ENERGY INNOVATION AND TECHNOLOGIES FOR UNIVERSAL ACCESS AND JUST TRANSITION

ENERGY INNOVATION AND TECHNOLOGIES ARE KEY DRIVERS TO DELIVER SOLUTIONS TO POWER AFRICA, PROVIDE UNIVERSAL ACCESS TO ENERGY AND JUST ENERGY TRANSITION

***Authored**: by OSAA in its capacity as the **IDTFAA** Secretariat in collaboration with the African Union Energy Commission (**AFREC**), and research contribution from **IRENA**. AFREC is a continental specialized energy agency of the **African Union** (AU), under the Commission for Infrastructure and Energy, in charge of coordinating, harmonizing, protecting, conserving, developing, rational exploitation, commercializing and integrating energy resources on the African continent. **This background paper reports on the current level of implementation by IDTFAA members across three working groups pillars** (see annex): i) Increasing access to affordable, reliable, and sustainable energy; ii) Increasing the global rate of improvements in energy efficiency; iii) Increasing the share of renewable energy in the global energy mix.*

ALIGNMENT WITH THE AFRICAN COMMON POSITION ON ENERGY ACCESS AND TRANSITION

- IDTFAA BACKGROUND PAPER -

I. CONCEPTUAL FRAMEWORK

Accelerating the implementation of SDG7 on energy is critical for making progress across the SDGs framework and the Paris Agreement on Climate Change, particularly due to the strong interlinkages between energy and most of the other goals and targets of the 2030 Agenda for Sustainable Development and Agenda 2063.

The supply of adequate, affordable, reliable, quality, safe and environmentally sound energy services is critical to support sustainable development and socio-economic transformation. Energy enables several services that makes SDG 7 a precondition for the successful implementation of Agenda 2030 and the 2063 Agenda. Against this background, Africa is clearly lagging, with only 46.79 per cent of the population in Sub-Saharan Africa with access to electricity, compared to the 90 per cent global average with 906 million people still lacking access to clean cooking fuels and technologies.

There is empirical evidence of a correlation between access to energy and economic growth[1]. It has been proven that income and electricity consumption are tightly correlated across all countries and over time; that no high-income country is low-energy, and that sufficient energy consumption is a necessary input to economic activity. Achieving SDGs 8 and 9 in Africa require a substantive increase in energy production and access. Energy also plays a

[1] Raising global energy ambitions: the 1,000 kwh modern energy minimum, Moss T., et al, Energy for Growth Hub, 2021

pivot role in fighting poverty and inequalities (SDGs 1 and 10). According to UNDP[2], in most countries, poor people spend a higher share of their income on energy, which implies that ensuring access to affordable energy increases the percentage of disposable income of poor households. Regarding gender equality (SDG 5), women in poor countries spend, approximately 5 hours per day in collecting and preparing fuel to cook[3]. In this regard, increased access to clean and affordable energy would allow women to save time and money, enhance their livelihoods and enable them to access education and employment options. Energy is also essential for the achievement of SDG 6. Around 3 per cent of water consumed worldwide and 10 per cent of water withdrawals comes from the energy sector[4]. Simultaneously, energy is also required for water treatment and to move water to where it is needed. The IEA estimates that the amount of water used by the energy sector could increase by 60% in 2040, and the total energy needed by the water sector could double. This implies that inefficient energy production would contribute to water scarcity and, conversely, that improving energy access and efficiency would help provide clean water and sanitation services. Achieving clean energy is also key for reaching sustainability (SDGs 11, 12, 13, 14, 15). Energy accounts for over two-thirds of global greenhouse gas emissions. And black carbon, which is used for cooking in most of Africa, through its impacts on deforestation, is an important contributor to climate warming and a relevant air polluter Per unit of mass, it has a warming impact on climate that is 460-1,500 times stronger than CO2. Further, energy access is a key element in peace building (SDG 16)[5].

This is the rationale behind IDTFAA's 2021 decision to consider energy access as the entry point to recover forward better.

However, progress towards SDG 7 and its targets are uneven, reflecting growing inequalities among regions and between urban and rural areas. Tracking SDG7 the Energy Progress Report[6] annually monitors progress towards achieving universal access to affordable, reliable, sustainable, and modern energy by 2030. The report confirms that today's rate of progress makes the world off track to achieve SDG 7, particularly in the most vulnerable countries, including in Africa.

It calls for scaling up investments in the energy sector to bridge the widening gaps and inequalities in access to reliable and affordable energy among regions and between urban and rural areas. Despite the effects of COVID-19 on the SDG 7 trajectory, electricity access in Sub-Saharan Africa rose from 46 percent in 2018 to 48 percent in 2020, an annual growth rate of 1 percentage point. However, the slowdown of improvements in the period, possibly owing to COVID-19, undermined the pace of progress. Sub-Saharan Africa accounted for more than three-quarters of the people (568 million people) who remained without access in 2020. The region's share of the global access deficit rose

[2] UNDP, Interlinkages among energy, poverty and inequalities, 2018

[3] Poor People's Energy Outlook 2019, Policy Paper

[4] IEA, Energy has a role to play in achieving universal access to clean water and sanitation, 2018

[5] UNDP, Green pathways out of crisis, 2021

[6] Tracking SDG 7: The Energy Progress Report, 2022

from 71 percent in 2018 to 77 percent in 2020, whereas most other regions, including Central and Southern Asia (the second-largest access-deficit region), saw declines in their share of the access deficits.

II. BACKGROUND

Renewables accounted for 29.5% of total electricity consumption worldwide in 2020[7], mainly driven by exponential growths in wind and solar energy capacity additions. The growth in renewables over the last decade is also linked to the falling costs of renewables worldwide. Solar PV and onshore wind energy generation costs have fallen by 85% and 56%, respectively over the last ten years (see Figure 1). Compared to other regions of the world, renewable energy consumption in Africa is well below the global average. The continent is not mobilizing enough investments at the domestic and international levels to accelerate the uptake of renewables. For example, over US$2.8 trillion was invested in renewables globally over the last 20 years with Africa getting only 2% of the investments, despite its huge renewable energy potentials and the need to provide access to over half of the population.

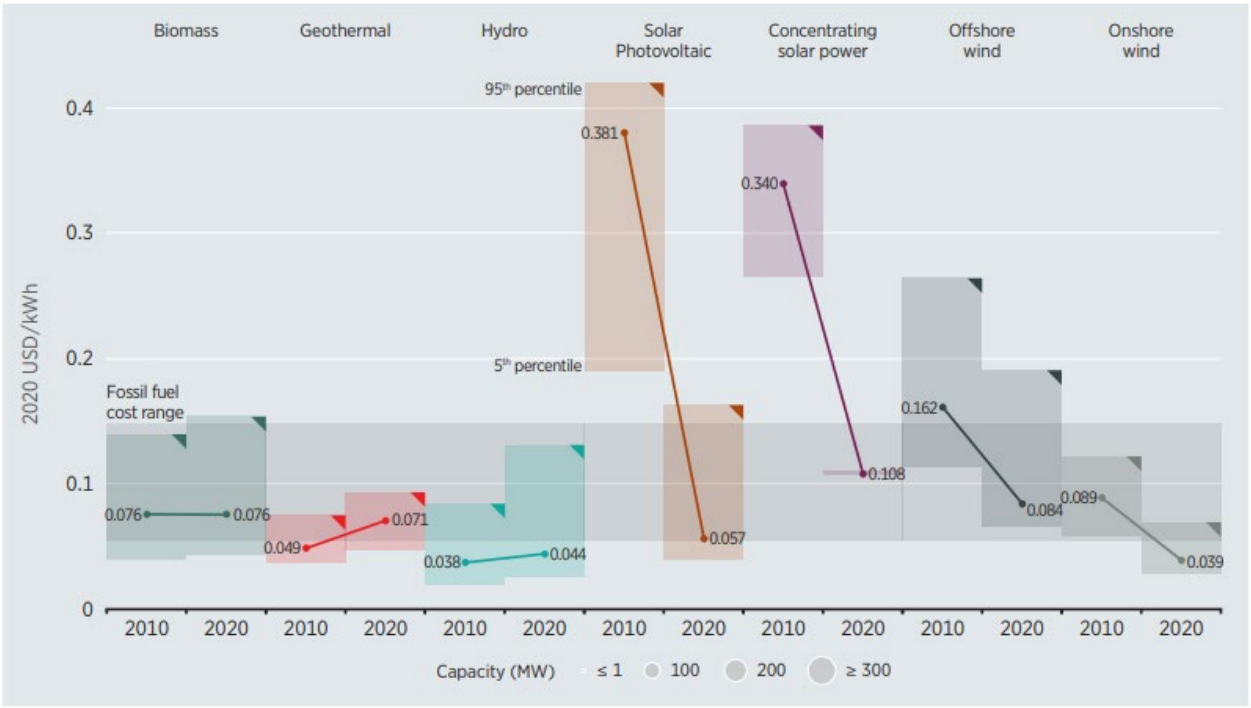

Figure 1: Global LCOEs from newly commissioned, utility-scale renewable power generation technologies, 2010-2020[8]

The total installed capacity for electricity generation on the continent is only about 232 GW, which is about 3% of the World's total despite accounting for 16% of the World's population. The challenge is even more glaring considering that Northern Africa and South Africa account for 49% and 25%, respectively of this installed capacity and suggesting that the rest of sub-Saharan Africa is left with only 26% of this capacity. Although the installed generation capacity

[7] International Energy Agency (IEA), 2021. World Energy Outlook 2021. Available at: https://www.iea.org/topics/world-energy-outlook

[8] Renewable Power Generation Costs in 2020 (irena.org)

in Africa grew at an average 5.6% per year from 2009 – 2019, the low levels of access coupled with increasing population and energy demand suggests a significant increase in capacity is required to meet the target of universal energy access by 2030.

Non-renewable energy, especially fossil fuels play major roles in the energy systems and economies of African countries. About 77% of the electricity generated on the continent is from fossil fuels while the transport and industrial sectors rely almost entirely on these fuels. Fossil fuels including account for about 50 – 80% of government revenues for major producing countries on the continent[9]. Fossil fuels represent around 40% of African exports. Along with other raw materials that continue to constitute a substantial proportion of African countries' exports. While fossil fuels provide revenue, they also reinforce commodity-dependence. In the context of a low-carbon future, fossil fuel dependent countries will be increasingly vulnerable to the risks of stranded assets, in addition to the already serious effects of price volatility for internationally traded commodities.

Despite having significant reserves of fossil fuels, more than 40 African countries are net oil importers indicating the high dependence of African economies on fossil fuels, mainly petroleum products, thereby being highly exposed to volatile world oil prices, jeopardizing their balance of payments positions. Most African countries also spend important amounts subsidizing fossil fuels, estimated at 5.6% of sub-Saharan African GDP[10]. This echoes the call by the UN Secretary-General for a shift of energies subsidies from fossil fuels to renewable energy.

It is essential to design the energy mix for African Member States considering energy innovation and technology, energy system options, energy investment planning, and environment policies within the context of accelerating energy access and transition in Africa.

III. RATIONALE OF AGENDA 2063 ON RENEWABLE AND NON-RENEWABLE ENERGY

Africa's energy landscape is characterized by a rich, highly diverse range of energy resources, from hydrocarbons to renewable energy. The main renewable energy sources are hydropower, geothermal, solar and wind. Central and Southern Africa have abundant mineral resources essential to the production of electric batteries, wind turbines, and other low-carbon technologies.

The currently low levels of access to modern energy services on the continent means that Africa will have to utilize all forms of its abundant energy resources including renewable and non-renewable energy to meet its energy needs. As the continent with the lowest energy consumption and the growing energy

[9] International Energy Agency (IEA), 2021. World Energy Outlook 2021. Available at: https://www.iea.org/topics/world-energy-outlook

[10] Coady, D., I. Parry, Nghia-N.-P., and B. Shang, 2019. Global Fossil Fuel Subsidies Remain Large: An Update Based on Country-Level Estimates." IMF Working Paper 19/89, International Monetary Fund, Washington, DC.

demand, the way forward for Africa is not about making a choice between energy resources and systems, but how the continent could strike a balance in meeting its energy demand in the short-, medium-, and long-term using a combination of both renewables and non-renewables.. In the short- to medium-term, fossil fuels, especially natural gas will have to play a crucial role in expanding modern energy access in addition to accelerating the uptake of renewables.

Despite implementation of several initiatives, policies and resource mobilization strategies at the continental, regional and national levels, the current state of the energy sector means Africa will not achieve the targets of the SDG7 by 2030 under existing policies and investment patterns. About 570 million people in Africa will remain without access by 2030[11]. This is a contrast with many developing countries in Asia where transformative policies and investments are implemented, ensuring near universal access by 2030.

It has therefore become imperative for Africa to use all available measures and resources to accelerate universal energy access within clear and well-structured energy planning processes. Being the most vulnerable region to the impacts of climate change despite accounting for less than 4% of the global GHG emissions, it is in the best interest of Africa to join the global efforts to transition towards net-zero emissions, driven by a clear and transparent mutual accountability framework, to mitigate future impacts of climate change on the continent and reduce the costs of adaptation, which is estimated to increase from the current US$35 per annum to US$200 per year in the 2070[12]. For that to happen subsidized investment in the mature renewable technologies that are affordable to the consumer is a pre-condition. It should be underscored here, for the sake of a transparent mutual accountability framework, as far as adaptation is concerned, even if African countries stop any efforts in fossil fuel production today, they will still contend with massive adaptation costs as long as the rest of the world continues business as usual.

While the long-term goal of Africa is to invest on clean energy sources, the current realities, and the specific needs of the continent in the energy sector call for a strong and well-structured energy planning so that each African country gains energy policy space to determine its own energy mix in the short, medium and long terms[13].

i. Renewable energy

Africa's development and commercialization of renewable sources of energy could be accelerated by leveraging technological comparative advantage, by addressing critical economic challenges, and adopting renewable energy policies, and by increasing knowledge and expertise of various technological options (manufacturing, deployment,

[11] World Bank, 2022. World Bank Open Data. Available at: https://data.worldbank.org/

[12] African Development Bank (AfDB), 2018. African Financial Alliance on Climate Change. Available at: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/AFAC_Brochure_2018.pdf

[13] African common position on energy access and transition (Afrec)

installation, quality controls, maintenance and other). Africa is endowed with significant resources, combined with energy technologies, could spur the leveraging of renewable energy.

- **Solar**: The quality of photo voltaic solar system which is crucial in the deployment and integration of the system leads to increased production of electricity. The solar energy resources on the continent could add more than 1000 GW to the African energy grid[14]. Although Morocco is building the largest CSP plant in the world, Africa still lags the rest of the world in utilizing CSP systems.

- **Storage**: Increased availability of energy storage system for some renewable energy technologies, particularly for solar and wind.

- **Hydropower**: Africa accounts for about 12% of the World's technically feasible hydropower potential, which could add 210 – 350 GW of electricity generation capacity to the African grid.

- **Wind**: Africa's wind energy potential is estimated at over 110 GW15. The total installed wind capacity in Africa is about 6 GW, representing a mere 0.8% of the total global installed capacity of 743 GW as of 2020[16]

- **Geothermal**: The potential for geothermal energy is 15 GW[17], mostly concentrated in Eastern Africa. The total installed geothermal energy capacity in Africa is about 868.3 MW, representing about 5.5% of the total installed capacity of 15, 854 MW worldwide[18]. Despite having a potential more than 15 GW, Africa is currently utilizing just 5% of the potential. Kenya (861MW) accounts for almost all the installed capacity of geothermal energy on the continent.

- **Biomass**: energy accounts for about 50% of the total primary energy consumption in Africa; the important reserves of biomass and the potential to produce bio-feedstocks offer opportunities to develop modern and more efficient energy commodities such as biogas, ethanol, and biodiesel.

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[14] World Hydropower Review, 2014. Africa's Hydropower Future. Available at: https://www.hydroreview.com/business-finance/africa-s-hydropower-future/#gref

[15] World Hydropower Review, 2014. Africa's Hydropower Future. Available at: https://www.hydroreview.com/business-finance/africa-s-hydropower-future/#gref

[16] International Hydropower Association (IHA), 2021. New guide on hydropower investment in Africa highlights huge opportunities. Available at: https://www.hydropower.org/news/new-guide-on-hydropower-investment-in-africa-highlights-huge-opportunities#:~:text=An%20estimated%20578%20million%20Africans,only%2011%20per%20cent%20utilised.

[17] World Hydropower Review, 2014. Africa's Hydropower Future. Available at: https://www.hydroreview.com/business-finance/africa-s-hydropower-future/#gref

[18] Think Geoenergy, 2022. Top 10 Geothermal Countries 2021 – installed power generation capacity (MWe).Available at: https://www.thinkgeoenergy.com/thinkgeoenergys-top-10-geothermal-countries-2021-installed-power-generation-capacity-mwe/

Green hydrogen: Green hydrogen could be used to phase-out fossil fuels consumption in the electricity, transport, and industrial sectors on the continent in the long-term. African countries need to continue their exploration of opportunities to develop sustainable and cost-effective domestic and international markets for green hydrogen. This necessitates various avenues of appropriate financing, technology sharing, regulatory and policy frameworks to ensure effective utilization of this resource.

- **Renewable energy policies:** National policies on renewable energy differ among sub regions, and among countries. Some of these policies are not mature because of the way they are being implemented.

ii. Non-Renewable energy

Natural gas: Africa will continue to utilize its natural gas resources in the medium- to long-term and develop its natural gas infrastructure at the local, national, and regional levels including the development of gas processing facilities, power plants, pipelines, and other necessary infrastructure. To minimize significant increase in GHG emissions in the future, Africa can focus on enhancing the efficiencies of natural gas processing and utilization.

Oil and coal: Some African countries might be in a position not to be able to discontinue the use of its oil and coal resources in the short- to medium-term due to the huge deficit in energy access. This reality makes energy planning for the definition of specific and country based energy mixes an imperative from an African policy making standpoint...

Nuclear energy: Africa will continue to develop and implement the appropriate frameworks to utilize nuclear energy in its energy transition adopting the most strict international standards.

Energy Type	Reserves	Regional Distribution
Non-renewable		
Crude oil	125.1 billion barrels[19]	Northern Africa: 53.2% Western Africa: 28.2% Central Africa: 16.9% Other Africa: 1.7%
Natural gas	12.9 trillion m[319]	Northern Africa: 55.8% Western Africa: 36.1% Other Africa: 8.2%
Coal	14.837 billion tonnes[20]	Southern Africa: 95.2% Eastern Africa:1.6% Other Africa: 3.2%

[19] British Petroleum (BP), 2022. Statistical Review of World Energy. Available at: https://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html
[20] Energy Information Administration (EIA), 2021. International Statistics. Available at: https://www.eia.gov/international/data/world

Nuclear	Reasonably assured resources: 888,000 tonnes[21] of Uranium	Northern Africa: 2.9% Western Africa: 36.7% Central Africa: 2.7% Eastern Africa: 4.2% Southern Africa: 53.5%
Renewable		
Hydro	210 – 350 GW[22]	Central Africa: 57% Eastern Africa: 32% Other Africa:11%
Biomass	242 – 337,000 PJ/yr[23]	All regions
Solar	Solar insolation: 1800 – 2850 kWh/m^2.a. Potential: 1000 GW[22]	Most of Africa
Wind	Wind speeds: Southern Africa (6 – 8 m/s) Northern Africa (5 – 8.5 m/s) potential: 110GW[22]	Most attractive sites in the Northern and Southern coasts
Geothermal	15, 000 MW[22]	Eastern Africa

Table 1: resources potential in Africa

iii. ECONOMIC CHALLENGES

- Financial institutions are not yet attentive enough to fund investments in certain forms of renewable energy generation. They have a propensity to comprehend renewable energy generation as risky due to high upfront costs (during construction of a generation plant) and often lengthy procedures or logistical challenges (licensing, network connection, power purchase contracts, market maturity; delivery, transport, and installation of equipment).
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- But besides upfront costs, there are other challenges: A) reliability and continuous generation, B) affordability without significant subsidies is not feasible, C) the need for governments when increasing public debt to be convinced that a specific investment is worthwhile compared with other alternatives.

- Although investment in Africa is growing at a higher rate than in other regions, the cumulative sum of renewable energy investment makes up just 2% of global investment over the two decades.

- Real or perceived risks continue to prevent many investors from committing their capital to renewables. At the macro level, chief among the risks that investors cite are political risks, governance and safety issues, off-taker risks and economic risks, including

[21] Mining Africa, 2021. High Grade Uranium in Africa. Available at: https://miningafrica.net/
[22] African Development Bank (AfDB), 2017. The New Deal on Energy for Africa 2016 – 2025. Available at: https://www.afdb.org/fileadmin/uploads/afdb/Documents/Generic-Documents/Bank_s_strategy_for_New_Energy_on_Energy_for_Africa_EN.pdf
[23] IRENA, 2013. Biomass Potential in Africa. Available at: https://www.gcca.eu/sites/default/files/2019-12/2013%20IRENA-DBFZ_Biomass%20Potential%20in%20Africa.pdf

those linked to foreign exchange. At the level of the energy industry, barriers present themselves in the form of policy-level support (or lack thereof) for the development of renewable energy, concerns about the power purchaser's creditworthiness and lack of sufficient investment in grid interconnection and transmission lines, among others. In addition, changes in legal or regulatory policies erode investor trust.

- Renewable energies have been unfavorably affected by financing challenge, and this perception makes it challenging to justify the investment needed, even if the cost of acquisition of the technologies, i.e., solar PV has significantly reduced over the years, and is expected to continue with this trend.

Making reliable, full scale cost comparison of energy from renewable and non-renewable sources of electricity has been the most significant challenge in adopting some of the renewable energy generation. While per unit of produced energy, renewable sources are already competitive, issues related to their integration into existing poorly developed networks are hampering higher uptake rates.

I. TECHNOLOGY AS A KEY ENABLER TO ENERGY ACCESS AND JUST TRANSITION[24]

Africa's universal energy access and just energy transition will involve the accelerated deployment of energy production, energy efficiency duly calibrated by energy planning exercises.

Innovation and technology are key drivers for energy transformation. It will bring power system flexibility that will result in increased energy and just transition in Africa.

Innovative solutions can make the energy production, transmission, and consumption more flexible, by harnessing non-renewable and, where feasible, allowing for a higher, cost-effective use of renewables.

[24] IRENA | this section of the background paper is a contribution from IRENA

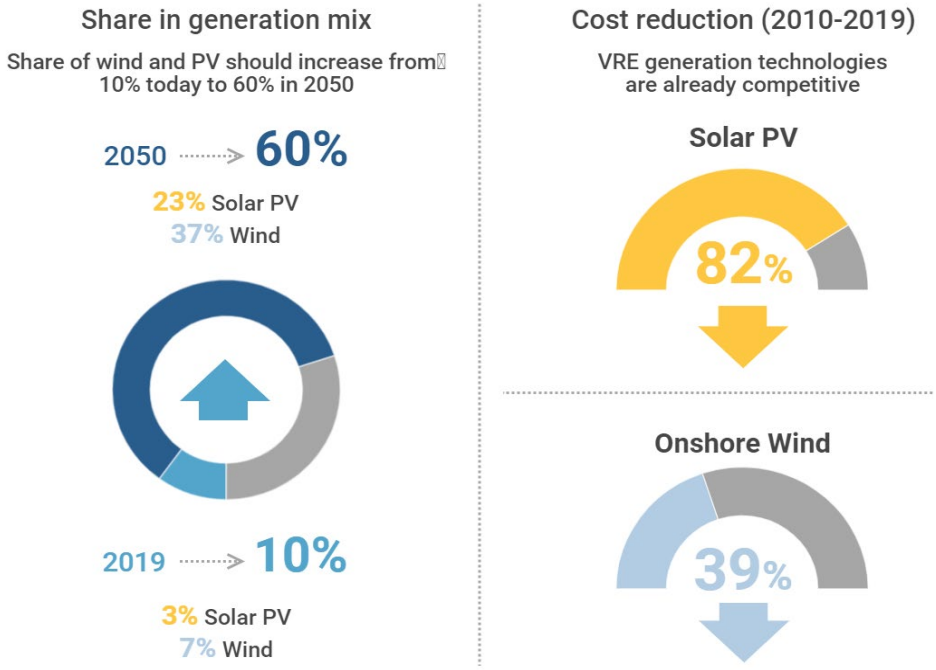

Figure 2: Innovation powers the energy generation (IRENA)

Electrification, decentralization, and digitalization are leading innovation trends that are changing paradigms, unlocking system flexibility for more renewables in a balanced energy mix for just transition. They result in a comparative advantage for Africa.

African power sector could lead the energy transition driven by the rapid decline of renewable generation costs and emerging innovative solutions that make energy production, transmission, and consumption more flexible. Manufacturing components on the continent and subsidizing the deployment of these systems would make them affordable for many Africans.

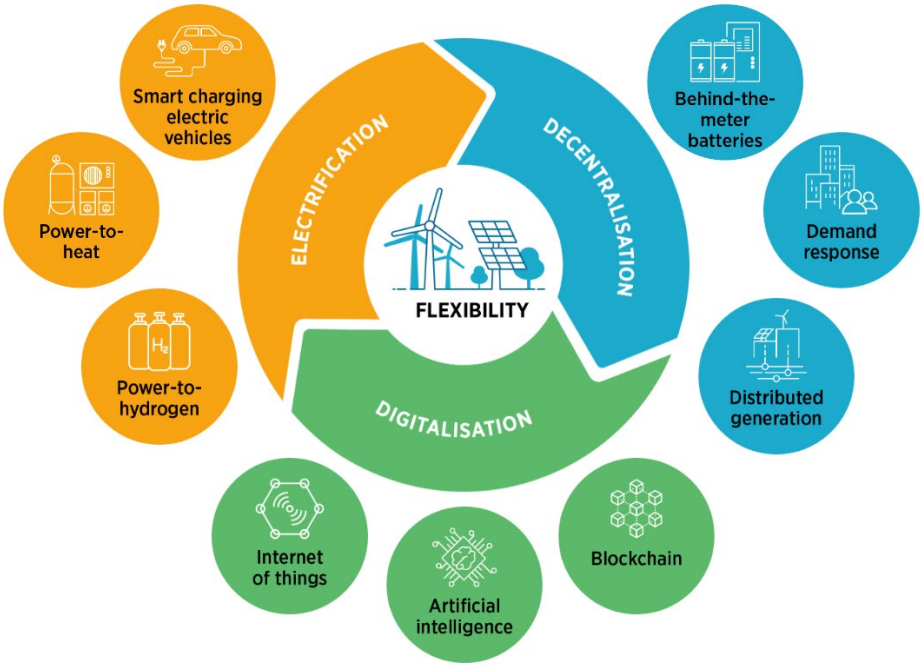

Figure 3: Innovation trend in power sector (IRENA)

IRENA's research shows that electrification of end-use sectors like industry, transport and buildings allows for deeper decarbonisation and reduces overall energy demand. Decentralized energy systems and small-scale generation turn the consumer into an active participant, fostering demand-side management. Digital technologies allow cost-effective management of assets, connecting devices, collecting data and monitoring and control, and help decarbonize other sectors. These findings need to be further researched and customized to make them fit in African contexts.

According to IRENA, emerging technologies that enable the integration of renewables into a power system allow new ways to operate it. They provide new services that enhance the system's flexibility. To monetise the flexibility created, new regulations are needed. Innovative market design in turn makes room for innovative business models, which ensure a stable revenue stream. Systemic innovation is needed for an integrated renewable energy system. The growth of decentralized electricity assets and increased digitalization creates new opportunities for consumers to engage in the energy transition and become active players. As consumers become prosumers, they increase system flexibility and help to boost the share of renewables.

The potential of energy technologies allows the active participation of consumers in the energy market, hence dynamizing the ecosystem with more private sector involvement and benefits for consumers. However, all these possibilities will become a reality only if various financial commitments come to fruition, not only in capacity building but also in physical implementation.

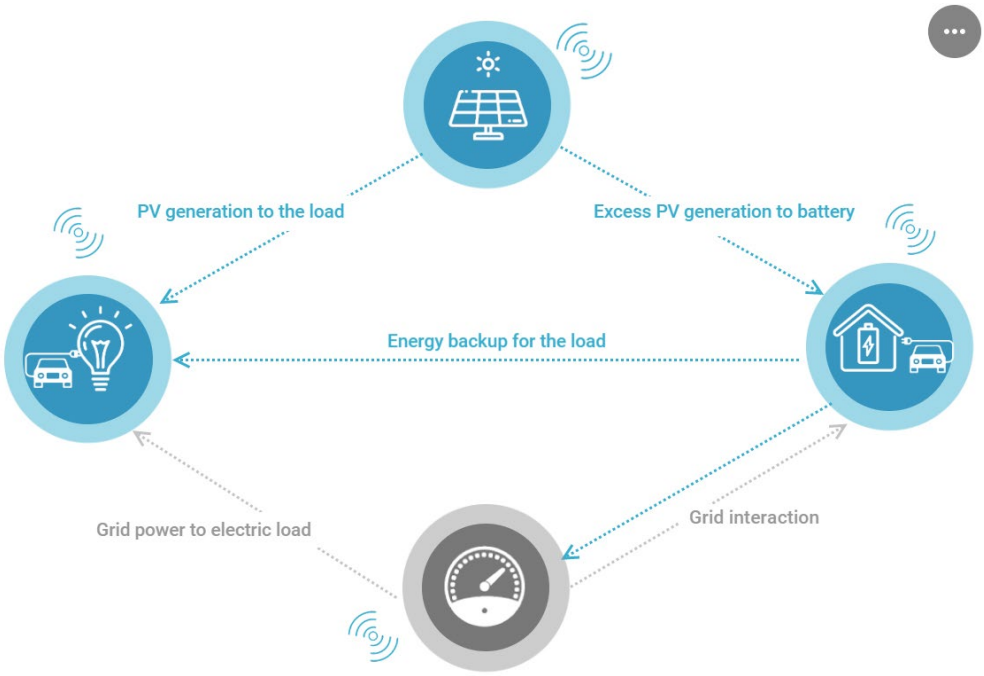

Figure 4: Enabling technologies connect at consumer end (IRENA)

Increased digitalization could allow to efficiently integrate private sector into competitive electricity markets, nurtured by systemic innovation, that will ultimately benefit consumers and industries in Africa. Systemic innovation means matching and leveraging synergies in innovations throughout the power system. This is key to increase flexibility, integrate high shares of various renewables and reduce system costs.

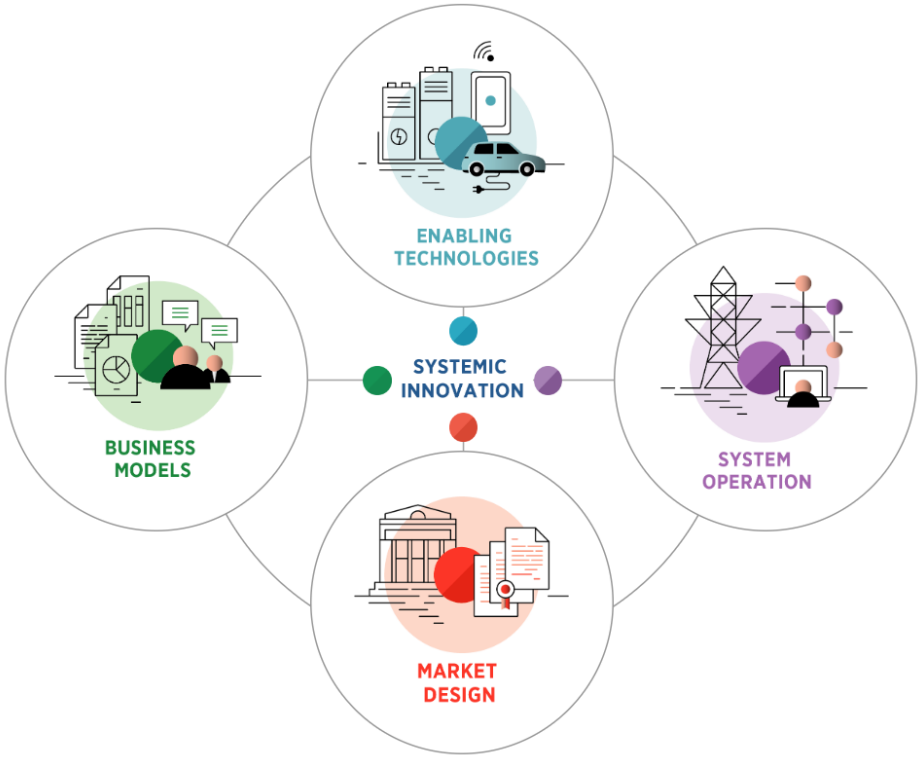

Figure 5: Systemic innovation is key to increasing flexibility (IRENA)

II. CONCLUSION

i. In delivering the solutions to power Africa, provide universal access to energy with just energy transition, African Member States should consider various non-renewable energy and renewable energy generation technologies to offer predictable, stable, and competitive energy cost, affordable for industries and households[25].

ii. The inclusive objective of African Member States' national energy policy should aim for ensuring sustainable, adequate, affordable, competitive, and reliable supply of energy at the minimum cost, which is aimed at meeting national and country needs, and at the same time protecting and conserving environment and climate.

iii. The development of the African energy sector requires an increase of technical capacity and skills resources to build and maintain infrastructures that will enable effective processing and supplies of energy commodities and services. Skills are required to manufacture, install, operate, and maintain energy infrastructure.

iv. Sustaining the development of frameworks and strategies to encourage technology innovation and transfer will enable technology absorption and uptake in this industry, and therefore position African in a comparative advantage by capitalizing on its energy mix and to power the continent that will result in sustainable transformation.

v. Adoption and adaptation of technologies to Africa's local needs is a prerequisite.

vi. Creating a manufacturing base for energy equipment and systems in Africa will also be important in reducing costs and production at scale. This calls for frameworks and initiatives to encourage technology innovation and transfer, technical cooperation, and technical capacity building and training. There is also a need for the design of well-informed and appropriate strategies in energy planning and services expansion.[26]

[25] Levelized Cost of Energy - an overview | ScienceDirect Topics

[26] African common position on energy access and energy transition

III. ANNEX

DASHBOARD ACTIVITIES OF THE THREE WORKING GROUPS ENERGY-P[3]

ACTION AREAS BENCHMARKED AGAINST THE THREE WORKING GROUPS	ACTION AREA 1 – WG1: INCREASING ACCESS TO AFFORDABLE, RELIABLE AND SUSTAINABLE ENERGY. ELECTRICAL, THERMAL AND MECHANICAL ENERGY NEEDS FOR HOUSEHOLDS, BUSINESSES AND COMMUNITIES, WITH AN EMPHASIS ON AFFORDABILITY, RELIABILITY AND SUSTAINABILITY OF ENERGY ACCESS FOR THE POOR. THIS INCLUDES DECENTRALIZED ENERGY SOLUTIONS AND THE USE OF MINI[1]GRID AND OFF-GRID OPTIONS. IT ALSO INCLUDES THE ROLE OF ENERGY ACCESS IN CONFLICT AND DISASTER RECOVERY EFFORTS, IMPROVED LIVELIHOODS AND SOCIAL INCLUSION	ACTION AREA 2 – WG2: INCREASING THE GLOBAL RATE OF IMPROVEMENTS IN ENERGY EFFICIENCY. PROMOTING ENERGY EFFICIENCY ACROSS SECTORS, CREATING STRONG MARKET DEMAND AND INCENTIVES FOR PUBLIC AND PRIVATE INVESTMENT IN ENERGY EFFICIENCY VIA A COMBINATION OF POLICY, FINANCIAL DE-RISKING AND DIRECT INCENTIVES	ACTION AREA 3-WG3: INCREASING THE SHARE OF RENEWABLE ENERGY IN THE GLOBAL ENERGY MIX. THE DEVELOPMENT OF ON- AND OFF-GRID RENEWABLE ENERGY TECHNOLOGIES AND DELIVERY SERVICES THROUGH TECHNICAL, POLICY AND FINANCIAL DE-RISKING
FAO	- Energy is essential for food security and development. Finding green and resilient solutions that can support sustainable food system transformation and agricultural innovation is an integral part of FAO's mission, and energy is a major component of this work. FAO's Energy-Smart Food (ESF) programme aims to increase access to sustainable energy in food systems through innovative, green energy solutions that encompass	- Within the ESF programme this area of work focuses on the specific context of agri-food systems in terms of baseline energy use and options to improve energy efficiency. The FAO/WB Energizing Agriculture Assessment Tool (EAAT) covers basic aspects of energy efficiency for agri-food value chains, namely, replacing lighting systems and the effect of improved maintenance. To date, it has not been used in Africa. However, energy efficiency in post-	- The ESF programme focuses on the use of renewable energy in agri-food systems. Recent examples of introduction of renewable energy systems in FAO field projects include: o Liberia: Solar energy for lighting and central cooling of Liberia's Central Veterinary Diagnostic laboratory; o Zimbabwe: Solar energy for charging stations of electric tricycles to transport goods and

	improved energy efficiency, the use of renewable energy, increased circularity through waste-to-energy along agri-food chains, and a water-energy-food nexus approach. A key publication on renewable energy for agri-food systems is here and more on ESF is here. - Within the ESF programme energy access concerns specifically energy needs for agri-food systems. It also looks at the potential to produce bioenergy, in particular at local level for rural households and communities. Under the ESF programme, recent examples of work in Africa include: o The assessment of the costs and benefits of solar and biogas systems in the milk chain in Tanzania, Kenya and Tunisia, and vegetables in Senegal and Kenya; o The review of the national biogas programme in Rwanda; o The assessment of the potential to use residues from selected food chains for local bioenergy in Zambia, Seychelles, and Rwanda. - The Bioenergy and Food Security (BEFS) Approach has been developed by FAO to support countries in designing and implementing sustainable bioenergy policies and strategies. The approach promotes food and energy security and	harvest operations is one component of a forthcoming project on low-carbon tea in Kenya. - Technical support to field project operations that promote sustainable wood fuel value chains, such as the "Forest Management and Sustainable Charcoal Value Chain" project in Uganda, and "Strengthening the Potential of Sustainable Wood Energy Project in the Republic of Congo". - Country of actions in Africa include Congo, Ghana, Gambia, Kenya, Uganda, Zambia. - FAO has published a report titled "Opportunity for agri-food chains to be energy-smart" aimed at assisting actors along the value chains, policy makers and other stakeholders in the agri-food industry to reduce the dependence on fossil fuels, reduce related greenhouse gas emissions, and become more resilient to possible future climate change impacts. See here More work of FAO on energy-smart food can be found e.g. here and here	extension service staff in rural areas; o Gambia: Solar water pumping systems for cattle drinking; o Nigeria and Seychelles: Charcoal briquette machines to supply fuel for improved cookstoves. - Assessment of policies and strategies relevant to interventions in the wood fuel sector in support of policy development on energy access and sustainable forest management. This activity covers 31 African countries that pledged to AFR100 (African Forest Landscape Restoration Initiative).

	contributes to agricultural and rural development. It consists of tools and guidance to support countries through the main stages of the bioenergy policy development and implementation process. Key publications can be found here - The followings are three sustainable energy solutions for food production that are promoted by FAO: solar-powered irrigation in Rwanda, biogas digesters to keep milk fresh in Tanzania and crop waste as bioenergy in India - The "Investing in Sustainable Energy Technologies in the Agri-food Sector" (INVESTA) project has developed a methodology for a comprehensive cost-benefit analysis of energy technologies. It complements the findings of the "Opportunities for Agri-Food Chains to become Energy-Smart" report published by FAO and USAID in 2016. - FAO conducts normative and programmatic work to promote the use of clean energy in African agri-food systems including through a water-energy-food nexus approach. Recent publications include: o FAO, 2022. Generating renewable energy and creating green jobs to improve		

	livelihoods for refugees and host communities in Mafraq Governorate. http://www.fao.org/documents/card/en/c/cb8881en ○ FAO, 2021. Biogas systems in Rwanda – A critical review, Food and Agriculture Organization, Rome, Italy. https://www.fao.org/policy-support/tools-and-publications/%20resources-details/en/c/1393280/ ○ FAO and the Ministry of Energy of Zambia. 2020. Sustainable bioenergy potential in Zambia – An integrated bioenergy and food security assessment. - Environment and Natural Resources Management Working Papers No. 84. Rome. https://doi.org/10.4060/cb1528en ○ FAO. 2019. Energy in and from agriculture in the African Nationally Determined Contributions (NDC) - A review. Rome. https://www.fao.org/3/ca6359en/ca6359en.pdf ○ FAO and GIZ. 2019. Measuring Impacts and Enabling Investments in Energy-Smart Agri-food Chains. Findings from Four Country Studies. Rome		

	https://www.fao.org/3/ca4064en/ca4064en.pdf ○ IRENA and FAO, 2021. Renewable Energy and Agri-food Systems: Advancing Energy and Food Security towards the Sustainable Development Goals and Paris Agreement. International Renewable Energy Agency, Abu Dhabi. https://www.irena.org/publications/2021/Nov/Renewable-Energy-for-Agri-food-Systems - To promote biogas, use in Africa via household bio-digesters, FAO is currently providing training on bioenergy for forestland rehabilitation in Ghana and Togo. Biogas by-products contribute to clean cooking solutions as well as improved soil quality and land rehabilitation – hence to improved food production. - A recent FAO project in Jordan used solar energy to heat a biogas unit that uses sewage water and solid waste from a refugee camp, and supplies electricity to the refugee camp. The by-product of the biogas was used to fertilize a fruit tree nursery – a good example of renewable energy powered circular agriculture (FAO, 2022).		

	Assessment of wood fuel consumption and production on natural resources degradation in displacement settings for development of project interventions. Relevant activities have been conducted in the following countries – Djibouti, Ethiopia, Kenya, Somalia, South Sudan, Tanzania, Uganda.		
WFP	- Access to energy is essential at every stage of the food supply-chain for production, processing and preservation; opening new economic opportunities in rural areas that build resilience and strengthen livelihoods. WFP is partnering to implement market-based, sustainable energy approaches to providing food assistance and resilience activities that strengthen local value chains. - WFP's Energizing School Feeding (ESF) aims to bring transformative change by turning schools into sustainable energy hubs that power solutions for children and surrounding communities through providing healthy, efficient, and convenient cooking; light to study after dark; connectivity and Wi-Fi; refrigeration, vaccines, solar water pumping; charging for mobile phones and lanterns. - WFP works with smallholder farmers to increase supply by improving their productivity, through the creation of community productive assets, access to agricultural inputs, promotion of SHF	- WFP is working with at least 39 governments and relevant IFIs to ensure its interventions are in support of NDCs (Nationally Determined Contributions to the Paris Agreement), while also contributing to the 2030 Agenda. For example, WFP's work on sustainable infrastructure is focusing on food systems, climate adaptation and disaster preparedness. This includes facilitating renewable energy infrastructure when possible while helping increase beneficiaries' access to energy. As renewable energy generation prices decrease - and fossil fuel prices continue to rise - the short-term tradeoff between energy access and climate is no longer a constraint. This is quite evident in settings with a lack of power grid coverage, where green and decentralized power generation is a much competitive option for smallholder farmers than the brown alternatives. - Climate Security Mechanism (CSM): The CSM is a joint initiative of the Department for Political and Peacebuilding Affairs (DPPA), UNDP	

	aggregation systems, and market-based provision of equipment and training to reduce post-harvest losses. Energy for production, processing, storage and preservation, and to charge communication devices, are pivotal to transforming subsistence agriculture into a more profitable business. - WFP is promoting and moving towards clean cooking solutions and exploring opportunities to scale up. - SAFE (Safe Access to Fuel and Energy) adopts a multi-faceted approach to meet the energy needs of displaced people worldwide through sustainable energy-related activities. - WFP strives to ensure that the food that it provides through its humanitarian programs can be prepared with clean cooking solutions, and that the negative socioeconomic and environmental impacts of inefficient energy sources can be avoided. In 2020, WFP enabled more than 1.6 million people to access sustainable energy services, promoting clean cooking solutions; providing households and schools with more efficient, less polluting appliances; and connecting smallholders to energy equipment and services that improve food production, processing, and preservation. - UN-Energy: WFP is a member of UN-Energy, a mechanism for inter-agency collaboration to support countries in achieving SDG7 (Ensure access to	and UNEP. It aims to strengthen the capacity of the UN system to analyze and address the impacts of climate change on peace and security. WFP is a member of the Community of Practice on Climate Security.	

	affordable, reliable, sustainable, and modern energy for all).		
JOINT SDG FUND	- Madagascar (funded) is among one of the top 20 countries with the largest number of people unable to access clean fuels and technologies. Only 16.5% of the population has access to an electricity grid, a number that drops to 6.2% in rural areas. The programme in Madagascar is committed to set-up a sovereign fund, a de-risking facility, and an incubator, to fund renewable energy projects. The programme aims to provide access to affordable and sustainable energy to at least 80,000 individuals, while simultaneously increasing Madagascar's solar capacity. In Rwanda (incubated) it is proposed to fund solar panels/energy in rural health centers on the basis of a social entrepreneurship model. Uganda (incubated) suffers from poor access to electricity with only 7-8% of the population in rural areas able to access electricity. This challenge is even greater in refugee camps, 97% of which do not have access to electricity. To close this gap, investments in solar power generation will be de-risked in the Ugandan humanitarian and social sectors. A guarantee fund is proposed offset the risk of early termination of purchasing power agreements, further support by technical assistance to ESCOs and UN agencies.	- North Macedonia (funded)'s Green Financing Facility will support loans to households and small businesses to adopt renewable and efficient energy technologies. To incentivize businesses and households to take advantage of the loans supported by the facility, it will also offer technical assistance and performance-based payments. The programme aims to extend loans to 105 businesses and 650 households, ultimately leading to 80,000 tonnes of GHG emissions avoided and 86,000 MWh of energy saved. -	- Uruguay (funded)'s primary energy matrix is still based for 37% on fossil fuel. The Renewable Energy Innovation Fund, a blended finance vehicle to support Uruguay's second energy transition will foster the decarbonization of the transport and industry sectors, universal access to renewable energy, and increased innovation and competition in the renewable energy sector. Zimbabwe (funded)'s Renewable Energy Fund will combine technical assistance with investment to leverage US$31 million toward renewable energy businesses. The Fund seeks to create at least 750 jobs in the renewable energy sector and create 180 GWhr renewable energy capacity. Djibouti (funded) and Bangladesh (funded) launched SDG Investor Maps identifying investment opportunities in renewable energy. In Bangladesh, the UN is also collaborating with PUMA and H&M on a baseline assessment for garment factories to integrate renewable energy in their supply chains. A new generation of financial products to combat climate change and promote renewable energy is being created in Indonesia (funded), including SDG bonds and the first Indonesian impact fund. Indonesia issued the first SDG bond in South-East Asia (US$584 million) in 2021.

ILO	- Skills for clean energy and green jobs assessments identifying skills needs and gaps for the deployment of renewable energy services. - Skills development, education, and vocational and technical training, including training for women and girls, to enhance human capacity for the delivery of clean energy services. - Promotion of quality and healthy jobs with decent working conditions.	- Research and analysis on the employment creation potential of increasing energy efficiency in buildings. - Development cooperation programmes promoting green jobs creation through a value chain approach for improving the sustainable livelihoods of rural and urban families through private sector development and sustainable housing.	- An enabling environment for sustainable enterprises, skills development, and enterprise promotion to enhance the deployment of renewable energies. - Social finance mechanisms promoting tailored consumer financing and adapted small business finance solutions.
IFAD	- Activities align with the increase of access but with a focus on productive uses of energy. - Through the Adaptation for Smallholder Agriculture Programme (ASAP), IFAD has promoted improved cook stoves, biogas digesters and solar powered pumping systems in several countries including Bolivia, Mali, Nigeria and Kenya. Also, introduction of energy-efficient processing and storage technologies (such as solar heating, cooling, drying, milling, lighting) in Kyrgyzstan, India, Rwanda and Mozambique. - In Mali, a US$39 million loan project entitled Multi-Energy for Resilience and Integrated Territorial management (MERIT). MERIT is fully aligned with the priorities set in Mali's Nationally Determined Contribution (NDC),	- The use of RETs for agricultural production means that farmers can undertake more value-added activities (grinding, milling, drying, and storage) and are able to access to water through solar pumps for irrigation and clean drinking water.	- The Renewable Energy for Smallholder Agriculture (RESA) approach is a policy document which enables IFAD to systematically invest in and scale up renewable energy for smallholder agriculture through the transfer of existing and emerging RETs, and by pursuing North-South, South-South, and Triangular Cooperation (SSTC). We are currently increasing our level of policy engagement with partner governments in the area of RE and exploring PPPs, and a range of blended finance approaches. IFAD is an assembler of development finance – blend-climate-private sector finance

	especially: (i) the protection of forest resources; (ii) the development of smart, climate-resilient agriculture, and (iii) the development of renewable energy and energy effectiveness through small hydroelectric plants and photovoltaic, wind and biomass energy (bio-gas). The project plans the installation of 5,00 biodigesters, 5,000 solar photovoltaic kits and 50,000 improved cookstoves. - In sub-Saharan Africa post-harvest losses account for 36% of production.15 In December 2017 IFAD therefore approved a US$2.2 million grant to SunDanzer International to adapt its direct drive refrigeration technologies that enable battery-free solar generation to the needs of smallholders in various ESA countries. The programme evaluates the needs of the selected milk, fish and horticulture value chains for cold chain requirements to determine technology needs. It targets smallholder dairy farmers with at least three cows; satellite milk-chilling centres; poor people engaged in fishing and related activities and farmers using irrigation techniques. The programme is designed to reach 2,500 direct and 10,000 indirect beneficiaries.		
UNFPA	- UNFPA supports effective tracking of progress on SDG7 through its work on data and statistics. This includes data	- UNFPA has been supporting the efforts by African governments and the African Union in their determination to harness	

	generation; analysis and use of disaggregated data (sex, age, geographic location, socio-economic status and various vulnerability markers) to ensure women, girls and young people within households have equitable access to affordable, reliable, sustainable and modern sources of energy. In 2020, UNFPA launched the COVID-19 Population Vulnerability Dashboard interactive tool to provide United Nations agencies, governments and policymakers, public health and frontline workers, as well as the general public access to data on populations vulnerable to COVID-19 to improve and inform both preparedness and response, and to save lives. - UNFPA has been working to ensure that efforts to achieve universal health coverage in Africa, underscore the urgency for resilient health systems powered by affordable, reliable, sustainable, and modern energy sources, which will enable the health system to provide quality essential health services to all persons on the continent, including women and youth. At Primary Health Care levels, life-saving interventions along the continuum of care and minimum initial services packages in humanitarian settings are all dependent on energy. - On protecting the vulnerable and Leaving No One Behind, given that women are disproportionately affected	the demographic dividend through investments in youth towards the economic transformation of the continent. This includes investments in innovation and energy solutions that would help power the continent's economic transformation. - UNFPA's investments in women and girls' empowerment, including through the provision of services and programmes to reduce unmet need for family planning, address gender-based violence in all its forms including harmful practices such as female-genital mutilation and child marriage and initiatives to reduce maternal mortality, directly contributes to healthier, better educated, resilient people needed to transform the state of energy in Africa. In turn, addressing energy poverty and inequities have a direct effect on the Three Transformative Results	

	by lack of access to sustainable energy especially in developing countries, UNFPA advocates towards women's equitable representation in sustainable energy decision making spaces in African countries as they are currently underrepresented despite being more affected by lack of access to sustainable energy.		
UN-HABITAT	- Multi-institution dialogue on local government and communities' access to sustainable energy	- Facilitation of household and private institutions access to photovoltaic energy and capacity building	- Dialogue with the African Union on the promotion of renewable energy infrastructure for green urbanization
IAEA	-	The IAEA supports national and regional technical cooperation projects to provide energy planning tools, enhance local energy planning capabilities and support policy and decision-making processes of African Member States. - The IAEA capacity building program equips national experts with tools, skills and knowledge to analyse energy demand and supply options, connect energy needs with provision of other basic services (household energy needs, services including public sector, sustainable transport, industrial development), conduct technical and economic analysis of options and identify cost effective energy policies. - the African countries embarking in Nuclear Power Plants Programmes are:	The IAEA publish regularly updated editions of its *Climate Change and Nuclear Power* Report. This report contains a chapter dedicated to the MENA region as well as Sub-Saharan African and provides an overview of the key drivers and impediments to energy infrastructure development in the continent.

		- Egypt, Nigeria, Ghana, Kenya, Morocco, Niger, Sudan, Uganda, Algeria, Senegal, Tunisia and Zambia.	