which is a burden on the budgets of African countries. To this is added the negative environmental impact of fossil fuels, such as greenhouse gas emissions.

3. Weak transmission and distribution networks: many African countries suffer from weak energy transmission and distribution networks, which hinders their access to all parts of the country. The World Bank estimates that 40% of Africa's population lives in areas that are not connected to electricity grids.

4. Population growth: the accelerated population growth in Africa is putting additional pressure on limited energy resources. The population of Africa is expected to grow to 2.5 billion people by 2050, which will lead to an increase in energy demand.

• It is important that the governments of the continent work to resolve this unfortunate situation by reviewing their policies in the field of energy security. **Perhaps the most important points to focus on:**

• **Increased investments:** African countries need to increase investments in the energy sector, focusing on renewable energy sources such as solar and wind energy. The International Renewable Energy Agency estimates that Africa has the capacity to generate the equivalent of 10 times its energy needs from renewable sources.

• Diversification of energy sources: African countries should diversify their energy sources to reduce dependence on fossil fuels, and this can be achieved by investing in renewable energy sources, especially solar energy for the hottest continent in the world and offshore wind energy for the non-landlocked continent.

• Improving transport and distribution networks: The improvement of energy transmission and distribution networks is necessary to ensure their access to all parts of the country. This can be achieved by investing in the construction of new transport lines and the modernization of existing infrastructure.

• Enhancing energy efficiency: African countries can reduce energy demand by enhancing the efficiency of their use in various sectors. This can be achieved by investing in energy-saving technologies and educating consumers about the importance of using energy efficiently.

The double burden: the environmental consequences of fossil fuel extraction and use in Africa:

The African continent is the third continent in terms of huge reserves of fossil fuels such as oil, natural gas, and coal, and although these resources have the potential to fuel economic development, both extraction and use face several environmental challenges for the region, the most important of which can be monitored:

Land Degradation:

Extractive activities, such as open-pit mining and oil exploration, significantly disrupt the landscape. A 2021 study published in the journal Land Degradation & Development found that coal mining in Botswana alone has degraded more than 1,200 hectares (2,965 acres of land). Such destruction leads to disruption of ecosystems, displacement of wildlife, and a reduction in land fertility.

Water Scarcity and Pollution:

Fossil fuel extraction often requires large amounts of water, which exacerbates water scarcity in arid regions. In addition, wastewater from mining and fracking can pollute freshwater sources with heavy metals and other pollutants.

A 2019 study in the journal Science of the Total Environment reported elevated levels of lead and chromium in water bodies near oil fields in the Niger Delta, Nigeria.

Air Pollution:

The leakage of methane, one of the most powerful greenhouse gases, during the extraction and transportation process contributes to climate change. Moreover, burning fossil fuels for power generation releases harmful pollutants such as nitrogen oxides and particulate matter, leading to respiratory diseases and acid rain, which is why the UN Environment Program UNEP in 2022 called for recommending several environmental measures to reduce air pollution and prevent climate change.

Through these recommendations, African governments can prevent 200 thousand premature deaths per year by 2030 and 880 thousand deaths per year by 2063; reduce carbon dioxide emissions by 55%, methane emissions by 74%, and nitrous oxide emissions by 40% by 2063; improve food security by reducing desertification and increasing the productivity of rice, corn, soybean, and wheat crops; significantly contribute to global efforts to keep temperature rise below 1.5 degrees Celsius; and reduce the negative effects of regional climate change.

Limited Access to Clean Energy:

A large part of Africa's population still lacks access to reliable electricity, and while fossil fuels may provide a temporary solution, they contribute to environmental degradation and lock these countries into unsustainable energy systems.

Despite the availability of renewable energy sources of all kinds on the African continent, Africa is still experiencing a crisis in dependence on this energy due to the increase in the cost of building and maintaining both solar and wind plants, as opposed to oil and coal extraction.

Africa faces a huge challenge in obtaining clean and reliable energy for its population, despite its huge potential in the field of renewable energy, and statistics indicate a worrying reality.

The International Energy Agency revealed in its report on Africa that 600 million people in Sub-Saharan Africa lack electricity, a figure equivalent to two-thirds of the region's population.

Women and girls in particular suffer from a lack of access to clean cooking energy; they spend hours collecting cooking firewood, which causes them health problems and wastes their time on education and economic opportunities.

Untapped Renewable Energy Potential:

Despite all this, Africa has a huge potential for renewable energy sources, such as solar, wind, and geothermal. Investing in these resources can provide clean energy, create jobs, and

reduce dependence on fossil fuels. The 2020 report by the International Renewable Energy Agency (IRENA) estimates that the Sub-Saharan Africa region has the capacity to generate 600 gigawatts (GW) of solar energy alone .

The Second Axis: The West and Energy in Africa

First: Chinese Energy Investments in Africa

In recent years, Africa has experienced a significant increase in Chinese investments across multiple sectors, particularly in energy. These investments stem from China's endeavors to meet its expanding energy demands, bolster its economic presence on the continent, and align with the Belt and Road Initiative. Additionally, they reflect the escalating influence of competition between China and the United States.

The energy projects in which China invests in Africa are diverse, including projects for the construction of coal, gas, and renewable energy power plants, as well as projects for the construction of electricity transmission lines and other energy infrastructure.

These investments are particularly focused on countries rich in natural resources, such as oil, gas, and minerals, such as Nigeria, Angola, and South Africa.

These investments are reflected in the economies of African countries by creating jobs, stimulating economic growth, and providing access to energy for millions of residents.

First: China's infrastructure financing: China's infrastructure investments in Africa: a blessing or a curse for the continent

In recent decades, China has become a prominent figure in infrastructure financing across Africa, ranging from roads and bridges to power plants and ports. Beijing's efforts to bridge the significant financing gap have garnered both praise and concern. Questions arise about China's motives, the nature of its projects, and the potential economic, social, and environmental impacts on African nations, particularly amid the escalating economic tensions between China and the United States.

It can be said that several factors are driving the large Chinese financing of infrastructure in Africa, including, **but not limited to:**

1. Resource security: Africa has an estimated 12% of the world's oil reserves and 30% of mineral resources, resources vital to China's booming economy. Infrastructure projects facilitate access to these resources and secure reliable supply chains.

2. Expanding markets: Africa, with a population of more than 1.4 billion, represents a huge potential market for Chinese goods, and improved infrastructure is facilitating trade by strengthening communication between markets.

3. Geopolitical influence: Large investments are strengthening diplomatic relations between China and African countries, strengthening their

global influence and challenging traditional Western hegemony in the region. As of 2021, China was the largest foreign investor in Africa, pumping USD 155 billion into infrastructure projects.

4. Development of the Belt and Road Initiative (BRI): Infrastructure projects in Africa are a key component of the Belt and Road Initiative, China's ambitious global development strategy aimed at enhancing the interconnectedness of trade and infrastructure across continents. In general, during these years, more than a thousand Belt and Road Initiative projects worth more than a trillion dollars are being implemented throughout Africa, enhancing intercontinental communications and international cooperation.

Second, energy investments: China has become a major energy player in Africa, resulting in a complex relationship that presents both opportunities and challenges for African countries. Here, we review the details of this relationship using statistics to better understand it.

Volume of Investments:

According to the China-Africa research initiative, between 2000 and 2021, the Chinese government and commercial banks provided more than USD 155 billion in loans for energy projects in Africa, highlighting the enormous scale of China's financial power in shaping Africa's energy future.

Details by Sector:

Although comprehensive details are not readily available, the 2021 report by the African Climate Foundation and the Natural Resources Defense Council **notes the following:**

Fossil fuels: almost USD 70 billion was invested between 2010 and 2018, focusing on oil and gas exploration in countries such as Nigeria (holdings exceeding USD 20 billion) and Angola (large investments in oil fields).

Renewable energy sources: more than USD 13 billion has been invested, and 10 gigawatts of clean energy capacity have been developed across Africa since 2000. Solar energy, hydropower, and wind energy are the main areas of focus, with Ethiopia (investment of more than USD 4 billion) and Kenya (major solar and wind farms).

Beyond Statistics:

While statistics offer insight into China's financial impact, it's crucial to examine its broader effects. For instance, energy investments have sparked economic activity in select African nations. The Center for Global Development Policy at Boston University underscores that Chinese involvement in resource extraction projects can foster job creation and revenue generation for resource-endowed countries. However, there are concerns about fair labor practices and ensuring a fair share of profits for African countries.

Second: American investments in the field of energy in Africa:

For decades, American energy investments in Africa have been largely focused on oil and gas. Companies such as ExxonMobil and Chevron have taken large stakes in African projects. The Carnegie Endowment for International Peace estimates in its report, "China and the United States are competing for influence in the energy sector in Africa," published in 2022, that public and private funding from a group of twenty countries, including the United States, amounted to a staggering 345.76 billion dollars in African energy projects between 2000 and 2021, an average of 35 billion dollars per year. This investment fueled African economies but raised concerns about dependence on fossil fuels and its impact on the environment. With the growing Sino-American conflict, these projects have grown and expanded; Africa has become an arena of economic war between the two giants. U.S. energy projects in Africa include a variety of initiatives, reflecting a complex balancing act between conventional and renewable energy sources. Here are some illustrative examples, classified by type:

1. Angola LNG project (LNG production and export):

ExxonMobil is leading this multi-billion-dollar project, developing LNG production and export facilities in Angola. This project opens up the country's vast natural gas reserves and

generates significant revenues; however, there are still concerns about the environmental impact and long-term resource management.

2. Exploration of the Lake Albert Rift Basin (oil and gas):

Several U.S. companies, including Tullow Oil and Cosmos Energy, are involved in exploration activities within the Lake Albert Rift Basin region that stretches across Uganda and the Democratic Republic of the Congo, and while these projects hold great potential for oil discoveries, they also raise environmental and resource management concerns.

3. Power Africa Program:

The US Overseas Private Investment Corporation (OPIC) has allocated 2.4 billion dollars for the Power Africa Program, an initiative to increase access to electricity in Africa. This funding supports various projects, including power plants, renewable energy solutions, and the financing of remote areas.

These projects are expected to generate 1,660 MW of new energy and benefit nine African countries, and since the launch of Power Africa in 2013, OPIC has been a key partner, contributing to 88 projects that will add 7,400 MW of energy and benefit more than 50 million people. OPIC's support includes a thermal power plant in Guinea, solar power equipment in Nigeria, wind and thermal power plants in Senegal, and hydroelectric power plants in Uganda.

By providing financing, insurance, and other tools, OPIC helps U.S. companies invest in Africa while promoting economic development and U.S. interests. OPIC operates at no cost to taxpayers and focuses on projects that follow best practices and do not harm jobs in the United States.

However, despite American efforts to continue on the continent economically, politically, and militarily, this influence has begun to wane economically in favor of China and politically in favor of Russia, despite the fact that the United States allocated 438 million dollars a year for renewable energy projects and related supply chains, electric mobility, environmental conservation, food security, and agriculture in Africa. And that number has increased to quadruple to 2 billion to support solar energy alone on the continent. The year 2023 did not witness any American disclosures about investments or grants in this area due to strategic changes in the landscape, where different regions of the continent witnessed the entry of Moscow or Beijing in exchange for an American withdrawal at both the economic, political, and military levels.

Third: EU Investments in the Field of Energy in Africa:

The EU plays a multifaceted role in Africa; energy is a key area of cooperation. This role is not limited to lending and financing but also extends to various partnerships. The countries of the European Union are geographically and historically the closest to benefiting from and contributing to Africa. While the old relationship was based on colonialism, current relationships in a post-colonial world are founded on partnership agreements.

Here is a detailed look at the EU's vision for energy in Africa and its development and investment endeavors, supported by statistics to paint a clearer picture:

1. European financing: the European Union, through the Global Portal Strategy, has pledged an amount of 150 billion Euros to mobilize Africa by 2027, and according to the portal's forecasts, this large amount is expected to significantly affect the continent's energy sector.

2. Pushing the public-private partnership: the broader Global Gateway initiative aims to leverage not only public funds but also private investments, and this ambitious goal could open a total of 300 billion euros for sustainable infrastructure projects in Africa, including energy.

The energy access gap and the renewable energy push:

The World Bank has revealed a stark reality: more than 600 million people in Sub-Saharan Africa lack electricity, highlighting the urgency addressed by the Africa-EU Green Energy Initiative, which prioritizes the expansion of electrification.

A greener future with renewable energy sources:

Recognizing the enormous potential of Africa in terms of clean energy sources, the green energy initiative aims to increase renewable energy generation capacity by an additional 300 gigawatts by 2030. This ambitious goal signals a major shift toward a more sustainable energy mix for Africa.

Beyond investments: job creation and knowledge transfer:

Jobs for the future: the EU-Africa partnership aims to create up to 10 million jobs in Africa by 2025 through investments in sustainable energy and other sectors. This initiative demonstrates a commitment to promoting economic growth along with energy transformation.

EU presence in Africa (Beyond Investments):

It is important to note that the EU's involvement extends far beyond purely financial investments. Here are some additional aspects of its existence:

The EU is Africa's largest trading partner; there are trade agreements in place that facilitate the flow of goods and services, including those related to the energy sector.

Political partnerships: The EU maintains close political relations with many African countries. These partnerships can provide a platform for dialog and cooperation on energy policies and security issues affecting the continent.

Research and development: The EU actively supports joint research and development projects focused on sustainable energy solutions for Africa. This promotes innovation and helps to develop technologies tailored to the specific needs of the continent.

By understanding the depth and breadth of the EU's involvement, we gain a clearer picture of the factors shaping Africa's energy transition. The future of Africa's energy depends not only on financial resources but also on effective cooperation, capacity building, and commitment to sustainable practices.

Seventh: In Focus

The Repercussions of the Escalation in the Red Sea on Security, Energy Supplies, and the Global Economy

Prepared by the Research and Studies Department at Saif Bin Helal Center

Introduction:

The Bab el-Mandeb Strait is considered one of the most important waterways in the world for shipments of global goods transported by sea, especially crude oil and fuel coming from the Gulf and heading to the Mediterranean through the Suez Canal or the Sumid pipeline, in addition to goods bound for Asia, including Russian oil.

Since the outbreak of the war in Gaza in October of last year (2023), the Yemeni Houthi group has begun targeting commercial ships passing through the Red Sea, transporting goods between East and West, especially oil, gas, and grain, which has caused negative repercussions on both international trade and the economy in general, and energy security and supply in particular. Due to the vital role played by this waterway in global trade and energy transfer, it is a major route for transporting oil and gas from the Gulf region to Europe and North America, and any unrest in this region can lead to negative effects on world energy prices and on African economies that depend on these resources.

The consequences of the escalation in the Red Sea can be explained as follows:

Rising energy prices: The difficulties of transporting oil through the Red Sea lead to a rise in its prices globally, which burdens oil-importing countries, especially poor countries that rely heavily on oil for energy generation.

Maritime security: The unrest affected investments in energy and infrastructure.

Regional cooperation: Stability in the Red Sea is necessary to strengthen regional cooperation in the fields of energy and trade.

Disturbances in power supply: About 20% of the world's oil trade passes through the Red Sea, which means that any disruptions in navigation in it lead to interruptions in energy supplies to many countries, which negatively affect industry, agriculture, transport and other vital sectors.

It is noted that the escalation in the Red Sea has affected global supply chains; it has led to the diversion of ships affecting the cost of transporting goods and raising their value, and here we find that some shipping companies have changed the route of their ships from the Suez Canal and circling the continent of Africa through the Cape of Good Hope, which caused the cost of transportation, shipping, and supply to rise by up to 173%; thus, commodity prices have risen and inflation in some countries reached record numbers, and the economies of many countries, foremost of which are Egypt, Saudi Arabia, and the UAE.

For example, revenues from the Suez Canal, which transports about 10 –15% of international trade, have fallen. About 30% of the world's oil containers also pass through it, where, under normal circumstances, more than 20 thousand ships pass through it every year, and it brings revenues of 10 billion dollars to the Egyptian economy annually.

The prices for shipping goods between Asia and Europe have increased by almost three times as a result of the increase in the length of shipping due to the diversion of hundreds of ships and tankers bound for the European market away from the Red Sea and the Suez Canal through the Cape of Good Hope in South Africa, which led to an increase in transit times for tankers from 16 to 32 days on average, thereby increasing the burden on the global consumer and reducing its purchasing power.

On the same matter, the American company "Flexport"," a shipping platform located in San Francisco, stated that the diversion of the route around Africa will increase the duration of the trip by 7 to 10 days compared to using the Suez Canal. In this context, the Danish shipping company "AB Mueller Maersk" announced the suspension of all container shipping through the Red Sea until further notice in order to take a longer route around Africa, and the German shipping company "Hapag-Lloyd" announced that it is studying the issue of temporarily stopping sailing in the Red Sea. Also, the Mediterranean Shipping Company (MSC), considered the largest container shipping company in the world and located in Switzerland, said that it would stop using the Suez Canal after the Houthis attacked one of its ships in the Bab el-Mandeb Strait.

In this regard, the file of the issue entitled "The repercussions of the escalation in the Red Sea on security, energy supplies, and the global economy" is covered by monitoring, research, and analysis of the problem and its dimensions. With the statement of the economic and strategic importance of the Red Sea and the repercussions of the escalation at the regional and international levels, in terms of its relationship to security, energy supplies, and shipping routes, **it can be stated as follows:**

First: The Strategic and Economic Importance of the Red Sea

Second: The Repercussions of the Escalation in the Red Sea on International Trade

Third: The Repercussions of the Escalation in the Red Sea on the Energy Security of the Arab and Gulf Countries

Fourth: The Repercussions of the Escalation in the Red Sea on the Energy Security of African Countries

Fifth: The Repercussions of the Escalation in the Red Sea on the Energy Security of European Countries

Sixth: Final Conclusions

First: The Strategic and Economic Importance of the Red Sea

At the northern end of the Red Sea is the Suez Canal, and the narrow Bab el-Mandeb Strait at the southern end, which leads to the Gulf of Aden, is considered a busy waterway with ships passing through the Suez Canal to transport goods between Asia and Europe, and huge amounts of energy supplies such as oil and diesel fuel all pass through this waterway.

The strategic importance of the Red Sea before the current conflicts is that it was responsible for transporting 12% of the world's oil by sea, and it also contributed to the transportation of 8% of liquefied natural gas to various countries around the world. According to the U.S. Energy Information Administration, in the first half of 2023, the Bab-el-Mandeb Strait in the Red Sea was responsible for transporting 8.8 million barrels per day of global oil, which is equivalent to 21% of global petroleum liquids consumption, and 4.1 billion cubic feet per day of natural gas transported globally. As for Europe, the Red Sea contributes to the transportation of 12.9% of the liquefied natural gas supplied to Europe from the Middle East, especially the state of Qatar.

The Red Sea is a waterway of enormous strategic importance for several reasons, including:

Natural resources: The Red Sea is rich in natural resources, such as oil, natural gas, minerals, and fisheries.

National security: The Red Sea is an important area in terms of national security, especially for the Arab countries bordering it. It passes through many vital maritime shipping lines, making it vulnerable to security threats such as piracy and terrorist attacks. Therefore, additional measures were taken, including:

Military presence: Many countries are strengthening their military presence in the Red Sea to ensure their national security and economic interests.

International initiatives: Several international initiatives have been launched aimed at strengthening cooperation between the countries bordering the Red Sea in several areas, such as maritime security, environmental protection, and economic development. In general, the Red Sea is a vital artery for world trade and an important region in terms of security and national and regional stability; therefore, maintaining the security and stability of the Red Sea is essential to ensuring the prosperity of the bordering countries and achieving sustainable development in the region.

Regional stability: The Red Sea plays an important role in the stability of the region; it connects many countries with different cultures and civilizations, and any unrest in the Red Sea can lead to instability in the entire region.

On the other hand, the Red Sea is a waterway of enormous economic importance for the countries bordering it and for the whole world, and its economic importance lies in many aspects, including:

1. International trade: The Red Sea is one of the most important maritime trade corridors in the world, as it passes through approximately 12% of the total world trade, 40% of international maritime trade, and 20% of the world oil trade. The Red Sea connects Asia, Africa, and Europe, making it a vital corridor for the transport of goods between these continents. The Suez Canal plays an important role in enhancing the importance of the Red Sea for international trade; it connects the Red Sea and the Mediterranean Sea, which shortens shipping distances and reduces costs.

2. Natural resources: The Red Sea is rich in natural resources, such as oil, natural gas, minerals, and fisheries. These resources contribute to the diversification of the economies of the countries bordering the Red Sea and are an important source of national income. Fisheries contribute to the food security of the countries bordering the Red Sea and provide employment opportunities for many people.

Tourism: The Red Sea has enormous tourist attractions, such as beautiful beaches, clear waters, and coral reefs. Tourism contributes to the development of the economies of the countries bordering the Red Sea and provides job opportunities for many people. Investments in tourism infrastructure, such as hotels, restaurants, and resorts, contribute to strengthening the importance of the Red Sea as a global tourist destination.

4. Sea transportation: The Red Sea is an important maritime transport corridor; logistics services related to maritime transport, such as storage, shipping, and insurance, are an important source of income for the economies of the countries bordering the Red Sea.

5. Industry: Many factories are set up along the coasts of the Red Sea to take advantage of the natural resources available in the region, such as oil, natural gas, and minerals. These factories contribute to the diversification of the economies of the countries bordering the Red Sea and provide job opportunities for many people. Industrial exports from the countries bordering the Red Sea contribute to strengthening their economies and improving the standard of living of their citizens.

Second: The Repercussions of the Escalation in the Red Sea on International Trade

The Red Sea is an important sea corridor for international trade; it connects the continents of Asia, Europe, and Africa, which means that any kind of attack in this sea would lead to damage to international trade, as the capacity of the 5 largest carriers decreased by about 65% (for ships passing through the Suez Canal), which proves the risk of military operations in the Red Sea on international trade. **This is shown by:**

1. Rising shipping costs due to attacks in the Red Sea: The cost of shipping increased by 173% at a price exceeding 4000 dollars from December 2023, and the cost of shipping from the US Gulf Coast to China reached 9.86 million dollars, an increase of almost two million dollars. The cost of transporting goods to the United States has also increased from less than USD 2,000 in December 2023 to about USD 3,000 in January 2024.

In the same context, freight rates for transporting a standard container from China to Northern Europe, which usually passed through the Suez Canal following the unrest in the Red Sea, have increased, as the price index for shipping ships from China to Northern Europe rose from 1687 dollars on December 20 after the Galaxy ship accident in November 2023 to its highest value on January 2024, to reach 5817 dollars, then began to decline from its peak and continued to decline until then.

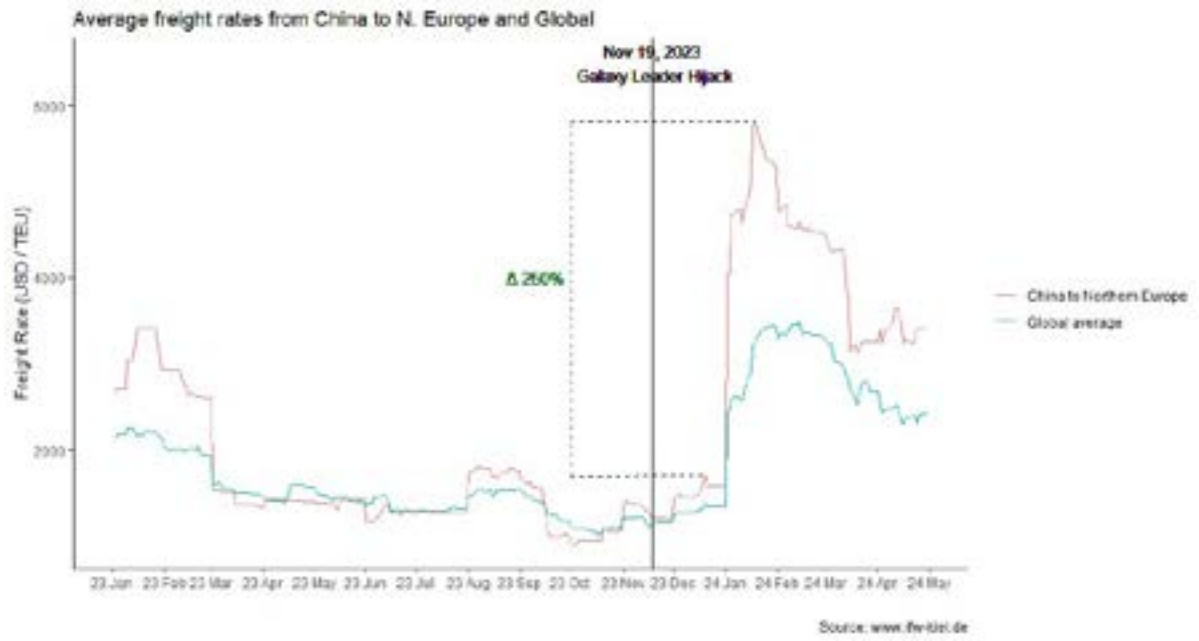


Illustration 1: The following figure shows the evolution of the global freight rate index from China to Europe from January 2023 to May 2024.

The increase in shipping costs due to attacks in the Red Sea can be attributed to the increase in the insurance allowance for ships due to the possibility of targeting them by the Houthi organization, whether in the Gulf of Aden, Bab al-Mandab, or the Red Sea. **We find that:**

- Ships wishing to complete their journey from Asia to Europe via the Mediterranean Sea have increased the cost of transportation due to increased risks and high demand in Europe.

- Some ships that did not want to venture decided to take the Cape of Good Hope route passing through South Africa, which means increasing the duration of the trip by about 10 to 12 days, and this means greater fuel consumption, which prompted these companies to increase the price of the trip.

In terms of numbers, the cost of shipping containers bound from Asia to northern Europe has increased from less than 1,500 dollars in mid-December 2023 to almost 5,500 dollars in January 2024.

2. Impact on traffic and transport: The interruption of the usual sea route through the Suez Canal delayed the arrival of the ships, as they had to take an unplanned course of about two weeks around the Cape of Good Hope off the African coast.

According to shipping data provider AXSMarine, the number of tankers in the Suez Canal decreased by more than 50% in the week beginning January 15, 2023, and the decline was most pronounced for LPG and LNG, which decreased by 65% and 73%, respectively.

During December and January 2023, the number of ships docked in Hamburg and Bremerhaven decreased by about 25%, in addition to the ports of Rotterdam and Antwerp, which are important for Germany, and in February, the difference narrowed to about 15%, with Bremerhaven rising to 2%. These percentages are based on the weekly average in 2023.

It seems that the detour around the Cape of Good Hope, which many ships are now taking to avoid the Suez Canal, also leads to an increase in traffic on the world's oceans. Shipping companies are deploying more ships to ensure a stable port schedule. The number of container ships per day increased slightly by 0.3 percent from January to February and currently stands at about 5,450 container ships.

Since the attacks in the Red Sea mainly led to higher energy prices—in addition to higher shipping costs—it put pressure on consumer goods prices and caused them to rise, which led to an increase in inflation.

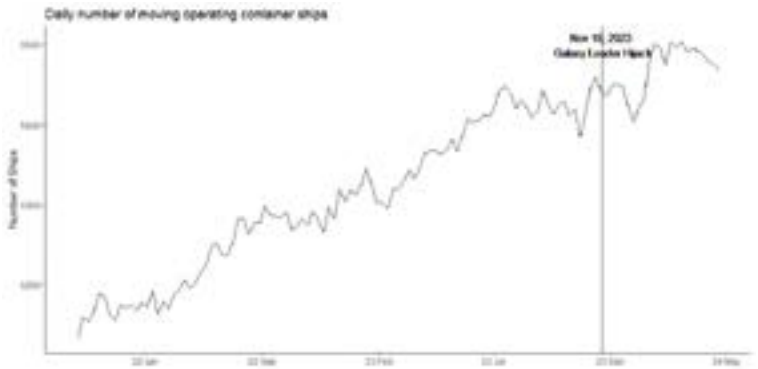


Illustration 2: The following figure shows the evolution of the number of ships operating in the ocean from 2022 to May 2024.

Third: The Repercussions of the Escalation in the Red Sea on the Energy Security of the Arab and Gulf Countries

The Red Sea is a pure Arab sea; it overlooks the eastern and western coasts of the major Arab countries, and in the event of unrest, all countries will be affected by it, and this impact will extend to all oil-exporting countries such as the Gulf Cooperation Council countries that use this waterway to reach Europe. It is necessary to note here that the Gulf countries produce more than 30% of the world's oil supplies, and the income from oil sales is a dominant factor in the economies of these countries. Governments are constantly seeking to increase income every year.

Energy supply and security are two key factors for the economy in many Gulf countries; oil export revenues finance approximately 80 to 90% of the budgets of the Gulf countries; therefore, any disruptions in oil supplies affect importing countries due to the high costs they bear and may lead to a possible reduction in supplies for producing countries due to operational factors affected by the conflict.

The most prominent repercussions of the escalation in the Red Sea on Arab and Gulf countries can be described as follows:

1. Impact on oil prices: The global oil market prices have risen since these attacks on ships in the Red Sea began, against the background of major oil companies, such as BP, halting their shipments several times through the Red Sea.

In this regard, the record price of Brent crude oil was at 81.63 USD per barrel at the beginning of November last year (2023), but it has remained below 80 USD for most of the past two months, and there has been some diversion of oil tankers since November, when Houthi militias based in Yemen began attacking ships crossing the Bab el-Mandeb Strait.

The escalation caused tremors in the oil markets, which led to a rise in prices to 94 dollars per barrel and also raised fears again among oil traders and economists that the markets may exceed the level of 100 dollars per barrel. The recent rise in oil and gas prices was driven by fears of possible disruption of exports from the energy-rich region, but so far, oil and gas flows from the Middle East have remained relatively unscathed despite these attacks.

Illustration 3: The rise in oil prices during the period from July to April 2023 after the Houthi attacks, in dollars per barrel.

2. Rising global demand for oil: OPEC predicted that the growth of global oil demand will exceed the growth of non-OPEC supply over the next two years; it expected demand growth to reach 2.25 million barrels per day in 2024 and 1.8 million barrels per day in 2025, while non-OPEC supply recorded about 1.34 million barrels per day in 2024 and 1.27 million barrels per day in 2025.

Therefore, without substantial disruptions in actual oil production, interruptions of oil flows that cannot be redirected, or a broader escalation of attacks on the most vital oil transportation routes in the region, we do not expect a strong rise in our assumption of the Brent crude oil price at USD 80 per barrel for 2024.

1. The impact on the economies of some Arab and Gulf countries: Comparing the economic impact of the escalation of the Red Sea on some Arab and Gulf countries, we find that Egypt is one of the countries most affected by this unrest. As there was a direct impact on the most important sources of foreign exchange, the Suez Canal, the main source of revenue for Egypt, witnessed a decrease in traffic due to the escalation and a decrease in toll revenues. There was also a significant loss in tourism revenues due to a decrease in tourist arrivals, and economic instability led to high inflation rates and currency devaluation as the Egyptian pound lost its value against the US dollar.

For Saudi Arabia, the disruption of oil exports and falling prices have severely affected the financial budget of the Kingdom of Saudi Arabia. A significant decrease in oil revenues, a high budget deficit due to lower revenues and increased defense spending, and the escalation

have caused challenges to the Vision 2030 plan for economic diversification in Saudi Arabia.

The UAE is facing global logistics hub challenges due to shipping disruptions in the Red Sea, represented by a decrease in re-export trade and increased shipping costs affecting major logistics companies. The tourism sector in the UAE has also been affected due to a decrease in visitor numbers; there are significant losses in the hospitality sector; and real estate investment is declining due to low investor confidence.

It is noteworthy that the tourism sector is one of the sectors most affected by the unrest in the Red Sea, as security concerns have led to a sharp decline in the number of tourists arriving in the Gulf countries. Egypt and the UAE have been particularly affected due to their high dependence on tourism and the decline in the number of tourists.

Illustration 4: A figure showing the revenues of the tourism sector in Egypt, Jordan, and the UAE in 2022 and 2023.

Egypt lost millions of revenues from the Red Sea resorts, and the UAE lost a significant part of its income from the hospitality and aviation sectors.

This graph shows the change in projected tourism revenues for 2024 compared to 2022 in some Middle Eastern countries.

In Egypt, it decreased from USD 8.9 billion in 2022 to USD 5.0 billion in 2024, and it also decreased in the UAE from USD 11.0 billion in 2022 to USD 6.5 billion in 2024. In Saudi Arabia, it decreased from 18.1 billion dollars in 2022 to 10.2 billion dollars in 2024.

On the other hand, the disruption of trade routes has led to higher import costs for basic goods; food prices have risen due to a decrease in grain imports; fuel prices have increased due to oil supply disruptions; and economic instability has weakened local currencies, causing high inflation rates, especially in oil-importing countries such as Egypt.

These disruptions had a direct impact on the unemployment rate in some countries. Key sectors such as tourism and oil suffered job losses due to lower revenues, layoffs in the hospitality and tourism sectors in Egypt and the UAE, and layoffs in the oil sector in Saudi Arabia due to lower oil exports.

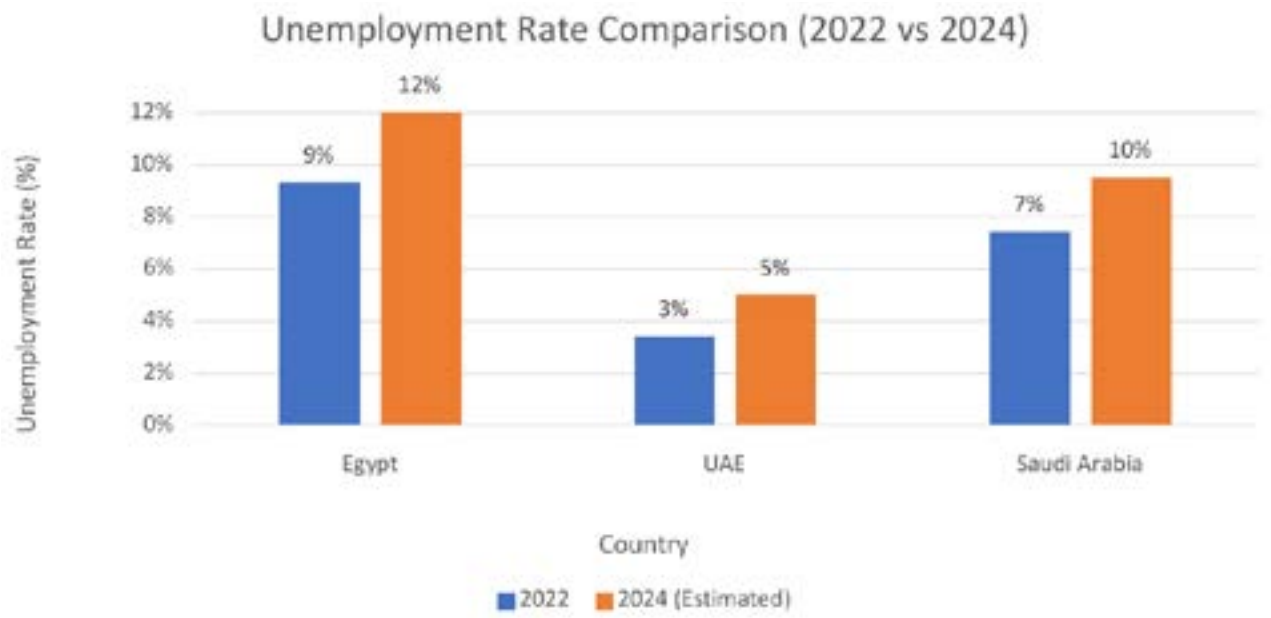


Illustration 5: The figure shows the inflation rate in the UAE, Egypt, and Jordan in 2022 and 2024.

This graph shows the change in the expected unemployment rates for 2024 compared to 2022.

In Egypt, there will be an increase from 9.3% in 2022 to 12.0% in 2024. As for the UAE: an increase from 3.4% in 2022 to 5.0% in 2024, and also in Saudi Arabia: an increase from 7.4% in 2022 to 9.5% in 2024.

Fourth: The Repercussions of the Escalation in the Red Sea on the Energy Security of African Countries

The Red Sea region is central to global energy security; a large proportion of global maritime trade passes through it, including crude oil, petroleum products, and liquefied natural gas. Conflicts and tensions in this region, especially the targeting of ships and tankers, raise concerns about the continuity of energy supplies and endanger the global oil and gas markets.

The repercussions of the escalation of the Red Sea in Africa are multifaceted:

1. Countries such as Egypt are suffering from reduced traffic in the Suez Canal, which reduces their revenues and negatively affects their economy on the other hand, and African countries dependent on energy imports through the Red Sea, such as Sudan and Eritrea, are vulnerable to any disruptions in these vital corridors.

2. The biggest impact of the escalation in the Red Sea is seen in African countries that rely heavily on imported energy. Disruptions in the Red Sea may force these countries to look for alternative sources of energy, which will cost them economically and complicate their energy policies. African energy-exporting countries may also find it difficult to access global markets, which affects their national income and their ability to invest in infrastructure development and public services.

3. Disturbances in the Red Sea can affect regional infrastructure projects and investments in renewable energy, which are an important part of economic growth strategies on the African continent.

4. Maritime security in the Red Sea affects the ability to develop marine energy projects and electric interconnection between African countries and the Middle East, and African countries and the international community must work together to ensure the stability of the region and strengthen cooperation in the fields of energy and trade to achieve economic and energy security on the continent.

5. The impact of the escalation in the Red Sea on the African economy:

Investments: Conflicts hinder investments in renewable energy projects and regional infrastructure.

Commerce: The Red Sea unrest affected maritime traffic, resulting in delays and increased shipping costs.

High transportation costs: Houthi attacks on navigation in the Red Sea and the risks of piracy lead to an increase in insurance companies for goods shipped through it, which leads to significantly higher transportation costs, and some shipping companies are forced to change their routes, which prolongs the duration of flights and increases fuel consumption, which also leads to increased costs.

Reduced investments: Security risks in the Red Sea discourage investors from pumping their money into new projects in African countries bordering it, which leads to a slowdown in economic growth in these countries.

The impact on the traffic of the Suez Canal:
In fact, the tensions in the Red Sea have significantly affected some African countries, including, for example, Egypt, where they led to a decrease in traffic in the Suez Canal, where the number of ships decreased from 777 ships at the beginning of 2023 to 544 ships in the same period in 2024, which represents a loss to the Egyptian economy, which depends heavily on the revenues of the canal, and Egypt was forced to increase transit fees through the canal by 15% to mitigate these losses. This can be stated as such:

- The traffic of commercial ships through the Suez Canal has fallen to its lowest level since the ship "Ever Given" disrupted the waterway 3 years ago, and this decrease reflects the significant impact of the existing tension in the Red Sea and the Bab el-Mandeb Strait, which caused World Trade to shift to a longer and more expensive route through the Cape of Good Hope, which is located in the south of the continent of Africa.

- The first two months of 2024 saw the volume of trade through the Suez Canal decrease by 50% year-on-year. In contrast, the volume of trade through the Cape of Good Hope Road increased by about 74% from the level of last year, and the following figure shows the volume of trade through both routes (Suez Canal Road and Cape of Good Hope Road) since the beginning of May 2023 until the seventeenth of April.

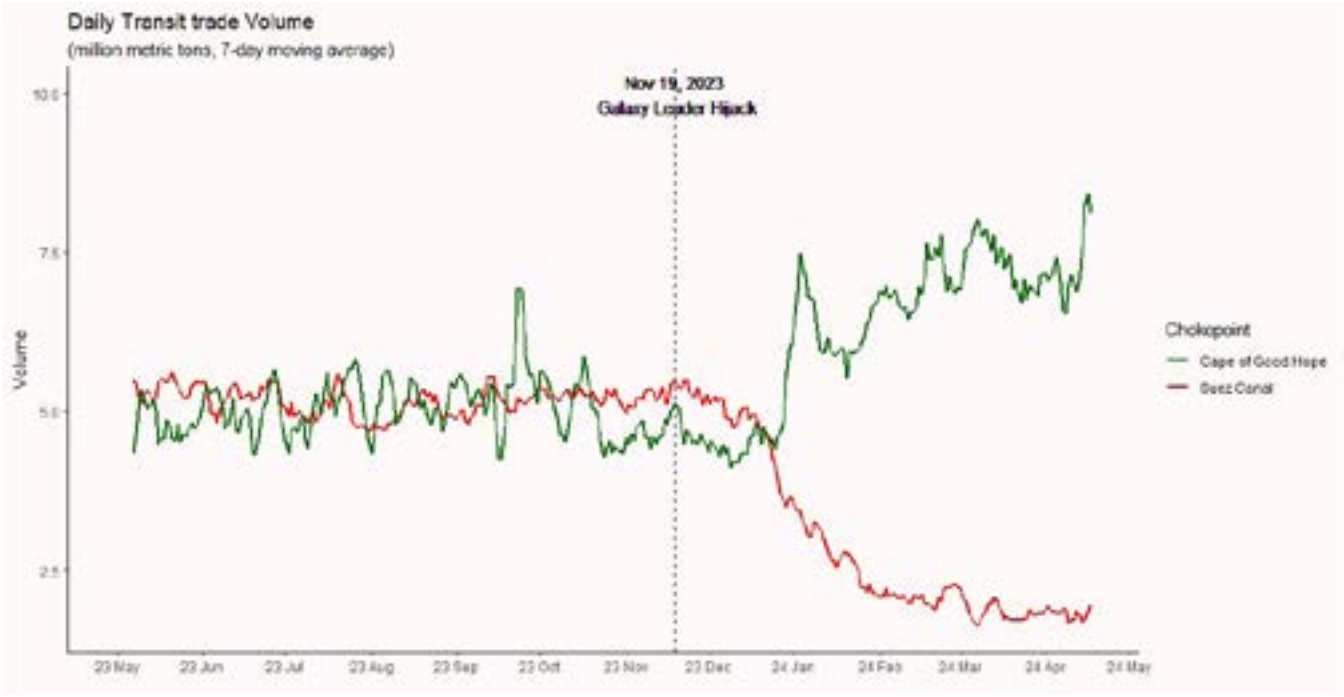


Illustration 6: The figure shows the daily transit volume of international trade through both the Suez Canal and the Cape of Good Hope Road from May 2023 until May 2024.

It is clear from the figure that the volume of trade passing through the Suez Canal began to decline, especially after the hijacking of the Galaxy leadership on November 19 by the Houthis in the Red Sea, and in contrast, the volume of trade passing through the Cape of Good Hope route increased.

In light of this, the traffic of commercial ships through the Suez Canal has decreased to its lowest level since the ship "Ever Given" disrupted the waterway 3 years ago, and this decrease reflects the significant impact of the tension in the Red Sea and the Bab el-Mandeb Strait, which caused World Trade to shift to a longer and more expensive route through the Cape of Good Hope, which is located in the south of the continent of Africa.

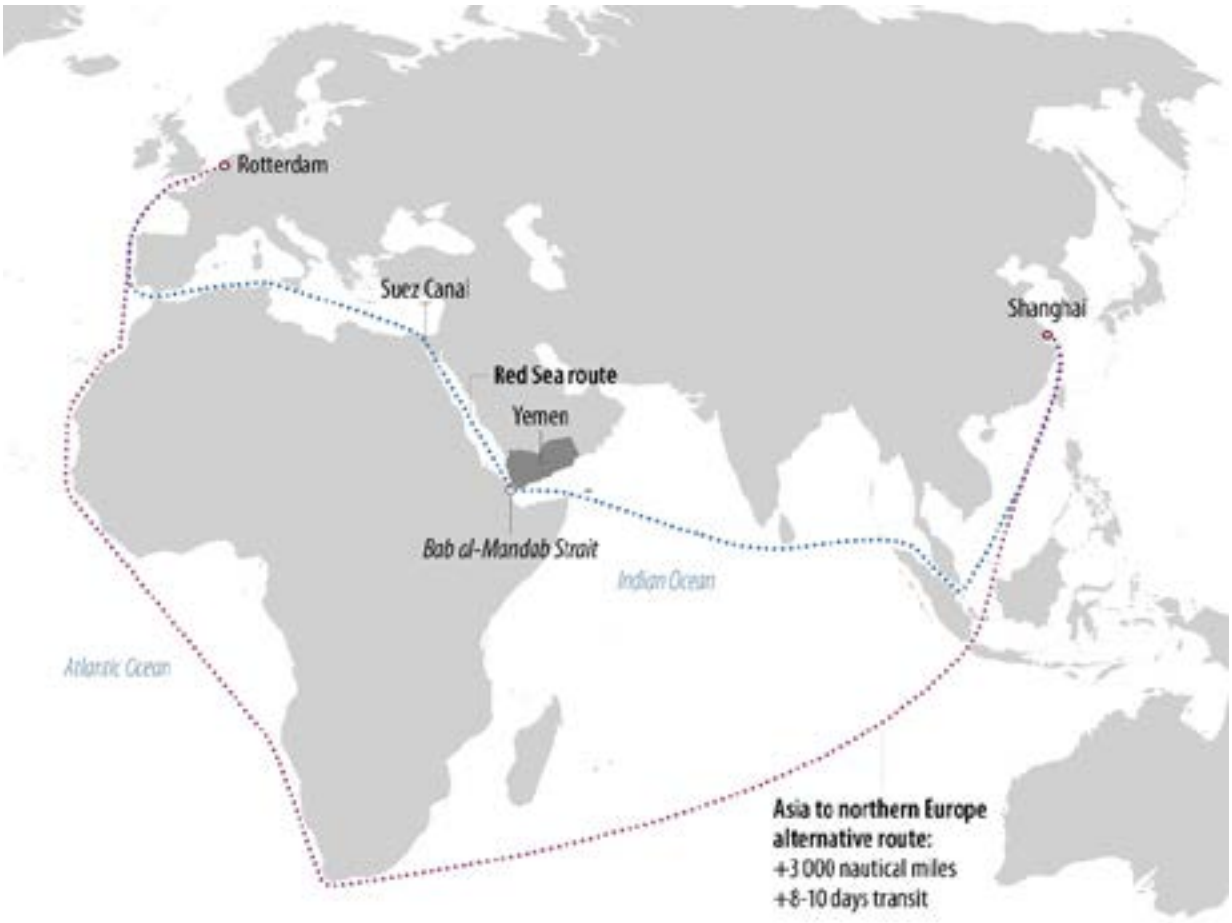


Illustration 7: The figure shows the shift in shipping methods due to disagreements.

The current traffic flow has been the lightest through the Suez Canal since the beginning of April 2021 after the huge container carrier "ever Geffen" settled between the two banks of the canal for about a week in late March 2021, which disrupted supply chains for several months as ships lined up.

About 10% of oil trade and about 8% of liquefied gas trade pass through the Suez Canal, and about two-thirds of crude oil coming from the Gulf region passes through the Suez Canal. About 30% of containers in the world pass through the Suez Canal daily, and about two-thirds of crude oil coming from the Gulf region passes through the Suez Canal. According to statistics from the Suez Canal Authority, about 30% of containers in the world trade all goods. The share of goods coming from the south of the canal, which pass before entering the Suez Canal through the Bab el-Mandeb Strait, is about 47% of the total volume of goods transiting the canal.

It is clear from the above that the escalation in the Red Sea region will have an impact on the global navigation traffic of the Red Sea, and hence the Suez Canal and global supply chains, as a result of doubling transportation prices, insurance, and production costs, as well as rising oil and gas prices at the global level and thus rising commodity prices globally. It is expected that the negative impact on the Suez Canal will increase if the Bab el-Mandeb Strait is completely closed, and this is prompting some Gulf countries to transit oil and gas tankers through the Cape of Good Hope Road instead of the canal to avoid insurance costs and work to reduce the cost.

Fifth: The Repercussions of the Escalation in the Red Sea on the Energy Security of European Countries

Sea routes and waterways play an important role for Europe in terms of its import of energy in all its forms through these waterways, and Europe pushes to import energy by sea because it lacks certain types of energy sources that depend mainly on its import, such as natural gas from Russia.

According to statistics, Europe ranked first globally as the largest importer of crude oil by sea in 2023; from January to July 2023, it imported 1,262.3 million tons, an increase of 8.2% year-on-year compared to the same period in 2022.

The Russian-Ukrainian war also raised the global demand for the import of seaborne liquefied natural gas due to the high European demand for seaborne liquefied natural gas instead of transported by land through Russian pipelines, as the global demand for seaborne natural gas in the first nine months of 2023 witnessed an increase of 1.6% year-on-year compared to the same period in 2022.

Given the most important seas that Europe relies on for its energy imports, we will find that there is the Red Sea, whose importance for Europe's energy supply has recently emerged after the ongoing conflict there.

The consequences of the escalation in the Red Sea on Europe's energy security can be explained as follows:

1. Ships loaded with oil imported by Europe from India and the Middle East are forced to take other routes that are longer than those that were used to it in the Red Sea, which will increase the probability of the length of time that these ships and goods will pass to reach Europe by 58% to 129% than before.

At the level of energy companies, a number of those companies announced the change of the route of their ships that were supposed to pass through the Red Sea. Among those companies are:

- bp, or what is known as "BP", is one of the first companies to take a position on December 18, 2023, on temporarily suspending the shipping of its ships passing through the Red Sea.

- The company "Hapag-Lloyd" for shipping ships, including oil and gas vessels, has decided to suspend sending its own ships either through the Bab el-Mandeb Strait or the Suez Canal.

- The American oil company "Chevron" decided to redirect oil shipments, pumped by the Caspian Pipeline Consortium of Kazakhstan, to Asia through the Cape of Good Hope in Africa.

- On January 16, 2024, the British Shell Company suspended its oil shipments passing through the Red Sea, and on the same day, Qatar Energy Company suspended oil shipments as well, but a source close to the company confirmed that this does not mean reducing the amount produced and exported of oil, which means diverting those ships to other routes.

On the other hand, many shipments have been canceled; for example, 70% of the LNG shipments that were scheduled to be transported from Qatar to Italy in January 2024 were canceled due to conflicts in the Red Sea, and Qatari LNG supplied to Italy is of great importance; Qatari LNG accounted for 40% of German LNG.

2. In theory, threats to the Red Sea will not only affect the transportation of ships loaded with energy to Europe but will also raise energy prices due to the increased cost of transportation, which will push the European Central Bank to extend the interest rate hike to eliminate possible inflation due to rising prices, and the consequent interest rate hike means economic activity stagnates more than the European continent is already experiencing during 2023.

In this context, the European Parliament, in a report issued in March this year, warned of the possible future effects of the escalation in the Red Sea on energy prices in Europe, as the report predicted that with the continued change of the route of cargo ships carrying natural gas and oil bound for Europe to avoid the danger in the Red Sea, the prices of energy sources in Europe will increase, which consequently means higher inflation and therefore the inability of the central banks of European and Western countries in general to reduce that inflation, taking into account the non-causing economic recession.

3. As for the repercussions of the escalation in the Red Sea on the European economy, so far, there are no specific statistics on the negative effects of the Red Sea on Europe's economy, but some European economic analysts claim that the delay of cargo ships and taking other longer routes would have caused the continent's economy losses, estimated at 35 billion dollars so far.

Economists fear the impact of these threats on the European economy if this war continues, and therefore the continuation of these threats, because the suspension of the transit of commercial ships through the Bab el-Mandeb Strait and the Suez Canal will lead to a delay in the arrival of various goods to Europe and therefore higher prices for those goods globally, not only in Europe. For example, the price of transporting one container from China to Europe via routes other than the Red Sea increased by more than 3000 dollars. According to preliminary estimates, trade between Spain and Asia in general was affected by the threats to the Red Sea, suffering losses of up to 135 billion euros.

Also in this context, the European Liaison Committee for Industries and Agricultural Products stated that the continued threats to the Red Sea would incur losses estimated at 70 billion euros for the European Union due to the delay in the delivery of goods related to grain, agricultural, and food products.

On the other hand, we note that the escalation in the Red Sea has a multifaceted impact on the manufacturing industry in Europe. Despite the geographical distance between the conflict zone and the European shores, the rise in energy prices certainly leads to an increase in the rest of the main goods consumed by citizens around the world.

Europe also imports a large part of its main oil and gas needs from the Gulf countries; which means that the attacks have directly affected it, at a time when Europe is looking for an alternative to Russian gas - many European countries were dependent on Russian gas by 50%, and then these countries began to increase their dependence on the Gulf countries after Russia invaded Ukraine; which means that the plan B for Europe is in danger due to military actions at Bab el-Mandeb - any interruption in shipping lanes can lead to delays in the delivery of goods; causing production bottlenecks and inventory shortages for European manufacturers, which hindering their ability to meet customer demand and fulfill contractual obligations. This may ultimately lead to a loss of sales and a decrease in competitiveness in the global market.

The economic effects of the Bab el-Mandeb Strait are associated not only with importers but also with exporters. While countries such as China and India are working to establish new sea and land trade routes to reduce the time it takes for merchant ships to reach Europe from Asia—this means reducing the cost of sea and land transportation, reducing the risk allowance, increasing exports, increasing revenues, and reducing global inflation—the attacks in the Red Sea proved that these countries should establish new routes in politically stable regions to avoid crises that may arise as a result of political conflicts.

Although European countries have been trying for a long time to plan a route connecting India with Europe through the Arabian Peninsula—a maritime trade route that increases the importance of the Strait of Hormuz at the expense of the Bab el-Mandeb Strait—these plans have become an urgent need for implementation as soon as possible because they give exporting and importing countries more flexibility in ending their trade operations in the shortest possible time without being affected by any political considerations anywhere in the Middle East, especially since the Arabian Gulf region is stable and does not witness any political or ethnic tensions.

On the contrary, we note that natural gas prices in Europe fell to 28.37 euros per megawatt hour in February 2024 from 45 euros per megawatt hour before the escalation in the Red Sea because temperatures did not drop significantly in the winter season in Europe, the continuation of the American, Norwegian, and Azerbaijani tide of liquefied natural gas, weak economic activity and demand for gas prices in case they

entered into force, and the continuation of conflicts in the Red Sea.

According to the analysis of the newspaper "The Economist," it is possible that oil and gas prices in Europe have not been affected so far due to the transit of cargo ships loaded with oil and gas from countries not targeted by Houthi forces, such as India, China, and Russia, and a report by The Atlantic Council that the lack of rising energy prices so far is due to the Houthi targeting ships not loaded with gas or oil so as not to cause a leak in the Red Sea and thus deep environmental disasters.

4. At the level of trade relations between countries about energy, especially about clean energy: After the threats to the Red Sea and the change of shipping routes, it is possible that the supply routes of a European country such as Finland with cobalt imported from the Democratic Republic of the Congo will be affected, which will lead to a delay in clean energy generation and therefore delay reaching the hoped-for carbon neutrality goal.

Some energy companies in the Gulf countries that supply energy to Europe have been looking for other ways of transportation, even if they are more expensive, which prompted them to postpone the delivery of those shipments. For example, Qatar announced in January 2024 that it has changed the delivery dates of six shipments of liquefied natural gas, which were scheduled to be delivered to the Adriatic coast of Italy, because they will take the route of the Cape of Good Hope instead of the Bab el-Mandeb Strait and then the Suez Canal.

From this, we conclude that the presence of natural gas and oil in Europe is severely affected by any international crisis that occurs. This was evident both after the Russian-Ukrainian war and after the threats to the Red Sea; therefore, there are some proposals for the European continent to achieve self-sufficiency from energy sources, including gas storage, as it will help it secure sustainable supplies available to citizens and companies; Europe should work to save energy by improving energy efficiency and encouraging sustainable use; and Europe should work to diversify energy import sources, which means reducing dependence on suppliers only so that the impact is less if supplies from one source are cut off.

Sixth: Final Conclusions

It is clear from the above that the escalation in the Red Sea will have negative repercussions on the security and energy supply at all regional and international levels, on the one hand, and will also affect the African, European, and Arabian Gulf economies on the other hand, as this escalation has affected international trade and energy prices have risen in the world due to fears of targeting commercial ships, as well as increased shipping costs due to the high costs of ship insurance. **This can be stated as follows:**

1. Naval traffic decline: If tensions escalate, shipping traffic in the Red Sea may be affected, leading to a decline in freight traffic and increased transportation costs.

2. The decrease in revenues from the Suez Canal led to a decrease in the number of ships transiting the Suez Canal. This reduces Egypt's vital revenues from the canal.

3. Rising energy prices: Tensions may lead to higher oil and gas prices, increasing pressure on energy-dependent African economies.

4. Impact on supply chains: Tensions may disrupt global supply chains, affecting the availability and prices of goods in African markets.

5. Increased inflation: If tensions persist and shipping costs rise, this could lead to increased inflation in African markets.

6. Effects on maritime security: Tensions may increase security risks in the Red Sea, affecting maritime security and investments in the region. These scenarios highlight the need to strengthen international and regional cooperation to ensure security and stability in the Red Sea and to minimize possible negative impacts on the African economy.

7. The continuation of the Houthi escalation will lead to disruption of navigation in the Suez Canal while diverting the shipping route to the Cape of Good Hope, damaging global trade, supply chains, and energy security.

8. The escalation of Houthi attacks has led to severe disruption of traffic in the Red Sea, and both global energy security and the dry goods trade will be dealt another blow, especially in Europe, which is still recovering from the enormous impact of the Ukrainian war.

Eighth: Issue Interview

Interviewed by: **Hala AlFardan**

Al-Sabban: Al-Faw Port is an added "value to the global energy market".

"The presence of major energy producers in the BRICS makes cooperation with OPEC+ constructive," he said.

Dr. Mohammed Al-Sabban
Economic and Oil Expert - Former Senior Advisor to the Saudi Minister of Petroleum, KSA

Dr. Mohammed Al-Sabban, an international expert in the field of energy, confirmed during his meeting with the "Energy Security Observatory" magazine that the Gulf Arab countries are moving toward diversification in the production and export of various types of energy and that it is not likely that production and export will be limited to oil and natural gas as it was previously.

Dr. "Mohammed"... How do you see the energy markets in the Gulf? And where are these markets going?

The energy markets in the Gulf are moving toward diversification in the production and export of various types of energy, not just oil and gas. This is completely different from the Western trend that is pushing the energy transition away from oil and gas, and this is

unrealistic and impractical and cannot be done in the short and medium term; therefore, the Arab countries and the Arab Gulf countries are moving to diversify to become a source and producer of various types of energy.

Do you think the OPEC group will be able to continue? "And to what extent does it need to develop or create a new entity in line with international changes, especially after the accession of the Kingdom of Saudi Arabia and the United Arab Emirates to the group of "BRICS" countries?

The (OPEC+) group can continue; development is certainly important, but for the twenty-one countries in (OPEC+), which include the largest producers and the largest exporters of oil around the world, their relationship with the BRICS group and other emerging or newly formed organizations will not be opposite; on the contrary, this will push to strengthen (OPEC+) in the oil markets due to the presence of major producers in the BRICS group, which will foster constructive cooperation between (OPEC+) and the BRICS group.

The topic of the Al-Faw Port has been of great interest lately as it is a development path; do you see that it is an addition to the global energy market?"

Of course, the development route through Al-Faw Port is an addition, as is clear from the question, and it is an addition to the global energy market at this particular time when the world is witnessing many problems, especially those hovering around the Bab al-Mandab road or even the Strait of Hormuz; therefore, we will see that this will reduce the costs of transporting oil and transporting global energy sources heading from the Gulf to Europe through Turkey; therefore, I believe that this is an addition and not a competitive field with other energy markets.

How do you see the share of green and blue hydrogen in the Gulf markets?

I expect that green and blue hydrogen will take a share of the Gulf markets, of course, but the main purpose of production will be to export and try to show that the Gulf countries are not against adopting this type of clean energy source but rather seek to be a source for blue and green hydrogen; therefore, it is a complement and not a competitor in the Gulf or international markets.

Ninth: Issue Report

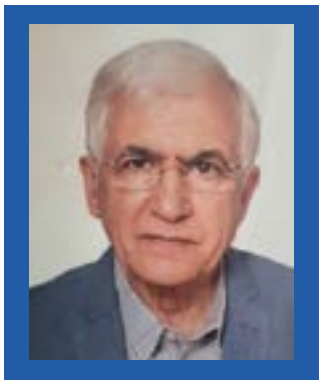
Interviewed by: **Hind Al-Nawawi**

Nuclear Stations in "Egypt".. Necessities and Challenges.. (Questions and Answers)

Experts for "Energy Security": "Egypt" is on the right path to nuclear energy.

Dr. Ali Abdul Nabi
a researcher and writer in energy affairs and former deputy chairman of the nuclear power plant authority.

Prof. Salah El-Din El-Morshedy
a professor of thermal hydraulics, head of the Nuclear Research Center at the Atomic Energy Authority, and visiting professor at the American University in Cairo.



Prof. Mohamed Yasser Khalil
a full-time professor of nuclear and radiological engineering at Alexandria University, is the acting chairman of the board of the Department of Nuclear and Radiological Engineering.

Prof. Karim El-Din El-Adham
a professor of nuclear engineering at the Atomic Energy Authority.

Dr. "Ali Abdul Nabi":

Those who live next to the "Dabaa" will receive a small annual radiation dose.

"Dabaa Plant" is a qualitative leap in the field of electric power production. "Egypt" can rely on nuclear energy to generate electricity by 80%.

Prof. "Salah El-Din El-Morshedy":

Nuclear power reduces gas emissions, global warming, and acid rain.

Nuclear energy can play a key role in the transition to clean energy.

The large capital cost at the construction stage is one of the main disadvantages of nuclear energy.

Prof. "Mohamed Yasser Khalil":

Nuclear energy is unique in achieving the requirements of progress and development in societies.

Clean energy has little waste and does not cause carbon emissions that affect the environment.

The price of nuclear-produced electricity is slightly higher than that of fossil fuels.

Prof. " Karim El-Din El-Adham":

"Nuclear safety" is an integrated process that requires an independent regulator.

Nuclear reactors are subject to several criteria that must be taken into account.

The necessary plans should be developed to deal with nuclear accidents according to their quality and severity.

The term nuclear energy is always associated with wars, weapons, and destruction, but this advanced magical technology has many peaceful uses that are beneficial to humanity in terms of development and improvement in several areas, including, but not limited to, energy, medicine, and technology.

Nuclear energy has recently occupied a large place on the global energy map and has received great attention from state leaders and decision-makers in the energy sector, especially in light of the global trend of sustainable energy transformation and attempts to search for alternatives to renewable energy in an effort by all countries to achieve net zero carbon emissions.

The use of nuclear energy is growing day by day in many fields, most notably electricity generation, as it is the second largest source of low-carbon energy in the world, according to the World Nuclear Energy Association. It is thus one of the most important ways to achieve the comprehensive renaissance of the country, as it contributes to activating industrial diversity and achieving the desired economic prosperity.

Nuclear energy is classified as a non-renewable energy source because the fuel used in nuclear reactors, uranium, is considered a limited resource; the available amount of it is depleted with its consumption and is not renewed during human life.

Although nuclear fuel is considered a non-renewable energy source, it is distinguished from fossil fuels as nuclear power plants do not emit greenhouse gases such as carbon dioxide and methane when operating.

The history of the peaceful use of nuclear energy for the production of electricity dates back to 1954, and the interest in the use of nuclear energy in electricity generation dates back to 1973, following the famous oil crisis, which resulted in the construction of a large number of nuclear reactors for the production of electricity.

In 1995, the participants of the second Arab Conference on the Peaceful Uses of Nuclear Energy, held in Cairo, recommended the importance of expanding the fields of its peaceful use, especially after non-renewable energy sources are about to be depleted.

Egypt has always had a rich history of interest in nuclear energy, which is one of the most prominent and most important sustainable energy resources in the world, and it has also enjoyed great potential in this field, which has witnessed continuous development over many years.

This interest reflects Egypt's strategic vision to achieve self-sufficiency in the energy sector by diversifying its energy sources to ensure a more secure and sustainable future for future generations.

In light of this, this investigation, through which we surveyed the opinions of several experts, came to explore aspects of the nuclear energy file in Egypt, through the diversity of issues and axes related to it,

starting from the history of nuclear energy and its development, and the uses of this vital energy in Egypt, up to the challenges facing Egypt in its quest to make the best use of it and future opportunities related to this vital sector, highlighting Egypt's efforts in that sector represented by the Dabaa nuclear power plant, as well as addressing nuclear safety standards, and the possibility of applying total dependence on this vital energy as a safe source and a clean alternative to energy, unlike other axes and problems take them in detail through the following lines.

Concept, Beginning, and Use:

Prof. Mohamed Yasser Khalil, professor of nuclear and radiological engineering at Alexandria University and acting chairman of the board of the Department of Nuclear and Radiological Engineering, says about the concept of nuclear energy that it is the energy extracted from the nucleus of some heavy materials, such as uranium or plutonium, that we can cause fission to it, so that some of the binding energy is released to the particles that make up the nucleus.

In this process, in which neutrons are used to cause fission, there is a loss in the weight of the fission nucleus; the weights of the fission products are less than the weight of the fission nucleus, and energy equivalent to the lost weight is released.

That energy is called fission energy. The key factor here is that the energy released should be greater than the energy needed for fission events, pointing out that nuclear energy is energy like the energy extracted from the burning of fossil materials.

Khalil said that nuclear fission was discovered in 1938 by German scientists. The first nuclear fission reactor was built at the University of Chicago in the United States in 1942, pointing out the need not to confuse the use of nuclear energy with the use of radioactive materials. The difference between the production of the two energies lies in the fact that in the case of nuclear energy, a chemical reaction does not occur as in the case of combustion; therefore, there are no carbon or sulfur emissions.

The amount of energy extracted from a weight of fissile material is also much higher than the energy that can be extracted from a similar weight of fossil fuels, indicating that nuclear energy can be obtained by the opposite process, with small nuclei fusing to produce a larger nucleus and also releasing energy called fusion energy,There are several major fusion projects, such as ITER, but they are all still in the experimental phase, and so far there are no working fusion reactors to produce energy.

Dr. Ali Abdul Nabi, a researcher and writer on energy affairs and former deputy chairman of the Nuclear Power Plant Authority, says that every substance in the universe is formed from small particles called atoms, and the mass of the atom is concentrated in the nucleus located in the center of the atom, pointing out that neutrons and protons are the two subatomic particles that make up the nucleus of the atom, explaining that nuclear energy is the energy at the heart of the atom, and there is natural nuclear energy and industrial nuclear energy.

Abdul Nabi explained that natural nuclear energy is radiation that comes out of the nucleus of atoms of

unstable elements, which have excess energy in the nucleus of their atoms, making them unstable. In order for unstable atoms to reach a stable state, they must get rid of excess energy in the form of radiation.

The process of getting rid of radiation is called "radioactive decay", as for industrial nuclear energy, in which nuclear energy is discharged by nuclear reactions, either by nuclear fission or nuclear fusion.

In nuclear fusion, light atoms, such as hydrogen, combine to form a larger atom, releasing energy. In nuclear fission, heavy atoms such as uranium (235) split to form smaller atoms, and energy is released.

Regarding the beginning of the discovery of nuclear energy, the former deputy chairman of the Nuclear Power Authority explained that its story began Already in 1895, when Roentgen discovered X-rays, Marie and Pierre Curie also studied this phenomenon, and their research led them, in 1898, to formulate a new word, namely radioactivity.

He noted that one of the most important and pivotal discoveries of the future of nuclear energy was also made by "Rutherford". In 1909, he discovered that the majority of the mass of an atom is contained in its nucleus.

Today, "Rutherford" is considered the father of nuclear physics. He went on to discover gamma radiation and formulate a theory about the existence of neutrons in 1920, although there was no evidence of their existence at all. Neutrinos were eventually discovered in 1932.

Nuclear Energy in Egypt:

Regarding the beginning of the use of nuclear energy, Prof. Salah El-Din El-Morshedy, a professor of thermal hydraulics and the Head of the Nuclear Research Center at the Atomic Energy Authority, as well as a visiting professor at the American University in Cairo, stated that nuclear energy began to be produced after the Second World War. Engineers and scientists involved in the development of the atomic bomb believed that a nuclear reactor would provide an excellent source of heat for the production of steam, which could be used to generate electricity.

Work has begun at Argonne National Laboratory and at Oak Ridge National Laboratory in the United States on various research and experimental reactor projects.

The first project was the experimental generator reactor (EBR-I). Construction of the reactor began in 1949 and was completed in 1951. On December 20, 1951, about 45 kilowatts of electricity were generated from the reactor. This was the first generation of electricity from a nuclear reactor; thus, the reactor was able to generate enough electricity to provide the necessary energy to operate the facility.

In the same context, Ali Abdul Nabi said that nuclear energy can be used for all peaceful purposes in Egypt, the most important of which are nuclear research, medicine, agriculture, industry, chemistry, genetic engineering, and others.

Prof. Salah El-Din El-Morshedy added to the above-mentioned uses that Egypt carries out many activities related to the peaceful uses of atomic energy in the fields of industry,

agriculture, medicine, and scientific research, and the Atomic Energy Commission is a pioneer in this field with its technical capabilities, scientists, and experts in all fields of peaceful uses of atomic energy.

Advantages and Disadvantages:

Regarding the advantages of nuclear energy, Dr. Ali Abdul Nabi stressed that all the advantages that we require in an ideal energy source used in all fields, we find in nuclear energy. Fossil energy sources and renewable energy sources are not used in the field of medicine, whether it is detection or treatment, nor in the field of genetic engineering, nor in agriculture, etc. In addition, nuclear energy is an available, cheap, and safe energy source.

Prof. Mohamed Yasser Khalil, professor of nuclear engineering at Alexandria University and Acting Chairman of the Department of Nuclear and Radiological Engineering, summarized the advantages of nuclear energy in that it is clean energy that does not cause carbon emissions that affect the environment, the amount of waste resulting from the production of nuclear energy is much smaller than the waste resulting from fossil fuels for the same amount of energy produced, and the ground footprint for the unit of energy produced is much smaller in the case of nuclear energy than fossil energy.

As for the disadvantages of nuclear energy, Prof. Mohamed Yasser Khalil stated that they include the production of radioactive waste that has no use, a long half-life, fear of nuclear accidents, and non-peaceful uses, pointing out that the price of nuclear-produced electricity is still slightly higher than the price of energy produced from fossil fuels.

For his part, El-Morshedy said that one of the advantages of nuclear energy is that it is a low-carbon energy source that reduces gas emissions and does not cause global warming or acid rain, as well as the possibility of reusing fuel from nuclear waste and reducing the environmental impact.

But one of the main disadvantages of nuclear power is that it requires a higher capital cost at the construction stage, but the cost is lower at the operation and maintenance stage, and it also requires solving the problem of long-term storage of high-level waste, along with the potential issue of nuclear proliferation.

Opportunities and Challenges:

Dr. Ali Abdul Nabi believes that one of the opportunities available to Egypt that encourages the application of nuclear energy in various fields is the Dabaa nuclear project, which represents a qualitative leap in the use of nuclear energy in the production of electric energy.

As for nuclear energy, which depends on the use of radiation and is already being applied in Egypt and in all scientific and research fields, nuclear energy, which depends on nuclear fission and is being applied in Egypt in two nuclear research reactors, represents a challenge facing the application of that advanced technology in Egypt, as these fields require full support from the state to upgrade the technologies used, as is happening in nuclear-developed countries.

Nuclear Reactors in Egypt:

Dr. Ali Abdul Nabi said that there are only research reactors in Egypt, including a Russian reactor with a capacity of 2 megawatts and an Argentine reactor with a capacity of 22 megawatts.

For his part, Prof. Salah El-Din El-Morshedy believes that the two reactors belong to the Atomic Energy Commission and are located at the Nuclear Research Center, pointing out that these reactors generate neutrons for various purposes, including the production of radioisotopes, testing materials, and conducting nuclear research.

Khalil added that, besides the research reactors, there are four power reactors under construction.

The Importance of the "Dabaa" Nuclear Project:

Prof. Salah El-Din El-Morshedy stated that the Dabaa nuclear power plant project, which is still under construction, is a dream we have been pursuing since the 1980s. This dream is now being realized after Egypt and Russia signed an agreement in November 2017 to establish a nuclear power plant to produce electricity in the Dabaa region. The project includes four 1200 MW pressurized water reactors with a total capacity of 4800 MW, and it is being implemented by Rosatom.

Dr. Ali Abdul Nabi stressed the importance of the Dabaa nuclear power plant, which is under construction, as it is the only alternative to power plants that run on fossil fuels (coal, petroleum, and natural gas), because new and renewable energy such as solar and wind energy is intermittent energy; the solar power plant operates only during the presence of the sun, and wind plants operate only during the presence of wind.

Accordingly, nuclear energy as a source of electricity production can feed the main load of the grid, and this does not apply to renewable energy (sun and wind), as it is considered complementary energy and not an alternative; because it is intermittent energy, solar and wind energy are not suitable for feeding the main load of the grid.

He stressed that the Dabaa nuclear power plant will achieve a huge boost to economic and technological development, in the electric power sector and in other fields, such as industry, medicine, agricultural production and animal production in Egypt, adding that if we talk about the return of the Dabaa nuclear power plant project, which it achieves for Egypt, we mention, for example, first, it is a project that represents national security technology for Egypt, secondly, it is a first-class investment project, as the project aims to cover its costs in less than 15 years, and thirdly, it is a national security project for clean and cheap electric energy to meet the needs of the Renaissance and development of the country.

He also stressed that electric energy is "national security," and the energy mix strategy has been developed for this purpose. It is not possible to rely on a single source of energy, and accordingly, it is not possible to rely on renewable energy only, and the expansion of renewable energy has limits, determined by technology, places, and available spaces.

Strengthening Cooperation Between Egypt and Russia:

Abdul Nabi praised the role of the "Dabaa" plant in enhancing cooperation between Egypt and Russia in nuclear energy, and this was not a spur of the moment, as cooperation between the two countries in the field of nuclear energy began in the mid-fifties and continues until now.

Russia has a major role in creating world-class Egyptian nuclear cadres, and Russia has also given Egypt a 2 MW nuclear research reactor, nuclear accelerators, and nuclear research laboratories. And there was a key role for scientists. The Russians are supervising the implementation of the Egyptian Nuclear Research Center.

Prof. El-Morshedy also stressed the role of the Dabaa nuclear power plant project in enhancing cooperation between Egypt and Russia in nuclear energy, considering Russia as a reliable strategic partner in providing nuclear fuel and spare parts necessary for the sustainable operation of the plant. This comes as an extension of the successful partnerships with the Soviet Union previously in the High Dam project and Egypt's first research reactor.

Yasser Khalil also added that a project of the Dabaa nuclear power plant's magnitude will certainly not be the last collaboration between Egypt and Russia. It fosters a shared understanding and cooperation in the field of peaceful uses of nuclear energy.

Nuclear Energy Is a Safe Source of Environmental Safety:

Regarding the extent to which nuclear energy is considered a safe source of environmental safety, Prof. Mohamed Yasser Khalil explained that mega projects are working toward reducing environmental emissions, which, together with other projects such as solar power plants and wind power plants, will lead to Egypt fulfilling its pledges to reduce carbon emissions.

Dr. Ali Abdul Nabi noted that the main requirement of mankind has become the rapid reduction of carbon dioxide emissions and other harmful emissions to mitigate climate change.

He explained that nuclear plants do not emit "carbon, sulfur, and nitrogen oxides," either during normal operation or during accidents, and that they are considered environmentally friendly plants. In addition, the safety standards for third-generation nuclear reactors are quite high.

He added that nuclear fuel is an energy source, and it does not threaten the natural system of the planet's climate as oil, natural gas, and coal do.

He continued that decarbonization has become the biggest challenge, and the global energy strategy is gradually moving toward clean energy. By 2050, electricity sources will be "zero carbon." "That is, they neither produce nor emit the gases "oxides of carbon, sulfur, and nitrogen" from which the problems of climate change result.

Renewable energy sources—solar, wind, and nuclear—have become the cleanest and reliable sources of energy available to us.

Transition to Clean Energy:

In this regard, Prof. Mohamed Yasser Khalil pointed out that nuclear energy is one of the pillars of environmentally clean energy, as it is characterized by being energy-intensive and reliable as an energy base because it is not as variable as solar or wind energy, which largely depends on climatic fluctuations and hours of sunshine or absence of sunshine.

Prof. El-Morshedy added that the main focus should be on the deployment of energy technologies that emit only small amounts of carbon dioxide per unit of energy because three quarters of carbon dioxide emissions are caused by burning fossil fuels for energy, which is the main cause of climate change caused by increasing concentrations of carbon dioxide in the Earth's atmosphere.

Total Dependence on Nuclear Energy:

Prof. Salah El-Din El-Morshedy answered about the possibility of total dependence on nuclear energy in electricity production in Egypt that it is not wise to rely entirely on only one type of energy source, but energy sources should be diversified while maximizing the use of renewable sources, such as solar energy, wind energy, falling and flowing water energy, tidal energy, biomass energy, and geothermal energy.

He explained that the total of these energies does not meet more than 10% of the country's electricity needs; therefore, reliance on fossil fuels is being relied on through steam, gas, and vehicle stations so far.

He added that after the inauguration of the Dabaa nuclear power plant, there is hope to gradually maximize the use of nuclear energy at the expense of the energy generated by burning fossil fuels. Besides, there are hopes related to the diversification of nuclear reactors at our plants and the use of other types, such as heavy water reactors powered by natural uranium, that do not need the enrichment process.

Prof. Mohamed Yasser Khalil also stressed that there is no such thing as total dependence on one source of energy and that there must always be diversity, as the diversity of energy sources is one of the policies followed in all countries in the world.

Also, the diversity of energy sources aims not only to take advantage of relatively cheap energy, such as renewable types of energy, but also to ensure the permanence and continuity of energy production necessary for society under various conditions.

Dr. Ali Abdul Nabi pointed out that nuclear energy cannot be completely relied on from a technical point of view. But Egypt can rely on nuclear energy to generate electricity by up to 75%. And that this figure is applicable, France reached it in its dependence on nuclear energy after the oil crisis after the October War of 1973.

The reliability rate can reach 80%, especially after nuclear plants have become load-tracking, with the diversity of nuclear reactors that pump electricity to the grid, including large-capacity nuclear reactors and small and medium-sized nuclear reactors.

The importance of the energy mix comes from the participation of other energy sources in electricity generation, the most important of which are renewable energy sources.

Safety Standards in Nuclear Reactors:

With regard to the safety standards of the design and operation of nuclear reactors, Prof. Salah El-Din El-Morshedy stressed that nuclear reactors are subject to strict safety standards at all stages, from design and site selection through operation and maintenance to decommissioning, where safety and security standards are a top priority.

He added that nuclear power plants are among the safest facilities in the world, but accidents can occur, which negatively affect people and the environment.

To minimize the likelihood of an accident, the IAEA helps member states apply international safety standards to enhance the safety of nuclear power plants.

Power Dr. Ali Abdul Nabi Highlighting the important measures taken to achieve the highest standards of nuclear safety, including the establishment of strict controls in the design and use of nuclear reactors to prevent the exposure of people to radiation and control the release of radioactive materials into the environment, as well as reducing the likelihood of events that may lead to loss of control over the nuclear chain reaction inside the nuclear reactor core, and in the case of "God forbid" if an accident occurred, there are mechanisms taken to mitigate the consequences and damage of ionizing radiation and full control over the incident and prevent its aggravation.

He explained that nuclear safety standards are applied through an effective management system, which requires leadership at the highest level, a leadership that can integrate all elements of management, so that safety requirements are developed and applied in a consistent manner with other requirements, including the requirements of human performance, quality, and security, and so that safety is not compromised by other requirements or demands.

Prof. Mohamed Yasser Khalil discussed the development of safety standards for the design and use of nuclear reactors, pointing out that they are constantly evolving and improving, especially that there are experiences gained every day during operations, and these experiences are transferred to research centers that include them in new designs or in updating designs that are already working, pointing out that the final results of development processes find their way quickly to approval by regulatory bodies and implementation by reactor operators.

Prof. Karim El-Din El-Adham, professor of nuclear engineering at the Atomic Energy Authority, spoke in detail about

the components of nuclear safety during the design and operation of nuclear reactors, which includes site selection so that it is subject to criteria in terms of seismic and volcanic stability, soil composition, groundwater, wave movement, climatic conditions, population distribution, and other factors that must be taken into account when designing the plant, and includes all parts of the plant, whether construction or components for all parts of the plant from nuclear, mechanical, electrical, and safety systems.

At every step and every part, all factors must be taken into account, including the characteristics of the site, manufacturing, and construction, so that we make sure that all components and systems have been manufactured in accordance with the relevant standards set by the regulatory authority and that the construction is carried out in accordance with what was previously approved during the licensing process for each stage and inauguration, before the necessary tests are carried out on the individual and assembled components of the plant and ensure their readiness for safe operation.

He pointed out that one of the safety criteria is also operation. It includes operating the plant in accordance with the organized rules, ensuring the safe operation of all components and systems, the validity of operators for their assigned tasks, and incident management. It includes readiness to face all types of accidents, expected scenarios, and steps to deal with them in order to protect humans and the environment from any dangers. To complete the safety elements, when designing the plant, a scenario for the forecasting process must be developed after the end of the operational life of the plant, including the fate of components and dealing with radioactive waste emergency preparations, including the preparation of plans according to the expected scenarios and how to deal with each event depending on its quality and severity.

El-Adham explained that nuclear safety is an integrated process that requires the presence of an independent regulatory authority supported by the necessary legislation and has the relevant regulations for all safety components, from site selection to speculation, to ensure that each step meets the corresponding requirements and has the right to inspect and review everything.

Nuclear Energy Safety Standards:

Dr. Ali Abdul Nabi defines the standards with regard to the basic task of nuclear safety, which is to prevent the exit of radioactive materials from the nuclear plant and their spread in the surrounding environment so as not to cause harm to the environment and to humans, animals, plants, etc., whether during normal operation or during accidents.

He added that third-generation nuclear reactors are developed, such as the Dabaa nuclear reactors, located inside a containment vessel withstanding an earthquake of 8 Richter, the fall of an aircraft loaded with passengers and cargo, devastating floods, tsunamis, severe hurricanes, and strong winds. Under the reactor pressure vessel, there is a "reactor core trap, which assures us that radioactive materials will not come out to the environment even if there is a meltdown of the reactor core.

He stressed that there is no fear for the residents of the Dabaa center or for tourism from the operation of the station or from an accident at the station, as the station is protected inside the containment container.

He pointed out that the operation of the nuclear plant produces very small amounts of radioactive gases and liquids, as well as small amounts of direct radiation. If you live next to the Dabaa nuclear power plant, you will receive an annual radiation dose of about 0.01 rem.

And to put this in from the right perspective, we find that the average person receives an annual dose of about 350 mm rem from the radiation of the surrounding nature, "natural background radiation," and is exposed to an annual radiation dose of 30 mm rem from eating and drinking.

Note that the radiation dose that causes cancer is 10 thousand rems, which was not caused by nuclear plants, only once in the "Chernobyl" accident in Ukraine in 1986.

Speaking about the safety standards, Prof. Mohamed Yasser Khalil said they consist of safety basics, safety requirements, and safety manuals, and they are the responsibility of the operator of the nuclear reactor. The state's regulatory bodies are also closely monitoring the implementation of these procedures.

The Cost of Nuclear Energy:

Dr. Ali Abdul Nabi stated that the cost of nuclear energy represents one of the challenges facing reliance on nuclear energy, as the costs of constructing nuclear plants with large capacities (1000 MW or more) are high. Therefore, we find that the future of nuclear energy in the world, especially in developing countries, will depend on the next generation of nuclear reactors.

Given that the operational life of the nuclear plant is 60 years and the operational life of natural gas-fired plants is 25 years, we find that the price per kilowatt per hour produced by nuclear plants is competitive.

In a related context, Prof. Mohamed Yasser Khalil pointed out that nuclear energy is still not the cheapest type of energy despite its advantages, mainly due to the high cost of constructing nuclear plants and the cost of producing nuclear fuel. However, research is continuing in many countries around the world, including Egypt, to select and test the fourth-generation reactors, which will be the safest and best in the use of nuclear fuel and the recycling of radioactive waste with a long half-life.

Nuclear Fusion Developments:

Prof. Salah El-Din El-Morshedy defines nuclear fusion as the process by which two light atomic nuclei are combined to form one heavier nucleus with the release of energy.

While almost all stable isotopes lighter than iron on the periodic table can fuse with some other isotope and release energy, deuterium and tritium are the most attractive for energy generation; they require the least activation energy (and therefore the lowest temperature) to do so.

Nuclear fusion has many attractions, such as abundant fuel, safety, the fact that it the fact that it does not produce carbon dioxide or atmospheric pollutants, and the fact that the fact that the resulting waste is relatively short-lived.

He mentioned an example of nuclear fusion, which is the ITER experimental thermonuclear reactor project, which is at the forefront of nuclear fusion projects in the world because it is an international cooperative project to design, build, and operate a fusion reactor with a capacity of 500 MW.

He added that the project participants are the world's leading fusion energy programs, represented by the European Union, China, India, Japan, South Korea, Russia, and the United States. The main goal of ITER is to demonstrate the scientific and technological feasibility of using nuclear fusion energy for peaceful purposes. He pointed out that on November 21, 2006, the seven participants officially agreed to finance the construction of a nuclear fusion reactor.

He pointed out that the ITER project is currently under construction on a 180-hectare site in Cadarache in the south of France, and the ITER Council has approved the general schedule of the project, which sets December 2025 as the earliest technically achievable date for First Plasma and 2035 as the beginning of the deuterium-tritium process. We at the Atomic Energy Commission are following the project with great interest and encourage our researchers to work in this area.

He explained that he personally has several research papers published in scientific journals classified Q1 in the hydrothermal design of Liter Divertor, the last of which was two months ago, in addition to his participation in a number of international conferences and technical meetings organized by the International Atomic Energy Agency on ITER.

For his part, Dr. Ali Abdul Nabi said that there are huge engineering challenges that accompanied the idea of designing this type of fusion reactor, and researchers are still facing some problems so far.

The initial challenges were: first, how to obtain electrically superconducting materials for the manufacture of very strong magnets. Secondly, how to obtain materials that withstand extreme heat for the construction of the walls of the reaction chamber.

The current challenge is how to achieve an engineering system that can confine the plasma for a long enough time at a high temperature and density to allow a long-term interaction to occur long enough to obtain sustainable energy in the required quantity.

He stated that nuclear fusion reactors are expected to have many theoretical advantages over nuclear fission reactors, including reduced radioactivity during operation, less nuclear waste, fuel availability and abundance, and an increase in safety.

He hopes that nuclear fusion reactors will be commercially available in 2040, with capacities that surpass those of fossil fuel plants and nuclear fission reactors.

Map of Nuclear Energy in the World:

Prof. Mohamed Yasser Khalil says that there are 32 countries around the world that have energy-producing nuclear reactors. These countries operate about 413 nuclear reactors of various

capacities. While a country like France has the highest percentage of nuclear energy use from domestically used energy, the United States of America has the largest number of reactors among the countries producing nuclear energy.

In this context, Dr. Ali Abdul Nabi pointed out that one of the challenges facing reliance on nuclear energy is the competition from natural gas and renewable energy. All this has weakened the possibility of building large new nuclear plants, especially in America and European countries. Investing in new nuclear plants has become very difficult for the private sector.

But at the level of nuclear power plant projects in some countries, such as Russia and China, we find them flourishing; because they are national projects, they are subordinate to government institutions and bodies, and the government is responsible for nuclear projects at all stages.

Today, Russia and China account for more than 60% of new nuclear plants under construction worldwide.

China has 56 nuclear reactors and is building 25 nuclear reactors, and Russia has 36 nuclear reactors and is building 4 nuclear reactors.

Russia dominates the global market for nuclear reactors, with America and France in retreat. Over the past ten years, the United States of America has lost its leading position in the market for nuclear power plants in favor of Russia, pointing out that today there are There are 442 nuclear reactors in 31 countries, and 58 nuclear reactors are under construction.

The Future of Nuclear Energy in the Middle East:
Dr. Ali Abdul Nabi stressed that nuclear power plant projects are huge projects with large investments, pointing out that there are challenges facing nuclear power plant projects, including the collapse of confidence in the safety of nuclear plants due to nuclear accidents, delays in the implementation of advanced nuclear power plants, especially in America and Europe, which caused an increase in costs, high costs of construction of large nuclear plants, and competition from natural gas and renewable energy. All this weakened the possibility of building new large nuclear plants. Investing in new nuclear plants has become very difficult for the private sector.

On the future of nuclear energy in the world, Dr. Ali Abdul Nabi explained that it depends on the next and advanced generations of nuclear plants, such as some fourth-generation reactors, small and medium reactors, ultra-small nuclear reactors, or nuclear fusion reactors. Therefore, we find that during the recent COP28 climate change conference, the crucial role that nuclear energy can play in helping the world's countries reduce their carbon emissions was recognized for the first time, and the climate change conference witnessed the signing of a declaration by 22 world leaders to make efforts to triple nuclear energy by 2050.

On the future of nuclear energy in the MENA region, Prof. Mohamed Yasser Khalil said that nuclear energy is constantly gaining new ground in the region.

He also said that many countries now see the decay of fossil energy sources and their devastating impact on the environment, and while renewable energy can only be relied on if there are means to store energy in huge quantities as a primary source of energy for the reasons mentioned earlier, nuclear energy stands alone in achieving most of the requirements for energy production necessary for life and progress in human societies.

Regarding the future of nuclear energy in Africa, Prof. Salah El-Din El-Morshedy said that it suffers from the largest energy gap, which must be filled in the coming years.

He stated that according to the International Energy Agency, 55% of the population of Sub-Saharan Africa lacks electricity, and in 13 African countries, no more than 75% of the population does not have access to electricity; therefore, nuclear energy is expected to play a key role in achieving development in these countries, especially with the advent of small and micro-modular reactors.

Egypt Benefits from Nuclear Energy:

Prof. Mohamed Yasser Khalil stated that Egypt is on the right path to acquire the means of production and development of nuclear energy. He stressed that this comes through the creation of a new generation of scientists and engineers with experience in the development, establishment, and operation of nuclear plants and continuous development in the feeder industries for nuclear plants to be able to meet the exact conditions of use in nuclear plants and complete the legal, regulatory, and administrative infrastructure necessary to control the operation and operation of nuclear plants.

Dr. Ali Abdul Nabi pointed out that, after more than sixty years since the operation of the first nuclear power plant, it has been found that nuclear energy is the safest type of energy. This applies to any measure, be it human error rates, equipment failure rates, worker injury or death rates, effects on the surrounding population of the plant or the environment surrounding the plant, or rates of unplanned shutdowns.

He stated that nuclear energy is the "energy of the future"; it is clean, safe, and cheap energy, and that the most important gain of the Dabaa nuclear power plant is the high quality of industry in Egyptian factories. When nuclear technology enters the country and is localized in Egyptian factories, the quality of industry rises and becomes the locomotive of progress and renaissance of the country, and we can compete with the major industrial countries.

Tenth: Presentations of Books and Scientific Dissertations in English

The Energy Sector and Energy Geopolitics in the MENA Region at a Crossroad

Ahmed Abou Youssef: Researcher at Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

The book entitled "The Energy Sector and Energy Geopolitics in the MENA Region at a Crossroad" was co-authored by Manfred Hafner, Pier Paolo Raimondi, and Benedetta Bonometti in 2023 and was published by Springer. The book analyzed the impact of the energy sector on shaping geopolitics in the MENA region, given that the area is full of natural resources needed to maintain progress in the MENA region.

The authors started their book by referring to the abundance of natural resources in the MENA region. However, the dynamics of the energy sector are rapidly changing, driven by factors such as climate change concerns, technological advancements, and evolving consumer preferences. As a result, MENA countries are facing the dual challenge of meeting their energy needs while also transitioning toward more sustainable and environmentally friendly energy sources.

A) More emphasis on investing in renewable sources of energy:

The Middle East and North Africa (MENA) are increasingly turning to renewable energy sources like solar and wind. This shift aims to achieve two goals: diversifying their energy sources and reducing their environmental impact. However, this transition comes with its own set of hurdles, requiring investments in infrastructure, policy changes, and workforce training. MENA countries see this move to renewables not just as an environmental necessity but also as a strategic move to ensure their long-term energy security and remain

competitive in a global energy market that's rapidly evolving.

The focus isn't solely on cutting carbon emissions. The MENA region's energy transition is also about reshaping its position in the global energy market and becoming more resistant to external disruptions. By adopting renewable energy and innovative energy policies, these countries can achieve multiple benefits: reducing their environmental footprint, creating new economic opportunities, strengthening their energy security, and promoting sustainable development. This book is a valuable tool for policymakers, researchers, and industry players who want to understand the complexities of the MENA region's energy landscape and navigate the challenges and opportunities of this ongoing energy transition.

B) The role of oil is still important despite the attention paid to other factors:

The world's dependence on oil, cemented by Churchill's decision, has had a major impact on global politics and economies. In the MENA region, decolonization led to independent states and a new power dynamic. The region's growing population, booming economies, and industries are creating a huge energy demand. Sustainable practices and investments are essential to guaranteeing long-term energy security and environmental well-being.

Beyond water scarcity, MENA faces social and economic challenges like high youth unemployment, income disparity, and a need to diversify away from oil dependence. These issues call for broad reforms to address weaknesses and promote inclusive economic growth. Renewable energy and energy efficiency are critical for MENA countries to fight climate change, lower emissions, and create a sustainable energy future for generations to come. By embracing innovation, investing in education and skills, and working together regionally, MENA nations can overcome these hurdles and unlock a path toward sustainable development and prosperity.

C) The connection between the energy landscape and the geopolitical dynamics in the MENA region:

The MENA region's energy landscape is also influenced by geopolitical dynamics, with countries like Saudi Arabia, Iran, and the UAE playing pivotal roles in global energy markets. These nations have significant oil and gas reserves, making them key players in shaping global energy policies and strategies. The region's energy policies are often intertwined with broader economic and political objectives, with energy security and diversification being key priorities for many countries.

In recent years, there has been a growing emphasis on renewable energy and energy efficiency in the MENA region. Countries are increasingly investing in solar and wind power projects to diversify their energy mix and reduce reliance on fossil fuels. The transition toward renewable energy is driven by both environmental concerns and economic opportunities, with renewable energy projects seen as a way to create jobs, attract investment, and enhance energy security.

Despite the shift toward renewable energy, fossil fuels continue to dominate the energy mix in many MENA countries. Oil and gas revenues remain crucial for government budgets and economic development, posing challenges for the region's transition to a more sustainable energy future. Balancing the need for economic growth with environmental sustainability remains a key challenge for policymakers in the MENA region, highlighting the complex interplay between energy, the economy, and the environment. The authors have provided a brief analysis of key countries in the MENA region, as follows:

- Syria has been deeply scarred by a prolonged civil war that began in 2011, resulting in widespread devastation, displacement of populations, and humanitarian crises. The conflict has drawn in various regional and international actors, shaping the dynamics of the war and its resolution.

- Iran has faced significant hurdles in its gas exports due to international sanctions and political isolation, impacting its energy sector and economic stability. Despite these challenges, Iran has pursued strategic partnerships and pipeline projects to enhance its gas export capabilities and strengthen its position in the global energy market.

- Jordan has grappled with energy supply disruptions, leading to a reliance on imports and efforts to diversify energy sources. The country's initiatives to import gas from various partners, including Egypt and Israel, reflect its strategic approach to meeting domestic energy demands and enhancing energy security.

- Mashreq Countries, encompassing nations like Egypt, have experienced diverse economic trajectories, with Egypt demonstrating notable GDP growth. These countries face complex economic landscapes shaped by factors such as political stability, regional conflicts, and global economic trends.

- Egypt's energy sector heavily relies on natural gas for electricity generation, with a significant increase in gas turbine installations in 2015 as part of an emergency program. The country has achieved energy security through a combination of LNG imports and domestic production. In 2019, oil and gas together represented 91.9 Mtoe, or 96% of Egypt's total primary energy supply, with natural gas accounting for 62% and oil for 34%.

- Algeria's energy sector is dominated by oil and gas exports, with limited diversification in its total primary energy supply. The country has been a major player in the global energy market since the 1960s, with significant reserves of natural gas. Algeria holds the second-largest proven gas reserves in Africa, amounting to 4.3 tcm in 2019, making it strategically important for Europe due to its proximity and gas exports.

- Palestine faces challenges in developing an efficient energy sector, with restrictions from Israel impacting its energy security. The country experiences extenuating blackouts lasting up to 18 hours per day, hindering the provision of essential services like healthcare. Palestine is negotiating with Jordan to increase imported electricity to address its power generation woes and improve energy access for its population.

- Saudi Arabia has set ambitious renewable energy targets, aiming for 5.9 GW of solar energy by 2023 and 59 GW of renewables by 2030. Initiatives like the Renewable Energy Development Office (REPDO) and the Public Investment Fund (PIF) Program are driving progress toward these goals.

- Qatar is also committed to renewable energy, with targets to reduce greenhouse gas emissions by 25% by 2030 and meet 20% of energy demand from renewables. Despite delays in projects like the 3.5 GW solar complex, Qatar remains focused on achieving its renewable energy objectives.

To conclude, the authors stated that the MENA countries are actively transitioning to renewable energy sources to enhance energy security, create trade opportunities, and facilitate the integration of renewable energy. Regional power interconnections play a crucial role in supporting renewable projects and increasing the share of renewable energy sources in the energy mix of MENA countries and beyond.

Low-Carbon Energy in the Middle East and North Africa

Dina Sherin: Researcher at Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

Introduction:

"Low-Carbon Energy in the Middle East and North Africa", edited by Robin Mills and Li-Chen Sim in 2021, delves into the evolving roles of energy stakeholders and geopolitical considerations in the Middle East and North Africa (MENA) region. It explores a wide array of planned and actual projects related to solar, wind, hydropower, waste-to-energy, and nuclear power. As the world transitions toward low-carbon energy sources, MENA countries face critical questions: Will they be losers or leaders in this energy shift? How will state-society relations be affected?

Key Points:

Energy Transition: Over the next few decades, favorable economics for low-carbon energy sources, coupled with stagnant oil demand growth, will drive a shift away from fossil fuel-based energy systems.

Geopolitical Considerations: The book emphasizes that politics, more than economics or environmental pressure, will determine the speed, scope, and effects of low-carbon energy adoption in the region.

Academic Relevance: This work is relevant to scholars in fields such as International Relations, International Political Economy, Comparative Political Economy, Energy Economics, and International Business.

Whether MENA becomes a trailblazer in sustainable energy or faces challenges, this book sheds light on the complex interplay of energy, politics, and society in the region.

Chapter One: "Low-Carbon Energy in the Middle East and North Africa: Panacea or Placebo?"

This chapter focuses on the Middle East and North Africa (MENA) region faces challenges and opportunities in transitioning to low-carbon energy sources. The region, rich in oil and gas reserves, is a significant energy consumer with a dominant role in global energy markets. However, political dysfunction and corruption hinder progress in adopting renewable energy sources. State dominance in the electricity market and limited privatization contribute to the slow implementation of low-carbon technologies. Despite efforts in solar and wind energy, the region struggles with bureaucratic obstacles and political rivalries, impacting the achievement of renewable energy targets.

Chapter Two: "The Politics of Low-Carbon Energy in Iran and Iraq"

This chapter focuses on Iraq faces challenges in its power sector due to damaged infrastructure from wars and looting, increasing power demand post-invasion, and a split electricity system between federal Iraq and the Kurdistan Region. Iran's energy landscape includes historical nuclear power plants, a state-dominated energy sector post-revolution, and challenges in renewable energy progress due to sanctions and bureaucracy. Kurdistan's hydropower projects are hindered by budget constraints affecting dam construction and water availability issues influenced by regional factors. Iran's energy transition is complicated by being a gas-rich state facing bureaucracy and domestic consumption challenges, making it unlikely to become a major gas exporter due to sanctions and regional tensions.

Chapter Three: "Pairing Coal with Solar: The UAE's Fragmented Electricity Policy"

This chapter focuses on Abu Dhabi's nuclear investment aims to leverage oil wealth for long-term power needs, with the Barakah reactors potentially providing electricity until 2080. The nuclearization process strengthens the central state and regime control, enhancing internal security measures justified by technology hazards while also increasing surveillance and reducing dissent tolerance. Going nuclear may raise the West's stake in the regime's survival, potentially preventing anti-US governance shifts. However, Abu Dhabi's experience with nuclear power has been challenging, with ambitious completion deadlines unmet and high costs making the Barakah plant uncompetitive. Despite this, mastering nuclear development opens doors for future options like small modular reactors to address climate challenges. Additionally, the UAE's fragmented energy landscape includes plans for coal-solar pairing, with Masdar's clean energy ambitions scaled back post-2009 recession, impacting projects like Masdar City and a hydrogen power plant. The slow start in renewables deployment in GCC states is attributed to historical obstructionist roles in climate forums, with hydrocarbon-rich states hesitant to shift from oil dependence. Challenges in diversification criteria include economic performance, energy security, dispatch ability, and environmental concerns, with the UAE aiming for gas self-sufficiency by 2032 through nuclear, coal, and renewables diversification. The UAE-Qatar conflict, despite airspace closures and trade bans, has been mitigated by Qatar's continued gas supply via the Dolphin Pipeline, maintaining

gas flow at contracted prices and enabling Abu Dhabi's lucrative LNG exports.

Chapter Four: "The Rise of Renewables in the Gulf States: Is the 'Rentier Effect' Still Holding Back the Energy Transition?"
This chapter focuses on the Gulf states have faced challenges in transitioning to renewable energy, with issues like capital diversion and energy subsidies impeding progress. Recent advancements in the UAE and Saudi Arabia suggest a move toward large-scale renewable energy projects, while Morocco's initiatives demonstrate a strong focus on sustainable development. Despite these positive steps, Saudi Arabia has encountered credibility issues with its renewable energy targets, underscoring the significance of economic factors in influencing the adoption of renewables across the MENA region. The region's journey toward renewable energy adoption is marked by a complex interplay of political, economic, and social dynamics, shaping the trajectory of sustainable energy development in these resource-rich states.

Chapter Five: "From Fuel-Poor to Radiant: Morocco's Energy Geopolitics and Renewable Energy Strategy"
This chapter focuses on Morocco's renewable energy policy focuses on utilizing renewable resources to achieve social and economic development goals, aiming to address challenges such as youth unemployment by creating green jobs through initiatives like Concentrated Solar Power (CSP) plants. The country's energy transition is influenced by external factors like financing from development banks and international climate change negotiations. In contrast, Turkey heavily depends on fossil fuels, with natural gas and coal dominating its energy mix, despite having significant renewable energy potential. The country's reliance on fossil fuels poses economic, geostrategic, and environmental risks, with coal emerging as a major competitor to natural gas in recent years.

Chapter Six: "Byzantine Energy Politics: The Complex Tale of Low-Carbon Energy in Turkey" This chapter focuses on the energy transition in Turkey has been influenced by political intervention, with politicians retaining control over production permits and pricing mechanisms, hindering significant reforms. The state's monopoly on natural gas imports persisted due to a reluctance to relinquish regulatory power. The AKP's embrace of neoliberalism allowed for renewable energy legislation, but the focus on hydropower and nuclear power reflected a growth-oriented state ideology. The institutional capacity of the AKP government, with its majority rule, facilitated effective energy reforms. Geopolitical dynamics, such as Egypt's renewable energy development driven by economic growth and population rise and Turkey's nuclear energy ambitions motivated by geopolitics and diversification of energy sources, have played a role in shaping the energy landscape in the region.

Chapter Seven: "Electricity Sector Developments in Egypt: Toward an Increasingly Clean and Independent Future"
This chapter focuses on Egypt's electricity sector has undergone significant developments, transitioning to competitive auctions for

renewable support and attracting investments for clean energy projects. Market reforms and policy agendas are encouraging private sector participation in power generation, leading to increased renewable energy capacity. The country's nuclear and radiological regulatory experience underscores the importance of effective oversight for safety and security in these sectors. Overall, Egypt is on a path toward a more sustainable and prosperous energy sector, with a focus on carbon-free electricity generation and managing potential risks proactively.

Chapter Eight: "Levant: Where Politics Defeat Alternative Energy Disruptions"

This chapter focuses on the Levant region, including Jordan, Lebanon, and Palestine, faces challenges in transitioning to renewable energy due to political obstacles, a lack of long-term planning, and institutional weaknesses. The energy sector suffers from shortages in electricity supply, with outdated infrastructure and a focus on thermal generation rather than renewables. Political rivalries and vested interests in the fossil fuel sector hinder progress, leading to delays in diversification efforts. Despite some initiatives like rooftop solar projects in Palestine and net-metering schemes in Jordan, the overall lack of strategy and clarity on the energy mix, coupled with political clashes, obstructs the region from achieving sustainable energy goals.

Chapter Nine: "Governance Amid the Transition to Renewable Energy in the Middle East and North Africa"

This chapter focuses on the transition to renewable energy in the MENA region is crucial for creating jobs, reducing reliance on fossil fuels, and addressing the burden of fossil fuel subsidies on governments, particularly affecting the poor. The resource curse theory explains the impact of oil wealth on politics, while nuclear energy contributes to electricity demand in MENA, albeit at a low percentage. The renewable energy transition offers opportunities to address youth unemployment, boost employment, use fossil fuel assets for financing renewable projects, enhance oil recovery through large-scale renewable power plants, and navigate the complex political and economic implications of the energy transition in the region.

Chapter Ten: "Powering the Middle East and North Africa with Nuclear Energy: Stakeholders and Technopolitics"

This chapter focuses on Turkey's 'double dependence' on Russia for gas and nuclear power raises concerns, while weak opposition to nuclear power in MENA countries is attributed to a nuclear-ambivalent public. Public trust issues in government impact perceptions of nuclear energy in Jordan. A comparison of policy choices between oil-exporting and non-oil-exporting Arab countries reveals differences. Arab countries have made progress in domestic climate change policy over the past decade. Rosatom faces challenges in the MENA region due to competition from China and Russia's foreign policy actions.

Chapter Eleven: "Climate Change Policy in the Arab Region"

This chapter focuses on Morocco has been proactive in climate change initiatives, particularly in African agriculture and the Sahel

region, actively engaging in international negotiations with a focus on renewables and adaptation financing. Egypt boasts a mature policy framework that attracts donor funding, as evidenced by the high number of registered CDM credits and its role as a coordinator in UNFCCC negotiations. Saudi Arabia maintains consistent international negotiating positions but hesitates to integrate clean energy into its national climate policy, instead focusing on softening its public image through research and project showcases.

Conclusion:

Overall, the book suggests that the future of energy in the Middle East and North Africa is far from predetermined. With careful planning, investment, and collaboration, the region has the potential to become a major player in the global shift toward a sustainable, low-carbon energy future.

Making Energy Markets: The Origins of Electricity Liberalization in Europe

Hadeer Abdelrahman: Researcher at Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

"Making Energy Markets: The Origins of Electricity Liberalization in Europe" by Ronan Bolton in 2021 offers a comprehensive examination of the emergence and early evolution of electricity markets in Western Europe during the late 1980s and 1990s. Focusing on the shift from state-controlled electricity systems to liberalized markets, the book explores political decisions, economic logic, and industry dynamics. It highlights the role of the European Economic Community (EEC) in shaping these markets and their contemporary relevance in discussions about renewable energy transitions.

Chapter One:

This chapter introduces the concept of economization to explain market construction through socio-technical work, viewing markets as socio-technical agencies involving various elements. However, there is a lack of historical accounts detailing the transition to competitive electricity markets in Europe. Western Europe encountered challenges due to political control, high energy prices, and environmental concerns.

The evolution of electricity liberalization in Europe showcased varied approaches in countries like Britain, France, and Germany. The differences in national styles of electricity liberalization are discussed throughout the study. The transition from centralized planning to competitive markets was influenced by concerns about industrial

competitiveness and a reevaluation of long-term electricity demand growth.

In the British context, the emphasis was on private ownership and competition in the electricity market, marking a pioneering case associated with the Thatcherite 'neo-liberal' project. The British experience played a significant role in shaping the European-level reform process, influencing proponents and opponents of competition and structural reform during a politicized period that lasted until the mid-1990s. Throughout the book, the distinctions between national approaches to electricity liberalization, such as those of Britain and Germany, are explored.

Chapter Two:

The chapter delves into the policy issues surrounding the privatization of the electricity industry in England and Wales. There was a significant debate regarding the separation of the transmission grid from generation, with various proposals considered. Options ranged from maintaining the CEGB intact to splitting it into competing generators of equal size to foster competition in the industry. However, proposals such as the en bloc sale of a unified industry or the creation of integrated utilities at the regional level were excluded due to concerns about competition and practicality.

The balance between compassion and efficiency in the privatization process was a key theme. Thatcher's commitment to promoting competition often clashed with Marshall's concerns about potential cost increases and power failures resulting from splitting the CEGB. The influence of One-Nation Toryism, echoing figures like Macmillan and Heath, could be seen in the evolving dynamics of the privatization process, highlighting the complex interplay between political ideology and economic pragmatism.

The concept of "inventing competition" within the CEGB was explored, with Marshall advocating for a competitive model while facing challenges from government interventions and industry performance. The role of the CEGB in lobbying for its interests and eventual sidelining in the privatization discussions underscored the power dynamics at play. Looking ahead, the emergence of retail competition as a central debate point hinted at the evolving landscape of the electricity industry in the context of privatization and regulatory reforms.

Chapter Three:

The contractual structure for the electricity industry involved long-term agreements between generators and British Coal for fuel supply, along with an obligation on RECs to purchase nuclear output at prices above market rates. This setup limited competition and retail competition for RECs, deviating from the initial vision outlined in the White Paper.

Challenges arose due to the poor performance of AGRs and Magnox Technology, escalating nuclear liabilities, and provisions. The privatization of the nuclear industry faced hurdles, leading to pricing disputes and uncertainties in market dynamics.

Political and market dynamics were influenced by the miners' strike of 1984/85 impacting coal markets and the UK's negotiations with the EU Commission for nuclear subsidies, which underwent scrutiny during this period.

Financial considerations played a significant role, with the impact of coal prices on investment decisions and the privatization aimed at reducing public sector borrowing. The chapter delves into the complexities of balancing industry needs with regulatory frameworks and financial sustainability.

Chapter Four:

The chapter delves into the evolution of Combined Cycle Gas Turbine (CCGT) investments, initially focusing on peaking plants before transitioning to baseload supply, challenging the dominance of coal in the market. It highlights concerns surrounding pool pricing and the potential bypassing of capacity charges, along with criticisms of market design and its impact on competition. The shift from coal to CCGTs is emphasized, showcasing struggles with market power and pool pricing dynamics.

Regulatory changes are explored, indicating pressure for diversification and divestment within the industry. The chapter discusses the transition toward more integrated generation and distribution models, reflecting on the challenges and adjustments made to adapt to the changing landscape of the electricity market. The dynamics of the market, regulatory interventions, and the strategic responses of key players are analyzed to provide insights into the ongoing evolution of the energy sector.

Chapter Five:

The chapter focuses on the economic logic of trade in Europe, focusing on the discussions within the European Economic Community (EEC) about liberalizing electricity trade between national systems. It explores the motivations behind this push, including electricity imbalances in national systems, particularly in France with its surplus nuclear capacity, and shifts in international energy markets. The chapter outlines the key drivers for liberalization and the challenges faced in implementing cross-border trade in the electricity sector.

Furthermore, it discusses the early proposals for electricity liberalization in the late 1980s and early 1990s, emphasizing the concept of 'common carriage' across transmission networks to enable consumers in one country to contract with producers in another. The chapter also addresses the role of the European Commission in facilitating market integration and the need for collaboration between Member States to achieve a more competitive and integrated electricity market. Challenges such as the influence of local supply monopolies and differing views on competition are highlighted, underscoring the complexities of transitioning toward a more open and competitive electricity market in Europe.

Chapter Six:

The chapter introduces the concept of the national electricity regimes of France and Germany, the two largest electricity markets in the European Community. It explores why these nations hesitated to adopt the competitive 'British Model' for electricity markets and how

this reluctance influenced EEC-level reforms in 1996. The French case highlights a shift from coal to nuclear power in the late 1950s, driven by the ambitious nuclear expansion program initiated by the 'Plan Jeanneney' in 1960, resulting in excess production capacity by the early 1980s. On the other hand, the German electricity industry faced challenges due to an entrenched power cartel, with municipalities, utilities, the mining industry, and trade unions resisting deregulation efforts.

The chapter also discusses the diverging interests within the industry, with municipalities opposing liberalization to protect their revenue from concession fees, while large utilities favored market expansion. The German energy sector was characterized by complex contractual structures and high electricity prices, leading to criticism of the 'cost-plus' regulation approach and accusations of excessive profits. Additionally, the chapter touches on the Franco-German relationship's significance in shaping the debate on the Internal Energy Market, with both countries initially skeptical of competition due to concerns about protecting their domestic coal industries and markets.

Chapter Seven:

The chapter discusses the challenges and dynamics surrounding the liberalization of the electricity market in Europe during the early 1990s. It highlights the European Commission's proposal for a phased approach to liberalization, aiming to give Member States autonomy in choosing the best system for their energy policies. Legal disputes, such as the ECJ ruling in 1991, played a role in shaping the push for liberalization, with different models like the single buyer concept being proposed, raising concerns about monopolies and competition.

Furthermore, the chapter delves into the complexities of the liberalization process, involving regulatory oversight and intervention by both the European Commission and national governments. It outlines the concerns raised by various stakeholders, including integrated utilities, about ceding control of their systems under a Transmission System Operator (TSO) regime. The discussions also touch upon the balancing act between reformist views from the Commission and more conservative perspectives within the industry, leading to a gradual watering down of liberalization proposals throughout 1991.

Moreover, the chapter sheds light on the political negotiations and compromises that took place, with Germany and France playing significant roles in shaping the common position presented to the European Parliament. The push for liberalization faced opposition and skepticism, with concerns about potential inefficiencies and a loss of cooperative spirit in the industry. Overall, the chapter underscores the intricate interplay of political, economic, and regulatory factors that influenced the path toward electricity market liberalization in Europe during this period.

Renewable Energy

Noran Nabil: Researcher at Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

Introduction:

"Renewable Energy" by Peter Yang, published in 2024, provides a comprehensive overview of various renewable energy sources, such as solar, wind, geothermal, and hydroelectric power. The book explores the benefits of transitioning from traditional fossil fuels to renewable energy, including reducing carbon emissions and combating climate change. Yang also discusses the challenges and limitations of renewable energy technologies and offers insights into the future of sustainable energy production. Overall, the book serves as a valuable resource for understanding the importance of renewable energy in addressing global energy needs and environmental concerns.

"Renewable Energy" is a seminal work that serves as a cornerstone for understanding the intricate world of sustainable energy sources. Authored by leading experts in the field, the book provides a detailed exploration of renewable energy technologies, their applications, and their overarching impact on the global energy landscape.

Within its pages, readers are introduced to a diverse array of renewable energy sources, each with its unique set of advantages and challenges. Solar power, harnessing the energy of the sun through photovoltaic cells or solar thermal systems, emerges as a prominent contender in the quest for clean energy solutions. Wind power, derived from the kinetic energy of moving air, is another key focus, highlighting the rapid

advancements in wind turbine technology and its increasing affordability and efficiency.

Hydropower, geothermal energy, and biomass also find their place in the book's narrative, offering insights into how these resources can be harnessed sustainably to meet the world's growing energy demands. The authors delve deep into the technological innovations driving these sectors forward, emphasizing the need for continued research and development to optimize their potential.

Moreover, "Renewable Energy" delves into critical issues, such as energy policy, regulatory frameworks, economic considerations, and the integration of renewable energy sources into existing power grids. The book underscores the urgent need for a transition toward a more sustainable energy future, advocating for a holistic approach that balances environmental concerns with economic viability.

In essence, "Renewable Energy" stands as a seminal work that not only educates but also inspires readers to embrace renewable energy as a cornerstone of a cleaner, greener future. It is a must-read for policymakers, industry professionals, and anyone passionate about shaping a more sustainable tomorrow.

Chapter One focuses on solar power.
Solar power generation has experienced substantial growth, with solar PV panels becoming more cost-effective. Challenges include uneven PV resource distribution, high variability of solar radiation, and inadequate solar power penetration. Solar power offers environmental benefits and job creation opportunities. Further improvements in solar cell efficiency and energy storage are crucial for sustainable solar power generation. Market challenges like technological lock-in and slow interconnections hinder solar PV expansion. The environmental impact of solar panels includes the use of toxic materials, CO_2 emissions from manufacturing, and habitat loss due to large land requirements. The document also discusses the importance of energy storage in rooftop solar PV markets and the need for government support to drive solar technology dissemination. Additionally, it highlights the political, social, and environmental challenges faced in solar power deployment, such as insufficient government support and solar curtailment issues in China.

Chapter Two focuses on solar thermal energy.
The chapter discusses the challenges and advancements in the Concentrated Solar Power (CSP) market. It highlights the impact of inexperienced companies on cost increases and the cancellation of support schemes in Spain, leading to the expansion of CSP in other global regions. The shift from parabolic trough to solar tower technology, the emergence of new CSP companies worldwide, and the competitive nature of recent CSP projects in Australia are emphasized. Additionally, the integration of Photovoltaic Thermal (PVT) collectors for combined power and heat generation, the importance of transparent performance models for solar thermal plants, and the potential of heat storage to enhance CSP efficiency and reduce costs are key points addressed in the chapter.

Chapter Three focuses on wind power.
Wind power deployment faces challenges in both onshore and offshore settings. Onshore advancements in design and environmental assessments are crucial for the global energy transition. Offshore wind confronts technical hurdles like severe weather and environmental impacts, necessitating solutions for corrosion and wildlife protection. Additionally, turbine blade disposal poses environmental concerns, with repowering and recycling efforts underway. Despite challenges, wind power maintains a price advantage due to decreasing costs and enhanced competitiveness in the energy market.

Chapter Four focuses on hydropower.
Hydropower is a renewable energy technology that harnesses the energy of flowing water to generate electricity, utilizing rivers, streams, lakes, and dammed reservoirs. It is a safe and abundant energy source, directly linked to solar energy through the water cycle. Challenges such as geographic variation and transmission grid limitations impact the expansion of hydropower, while innovations like smart hydropower technologies and fish-friendly solutions are being developed to address these issues and enhance the efficiency and sustainability of hydropower generation.

Chapter Five focuses on bioenergy.
The chapter discusses the significance of bioenergy technologies as a promising renewable energy source, highlighting their benefits, such as energy security, greenhouse gas reduction, waste management, and rural development. It explores the deployment history of bioenergy technologies across various sectors worldwide and addresses the challenges they face for sustainable growth. The chapter emphasizes the importance of public education initiatives, policy frameworks, and technological advancements in fostering the development and expansion of bioenergy to align economic interests with environmental goals.

Chapter Six focuses on geothermal power and heating.
Geothermal power and heating technologies encompass a range of methods, such as binary cycle, dry steam, and flash steam systems. These technologies enable the utilization of geothermal heat for direct heating, cooling, and industrial applications. Geothermal power serves as a reliable and renewable baseload power source, offering stability to the grid. Challenges in geothermal drilling, such as wear on drill bits and circulation loss, need to be addressed. Advanced geothermal systems like AGS present sustainable solutions through closed-loop technology, mitigating environmental risks. Government support and innovation play crucial roles in overcoming the challenges associated with geothermal power generation.

Chapter Seven focuses on energy storage.
The chapter discusses various energy storage technologies and challenges. It highlights the importance of addressing grid storage efficiency and high capital costs in energy storage solutions. Different battery technologies, such as lithium nickel cobalt aluminum and silicon anode batteries, are mentioned for their energy density and safety features. Additionally,

hydrogen storage methods and challenges related to hydrogen fuel cells are outlined. The chapter also touches on emerging technologies like graphene and lithium-sulfur batteries, emphasizing their potential benefits and current limitations that need to be addressed for wider adoption in the future.

This chapter provides insights into various energy-related concepts and technologies. It covers topics such as geothermal energy, power generation methods, environmental impacts, and energy conversion processes. Key terms like the Rankine cycle, hot dry rock geothermal resources, hydropower plants, independent power producers (IPPs), and renewable energy sources are discussed. The chapter emphasizes the importance of sustainable energy practices and the diverse range of energy options available, including solar, wind, biomass, and nuclear energy. It highlights the significance of efficient energy production, environmental considerations, and the transition toward renewable energy sources for a more sustainable future.

Conclusion:

In conclusion, "Renewable Energy" serves as an indispensable guide, shedding light on the critical importance of transitioning to sustainable energy sources. Through its comprehensive exploration of solar, wind, geothermal, and hydroelectric power, the book not only highlights the benefits of renewable energy but also underscores the urgent need to address global energy needs and environmental concerns. By delving into the challenges, innovations, and future prospects of renewable energy, this seminal work inspires readers to embrace a cleaner, greener future and advocates for a holistic approach toward a more sustainable energy landscape. "Renewable Energy" stands as a vital resource for policymakers, industry professionals, and all individuals seeking to shape a more sustainable tomorrow.

The World for Sale

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Overview:

The World for Sale by Javier Blas and Jack Farchy, published in 2021, delves into the intricate world of commodities trading, focusing on the rise of trading houses like Glencore and Trafigura. The book explores how these companies revolutionized the industry by capitalizing on market inefficiencies and exploiting opportunities in emerging markets.

The authors highlight the key players in the commodities market and their strategies for achieving success. They delve into the history of commodity trading, tracing its evolution from a secretive and niche industry to a global powerhouse that influences economies and shapes geopolitics.

Blas and Farchy discuss the impact of commodities trading on various regions around the world, shedding light on the challenges faced by local communities and the environment. They also address the controversies surrounding the industry, such as corruption, market manipulation, and human rights abuses.

Overall, *The World for Sale* provides a comprehensive overview of the commodities trading industry, offering insights into its operations, key players, and impact on the global economy. It serves as a must-read for anyone interested in understanding the complex world of commodities trading.

Introduction: *The Last Swashbucklers*

In *The Last Swashbucklers,* the focus is on Ian Taylor, the chief executive of Vitol, the world's largest oil-trading company, and his involvement in supplying fuel to Libyan rebels during the Arab Spring. The document outlines the risks and challenges faced by Taylor and Vitol in providing diesel, gasoline, and fuel oil to the rebels during a civil war. It highlights the significant geopolitical and financial implications of this deal, showcasing Taylor's charisma and political connections, which played a crucial role in navigating the complexities of this operation. The narrative also delves into the pivotal impact of Vitol's intervention, which shifted the balance of the war by providing crucial fuel to the rebel army, ultimately influencing the outcome of the conflict. However, it also raises ethical and moral questions about the implications of such interventions, particularly in light of the subsequent destabilization and conflicts that unfolded in Libya and the wider region.

Furthermore, the introduction sheds light on the broader context of the commodity trading industry, depicting the enormous power and influence wielded by commodity traders in the modern world. It outlines the key role played by these traders in global trade, emphasizing their significance in ensuring the smooth flow of natural resources and their impact on the global economy. The narrative also underscores the lack of transparency and scrutiny in the industry, highlighting instances of corruption, tax avoidance, and environmental concerns. Overall, the introduction provides a comprehensive exploration of the history and operations of commodity traders, offering insights into their complex and influential role in shaping global commerce and geopolitics.

Chapter One: The Pioneers

The chapter narrates the story of the efforts of Theodor Weisser, a German soldier and prisoner of war who, after World War II, courageously ventured into the Soviet Union to secure an oil deal amidst the Cold War tensions. Despite initial ostracization by the oil industry for dealing with the Soviet adversary, Weisser's tenacity paid off, establishing a profitable relationship that underpinned his company's success. The chapter also highlights the broader context of the post-war era, marked by economic prosperity and the rise of commodity traders like Weisser, who capitalized on the booming global economy and the loosening of trade restrictions, ultimately shaping the modern commodity trading industry and its significant role in the global economy.

Chapter Two: The Godfather of Oil

The chapter delves into the geopolitical and economic implications of oil in the late 1960s and 1970s, focusing on the construction of a pipeline from Eilat to Ashkelon to bypass the Suez Canal. It highlights the strategic alliance between Israel and Iran, despite their later enmity, and the CIA's interest in this development. The narrative also covers the weakening control of the Seven Sisters oil companies, the emergence of OPEC, and the nationalization of oil resources by producing countries. The chapter introduces Marc Rich, a key figure in oil trading, and describes his role in exploiting the Eilat-Ashkelon pipeline and his eventual departure from Philipp Brothers to establish his own company, which would

significantly influence the global oil market. The chapter concludes with the Iranian revolution's impact on the oil industry, setting the stage for further upheaval and the rise of independent oil traders.

Chapter Three: The Last Bank in Town

The chapter recounts a critical moment in Jamaica's economic history during the 1980s, focusing on the island's financial crisis when it nearly ran out of money and oil. It highlights the role of commodity traders, particularly Marc Rich + Co., in rescuing Jamaica from economic collapse by providing oil without a contract and later financing. The narrative illustrates the traders' influence and the shifting power dynamics in global commodity markets, as well as the political and economic challenges faced by countries like Jamaica during periods of nationalization and economic turmoil. The chapter also delves into the broader context of the aluminum industry, the impact of energy costs on production, and the strategic maneuvers of traders during market downturns to secure profitable deals.

Chapter Four: Paper Barrels

The chapter recounts the story of Andy Hall, an oil trader who made a fortune during the Gulf War by predicting a rise in oil prices. Hall's company, Phibro Energy, capitalized on the invasion of Kuwait by Iraq, which led to a significant increase in oil prices. The narrative details Hall's strategic moves in the oil market, his use of futures and options, and the financialization of the oil trade. It also touches on the broader changes in the oil industry, the rise of financial derivatives, and the shift from physical trading to a market dominated by financial instruments. The chapter highlights the transformation of the oil market and the emergence of traders like Hall, who navigated both the physical and financial aspects of the industry to amass wealth.

Chapter Five: The Fall of Marc Rich

The chapter describes the tumultuous period in the early 1990s at Marc Rich + Co., a dominant commodity trading company based in Zug, Switzerland. Amidst financial struggles and internal conflicts, the company faced a crisis that led to the departure of key traders and the eventual downfall of Marc Rich, its founder. The narrative details the company's dependency on banks for trading operations, the failed zinc market cornering attempt that resulted in significant losses, and the power struggles within the organization. This period of instability gave rise to two new trading powerhouses, Glencore and Trafigura, as former employees seized the opportunity to establish their own ventures, shaping the future of commodity trading and distancing themselves from the controversial legacy of Marc Rich. The chapter captures the end of an era and the birth of a new one in the commodity trading industry.

Chapter Six: The Biggest Closing-Down Sale in History

The chapter describes the tumultuous period following the Soviet Union's collapse, focusing on the experiences of David Reuben, an aluminum trader. Amidst the chaos, Reuben encounters Lev Chernoy, a savvy dealer with connections to aluminum supplies. Their partnership and strategic moves in the disintegrating Soviet economy allow them to capitalize on the vast

natural resources, particularly aluminum, leading to immense wealth. The narrative details the shift from a centralized Soviet trade system to a free market, highlighting the traders' crucial role in connecting Russian commodities to the global market and the subsequent rise of oligarchs. It also touches on the broader impact of the Soviet Union's fall on the commodity trading industry and the emergence of a new Russian elite. The chapter concludes with the Reuben brothers' successful exit from the Russian market and their subsequent ventures. Engagement: The chapter provides an insightful look into the transformation of a nation's economy and the opportunistic nature of commodity trading during a period of significant geopolitical change.

Chapter Seven: Communism with Capitalist Influences

The chapter discusses the economic challenges faced by Cuba following the collapse of the Soviet Union and its subsequent reliance on foreign investment to revive its economy. It highlights the construction of the Parque Central hotel as a symbol of this new era, funded by the commodity trader Vitol. The narrative then shifts to the broader impact of the Soviet Union's collapse on global trade, detailing how commodity traders like Vitol capitalized on new opportunities in former Communist countries. The chapter also delves into the career of Ian Taylor, Vitol's ambitious crude oil trader, who played a pivotal role in the company's expansion into hospitality and other ventures in Cuba. Taylor's approach exemplifies traders' ability to navigate political landscapes and leverage market logic to thrive in a post-Cold War economy. The chapter concludes by reflecting on the transformation of Vitol from a modest Dutch company to the world's largest oil trader, emphasizing the traders' adaptability and the shifting ideologies of the time.

Chapter Eight: Big Bang

The chapter outlines Mick Davis's ambitious plan in 2001 to transform Xstrata, a small mining company, into a global giant by capitalizing on rising commodity prices, particularly in China. Davis, with his keen insight into China's burgeoning industrialization, predicted a significant increase in demand for natural resources. His strategy involved acquiring mining companies worldwide, and his foresight was validated as China's rapid growth led to a commodities supercycle, propelling Xstrata to become one of the world's largest mining companies and significantly impacting the global commodity markets. The narrative also touches on Ivan Glasenberg's role in Glencore and the broader industry awakening to China's influence on commodity demand.

Chapter Nine: Petrodollars and Kleptocrats

The chapter delves into the intricate world of oil trading, focusing on the activities of Murtaza Lakhani, a consultant for Glencore, during the early 2000s. It highlights Lakhani's role in facilitating illegal 'surcharges' to the Iraqi government in exchange for oil contracts, a practice that was part of the UN's oil-for-food program and considered illicit. The narrative explores the dynamics of the commodity boom, the rise of oil barons and kleptocrats, and the complex relationships between traders, oligarchs, and authoritarian regimes. It also touches on the political and economic implications of the oil trade, particularly how it empowered leaders of oil-rich countries and the traders who ensured the flow of oil and money in the global market. The chapter provides a glimpse into the shadowy dealings and the geopolitical chess game that defined the oil industry during that era.

Chapter Ten: Destination Africa

The chapter describes the transformation of Africa's mining industry, focusing on the Democratic Republic of the Congo's Mutanda mine, owned by Glencore. It outlines the historical neglect of Africa by Western companies due to perceived challenges and the subsequent rush for Africa's resources driven by the commodity supercycle of the 2000s. The narrative highlights the role of commodity traders like Glencore in supporting authoritarian regimes and facilitating corruption, as exemplified by the relationship between Glencore and Israeli businessman Dan Gertler. It also touches on the broader economic impact of commodity dependence in Africa, the exploitation of the continent by less scrupulous traders, and the environmental and social consequences of such activities. The chapter ultimately reflects on the complex interplay between natural resources, political power, and economic development in Africa.

Chapter Eleven: Hunger and Profit

The chapter discusses the global food crisis of 2008, highlighting the panic within the Chinese government despite public reassurances of grain sufficiency. It delves into the causes of soaring food prices, such as increased demand from emerging markets and poor weather affecting crop yields. The narrative also touches on the role of commodity traders, particularly the 'ABCD' companies, in managing the crisis and profiting from market insights. The chapter further explores the broader implications of the crisis, including its contribution to political instability and the Arab Spring, while also examining the influence of policies like ethanol fuel mandates on food supplies and prices. Overall, it presents a complex picture of the interplay between agriculture, trade, and politics during a period of economic turmoil.

Chapter Twelve: The Billionaire Factory

The chapter titled "The Billionaire Factory" delves into the story of Glencore's IPO and the revelation of its shareholders' wealth, particularly focusing on the morning of the prospectus release in 2011. It highlights the secretive nature of shareholdings within the company and the anticipation leading up to the disclosure of ownership details. The narrative outlines the journey of Glencore's rise to power, driven by the commodity boom and Chinese growth, and its transformation from a trading company to a global empire with significant stakes in various commodities. The chapter also discusses the challenges and changes brought about by the company going public, including increased scrutiny and the need for transparency, which marked a significant shift from the industry's traditionally secretive operations. Ultimately, the IPO not only enriched Glencore's traders but also propelled the company into a new era of expansion and public visibility.

Chapter Thirteen: Merchants of Power

The chapter discusses the complex and often opaque investments made by American pension funds in high-risk regions like Iraqi Kurdistan, facilitated by entities like Oilflow SPV 1 DAC. It highlights the intricate financial structures and the journey of pension funds' money through various tax havens to finance an independence movement in Kurdistan. The chapter also explores the political implications of such investments,

which inadvertently influence global politics and conflicts, such as the Kurdish struggle for independence and the subsequent backlash from the central government in Baghdad. The narrative reveals the interconnectedness of global finance, politics, and commodity trading and how pension funds seeking higher returns can become entangled in international affairs far beyond their borders.

Conclusion:

The chapter discusses the rise and challenges of commodity traders, focusing on Trafigura and its founder, Claude Dauphin. It details Trafigura's relationship with BNP Paribas, the bank's withdrawal of credit lines due to a sanctions violation, and the subsequent impact on the commodity trading industry. The narrative covers the evolution of global trade, the increasing enforcement of US sanctions, and the shift in the commodity market due to technological advancements, ethical sourcing, and climate change. It also touches on the changing landscape of the industry, with new players emerging and traditional practices being scrutinized. The chapter concludes by reflecting on the industry's future amidst these changes.

Eleventh: Issue Figure

Prepared by the Research and Studies Department at Saif Bin Helal Center

Mr. Adnan Amin

Adnan Amin, a Kenyan of Pakistani descent, stands out as a prominent figure among international leaders. Throughout his illustrious career, he has held key positions within various international organizations. Notably, Amin has wielded significant influence in steering the trajectory of global initiatives addressing pressing climate challenges, which now pose a fundamental threat to our world. Adnan has dedicated his career to contributing to the global transition to clean and renewable energy sources, believing in the role of energy issues in creating a clean future free of harmful emissions, which was and remains the main cause of the global warming crisis.

His Life and Upbringing:

Adnan Amin was born in Kenya in 1957 to Pakistani parents, and his multicultural upbringing contributed to conveying a deep appreciation of the interconnectedness of global issues and the importance of cooperation at the global and local levels.

Amin's scientific career was full of achievements; he received a bachelor's degree in law and political science from the University of Nairobi in Kenya, and then received a master's degree in international relations from the University of Nottingham in the United Kingdom. Amin's academic education provided him with the essential foundation to undertake numerous diplomatic roles, both within the Kenyan Ministry of Foreign Affairs and within intergovernmental organizations. His academic journey has also given him the analytical skills and knowledge base necessary to navigate the complex intersection of Law, Policy and environmental sustainability.

Top Positions:

After completing his studies, Amin assumed several prominent diplomatic positions in Kenya. **He held high-level diplomatic posts, including:**

- First secretary at the Embassy of Kenya in Washington, DC (1985–1988).
- Director of the Department of International Cooperation at the Kenyan Ministry of Foreign Affairs (1988–1991).
- Ambassador of Kenya to the United Nations in New York (1991–1996).
- Ambassador of Kenya to the United States (1996–2001).

Afterward, Adnan embarked on a career with various international organizations, assuming executive roles across several. Among the most notable are:"

- International Fund for Agricultural Development (IFAD).
- Global Alliance for Climate Change (GAC).
- International Clean Energy Council (ICEC).
- International Institute for Sustainable Energy (IIASA).

International Renewable Energy Agency (IRENA):

Amin assumed the post of general director for the International Renewable Energy Agency (Irina) in 2011, which is a milestone in his career.

As president of the International Renewable Energy Agency, Amin led efforts to accelerate the deployment of global renewable energy technology, promoting its widespread adoption as a solution to combat climate change and energy poverty. Adnan Amin was appointed to a first four-year term in 2011 and was unanimously reappointed by the Assembly for a second term in 2015. During his tenure, the International Renewable Energy Agency has become an influential voice in the field of renewable energy and has become one of the key players in the global energy transition. The International Renewable Energy Agency (Irena) has emerged as a leading voice on the global stage under the leadership of Amin. The organization has played an important role in emphasizing the need to adopt renewable energy policies and facilitating knowledge exchange and capacity-building initiatives among member states. Amin's diplomatic intelligence and strategic vision contributed to the restoration of the International Renewable Energy Agency as a key player in international efforts to combat climate change and achieve the Sustainable Development Goals.

The membership of the IAEA has now tripled, as it currently has 160 members and 24 countries in the accession process, which is a remarkable achievement in the history of international multilateralism. Amin oversaw the development of not only the International Renewable Energy Agency's operations and programming work but also led the growth of the agency's knowledge framework, country support, and regional engagement. Thanks to his proposal, the association promoted the business case of renewable energy as a strategic priority of the agency. Efforts have been made by the International Renewable Energy Agency. This played a key role in highlighting the importance of renewable energy in achieving sustainable economic growth and job creation while achieving sustainable development and climate goals, which contributed to the adoption of the Paris Agreement and the 2030 Sustainable Development Plan in 2015.

Amin has also pushed the International Renewable Energy Agency (Irena) to the global rank; the agency is a regular contributor and a sought-after partner to global and multilateral organizations such as the United Nations, the group of seven, the group of twenty, as well as international forums such as the Clean Energy Ministerial Meeting, the Berlin dialog on energy transition, the Suzhou international forum on energy transition, and others.

During Amin's tenure, Irena engaged with a wide range of stakeholders, including members of Parliament, the private sector, and civil society, to create a

comprehensive global platform for collaboration. One of Amin's most notable achievements during his tenure at the International Renewable Energy Agency was the creation of the Global Geothermal Alliance, an alliance of countries committed to promoting the sustainable development of geothermal energy resources. This initiative focused on cooperation and innovation in the renewable energy sector, with a particular focus on exploiting the untapped potential of geothermal energy.

In addition, Amin defended the concept of renewable energy as a key driver of economic growth and job creation, especially in developing countries. He stressed the importance of investing in renewable energy infrastructure as a way to stimulate economic development, enhance energy security, and improve the livelihoods of millions of people around the world.

Prior to assuming his position at the International Renewable Energy Agency, Amin led a distinguished career in the service of the United Nations; he was the chairman of the United Nations Coordination Council of heads of the United Nations system (CEB) and was part of the policy coordination body of the secretary-general of the United Nations, which includes the executive heads of the United Nations system. Amin also led the secretariat of the high-level committee of the UN secretary-general.

In 2023, Adnan Amin served as the executive director of COP28 in the UAE. He had a remarkable role when, during his speech, he stressed the UAE's leading role in confronting the major climate changes that the world is witnessing, as well as calling on the representatives of concerned countries and observer organizations to apply the principles of transparency by announcing the measures taken to confront international climate changes.

In conclusion, the life and career of Adnan Amin represent the driving force of leadership through his strong vision and his firm commitment to a cause that serves a noble goal, which is the necessity of the energy transition to clean sources to ensure a more secure and sustainable future. Amin, through his tireless efforts and promotion of renewable energy solutions, has left an unforgettable mark on the global energy scene and has also been credited with stimulating and encouraging dialog about action on climate change and sustainable development for future generations. Throughout his career, Adnan Amin has received recognition for his influential contribution to the field of renewable energy and sustainable development, where, throughout his executive positions, he inspired many individuals and organizations to join the global movement toward a more sustainable future.

Twelfth: Energy News Around the World

Prepared by the Research and Studies Department at Saif Bin Helal Center

“59% increase in the use of Green Charger for electric vehicles in "Dubai"

The General Authority of Electricity and Water of Dubai (Dewa) revealed that it recorded a 59% increase in the use of "Green Charger" services by electric vehicles in the emirate during 2023, where 1.15 million charging sessions were made for registered vehicles. Saeed Mohammed Al Tayer, CEO and general manager of DEWA, said in a statement: "We will continue to promote the use of electric vehicles through the continuous development of green charging stations using the technologies of the Fourth Industrial Revolution."

Al Tayer emphasized that these projects align with the Dubai Green Mobility Initiative 2030 and the national policy for electric vehicles, underscoring their commitment to bolstering the UAE’s efforts toward achieving net zero emissions. This includes reducing the carbon footprint in the transport sector, cutting energy consumption by 40%, slashing carbon emissions by 10 million tons by 2050, and aiming to have electric vehicles constitute 50% of all vehicles on UAE roads by 2050.

It’s worth noting that since the launch of this initiative in 2015, the company has provided 23,419.8 MWh of electricity to charge electric cars in Dubai, enabling them to cover a distance of 117 million kilometers. Moreover, the number of electric car owners has surged from just 14 in 2015 to 13,959 by the end of December 2023.

DEWA has created several features to facilitate charging electric vehicles on its public charging network, reduce charging time,

enhance infrastructure, and provide better access to charging facilities throughout Dubai. DEWA has deployed 382 green charging stations for electric vehicles in the emirate, with many of them having dual charging ports, and these green stations are available around the clock at key locations in Dubai.

According to "DEWA", Locations can be easily found through its website and its electronic application, and customers can start using charging stations within an hour of registering the vehicle. This can also be done via the company's digital solutions, and unregistered customers can also use the Guest Mode feature to charge their cars.

Construction of the Fourth Power Unit in the "Nuclear Daba'ah" Begins

Egyptian President Abdel Fattah al-Sisi and Russian President Vladimir Putin gave the starting signal for the launch of the main stage of the construction of the fourth power unit at the Dabaa nuclear plant in the Arab Republic of Egypt, which is the largest nuclear construction project on the African continent. A special ceremony was held to pour the "first concrete" that forms the basis of the unit, and the presidents of the two countries participated in the ceremony via video conference session.

Alexey Likhachev, general director of the Russian state company Rosatom, stressed in his speech the importance of this achievement, which reflects the close cooperation between the two countries, noting that this day is a landmark event in the history of nuclear energy in Egypt and Russian-Egyptian relations, with the beginning of the pouring of the "first concrete" for the fourth power unit, where the largest cooperation project between the two countries since the construction of the Aswan Dam, the construction of the first nuclear power plant in Egypt, was launched.

Likhachev pointed out that the progress of work on the construction of the Dabaa nuclear power plant makes the project one of the most prominent nuclear projects in the world, stressing the support of the political leadership of the two countries and continuous work to achieve the main milestones of the project in accordance with the schedule set for it.

For his part, Dr. Mohamed Shaker, Egyptian Minister of electricity and renewable energy, pointed out that Egypt, under the leadership of President Abdel Fattah al-Sisi, is striving to explore new horizons and achievements, stressing that these achievements have been achieved exceptionally, pointing to the continuous support and attention from the political leadership in the two countries, and stressing that this day is not just a coincidence but is the result of continuous efforts and effective cooperation with the Russian partner.

The Russian state-owned company Rosatom is a major exporter of nuclear energy technology, has succeeded in producing five sets of reactor equipment in 2023, and has completely delivered the Belarusian nuclear power plant. This company is the responsible entity for the construction of the Dabaa nuclear power plant, according to contracts that began to be executed in December 2017.

The Dabaa nuclear power plant is the first nuclear power plant in Egypt, and it will be built in the city of Dabaa in Marsa Matrouh governorate on the Mediterranean coast. It consists of four power groups with a capacity of 1200 MW each, with reactors of the 1200-VVER type. The third-generation hydro/hydropower reactor was developed, and this project reflects the development of successful modern generation technologies in the field of nuclear energy.

The construction of the nuclear power plant will be carried out in accordance with the package of contracts concluded between Egypt and Russia in December 2017. The contractual obligations include the construction of the plant and the supply of nuclear fuel throughout the life cycle of the plant, and the Russian side will train cadres and provide support in operation and maintenance during the first ten years of operation.

"South Africa" Uses "China" to Charge Its Electric Cars with Solar Energy

Zizhou Carbon Charge signed a deal with a Chinese company aimed at manufacturing electricity storage systems for superchargers, which has established 120 charging stations for electric cars throughout South Africa, and solar electric car charging stations in South Africa are waiting for integrated Chinese systems under a memorandum of understanding concluded by the South African company "Zero Carbon Charge" with the Chinese company "Shanghai Magic Power Tech", in addition to its local partner "Greencore energy".

Throughthedeal,itwasagreedtobuildandimport the first-of-its-kind integrated supercharging systems for solar-powered electric car charging stations, which number about 120 stations, and currently the Chinese company is working to deploy them throughout South Africa. The MoU was signed in light of the "zero carbon charge"company'striptoChinaattheendof2023, with the aim of obtaining the best-integrated solutions to establish the national charging network completely off-grid, and customers in the Off-Grid Electric and solar car charging stations of the "Zero" company can charge all-electric cars at the maximum charging rate, Two Chinese companies, "Magic" and "Greencore Energy" are working on integrating liquid-cooled supercharger systems with a capacity of about 480 kilowatts, which will be provided through solar energy, in addition to storing batteries at all charging stations, which number about 120 stations.

Zero Carbon Charge expects that the first batch of superchargers will be delivered to South Africa before next July, as the company is awaiting regulatory approvals to put into operation a full network of 120 facilities for charging solar-powered electric vehicles by September 2025, according to the company's founder, Joubert Roux.

Eskom's electric, coal-fired, electric cars emit about 5.3 metric tons of carbon emissions per year, and in view of this, a gasoline-powered car emits about 4.4 metric tons of carbon emissions every year. Zero Carbon has started its work in the town of "Lamaranstad "and the province of "Northwest", located in South Africa, and it intends to be the first national network in South Africa, which includes 120 facilities for charging electric cars with solar energy to be spaced at a distance of about 150 kilometers. Work is underway to have the station ready by next June. The company's co-founder, "Andres Malherbe", will join a panel discussion on electric car solutions to make Africa sustainable at the solar energy conference in Cape Town, South Africa, and the company stressed the importance of having an electric car charging solution, focusing on creating a high-speed car charging model and working to spread it throughout Africa.

"Mauritania" Is Preparing to Extract 2.2 Trillion Cubic Feet of Gas

The Ministry of Petroleum, Minerals, and Energy of Mauritania has concluded a contract aimed at developing huge reserves of natural gas, which is in line with the state's trend to increase dependence on gas as an important and reliable source of energy. The contract was signed on Monday, April 1, 2024, by the minister of Petroleum, Minerals, and Energy, "Ould Ashraqa", and aims to exploit gas reserves in the Banda and Taft fields located in the Mauritanian coastal basin.

Khaled Abubakar, CEO of Kogaz and the representative of the Kogaz and Taqa Arabia group, with whom the ministry signed a gas production agreement, said that the Banda and Taft fields in Mauritania contain 2.2 trillion cubic feet of natural gas. The representative of the Assembly expressed pride in participating in the development of this promising economic project, as it will provide great potential in the field of electricity production to the local market and major industrial entities in the country, pointing out that political and security stability is an important motivating factor for the creation of large investment projects, especially in the energy fields.

The agreement represents an important step in the framework of new moves to value Mauritanian sources of gas, in addition to strengthening the energy sector, stimulating investments in exploration and production in the coastal basin, and raising the level of exploitation of national reserves. The project includes the Mauritanian company for hydrocarbons and Kogaz,

which is headquartered in Dubai, in addition to the Egyptian Arabian Energy Company.

The total investment in this project exceeds one billion US dollars and covers the extraction, transmission, and distribution of gas from extraction to electricity generation through the construction of a new station and gas transmission facilities. The field will provide mineral companies with electricity produced from liquefied gas to operate factories and heavy machinery that is energy-intensive.

The field was discovered for the first time in 2003 in the national waters 60 kilometers southwest of Nouakchott by the Woodside oil company. It contains huge reserves estimated at about 1.5 trillion cubic feet, considered sufficient quantities to ensure electricity production up to 300 megawatts for more than 20 years. Despite numerous attempts to develop it, the project was unsuccessful for many reasons, most notably gas and the global economic crisis.

The project will achieve the goals of the sector strategy, which aims to ensure universal access to electricity in Mauritania by 2030 and support the collaboration between the gas and electricity sectors aimed at supplying industrial and electrical companies at competitive prices.

The current field can significantly increase these reserves as the North African country seeks to support its oil and gas reserves to contribute to meeting global energy demand in addition to becoming an important regional player in the field.

Mauritania had announced its intention to use the expertise of Egyptian and Emirati companies to develop the two gas fields, as it announced on March 28, 2024, that the Mauritanian Cabinet reviewed during its meeting a statement submitted by the minister of Petroleum, Minerals, and Energy on the contract for gas exploration and production.

"Mozambique" Bets on Green Hydrogen in Its Clean Energy Transformation

Mozambique is characterized by an abundance of natural resources in addition to its strategic geographical location. As it is considered one of the coastal countries overlooking the Indian Ocean and bordered by South Africa from the south, Mozambique is developing a clean energy transformation strategy, and the African country is counting on it to become a center for the hydrogen industry in South Africa by 2030.

The African country has developed an energy transformation strategy that indicates its desire to shape the energy future on the continent, and Mozambique will launch a green hydrogen production project, which is among the 11 largest projects in the world, the project is located in Inhambane city in the south of the country, southeast Africa, and is being developed by Gerard energy resources, it was established during 2021 and is located in the United Kingdom with a production capacity of about 1.6 million tons per year, the project depends on solar electricity and the production capacity of the project is about 12 gigawatts, production will be for export, and it is expected that its production starts in the middle of the current year 2024.

Mozambique is developing an energy transition strategy through which it seeks to exploit its wealth of hydropower to produce green hydrogen, in addition to achieving sustainable economic growth to preserve the environment and becoming a hub for the hydrogen industry in the South African region.

Mozambique aims to harness the power of green hydrogen to drive sustainable economic growth in addition to preserving the environment. As the infrastructure in Mozambique is considered a key platform in achieving its ambitions in the hydrogen industry, Mozambique focuses on benefiting from abundant hydropower resources, and green hydrogen fuel is characterized by its high cost, which limits the demand of investors.

There are several developing countries seeking to adopt the green hydrogen industry as the fuel of the future, including Egypt and Morocco, where Egypt entered the green hydrogen industry and worked to attract foreign investments and succeeded in obtaining investments by some international companies. Egypt is also working to deploy advanced technologies for generating renewable energy and distribution in addition to storage, and the demand for green hydrogen will rise to reach 100 million tons by 2030.

Mozambique launched the energy transition strategy in February 2024, and the cost of its implementation is about 80 billion dollars. The strategy aims to generate about 14 thousand megawatts of hydroelectric power from the dams of the Zambezi River, and Mozambique encourages the private sector to enhance its ability to compete with two countries, Ethiopia and the Democratic Republic of the Congo.

Mozambique has huge energy assets, which makes the cost of its energy transition about 80 billion dollars, and the strategy depends on the exploitation and expansion of assets. Some countries are planning an energy transition, including South Africa, Senegal, Vietnam, and Indonesia, and have succeeded in raising funds worth about 47 billion dollars.

The "Cahora Bassa" plant is located in Mozambique with a production capacity of about 2.075 MW and is building another plant with a production capacity of about 1.5 thousand MW. For investments amounting to about 5 billion dollars, Mozambique, despite its orientation toward green hydrogen projects, is still planning to develop fossil fuel projects, especially gas.

The French company "Total Energy" is developing the first liquefied gas projects through two terminals based on two seas, Gulfenhome and Atom, with a production capacity of about 13.1 million tons per year.

"Morocco" Provides 7 Million British Homes with Electricity Via the Longest Sea Line

X-Links announced that 2024 is considered the year of manufacturing power lines that extend under the sea, and it is expected that the world's longest offshore power line will be manufactured, during which electricity generated from renewable energy in Morocco will be transferred to Britain.

A British company explained that the longest offshore power line in the world is linked to renewable energy projects in Morocco, especially solar and wind power plants, and through an agreement between the Moroccan side and the British, it is considered the longest offshore power line in the world and will supply Britain with about 3.6 percent of the electricity produced from renewable energy sources in Morocco.

The project will provide clean electricity to more than 7 million homes by 2030 and will cover about 8% of the electricity demand in the UK. This is the longest project to transmit electricity generated from renewable energy sources in Morocco through seven lines over long distances and export it across borders.

As for the first phase of the project, during which about 4 subsea lines will be laid with a length of about 3,800 kilometers, the aim of the project is to connect a huge renewable energy farm in the Moroccan desert with the city of Devon in the south-west of the United Kingdom.

The project is expected to extend for a distance of about 1400 kilometers in the area of Klim Oued noon in Morocco, and the

remaining 3 lines will enter during 2029 from Alverdiscot in North Devon, Britain, to cross the Bay of Biscay toward Klim in Morocco.

Morocco will work to accumulate electricity generated from renewable energy in Morocco, where electricity will be generated in the "Kalmim Oued noon" area through a solar and wind power plant with a production capacity of about 10.5 MW in addition to storage batteries with a capacity of about 20 MW.

The supervisor of the project will be the "Vigar certification" technology implementation manager, who is considered the direct supervisor of the manufacture of marine plans. It is expected that the project will provide about 10 thousand jobs in Morocco and will provide about 2000 permanent jobs, while the electric line factory of the project will provide about 900 permanent jobs.

The French company Total Energy announced in November that it had invested GBP 20 million to acquire a stake in xlinks, which was founded in 2019, and the Scottish Government pledged to repurpose the Hunterson nuclear plant and work on converting it to the high-current cable plant needed for the world's offshore power line project to connect Morocco and Britain.

In April 2023, the Abu Dhabi company announced an investment of 30 million pounds sterling in the world's longest offshore power line at 25 million pounds sterling, and Morocco aims to become a global energy source and plans to be low-carbon.

Morocco is leading the most developed countries in North Africa and the Middle East in renewable energy projects and is working to increase the contribution of clean energy to reach 52% of the national electricity mix by 2030. Morocco's plan is to make a major shift in the renewable energy sector in Morocco to keep pace with the global transformations of renewable energy.

The project supports the world in achieving carbon neutrality in Britain and Morocco, and Rabat is an important partner for Britain due to its proximity to Europe.

For the First Time in "Europe" ... Wind Power Surpasses Coal

The Ember think tank has released a report revealing that Europe's production of wind energy last year surpassed its production of energy from coal, gas, and fossil fuels in general.

The report revealed that the use of fossil fuels in power generation has decreased to the lowest level since 1990, and electricity generation from renewable energy, including wind energy, accounted for two-thirds of the energy mix, while fossil fuels accounted for the remaining third of the mix.

Coal contributed to Europe's energy production in 2023 by 26% less than it did in 2022, and gas contributed 15% less in 2022. These decreases led to a decrease at another level, namely, the proportion of greenhouse emissions resulting from the use of fossil fuels in the energy mix by an estimated 19%, and this decrease is greater than that which occurred at the time of the COVID-19 pandemic.

Europe has been on its way to reducing the use of coal in power generation for a long time, but the Russian-Ukrainian war and the reduction of Russian oil and gas imports delayed Europe from achieving its goal in this regard. Europe soon recovered from that crisis, and the proof is the continent's dependence on wind instead of coal.

Renewables accounted for 44% of Europe's energy mix last year, the highest proportion in history. Wind energy contributed 18% to power generation last year, which is equivalent to France's energy demand, and solar energy accounted for 9% of the mix.

The reason for these low rates is the low demand for electricity in general by 3.4%, which is also the result of increased energy efficiency.

Despite the significant increase in wind energy production, the EU needs to increase that production by 18% per year to meet its clean energy targets.

"Bosnia Is Preparing to Create the Largest Solar Farm in the "Balkans"

The Export Promotion Agency of Bosnia and Herzegovina and the Hungarian company Logos Renewables have signed a memorandum of understanding intending to establish the largest solar farm in the Balkans, namely in Bosnia and Herzegovina.

The memorandum stated that the construction work on this farm will begin in the current year 2024 and will be put into operation in 2025, as it was agreed to establish this farm following Hungary's plan to finance and encourage Hungarian companies operating abroad.

It is expected that this farm will produce 146 MW, with the first phase costing 53.6 million dollars, which together with the second phase will produce the equivalent of 73 MW each. Farouk Sher, a doctor at Nottingham Trent University, said that Bosnia and Herzegovina is a key stronghold in Europe for solar energy; the country can benefit from 2,400 hours of sun per year. Despite this, the country does not benefit from these huge solar energy capacities due to the high prices of the tools needed to generate solar energy, as evidenced by the fact that 60% of the energy mix in Bosnia and Herzegovina is from coal and brown coal, 35% from hydropower, and 2% from wind.

Bosnia and Herzegovina does not pay much attention to renewable energy because it is not a member of the European Union, and therefore it is not obliged to achieve the EU target of producing 42.5% of its electricity from renewable energy sources.

The Hopes of "Britain" to Build the Largest Factory of Batteries for Electric Cars Are Dashed

Britain's plans to become a leader in the field of electric car battery manufacturing faced a major setback with the collapse of the project to build its first giant plant in this field. The plant was supposed to be built on a plot of land purchased by British Volt with the support of Glencore, but the company entered into judicial liquidation in January 2023 before it could implement its ambitious plans.

The collapse led to the loss of more than 200 jobs and left Britain without a large domestic manufacturer of electric car batteries.

The failure is a major blow to Britain's hopes of achieving carbon neutrality by 2050, as it relies heavily on importing electric car batteries from China.

This land acquired by Blackstone is now out of reach of the plans of the electric car battery industry in Britain, which reduces the space available for the construction of a huge factory, yet Britain still offers incentives to increase domestic production of electric car batteries, such as cheap land and exemptions.

Despite these challenges, new car sales in the UK saw a significant increase in February 2024, driven by companies buying electric cars for their fleets, and the number of registrations increased by 14% year-on-year, the best performance for February since 2004.

The main driver of this growth was investments in corporate fleets, while sales of electric cars for individuals experienced a decline.

Renewable Energy Projects Are Booming in "Uzbekistan"

President of Uzbekistan Shavkat Mirziyoyev participated in the connection of five solar-related plants, as well as one more in wind energy, to be inaugurated in six different regions of the country.

The ceremony was attended by several company representatives, headed by Mohamed Jameel Al Ramahi, CEO of Masdar; Wuyun, vice chairman of China Power Engineering Company; Liu Zixiang, chairman of China Energy International Group; and Lin Xiao Dan, chairman of China Jichuba Group.

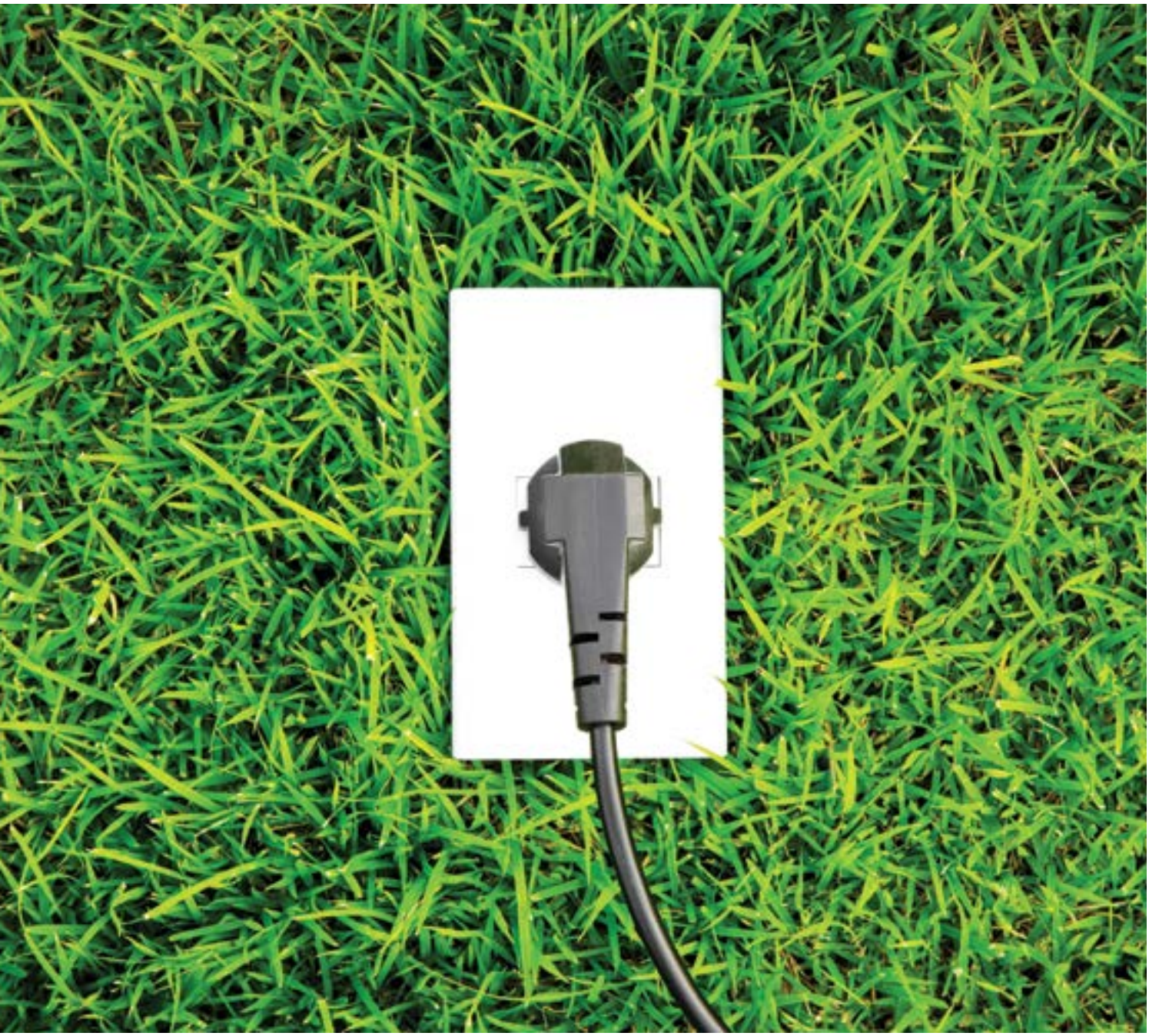
The president of Uzbekistan said that the country is adopting new reform plans that will increase the sustainability of the energy system by rehabilitating the surrounding environment for private sector investments and foreign companies to implement large-scale projects in renewable energy.

The president of Uzbekistan also mentioned that several solar power plant projects have been commissioned in the Karmana and Nurabad regions, which were operated under a public-private partnership with a production capacity of up to 200 MW, photovoltaic power plants with a production capacity of up to 900 MW, as well as the operation of the first station of the wind power project with a production capacity of 500 MW. The president agreed with foreign partners to start connecting and commissioning new energy to the grid.

President Mirziyoyev added that the cost of these projects, which reached 2 billion dollars,

will be invested in enabling more than one million households to have uninterrupted access to electricity. In addition, it is possible to save about 2 billion cubic meters of natural gas worth 4 billion dollars, which will lead to easier production of industrial gas.

The president concluded his speech by stressing that the large-scale plan aims to implement reforms in the energy industry, and the state also plans to increase the capacity of green power plants by 2030, which in turn will contribute to saving 25 billion cubic meters of natural gas and reduce carbon emissions by 34 million tons.



Thirteenth: News of the International Agency for Energy Security (IAFES) and News of Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

News of the International Agency for Energy Security (IAFES)

To support him in exploiting the huge potential of renewable sources...
Reducing dependence on fossil fuels

The International Energy Security Agency Is Preparing to Enter "Iraq"

The "International Energy Security Agency" intends to enter the Iraqi energy market and open channels of cooperation in each of the provinces of Anbar, Nasiriyah, and Samawah within the framework of the agency's orientation toward investing in electric energy and the security of oil installations in Iraq.

His Excellency Saif Bin Helal, founder and chairman of the International Energy Security Agency and founder and CEO of Saif Bin Helal Center, said that the "International Energy Security Agency" is keen to work in many Arab and African countries with the aim of helping them diversify energy sources and switch to clean energy while ensuring the safety of production sources and the safe access of energy products to their users.

The founder and chairman of the "International Energy Security Agency" noted that the "International Energy Security Agency" believes that energy security requires in the short and long term a variety of initiatives and policies compatible to meet the objectives of the market and ensure a safe path to provide energy sources.

It is worth noting that Iraq relies heavily on fossil fuels for electricity generation; thermal power plants consume approximately 22 million tons of gas and liquid fuels, and hydroelectric energy contributes only about 4% despite the presence of the main Euphrates and Tigris rivers. The percentage of renewable energy contributions, such as biomass, solid waste, solar, and wind energy, from total electricity generation is very small, despite the huge potential of renewable sources in Iraq.

News of the International Agency for Energy Security (IAFES)

Equipped with the latest systems and programs powered by artificial intelligence and modern technologies

The International Energy Security Agency Launches a "Turbine" Company in Bahrain.

The International Energy Security Agency (IEA) has launched the "turbine for energy security systems" company in the kingdom of Bahrain, equipped with the latest energy security systems and programs powered by artificial intelligence and modern technologies.

His Excellency Saif Bin Helal, the founder and chairman of the International Energy Security Agency and founder and CEO of Saif Bin Helal Center, said on this occasion, "We are pleased to cooperate with the kingdom of Bahrain in establishing projects that help it benefit from renewable energy sources, which the kingdom is rich in, and thus contribute to accelerating the pace of transition to clean energy."

The head of the "International Energy Security Agency" stressed the commitment of the "International Energy Security Agency" to provide advanced technologies and services in the field of gas turbines equipped to work with hydrogen fuel, which supports our partners in the Kingdom of Bahrain to achieve their goals in the field of energy sector and decarbonization, in line with the economic vision of the Kingdom of Bahrain 2030 toward achieving sustainable development.

Saif Bin Helal pointed out that the International Energy Security Agency supports the trends toward the green economy and is working to develop strategic industrial investments in a number of Arab and African countries, meet the growing regional and international needs of renewable energy, localize the energy industry in the countries with which it cooperates, and create partnerships with other workers in this vital field.

News of the International Agency for Energy Security (IAFES)

The first will concern the countries of the African Union... The second is in the Arabian Gulf and the Middle East

The inauguration of two headquarters for training and capacity development in renewable energy in "Egypt and "Bahrain" is coming soon.

The "International Energy Security Agency" is preparing to launch two headquarters for training and capacity development in the fields of renewable energy, energy security, and the environment; the first will be in Egypt, and the second in the kingdom of Bahrain.

The first training center will be specialized in the African Union countries, the second will be specialized in the Arab Gulf countries and the Middle East countries, and the two centers will take their name, which is "turbine Energy Security Training Institute".

On this occasion, His Excellency "Saif Bin Saif Helal Al Shehhi", founder and CEO of the International Energy Security Agency (IEA), said that the establishment of the two centers comes within the framework of the IEA's keenness to expand the provision of various qualitative trainings related to the field of energy and maintain its security and sustainability for future generations.

The executive chairman of the International Energy Security Agency" explained that, believing in the importance of energy and the need to rationalize its consumption—to preserve it for as long as possible and to continue for future generations—it was decided to open the first qualitative training center specialized in providing all trainings related to energy in its various branches, especially energy security.

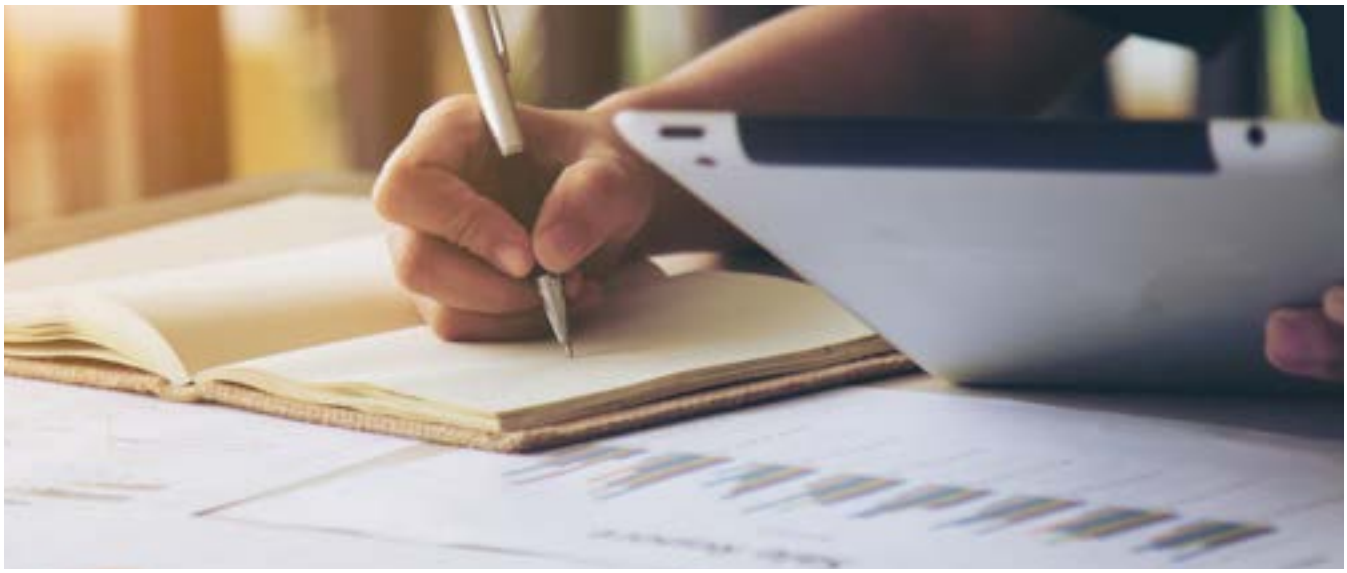
"Saif Bin Helal added that the two training centers aim to cooperate with the best international training centers in the group of twenty countries to provide various training programs in the fields of new and renewable energy and energy security, keeping pace with the latest global developments in the field of energy.

For her part, Ms. Nashwa Nashaat, the executive director of Saif Bin Helal Center for Energy Science Studies and Research, the research arm of the International Energy Security Agency (IEA), stressed that the main objective of the two training centers and the agency together is to address energy issues, developments, and topics, especially energy security, from an academic perspective based on monitoring, research, and scientific analysis.

The executive director of the Center explained that the "International Energy Security Agency"—through its training center in Cairo—seeks to provide training courses in various energy fields, including, but not limited to: hydrogen energy, energy storage, wind energy, solar energy, renewable energy solutions, carbon finance, and others.

It is worth mentioning that the "International Energy Security Agency", located in the state of California, USA, is an international business organization concerned with and specializing in energy security and sources, in addition to studying risks and opportunities, to achieve excellence, leadership, and innovation in research, analysis, and scientific foresight in the field of energy security and areas of impact, so that energy security serves as the main pillar of development issues at the humanitarian level.

The "International Energy Security Agency" is interested in studies of energy security and the political and geopolitical effects on it, as well as the effects of energy security on stability in the system and international peace, through the energy security programs that it provides, which reflect on the political and social stability of oil exporting and consuming countries in those countries and different regions of the world.



News of Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

A round table of Saif Bin Helal Center sets a roadmap for joint international research cooperation.

SaifBinHelalCenterforEnergyScienceStudiesand Research, the research arm of the International Energy Security Agency, organized its second event through a round table held on December 18, 2023, under the title "Research cooperation in the issues and fields of energy security and the environment. Priorities and mechanisms".

The table activities witnessed the presence of a crowd of representatives of research centers on energy and the environment in Egypt, in addition to the representation of a number of embassies of African countries in Cairo, such as Congo, Gabon, and South Sudan, in addition to the presence of representatives of the parliament in its two chambers, "deputies and senators", and representatives of specialized government institutes. The list of the most prominent attendees is topped by the United Nations Office in Cairo and the energy and environment committees of the League of Arab States.

His Excellency Saif Bin Helal Al Shehhi, president and founder of the International Energy Security Agency (IEA), stressed the importance of promoting scientific research as it represents the main pillar for the development of societies, as well as the important role that scientific research plays in achieving the Sustainable Development Goals.

The founder and CEO recommended the establishment of a joint research cooperation network, the task of which is to coordinate

between research centers concerned with various topics and issues, especially in the fields of energy and the environment, whether inside or outside Egypt, and this network is followed by specialized committees and working groups, adding that the network will take its name, which is the "global network for knowledge and research cooperation.".

For her part, Nashwa Nashaat, the executive director of Saif Bin Helal Center for Energy Studies and Research, confirmed that the organization of this round table was based on the center's awareness of the importance of research cooperation between research centers with different specializations and interests to discuss cooperation in energy security and environmental issues and fields. During the discussions, all the representatives of the centers presented their goals and visions, and the participants concluded a number of important recommendations, most of which were based on supporting scientific research in the Arab region and working to confront and find solutions to all the challenges related to that sector, in addition to supporting cooperation relations between research centers and some of them, both inside and outside the Arab region.

During their presentation of the various recommendations - within the framework of supporting and strengthening the research field, and strengthening cooperation ties between various research centers located on the local or international scene - the participants stressed the need to implement a series of seminars, seminars and scientific conferences on various research issues and fields, including the issues of energy and the environment, as well as the implementation of a series of qualitative training for young people on energy issues of various dimensions "political, economic and strategic", joint exchange of publications, reports, and various research studies, as well as integration between scientific research institutions to develop and activate the scientific, technical and informational base.

News of Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

It publishes news, research, statistics, and events.

The official website of Saif Bin Helal Center is a regional and international window on energy security issues

The "Saif Bin Helal Center for Energy Studies and Research" has launched its website on energy and all its various issues and branches locally and globally, including the Middle East, Africa, and other Western countries.

Nashwa Nashaat, the executive director of the center, said that the center's website is considered an international energy window, allowing the reader to access and view all the energy news, issues, and developments that the site addresses by following up, monitoring, and systematic analysis moment by moment, providing the reader with a unique and distinctive experience, and making him aware of all the global energy developments daily.

She explained that the sections of the site vary to include a combination of specialized energy issues and research related to it and interest in its various topics, in addition to other sections, pointing out that the interface of the site is topped by the main page where there is a display of the latest news published on the site, which follows monitoring and analysis of the latest news and the latest energy developments, as well as the presence of a news tape that includes the most prominent daily trending news headlines about energy.

She pointed out that the website contains the center's "publications," which include the journal "Energy Security," a quarterly scientific journal issued by the "Saif Bin Helal Center for Energy Studies and Research" after its first and second editions so far, dealing with various energy and energy security topics, as well as specialized brochures on various energy topics and problems and important energy research, which occupy a large space at all local, regional, and international levels.

She pointed out that one of the most prominent publications published on the website is "Energy Security Observatory," a bi-monthly scientific periodical that deals with news related to energy and energy security in its various dimensions from all over the world, according to a scientific methodology based on monitoring, research, and careful analysis, including analytical figures and statistics, prepared by the center's researchers. In its first and second issues, the periodical dealt with various developments related to energy issues and energy security in the Arab region, the African continent, and Western countries.

She pointed out that the center's website includes a section on "center's activities", in which all activities are published from seminars, training workshops, discussion panels, and annual forums, whether at the local, regional or international levels, pointing out that one of the most important sections of the site is the section on "news" related to energy with all its topics and issues in all countries of the world, divided by different energy sectors; as these sections fall under the news item, represented by the following: energy security, nuclear energy, renewable energy, non-renewable energy, hydrogen, climate change, institutions, reports, special translations translate what is being reported about energy from the perspective of foreign newspapers.

She pointed out that the "Indicators and Statistics" section has recently joined the site and includes two parts: the first is for statistical reports that monitor all the topics of the energy sector in numbers and statistics, and the second part of the section is entitled "Data Explorer," launched by Saif Bin Helal Center, which serves as a dashboard to browse and explore the data of energy flows for a group of countries.

The Navigator aims to provide a visual presentation of a set of data that is being collected to help readers and visitors discover trends in the data and form insights by providing a quick tool on the site that shows chronological developments and comparisons between countries.

She pointed out that the site also includes the "multimedia" section, which includes a section specialized in the center with the other eye," and in it all the news and articles collected about what was published on the tongues of newspapers and multiple websites about the center. Through this section, we show photos and videos documenting the coverage of the various activities of the center, whether seminars, conferences, or other events.

The executive director of the Center explained that one of the sections of the center's website is studies and research" of all kinds of political, economic, environmental, and legal agreements on energy, energy security, and renewable energy, as well as energy strategies and sustainability. There is also a part that falls under the studies section, dealing with various terms and concepts related to energy. It is worth noting that there is a special section on "Who are we?"" The website includes all the information about the center in terms of its vision and mission, the message of the founder, the goals of the center, its mechanisms, as well as its activities and events, along with the publications of the center.

News of Saif Bin Helal Center for Studies and Research in Energy Sciences (SBHC)

It includes analytical figures and statistics prepared with scientific methodology.

The periodical "Energy Security Observatory" the latest publication of the center "Saif Bin Helal"

Saif Bin Helal Center for Energy Science Studies and Research, the research arm of the International Energy Security Agency, has issued a bi-monthly scientific periodical entitled "Energy Security Observatory", which deals with news related to energy and energy security in its various dimensions from different countries around the world according to a scientific methodology based on monitoring, research, and sober analysis, including analytical figures and statistics, prepared by the center's researchers.

Saif Bin Helal Al Shehhi, founder and CEO of the International Energy Security Agency, said that the issuance of the "energy security" periodical comes within the framework of Saif Bin Helal Center for Energy Studies and research to put energy issues at the focus of attention of various circles in the Arab region, whether with regard to governments, research and academic bodies, or the Arab citizen, especially in light of the increasing global interest in these issues.

He explained that the periodical deals with various developments related to energy issues and energy security in the Arab region, the African continent, and Western countries. For her part, Nashwa Nashaat, the executive director of the center, said that Saif Bin Helal Center for Energy Studies and Research hopes to be an "energy security" observatory in addition to all those concerned and interested in energy issues, whether in research centers within Egyptian universities, in the relevant ministries, or energy-related committees, whether within the House of Representatives and the Senate or in the League of Arab States.

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IAFES 2022
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