REPORT ON

ISCA DISCUSSION SERIES

Contemporary Energy Dynamics and Strategic Options for Africa

Executive Summary

The International Security Conference on Africa (ISCA) held a Discussion on ***Contemporary Energy Dynamics and Strategic Options for Africa*** on 28 October 2026. It brought together policymakers, energy-sector leaders, investors, academics and security practitioners. The Discussion examined how changes in global energy markets affect Africa's security and development, and the strategic choices available to African countries.

Geopolitical tensions, conflicts and disruptions to global energy markets have exposed African economies to rising fuel costs, supply uncertainty and wider economic pressures. These shocks compound longstanding challenges, including inadequate infrastructure, high financing costs and fragmented regional energy markets. Hundreds of millions of Africans remain without access to electricity, while many connected consumers face unreliable and costly supply. These conditions constrain industrialisation and economic resilience.

The Discussion emphasised diversified energy strategies suited to the resources and needs of individual countries. Regional electricity integration offers opportunities to improve supply reliability, reduce costs and make better use of available generation capacity. Mobilising domestic capital and strengthening technical capabilities through skills development and technology transfer are equally important. Linking reliable energy supply to mineral processing and manufacturing would create jobs, expand industrial capacity and improve livelihoods.

The report calls for integrating energy security into development planning, expanding reliable and affordable energy access, and accelerating regional electricity integration. It also calls for greater domestic and regional investment, sustainable mineral value addition, technical skills development and technology transfer. These measures aim to strengthen energy security, advance industrial development and reduce vulnerability to external shocks.

1. Introduction

The International Security Conference on Africa (ISCA) convened a Discussion on *Contemporary Energy Dynamics and Strategic Options for Africa* on 28 October 2026 in Kigali, Rwanda. The event brought together 114 participants from seven countries across three continents, representing governments, the African Union Commission, industry and academia.

Energy security has become increasingly important to Africa's economic resilience, development and strategic autonomy. Despite its abundant energy resources, the continent continues to face challenges in providing reliable and affordable energy. Global energy disruptions compound these challenges, affecting fuel prices, food security, livelihoods and economic stability. These realities underscore the need for strategic choices that reflect the diverse circumstances and development priorities of individual countries.

The Discussion was organised into two complementary sessions. First, *Understanding Contemporary Energy Dynamics and Implications for Africa*, examining the geopolitical, economic and structural forces shaping global energy

markets and their implications for Africa. Second, *Africa's Strategic Energy Choices*, exploring policy, investment, technological and institutional options for strengthening energy security, regional cooperation and industrial development.

2. Global Energy Dynamics and Implications for Africa

Geopolitical tensions and conflicts have heightened uncertainty in global energy markets, exposing African economies to supply disruptions and price volatility. The COVID-19 pandemic, the Russia–Ukraine conflict and instability in the Middle East exposed vulnerabilities in international supply chains. Drawing on developments in the Persian Gulf, the Discussion was cautioned that petroleum supplies faced considerable uncertainty. It was also stressed that African policymakers, business leaders and other stakeholders must work together to address these growing vulnerabilities.

The consequences of global energy disruptions extend well beyond fuel markets, affecting agricultural production, food prices and livelihoods. Attention was drawn to the interconnected pressures on food, fuel and fertiliser, described as the "three Fs", all becoming scarce and more expensive amid the Persian Gulf crisis. The vulnerability was further illustrated by disruptions to the supply of sulphur, a critical input for mining and fertiliser production. Sulphur prices were reported to have risen from USD 50–70 per tonne in early 2026 to approximately USD 1,000 by July–August 2026, sharply increasing costs for mining and fertiliser production. This illustrated how disruptions in distant energy markets could raise production costs and threaten food security across import-dependent African economies.

The global energy landscape is changing as renewable energy expands alongside continued reliance on conventional fuels. The Discussion emphasised that Africa's energy transition must reflect its own circumstances rather than react to external developments. Drawing on the African Union's Common African Position on energy access and transition, it was stressed that countries must use the resources available to them in line with their development needs, while ensuring affordability and inclusion. The exchanges on conventional fuels revealed divergent views on coal. The central consideration was the need for an energy mix that reconciles resource availability, development priorities, environmental concerns and security of supply.

> *"The challenge, therefore, was not simply a shortage of capital, but the failure to mobilise available resources for productive energy investment.*

Global energy investment remains unevenly distributed, with Africa receiving a disproportionately small share despite its considerable energy needs and resources. It was observed that the continent, home to approximately 20 per cent of the world's population, attracts only about 2 per cent of global clean energy investment. Annual energy investment was estimated at USD 68 per person in Africa, compared with a global average exceeding USD 400. High financing costs and perceived investment risks were identified as major barriers, compounded by the mismatch between foreign-currency financing and local-currency revenues. Yet it was also noted that Africa possessed considerable untapped domestic financial resources. African commercial banks were estimated to hold approximately USD 2 trillion, alongside

more than USD 600 billion in pension funds. The challenge, therefore, was not simply a shortage of capital, but the failure to mobilise available resources for productive energy investment.

Growing global demand for critical minerals is intensifying competition for resources essential to energy technologies and advanced manufacturing. While major global powers have defined minerals critical to their strategic interests, Africa has yet to establish its own priorities. It was estimated that the continent holds approximately 30 per cent of the world's mineral resources, yet only about 12 per cent has been fully explored. This limits the information available for investment planning, industrial development and negotiating favourable partnerships. The changing strategic value of minerals as technologies and geopolitical circumstances evolve further complicates long-term planning. Despite its considerable resource endowment, much of the continent's mineral production continues to be exported in raw or semi-processed form, with higher-value processing and manufacturing undertaken elsewhere.

These developments expose African economies to external shocks and underscore that energy security extends beyond resource availability. It requires sustained investment and the capacity to convert resource wealth into economic value. These challenges inform the continent's structural constraints and strategic choices.

3. Africa's Energy Deficit and Structural Constraints

3.1 Access, Affordability and Reliability

Dispersed settlements make electricity connections costly, particularly in rural and remote communities. Experience from Tanzania illustrated how long transmission distances increase losses and costs, while growing demand for irrigation and other productive activities requires continued investment in local electricity infrastructure. Mini-grids and standalone systems offer alternatives for dispersed communities, but their viability depends on local demand and affordability. Expanding access therefore requires coordinated planning that accounts for settlement patterns, future electricity needs and productive economic activity.

Electricity access has limited value when households and businesses cannot afford to use it. High electricity costs constrain livelihoods, increase production expenses and weaken industrial competitiveness. Experience from Kenya illustrated how improved network management and smart metering can reduce losses, operating costs and consumer bills. Regional electricity trade also offers access to cheaper power and reduces dependence on costly generation. Affordability therefore depends not only on tariffs, but also on efficient electricity systems and the cost of supply.

Reliable electricity supply remains a challenge even where generation capacity has expanded. Tanzania illustrated this gap, reporting an increase in installed capacity to approximately 4.6 gigawatts. Although the country had surplus electricity, transmission constraints limited its delivery to major demand centres and regional markets. Kenya reported similar constraints, compounded by grid stability challenges associated with variable renewable generation. Rwanda's experience illustrated the industrial consequences of unreliable power supply. Its tantalum refinery and tin smelter require uninterrupted electricity, as furnace shutdowns are costly to reverse. Reliable electricity therefore depends not only on genera-

tion capacity but also on adequate transmission, grid stability and effective distribution.

> *Electricity access has limited value when households and businesses cannot afford to use it.*

Expanding electricity access must therefore go beyond increasing connections and generation capacity. Its value lies in providing affordable, reliable power that meets household needs, supports livelihoods and sustains productive economic activity.

3.2 Structural Constraints

Infrastructure deficiencies extend beyond inadequate generation capacity and weak electricity networks to fuel transport, storage and distribution. Experience from Tanzania and Kenya illustrated how domestic transmission bottlenecks restrict electricity delivery and regional trade, even where generation capacity and interconnections have expanded. Rwanda's experience reinforced that "connection isn't the whole story": with approximately 467 megawatts of installed capacity, growing industrial demand is placing increasing pressure on available supply. The Discussion also distinguished between "hard infrastructure", including ports, receiving terminals and pipelines, and "soft infrastructure", involving contracts, procurement and market organisation. The Sultanate of Oman's experience highlighted inefficiencies arising from fragmented fuel procurement and distribution. Consolidating fuel purchases offers opportunities to secure better terms. Additionally, congestion and cargo-handling delays at East African ports have increased transport costs and disrupted regional supply chains. For landlocked and import-dependent countries, inadequate transport and strategic storage infrastructure further increase exposure to external supply disruptions.

High borrowing costs, limited access to long-term capital and currency risks continue to constrain energy investment. Private-sector experience identified two major obstacles: the high cost of debt and equity, and the structure of electricity purchase contracts. Under long-term "take-or-pay" agreements, utilities may be required to purchase electricity for 20–30 years, regardless of actual demand. This creates substantial financial obligations, particularly when payments and investment returns are denominated in foreign currencies while revenues are collected in local currencies. Restrictive financing conditions also hinder domestic developers from securing investment financing.

Weak regulatory frameworks and fragmented institutional arrangements continue to impede energy development. Rwanda's experience illustrated the distinction between favourable investment policies and effective regulation. Despite a supportive policy environment, unclear regulatory requirements were identified as a deterrent to international financiers considering private energy projects. Regional electricity trade faces similar institutional barriers. The absence of a common regulatory authority for cross-border electricity transactions was cited as a constraint in Tanzania, leaving countries reliant on bilateral agreements. Consequently, even where transmission interconnections exist, differences in national regulations and trading arrangements complicate electricity exchanges and limit regional market integration. These experiences demonstrate how institutional weaknesses can undermine investment and restrict the use of existing energy infrastructure.

Shortages of specialised technical expertise continue to constrain energy development and industrial value addition. Rwanda's mineral-processing experience illustrated this challenge. It was observed, for example, that op-

erating tantalum refineries and tin smelters requires metallurgists, mechanical engineers and electrical engineers, while reliance on foreign specialists increases production costs. Similar skills gaps affect energy project development, increasing dependence on external technical support. Shortages of specialised expertise within financial institutions also limit their capacity to assess complex energy investments. These deficiencies increase costs, restrict domestic participation and weaken the capacity to develop and manage energy infrastructure.

Limited electricity trade prevents countries from fully exploiting differences in their energy resources and generation capacity. The Discussion illustrated this imbalance through the experience of Zambia, which faced prolonged load-shedding during the 2024 drought, while hydropower facilities in Kenya, Uganda and Ethiopia had surplus power generation capacity. Electricity shortages in one part of the continent therefore coexisted with underutilised generation potential elsewhere. Despite progress in regional interconnections, inadequate transmission capacity and fragmented electricity markets continue to restrict cross-border trade in energy. These limitations increase reliance on costly domestic generation and weaken opportunities to improve supply security through regional cooperation.

4. Strategic Energy Options for Africa

4.1 Energy Mix and Supply Security

Energy security requires a diversified energy mix that reflects differences in resource endowments, demand, financing capacity and development priorities. The Discussion emphasised that no single energy pathway suits all African countries. This approach is consistent with the African Union's Common African Position on energy access and transition, which recognises the need for countries to utilise their available energy resources according to national circumstances. The strategic priority is to ensure reliable and affordable energy supply, support industrialisation, develop local value chains and reduce dependence on external sources.

Expanding renewable energy generation requires an appropriate mix of technologies, adequate storage and effective grid management to ensure reliable electricity supply. Kenya's experience highlighted geothermal energy as a dependable source of baseload power, while hydropower remains vulnerable to drought and variations in water availability. Solar and wind generation require complementary storage and sufficient grid flexibility to manage their variable output. The Discussion noted battery storage, including systems providing two to four hours of supply, alongside opportunities for pumped hydropower storage. The commercial potential of solar energy was illustrated by the Sultanate of Oman's experience, where a solar project of approximately 500 megawatts, incorporating battery storage, was reported to have achieved a cost of 4.6–4.8 US cents per kilowatt-hour. Utility-scale projects, commercial and industrial installations, and mini-grids were identified as complementary approaches to expanding renewable electricity supply.

Nuclear power was identified as a strategic option for providing reliable baseload electricity to support industrialisation. The Discussion challenged the tendency to assess nuclear investment primarily against its high upfront capital costs, arguing that these must be considered alongside generation capacity and long-term electricity supply. Conventional nuclear plants of 1,000–1,200 megawatts were

estimated to cost approximately USD 5 billion, while Small Modular Reactors (SMRs) of around 300 megawatts costing about USD 1.4 billion were presented as an option. Construction periods of eight to ten years for conventional nuclear plants underscored the need for sustained planning and financing commitments. Despite these demands, nuclear energy offers a long-term option for securing reliable electricity supply to support industrial development.

Natural gas was identified as a source of dependable baseload generation, particularly for countries with domestic reserves such as Tanzania and Mozambique. Kenya's consideration of liquefied natural gas also illustrated the need for reliable generation to meet evening peak demand when solar output declines. Coal attracted contrasting perspectives. While its baseload potential was recognised, concerns over environmental impacts favoured cleaner alternatives, including natural gas and nuclear energy, where viable. An alternative view argued that coal-rich countries should incorporate their reserves into long-term industrial plans, particularly metallurgy, supported by affordable power and technical skills. The Great Lakes Cement Plant in the Democratic Republic of the Congo illustrated this potential, drawing on nearby coal and limestone deposits to produce clinker for regional markets. The exchanges reinforced the need for energy choices that reflect resource endowments, industrial priorities, financing capacity and environmental commitments, consistent with a just transition suited to national circumstances.

Security of petroleum supply remains a strategic priority, particularly for import-dependent economies exposed to international price volatility and disruptions in refined fuel markets. Rwanda's experience illustrated the value of consolidated petroleum procurement, including partnerships with the Sultanate of Oman, to secure supply and improve purchasing terms. Similar arrangements were noted elsewhere in East Africa. The Discussion emphasised that effective procurement requires more than physical infrastructure. Long-term supply contracts, coordinated purchasing and efficient distribution arrangements were identified as important complements to investment in ports, receiving terminals, pipelines and transport networks. Strategic fuel reserves, including storage at or near supply sources, were proposed to cushion disruptions and enable purchases when market conditions are favourable. The development of regional refining capacity was also highlighted, with reference to the Dangote refinery in the Federal Republic of Nigeria and the proposed refinery at Lamu, Republic of Kenya. Together, these measures offer options for improving supply reliability, reducing procurement and logistics costs, and limiting exposure to external shocks.

Green hydrogen was considered a potential long-term energy and industrial development option, although its commercial viability remains constrained by high production and transportation costs. The Sultanate of Oman's experience illustrated these challenges. Despite substantial solar and wind resources, its ambitious green hydrogen programme lost momentum as production costs remained higher than those of alternative fuels, including blue hydrogen. Transporting hydrogen also presents additional costs, particularly where conversion into ammonia or methanol is required before shipment. The Discussion highlighted that using renewable electricity directly is generally more cost-effective than converting it into hydrogen for subsequent electricity generation. Green ammonia nevertheless offers potential industrial applications, particularly in fertiliser production. These considerations reinforced the need to prioritise commercially

viable projects with identifiable demand and clear prospects for local value addition.

4.2 Regional Integration and Electricity Trade

Regional electricity integration offers a strategic means of strengthening energy security through shared generation capacity, cross-border trade and more efficient use of available resources. Differences in energy endowments, generation costs and demand create opportunities for countries to complement one another's electricity supply rather than rely exclusively on domestic generation. Interconnected power systems can also improve grid stability by allowing neighbouring power networks to absorb disruptions. However, the Discussion emphasised that "interconnectors aren't enough". Effective regional trade requires adequate domestic transmission capacity, harmonised regulations and functioning electricity markets. These arrangements would improve supply reliability, reduce costs and support industrial development, while advancing the longer-term objective of an integrated continental electricity market.

> *Effective regional trade requires adequate domestic transmission capacity, harmonised regulations and functioning electricity markets.*

Expanding regional electricity trade requires coordinated investment in cross-border interconnections and domestic transmission networks capable of evacuating power to demand centres and neighbouring markets. Tanzania's operational interconnection with Kenya, links with Rwanda and Burundi through the Rusumo hydropower project, and planned connection with Zambia illustrate progress towards linking the Eastern and Southern African power pools. Kenya's electricity imports from Ethiopia provide a further lesson. Although the power purchase agreement between the two countries envisaged 400 megawatts, imports initially remained at 200 megawatts because of voltage instability risks within Kenya's electricity network. Tanzania similarly highlighted the need to reinforce internal transmission to utilise its growing generation capacity and participate effectively in regional trade. These experiences underscore the importance of planning domestic networks and cross-border infrastructure together, with adequate transmission capacity and grid stability to support reliable electricity exchanges.

Effective regional electricity trade requires compatible regulatory frameworks, common technical standards and coordinated market rules. Continued reliance on bilateral agreements for cross-border electricity transactions highlighted gaps in regional regulatory integration. Progress was nevertheless reported in establishing regional regulatory institutions and harmonising grid codes, tariffs and electricity-trading rules under the African Union's wider electricity market integration agenda. Greater coordination among these institutions would help align national and regional arrangements, facilitate cross-border transactions and provide regulatory certainty for electricity suppliers, purchasers and investors. Such harmonisation is essential to translating physical interconnections into functioning regional electricity markets.

The African Single Electricity Market, an Agenda 2063 flagship initiative, provides a framework for progressively connecting national electricity systems, integrating regional power pools and establishing a continental electricity market by 2040. The planned Tanzania–Zambia interconnection, expected to link the Eastern and Southern African power pools by 2029, illustrates progress towards this objective. Beyond conventional utility-to-utility transactions, the Discussion identified

opportunities for captive power producers to sell surplus electricity into national grids and, eventually, regional markets. Realising these opportunities will require sustained investment, coordination among regional institutions and compatible electricity-trading arrangements. A functioning continental market would expand access to generation resources, create wider markets for electricity producers and reduce the need for individual countries to meet all their demand through domestic generation.

Regional cooperation offers opportunities for neighbouring countries to pool resources and jointly develop large-scale electricity generation projects. The 80-megawatt Rusumo Falls Hydroelectric Project, developed by Burundi, Rwanda and Tanzania, was cited as a practical example of shared generation infrastructure. Drawing on this experience, joint investment in nuclear power plants was proposed as a longer-term option for developing substantial baseload capacity to meet regional electricity demand and support industrialisation. Such investments would require significant financing, long-term planning and sustained cooperation among participating countries. Joint generation projects could enable neighbouring countries to undertake investments that may be difficult to pursue individually, while sharing the benefits of reliable electricity supply.

Regional electricity investment must respond to industrial development needs. The African Union's integrated economic corridor approach was highlighted as a means of coordinating electricity infrastructure with industrial corridors, mineral-processing centres and economic zones. Private-sector experience reinforced this approach, warning that conventional electricity development plans often underestimate demand from mineral processing and emerging technologies. Reliable and competitively priced power, adequate financing and supporting infrastructure were identified as important factors in attracting industrial investment. Regional cooperation also offers opportunities to pool mineral resources, develop complementary industries and build value chains that individual countries may struggle to establish independently. Coordinated planning would align generation capacity with productive demand, strengthen industrial competitiveness and support local value addition, while balancing emerging electricity-intensive industries with the needs of households and smaller businesses.

4.3 Energy Financing

Expanding energy investment requires more effective mobilisation of domestic capital, greater private-sector participation and access to affordable long-term financing. The Discussion highlighted a persistent gap between available financial resources and investment in viable energy projects. High borrowing costs, contractual risks, restrictive financing conditions and limited institutional capacity continue to impede investment. Addressing these barriers requires financing arrangements that reflect the long-term nature of energy infrastructure, improve access to capital and distribute investment risks more effectively.

African pension funds, commercial banks, insurers and private investors hold substantial financial resources that could be mobilised for energy infrastructure. Pension funds offer opportunities to invest in long-term, revenue-generating energy assets, supported by infrastructure bonds and other investment instruments. Kenya's National Infrastructure Fund was cited as an emerging mechanism for attracting co-financing, while the Grand Ethiopian Renaissance Dam illustrated domestic resource mobilisation for major infrastructure. Greater participation by domestic investors, including through regional part-

nerships, would also help reduce dependence on foreign-currency financing and ease exchange-rate pressures on electricity utilities. Mobilising these resources would expand investment opportunities while reducing reliance on public borrowing and external capital.

Long-term power purchase agreements provide revenue certainty for investors but can impose substantial financial and operational obligations on electricity utilities. Under take-or-pay agreements, utilities may be required to pay for contracted electricity over periods of 20–30 years, regardless of actual consumption. Kenya's experience illustrated this trade-off. Contractual commitments to wind and solar generators sometimes require reductions in geothermal or hydropower generation to accommodate variable renewable output. While these arrangements support project bankability, they can constrain electricity dispatch and increase financial exposure. Foreign-currency payment obligations further compound these risks where utility revenues are collected in local currencies. The Discussion underscored the importance of structuring contracts to balance investor confidence, projected electricity demand, grid requirements and the financial sustainability of utilities.

High borrowing costs undermine the viability of energy projects, particularly for domestic developers. The Discussion challenged the risk premiums applied by international lenders, arguing that these often exceed underlying investment risks. Restrictive lending conditions further limit access to capital, as illustrated by difficulties in developing and manufacturing solar technologies locally. Blended finance, concessional lending, revolving funds and targeted investment incentives were proposed to address these constraints. Greater use of local-currency financing and stronger African financial institutions would also reduce dependence on costly external borrowing and support domestic participation in energy development.

Limited expertise within financial institutions restricts access to financing for commercially viable energy projects. Banks traditionally focused on commercial trade often lack specialists to assess complex energy and mining investments. Insurers face similar gaps in evaluating technical and operational risks. The African Union's Africa Green Transition PPP Fund (AGTPF) was cited as an example of an initiative that helped financial institutions better understand renewable energy and energy-efficiency projects through targeted training. Developing such expertise would improve project appraisal, strengthen risk assessment and expand access to capital.

4.4 Industrialisation and Value Addition

Reliable and affordable energy is essential for converting Africa's mineral resources into greater industrial and economic value. Moving beyond raw material exports towards local processing and manufacturing was suggested as a strategic priority. Achieving this demands realistic industrial priorities, coordinated energy planning and regional cooperation to develop competitive value chains.

Mineral value addition depends on reliable and affordable electricity, industrial chemicals and specialised skills. Rwanda's Power-X Tantalum Refinery and LuNa Tin Smelter illustrate the importance of uninterrupted electricity supply, as restarting furnaces after a shutdown is very costly. Limited local chemical production increases dependence on imported inputs, while shortages of metallurgists and engineers raise operating costs. Developing competitive mineral-processing industries therefore requires coordinated investment in energy supply, chemical production and technical expertise.

Progressing from basic mineral processing to advanced manufacturing requires ambition grounded in realistic assessments of existing capabilities. Rwanda currently produces tantalum metal and oxide powders, with the long-term ambition of moving further up the value chain to manufacture capacitors. Achieving this requires long-term industrial planning, strategic partnerships and technology transfer. Domestic equipment assembly and structured training of specialists offer practical ways to retain greater economic value and reduce dependence on imported expertise. Progress towards advanced manufacturing must therefore be matched by sustained investment in technology, skills and industrial capacity.

Africa has yet to define which minerals are critical to its own development, while major global powers have established priorities reflecting their strategic interests. The Discussion emphasised the need for African countries to identify their own priorities rather than rely primarily on external demand. Recent developments illustrated how the strategic importance of minerals can change. Lithium prices surged during the recovery from the COVID-19 pandemic, as supply constraints coincided with growing demand for batteries. The Russia–Ukraine war heightened interest in beryllium for defence, nuclear and aerospace applications, while emerging battery technologies could increase demand for mica if its potential applications become commercially viable. Yet much of the continent's mineral wealth remains unexplored, limiting the geological information needed for industrial planning, investment and effective negotiations. Defining critical mineral priorities therefore requires a clearer understanding of available resources, emerging technologies and long-term industrial needs.

> *Regional cooperation must therefore move beyond trade agreements to coordinated investment in industrial capacity and value chains.*

Battery manufacturing illustrates why regional cooperation is essential for mineral value addition. No single country possesses all the minerals required for the manufacture of lithium-ion batteries, including lithium, nickel, manganese, cobalt and graphite. The Discussion noted the limitations of negotiating individually with manufacturers, particularly where national markets and mineral supplies are too small to attract investment. Pooling resources across neighbouring countries would provide larger markets and more reliable supplies of raw materials, creating opportunities for regional battery production and, eventually, electric vehicle manufacturing. The African Continental Free Trade Area offers a framework for reducing tariffs, harmonising standards and facilitating cross-border trade. However, competitive regional industries also require reliable electricity, industrial chemicals, access to technology and licences, and greater domestic investment. Regional cooperation must therefore move beyond trade agreements to coordinated investment in industrial capacity and value chains.

4.5 Technology and Skills Development

Digital technologies improve electricity network management, reduce losses and lower costs for utilities and consumers. The experience of Kenya Power and Lighting Company Ltd (KPLC) illustrated how smart metering tracks electricity flows from substations through feeders, helping utilities detect theft, losses caused by fallen trees or poor conductors, and transformers that are overloaded or underutilised. This enables utilities to rebalance loads, prevent equipment damage and reduce outage losses. Smart metering also

eliminates the costs and errors of manual meter reading. Customers can monitor their hourly electricity use, identify excessive consumption and reduce their bills. Fibre-optic networks connecting smart meters to utility systems can also support internet services, extending the benefits beyond electricity supply. Digitalisation must therefore be prioritised to improve electricity reliability, reduce costs and strengthen operational efficiency.

Developing domestic technical expertise is essential for operating, maintaining and expanding energy infrastructure. The Discussion emphasised practical training, technology transfer and greater use of African expertise. A Rwandan factory was cited where specialists from China and India were paired with local graduates and required to train them to assume full operational responsibility within three years. Tanzania's Julius Nyerere hydropower project also demonstrated the value of regional expertise, with Egyptian contractors, Ethiopian technical support and Tanzanian engineers supervising the project. The African Union's Youth in Energy framework was highlighted as an initiative examining young people's skills needs, internship opportunities and barriers facing energy entrepreneurs to inform future support. These experiences demonstrate that technical training must build local expertise, transfer operational responsibility and draw on skills available across Africa.

> *Cybersecurity must therefore be built into the planning, operation and protection of energy infrastructure, rather than addressed only after vulnerabilities emerge.*

Digital energy systems improve efficiency but also expose critical infrastructure to cyber and remote threats. As electricity networks become increasingly interconnected, attacks on digital systems could disrupt power supply and affect essential services across national borders. The Discussion emphasised the need for national protection measures, stronger cyber defences and specialised technical skills. Common standards and appropriate legal frameworks are also necessary to address vulnerabilities, while cross-border information sharing would help countries identify and respond to emerging threats. Cybersecurity must therefore be built into the planning, operation and protection of energy infrastructure, rather than addressed only after vulnerabilities emerge.

5. Key Recommendations

Drawing on the issues and strategic options examined during the Discussion, the following recommendations identify priorities for strengthening energy security and supporting sustainable economic development across Africa.

5.1 **Integrate energy security into national development and security planning.** Protect critical energy infrastructure against physical and cyber threats, strengthen preparedness for supply disruptions and promote cooperation among relevant institutions and neighbouring countries.

5.2 **Invest in electricity generation, transmission, distribution and storage, using energy mixes suited to national resources and needs.** Prioritise underserved communities, improve supply reliability and affordability, and expand electricity access for productive economic activities.

5.3 **Mobilise domestic and regional capital, expand access to affordable long-term financing and strengthen financial institutions' capacity to assess energy projects.** Reduce foreign-exchange risks and align power purchase agreements with realistic electricity demand.

5.4 **Expand cross-border interconnections and domestic transmission networks, and harmonise technical standards, regulations and electricity-trading rules.** Strengthen regional power pools and accelerate implementation of the African Single Electricity Market.

5.5 **Align energy investment with realistic priorities for mineral processing and manufacturing.** Identify minerals critical to Africa's development, promote regional value chains and negotiate collectively for fairer partnerships. Ensure industrial investments are commercially viable and account for their environmental impact, including carbon emissions across supply chains.

5.6 **Tailor technical and vocational training to energy-sector needs and require structured technology transfer in energy projects.** Develop local expertise, progressively transfer operational responsibilities to domestic professionals and promote technical cooperation among African countries. Build the skills needed to operate, maintain and protect energy infrastructure.

6. Way Forward

ISCA will disseminate the report to relevant stakeholders to inform policy dialogue and continued engagement on the issues raised. The report will also guide future research and discussions on emerging energy security challenges and their implications for Africa's security and development.

7. Conclusion

The Discussion reaffirmed that energy security is fundamental to Africa's economic resilience, industrial development and strategic autonomy. Despite its considerable energy resources, the continent remains vulnerable to external disruptions and constrained by inadequate infrastructure, costly financing and limited regional integration. Overcoming these challenges requires deliberate long-term planning, effective institutions, sustained investment and stronger cooperation among African countries.

The central challenge is not a lack of resources, but the capacity to convert them into reliable and affordable energy, industrial strength and lasting economic value. Africa's energy future must therefore be shaped by its own development priorities, economic interests and strategic aspirations, rather than the uncertainties of global markets or the priorities of external actors.