AUDA-NEPAD
AFRICAN UNION DEVELOPMENT AGENCY

The African Continental Power Systems Masterplan

Support Studies – Solar power

African Union

THE AFRICA-EU PARTNERSHIP
LE PARTENARIAT AFRIQUE-UE

Africa-EU Energy Partnership

African Union Development Agency - NEPAD
230 15th Road, Midrand, Johannesburg, South Africa
Tel: +27-11 256 3600
Email: info@nepad.org
Web: www.nepad.org
Twitter@Nepad_agency
#TheAfricaWeWant

June 2023
This work is a product of the African Union Development Agency - NEPAD.

Introduction

Development of a continental master plan

The African Union (AU) has articulated a vision for a continent-wide interconnected power system (the Africa Single Electricity Market (AfSEM)) that will serve 1.3 billion people across 55 countries, making it geographically the biggest electricity markets in the world. Interconnection offers immense technical and economic opportunity[1], while a fully integrated and competitive market will accelerate development and energy access across the continent. Increasingly, the enhanced system flexibility and resilience of an interconnected power system is also an imperative for a modern power system able to navigate the developments impacting global energy systems. This includes growing shares of low-cost variable renewable energy; commitments to climate change and decarbonisation, decentralisation and democratisation of energy; intelligent grid infrastructure and digitalisation of the energy sector; infrastructure resilience in the face of climate risks; and the rise in energy storage technology and electric vehicles.

Concrete steps have been taken towards realising the broader vision described by the AfSEM together with the AfDB's new deal for energy and clean energy corridor concepts. Among these is the development of a Continental Power System Masterplan (CMP) expected to create the framework conditions that will allow countries to trade electricity to leverage national and regional surpluses and deficits through cross border power exchanges and inter power pool trade. This harmonized platform will aid optimised project decision-making regarding the location, size and timing of generation and transmission infrastructure investments.

The CMP is being developed under the governance structure of AUDA-NEPAD (the African Union Development Agency) with direction from ministerial committees to ensure political and technical alignment. Development spans two phases (Figure 1) and is implemented over several years, with targeted completion by the end of 2023.

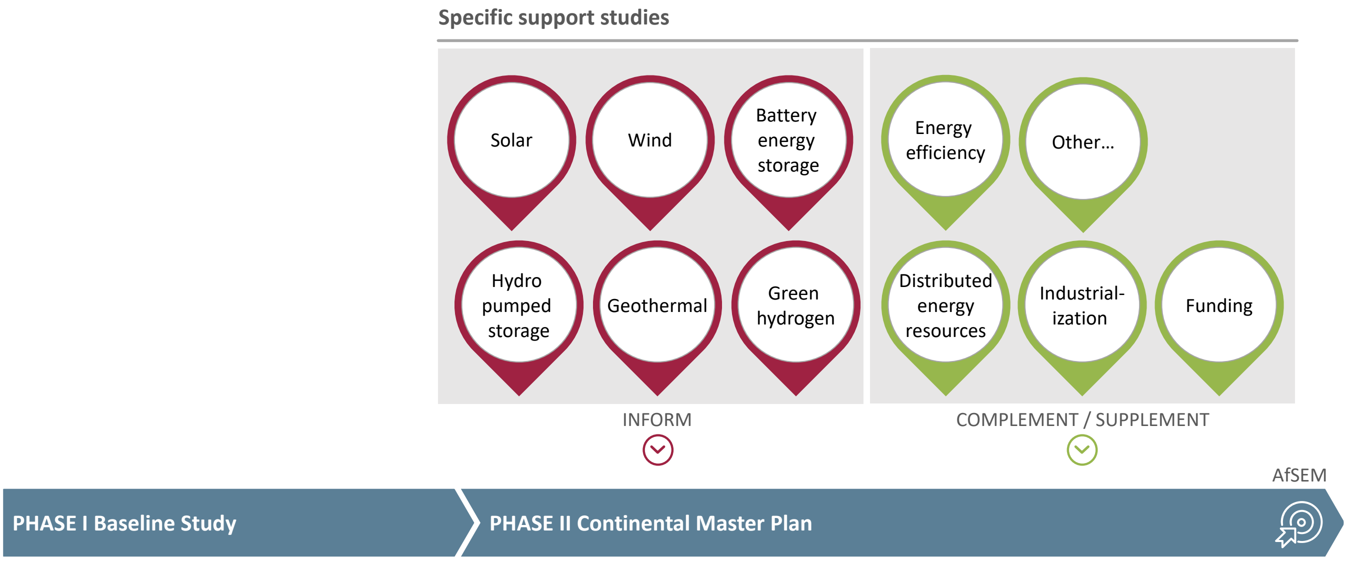


Figure 1: CMP development phases with input from specific support studies

[1] Benefits include increased system reliability; access to more diverse generation resources; enhanced security of supply; improved system flexibility, redundancy, and resilience; reduced or deferred capital investments; diversified loads and improved load factors; and operational and maintenance efficiencies gains, among others.

In parallel, several studies are being developed to help refine and enhance the CMP (Figure 1). These specific support studies (SSS) aim to inform or complement the planning of the CMP, providing a clearer understanding of the potential contribution to the continental power system or the potential for adjacent developmental opportunities.

Solar power as part of the energy generation mix

This study, which was supported by GET.transform, focuses on the findings of the solar SSS, providing an overview of the identified resource potential, opportunities, barriers or challenges and recommendations to achieve an optimal contribution to the CMP.

Global projections to 2040 show renewable energy – including solar power – as a critical part of a diversified electricity mix to meet the power needs of the world (Figure 2).

The CMP being developed for the African continent show solar power growing from a very low base (~2% in 2023) to contributing approximately 15% of the electricity production mix in 2040.

Current planning for the future diversified energy mix includes both solar photovoltaic (PV) and concentrated solar power (CSP). Evident from the planning for 2040, solar PV is expected to be the dominant solar technology deployed on the continent.

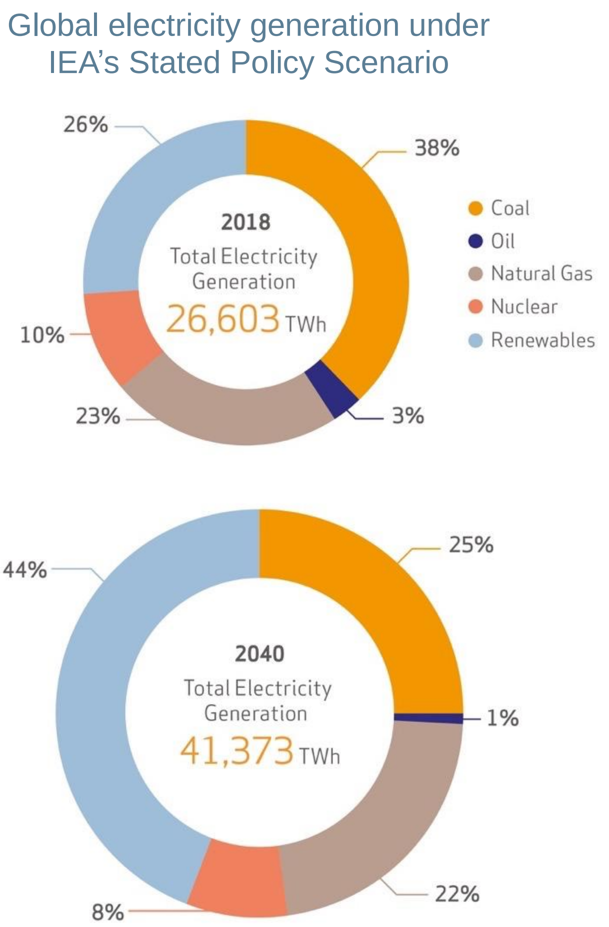


Figure 2: Changes in the global electricity mix[2], 2018 – 2040 (measured in TWh)

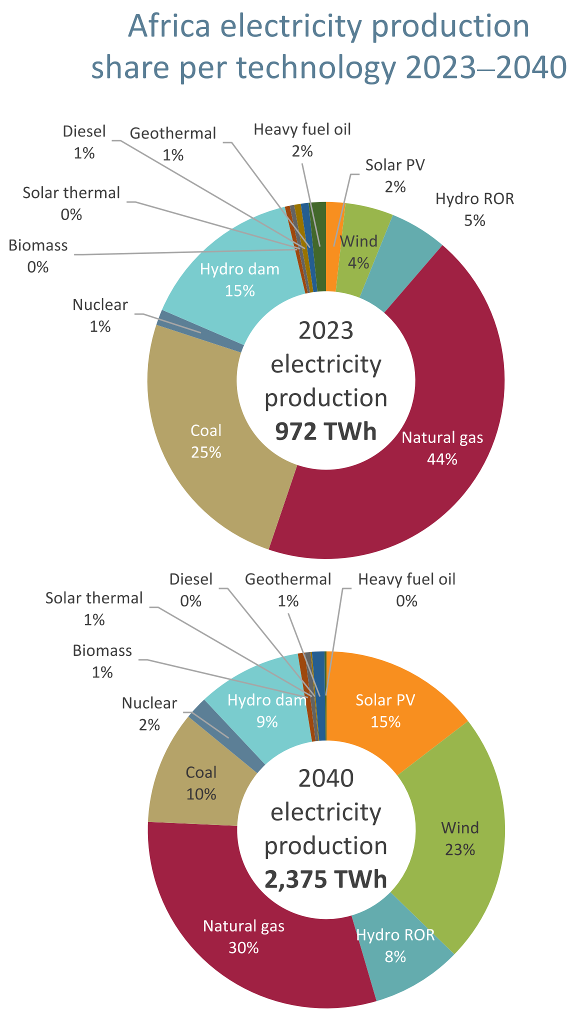


Figure 3: Africa's current and future generation mix, 2023-2040 (measured in TWh)

[2] International Energy Agency (IEA) World Energy Outlook, 2019 data

Box 1. Solar electricity generation technologies

The study focused on the two most common technology options for converting sunlight into electricity, but noted a third, emerging option, for future reference:

1. **Solar PV.** Flat plate PV is the most common generation option where light impinging on the panel is directly converted into electricity. This electricity can be fed into the grid or stored in batteries for later use. Plant sizes vary from a few watts to over 1GW in large, ground mounted solar parks. PV power plants in Africa are currently not larger than 90 MW each. More than 4,000 solar PV plants are operational with an approximate 8GW in capacity.
2. **Concentrated solar power (CSP).** CSP encompasses three solar thermal conversion technologies: (i) solar tower, (ii) parabolic throughs and (iii) linear fresnel. for all CSP options, power is generated when the impinging sunlight is concentrated by heliostat mirrors onto receiver e.g. a tubular receiver (fresnel) or central tower. CSP power plants have a minimum size, typically 50 MW. CSP power plants usually have integrated storage lasting several hours. Fifteen CSP plants are known to be operational on the continent with approximately 1 GW capacity.
3. **Concentrated photovoltaic (CPV).** CPV concentrates sunlight and directly converts it into electricity using highly efficient photovoltaic multi-junction cells.

In contrast to solar PV technologies, which can make use of diffuse and direct sunlight to produce electricity, CSP and CPV plants have a narrower operating range, requiring direct sunlight under clear skies to generate at capacity.

Resource potential

A growing contribution from solar is possible – and highly desirable – because of the technology advances and price developments that have made solar power the lowest cost electricity in history at an average levelized cost of electricity (LCOE) for solar PV of USc 3.6 per kWh (as per the solar SSS study findings).[3] The cost reduction in solar power and the comparison with other power sources are evident in **Error! Reference source not found.** where LCOE trends for various generation sources since 2009 are compared.

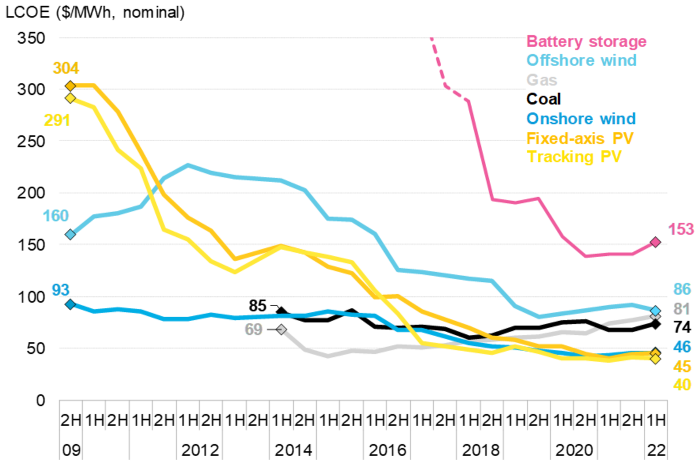


Figure 4: Global average levelized costs of electricity benchmarks, 2009 – 2022[4]

This could be particularly true for Africa where the solar radiation on only 200,000 km^2 – approximately the size of Senegal[5] – could satisfy 100% of the projected power needs of the entire continent by 2040[6].

As technology continues to advance, solar capacity factors also improve. Additionally, tracking and energy storage further contribute to

[3] The solar specific support study found the Levelized Cost of Electricity (LCOE) generated by photovoltaic (PV) power plants now ranges between USD 2 and 5 cents/kWh, with an average of USD 3.6 cents/kWh. Costs contributing to the LCOE are Capex, Opex (fixed and variable costs of Operation & Maintenance), as well as fuel cost. The 'fuel' of solar power plants, the solar irradiance, is free. Though the cost of capital in Africa has a significant impact on the LCOE of solar, policy and regulatory de-risking have made it possible to achieve prices for solar power in the USD 2.5 cents/kWh range in some countries.

[4] Source: BloombergNEF. Note: The global benchmark for PV, wind and storage is a country-weighted average using the latest annual capacity additions. Storage LCOE is reflective of utility-scale Li-ion battery storage system with 4-hour duration running daily cycle and includes charging costs.

[5] Senegal land size: 196,723 km^2 (75,955 sq mi)

[6] The African population will grow from 1.29 billion in 2018 to 2.10 billion in 2040. The annual consumption of electricity should reach at least current world average, increasing from 670 kWh/a in 2018 to 3,500 kWh/a by 2040 (International Energy Agency (IEA), "Energy statistics data browser" 2022. [Online]. Available: www.iea.org/data-and-statistics). To supply 100% of this

higher capacity factors. Capacity factors[7] of PV plants in the US are at 25%, with the top installations reaching 32%.

In Africa, the installed fleet of PV powerplants has a weighted average capacity factor of 16%. With new solar plants using newer technologies, the weighted average is projected to increase across all solar technologies (Table 1).

Table 1: Projected capacity factors for the portfolio of solar powerplants in Africa

Weighted Average Capacity factor (%)	Statistics 2020	Projections 2025	2030	2035	2040
Solar PV	16	*17*	*18*	*19*	*20*
Solar PV and battery storage	22	*26*	*29*	*33*	*40*
CSP	40	*40*	*45*	*50*	*55*

The modularity and versatility of solar technology enables solar power to be developed close to end users and within short timeframes, delivering power to consumers quickly[8]. CMP studies found that solar PV specifically has among the shortest development lead times, typically between 6 and 12 months (refer comparative construction lead times, Figure 5).

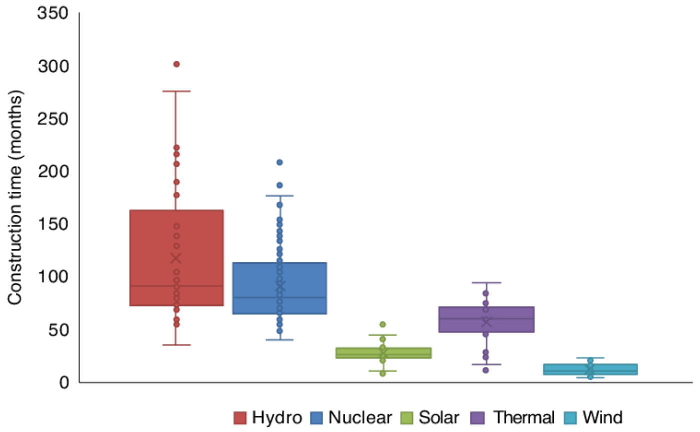


Figure 5: Construction lead times for generation technologies[9]

Given Africa's excellent solar resource and the short lead times, low-cost solar power can quickly deliver abundant affordable electricity to the many African households who are currently unserved[10] (**Error! Reference source not found.**). The study pointed to the potential for solar power to offer both centralised and decentralised solutions, recognising that many of the communities that lack access to electricity live in remote rural areas (i.e. more than 70% of the population without electricity in sub-Saharan Africa), where the remoteness premium for grid expansion can become particularly high[11].

The CMP study considered whether this enormous solar potential can be practically and fully exploited for the benefit of the continent and whether the available solar radiation can be matched with the high demand for power experienced in the early mornings and evenings. The work done for the CMP showed this to be increasingly possible when the following are considered.

1. **Grid interconnection maximises the solar day.** Grid interconnection across the continent will significantly extend the hours of daylight that can be utilised. The size of the continent, from East to West (spanning daylight hours[12]) and North to South (spanning seasons[13]), means solar power can be harnessed for extended hours every day without any energy storage capacity, provided transmission networks are in place to share this resource. Simulation data for **this study revealed a possible 15 hours of solar energy production between existing solar plants**.
2. **Bundling of variable renewable energy (VRE) plants improves consistency in energy production.**

energy need, the total area of the PV power plants would be 24,000 km² and 200,000 km² in 2018 and 2040 respectively.

[7] Capacity factor as defined in the SSS: The ratio of the electrical energy produced by a generating unit for the period of time considered to the electrical energy that could have been produced at continuous full power operation during the same period.

[8] Solar PV offer far shorter lead times (6-12 months) than virtually all other power generation projects.

[9] Sovacool, Benjamin & Schmid, Patrick & Stirling, Andy & Walter, Goetz & Mackerron, Gordon. (2020). Differences in carbon emissions reduction between countries pursuing renewable electricity versus nuclear power. Nature Energy. 5. 10.1038/s41560-020-00696-3.

[10] AfDB. 2019. The AfDB Light up and power Africa report noted that over 640 million Africans had no access to energy by 2019.

[11] The potential for off-grid solar was not included in the work, but further investigation into this potential was encouraged.

[12] The African continent stretches over the equivalent of five hours of longitude. By means of an example, when the sun sets in Dakar, Senegal, it is already 10PM in Addis Ababa, Nairobi, and Dar es Salaam. Accordingly, increased capacity of east-west interconnections in the African power system would therefore significantly improve the integration of solar power.

[13] Connecting solar power plants over long distances in North-South direction moderates seasonal variations of the combined capacity factors and combined energy generation.

Simulation data demonstrated the benefits of bundling VRE power plants, including solar, over any geographic area to homogenize the energy output of the power plants thereby reducing the effects of localised weather conditions. The study further noted that although solar is labelled a VRE, it is remarkably predictable, facilitating integration into a power system.

3. **Maturity of solar technology.** Solar PV is a mature, proven technology that is modular, scalable, and suitable everywhere in Africa in various configurations: households, businesses, and at utility scale. Whilst most familiar, solar PV is also not the only option for converting solar radiation to electricity. Concentrated solar power (CSP) offers a second, mature technology option with inherent potential for energy storage. The price of CSP has however not shown the same steep learning curve as solar PV. The LCOE for CSP is highly location and technology dependent, but on average has dropped below USc 10 per kWh. CSP with thermal energy storage can offer long-term storage (9 hours or more) and can be cost-effective and cost competitive with technology advances. Now however, and surely in the next decades, the LCOE of solar PV plus battery storage LCOE beat the LCOE of CSP plus thermal energy storage options. Current trends and projections suggest that solar PV in combination with batteries will follow the path of PV to achieve record low Capex, Opex, and LCOE.
4. **Solar PV in combination with energy storage or hybrid systems.** Solar PV combines well with energy storage systems or as part of a hybrid solution that incorporates other technologies such as wind, hydropower and energy storage, including pumped storage hydropower. These combined power solutions can overcome the diurnal changes in the solar resource and offer significantly advanced versatility and flexibility. The study quoted an example from India where the combination of solar PV with both wind and storage enabled the project to meet a combined annual plant load factor[14] of 80%.
5. **Modernisation of power systems.** Increased digitalisation, decentralisation, decarbonisation and democratisation of the power system – seen globally, including in African countries, as the leading development trends in the energy sector – contribute to greater adoption and an environment that is more conducive to the integration of a larger share of solar PV.

Opportunities

Notwithstanding this potential, the energy mix on the African content has remained largely undiversified, with the solar potential significantly underdeveloped. The approximately 9.5 GW of utility-scale solar PV projects that are currently in operation across the continent contribute less than 1% of the total installed solar capacity in the world which had surpassed 1,000 GW in 2022. For CSP the operational capacity of utility scale plants on the continent is only approximately 1 GW.

As evident from the map of utility scale solar PV and CSP plants, installed capacity has been confined to a few jurisdictions (refer Figure 6). Together, the installed capacity in South Africa, Morocco and Egypt represents 76% of all solar installations in Africa. The map points to the massive untapped solar potential despite the recent growth rate on the continent of 14% year-on-year (9% in 2021).

[14] Most thermal power stations, such as coal, geothermal and nuclear power plants, have availability factors between 70% and 90%. Source: Motghare, V. Cham, R. K. (Dr) 2015. Plant Load Factor-Key Parameter for Evaluation of Performance of Thermal Power Plant 2015. International Journal of scientific research and management (IJSRM), Vol.3 Issue 1, Pages 1904-1907 Website: www.ijsrm.in ISSN (e): 2321-3418

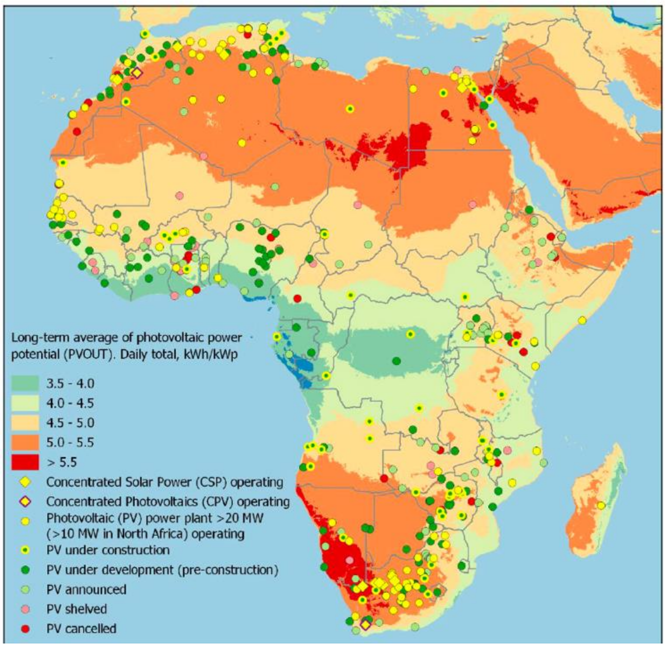


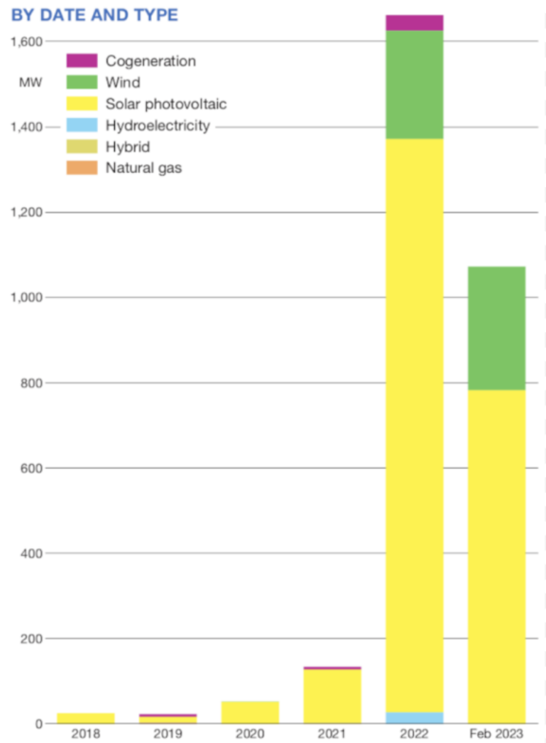
Figure 6: Locations of solar PV and CSP power plants on the African continent (January 2023)

Until recently, stand-alone utility-scale solar power plants have been the primary focus of governments, development partners and concessional lenders. However, in addition to these, numerous other opportunities are emerging to leverage Africa's solar resource for the benefit of economic growth and development. These include:

1. **Commercial and industrial solar plants.** Solar PV can easily be embedded within the power system to contribute directly to end users and feed into the power network. The commercial and industrial (C&I) market segment has shown significant uptake, with an estimated 1.2 GW solar capacity already established by 2022. Estimates by the Africa Solar Industries Association (AFSIA) show 100 new C&I solar rooftop projects being added across the continent per day. Box 2 illustrates the potential for rapid expansion in the C&I market as seen in South Africa. If encouraged and harnessed, this segment can markedly grow solar capacity on the continent using private sector finance while confining the investment needed for grid development. The study recommended that the CMP take the rapid growth of this market segment into account, as it will have important implications for load growth, capacity planning as well as grid development in the years ahead.

Box 2. C&I investments in South Africa

South Africa has seen a sharp rise in C&I investment in renewable energy production – particularly solar power – since 2021 with the easing of licensing requirements for private sector developments.



Source: NERSA data. Graph: African Energy, Issue 483 - 30 Apr 2023

2. **Agricultural photovoltaics (or Agrivoltaics or Agri-PV).** Agri-PV refers to technical solutions that combine agricultural infrastructure and solar PV. Simply put, this means combining energy and food production on the same plot of land. Already being trialed in several African countries[15], Agri-PV can significantly increase the benefits of solar deployment while simultaneously delivering on other social

[15] Known developments and pilot projects in Kenya, Senegal, Angola, Mali and the Gambia

and economic development objectives[16]. Ground mounted solar panels are used to provide shading for crops which expands the range of crops that can be grown while reducing water loss and cooling ground temperatures. Cooler temperatures in turn increases solar panel efficiencies. The potential of Agri-PV has only begun to be tapped, and Africa is uniquely positioned to take the lead in this burgeoning new sector.

3. **Floating photovoltaics.** Floating Photovoltaics (FPV) are PV power plants floating on water bodies such as natural lakes, artificial reservoirs or dams, as well as offshore on oceans; they are highly complementary to hydropower stations. Floating photovoltaics in Africa have a technical potential of 300–1,000 GW. Thus far, this potential remains largely untapped. Floating solar can help reduce water loss at existing hydropower dams, as well as in irrigation canals and other applications; evaporation can be reduced by between 6 and 20% for a 10% reservoir coverage. Though installation and operating costs are slightly higher than ground-mounted installations, floating solar can contribute to the continent's abundant renewable energy supply.
4. **Hybridisation of solar PV and CSP.** This combination of solar technologies is also showing potential with a first site being developed in Morocco at the Midelt solar site. Hybridisation of the two solar technologies is done to incorporate the storage capacity of the CSP plant with PV as the least cost option. The PV component will produce electricity during the day while the large storage option of the CSP plant can fulfil peak demand in the early evening and provide power throughout the night. Excess power generated by the PV plant can be used to heat the working fluid of the CSP solar field. While it was noted that the combination of solar PV plus batteries is projected to be the least cost option, advances in this solar hybrid solution could still offer a competitive alternative.
5. **Solar PV with energy storage and/or other generation sources.** As noted earlier, combining low-cost solar PV with other energy production or storage options are becoming cost-effective options for power production suitable to the continent. The expansion of grid interconnections combined with the greater use of storage can enable solar to contribute directly to meeting evening loads across the continent. By combining solar with storage, it can produce power when utilities need it most, alleviating pressure on other peaking power plants, reducing load shedding, while improving overall system reliability.

As noted earlier, the development of a **continent-wide transmission grid will considerably increase the length of a solar day** thereby **increasing the exploitable solar potential** even before the addition of energy storage. It can also limit the required investment in energy storage needed to extend the availability of solar power to match peak demand periods.

Mentioned, but not detailed in the SSS is the opportunity for employment creation related to solar power development and operation. The International Labour Organisation, IRENA, the IMF and the World Bank have all confirmed the significant potential for both direct and indirect job creation linked to installing and operating solar PV capacity.

Barriers or challenges

Despite the continent's phenomenal solar potential, massive technological and price advances, solar uptake has remained subdued.

[16] Agri-PV solutions hold a high potential to simultaneously enable sustainable agriculture and clean energy transitions across Africa. Agri-PV can optimize agricultural land use, provide new revenue streams for rural communities, and enable the adaptation of agriculture to help combat climate change.

The following key barriers were identified as hindering implementation at scale:

High cost of finance. High financing costs[17] will disadvantage all generation infrastructure projects on the continent and impact the cost of electricity to consumers. The study noted that high cost of capital can partly or completely offset the low installation costs that are being achieved globally for solar PV; high capital costs typically translate into high tariffs, reducing the affordability of electricity to consumers and/or will reduce the attractiveness of investments. Although it is common to focus on the installation cost of solar projects, growing evidence underscores the critical importance of the cost of capital in determining the actual cost of solar generation.

Policy and regulatory uncertainty. Policy and regulatory stability often outweigh resource quality in the decision making of investors and developers. Investments in the renewable energy sector tend to flow to countries where policy and regulatory frameworks are transparent and stable. Efforts to reduce the cost of capital (in short, policy and financial de-risking measures) including streamlined permitting and project approvals are therefore vital to unlocking solar at the lowest possible cost for utilities and ratepayers. This applies equally to the critical issue of currency risk, which affects virtually all solar projects – and, in fact, all generation projects – on the continent.

Financial position of off takers. The weak financial position of many utilities in Africa is a direct barrier to investment in utility-scale generation capacity and the scale-up of utility-scale solar power. An Africa-wide analysis show more than a third of the utilities on the continent are in precarious financial health with 35 utilities failing to recover costs even after subsidies. Investor decisions depend on the ability to enter into long-term power purchase agreements (PPAs) with financially stable, creditworthy buyers.

Land availability challenges. While Africa has vast areas of land, siting solar power projects is not always easy. Several layers of negotiation are frequently required between local officials, local landowners and the central government before a suitable site (or sites) can be agreed upon. Governments can improve this situation by clarifying rules around land access and title, or by designating special zones, in concert with local and indigenous communities, for renewable energy development. Combining solar PV with agriculture (Agri-PV), as well as rooftop or industrial deployment can allow for symbiotic land use.

System integration and operation challenges. Echoing and contrasting with the opportunity presented by grid integration, isolated power systems present a hurdle for deploying solar power at scale and fully utilising Africa's solar resources. At low penetrations, solar PV can be integrated relatively easily. As the share of solar PV grows, strategies need to adapt, with improved forecasting, balancing, storage, modern inverters, and interconnections with neighbouring regions playing an increasingly important role.

Limited availability of energy storage and integrated transmission networks as enablers for solar PV adoption. To unlock the full solar PV potential on the continent planning needs to focus on a rapid expansion of storage and transmission infrastructure. Storage helps ease solar integration, while larger balancing areas help shift power quickly and efficiently from where it is generated to where it is consumed. In the absence of an integrated grid and/or energy storage systems Africa will not be able to take full advantage of solar PV as the lowest cost generation source in history.

Recycling and e-waste concerns. Concerns have been raised about e-waste and recycling of solar PV panels and associated components. The solar industry is making significant progress in addressing the twin concerns of e-waste and the recycling of solar PV panels and associated components. The issue is now rising to the political agenda both in Africa and around the world. Meanwhile, recycling facilities for e-waste now exist on all continents, including in Africa. In 2014, the EU introduced an obligation for manufacturers to take back and recycle panels at their end-of-life, and similar efforts are under way

[17] The cost of capital is impacted by the perceived investment risk across a range of risk factors, many of which are associated with new and developing markets. Risk considerations span a range of potential factors including risks related to: market, political, regulatory, counterparty, macro-economic, currency, financial sector, grid integration and social acceptance.

elsewhere. Research aims to increase the lifetime of PV panels to 50 years.

What is needed to unlock the potential?

It is apparent from the investigations done as part of the CMP that the African continent has the potential to optimally deploy low-cost solar power as part of an overall, diversified and distributed generation solution. To be able to meaningfully scale up solar development, consideration needs to be given to the strategy, planning, policy, regulatory and investment environment. While the political, market and utility context of each country is unique, several key building blocks are universally relevant for creating a conducive investment landscape.

The CMP study structured recommendations into three categories: technical, grid related and policy- and financing-related. A selection of these is highlighted here:

Technical interventions

Focus on high-level planning. Solar technologies have matured to provide reliable and efficient generation solutions. Instead of dictating the choice of technology, high-level decision-making can rely on project economics and developers to recognise the most suitable solutions for the country context or supply requirements.

Grow local knowledge and technical capacity. It is an imperative to grow local knowledge and skills to harness solar technology's potential for the African context. Research facilities, innovation hubs, and test laboratories could serve this purpose.

Prioritise Agri-PV. Agri-PV presents enormous potential for the integration of food, energy and water systems most especially in the many African countries where rural electrification rates are low and food security needs to be improved. It is crucial that a better understanding of this opportunity is developed for each geographic context coupled with how best to utilise and expand the role of Agri-PV across the continent.

Pursue floating PV. Floating solar makes sense especially where it can be deployed on existing hydro reservoirs and canals to reduce evaporation rates and/or installed on conjunction with hydropower production.

Invest in local manufacturing. Expanding the local production capacity of solar can start by supporting the local manufacture of mounting structures and trackers, while building capacity toward the manufacture of modules and other key supporting technologies.

Develop a suitably skilled workforce with a focus on youth and gender. At scale, the solar industry promises plentiful employment opportunities, both directly for installation, plant operation and maintenance, as well as indirectly within the supply chain and related components. Expanding the local workforce for solar deployment is at the heart of successful and sustained solar adoption continent-wide. This capacity needs to be fostered, and built, and opportunities for women and youth, in particular, need to be expanded and diversified.

Grid-related interventions

Accelerate the deployment of hybrid solar PV plus energy storage. Given the greater difficulty of integrating solar PV in weaker grids and the frequent lack of capacity at the utility/system operator, utility-scale solar PV plants should be incentivized to integrate energy storage (e.g., battery storage) where necessary to mitigate output variability at the source. Such hybrids of generation and storage allow faster adoption of solar power while helping reduce grid expansion costs and enabling simpler grid integration – due to reduced variability in comparison to solar power plants without storage.

Improve grid codes and regional harmonisation. Grid codes are meant to enable fair participation between system users, and fair sharing of responsibilities between system users and operators. For optimal utilisation of solar PV capacity across Africa, discussions on establishing regional grid codes and harmonizing national grid codes should be given priority where possible. This should be considered a foundational element of the African Single Electricity Market (AfSEM).

Set requirements for modern inverters. Modern inverters contribute significantly to grid stability, power quality and resilience. A growing number of jurisdictions world-wide are requiring the use of modern inverters for all new grid-connected solar PV projects. While such inverters are marginally more expensive than older inverter types, enforcing the use will capture the wide range of capabilities increasingly important to modern grid operators and even more so for an integrated grid as envisaged for the continent.

Expand grid interconnection among power pools. A larger overall balancing area brings greater redundancy, diversity and increases the ability of the grid to integrate variable renewables with greater ease. As the study showed, East West connections between existing power plants can stretch solar the solar day to 15 hours.

Make solar power the workhorse of off-grid electrification. Solar PV offers the cheapest source of electricity not only on-grid, but also for off-grid supply. As such, solar PV can provide the default power solution for non-electrified regions. Decentralised electricity supply can be developed to complement a national power grid, improve reliability of supply and reduce costs.

Policy and financing-related interventions

Prioritise efforts to reduce investment risk and lower the cost of capital. Efforts to reduce the cost of capital (in short, policy and financial de-risking measures) are vital to unlocking solar at the lowest possible cost for utilities and ratepayers. Governments can reduce the cost of capital by introducing a host of de-risking measures, and by increasing the stability and predictability of power sector development and planning.

Provide a clear line of sight on planning and targets. Solar is inexpensive and its potential is vast. Unambiguous plans, solar deployment targets, and an appropriate strategy for deployment creates an investment environment that can be leveraged effectively to achieve lowest-cost solar development and encourage local production capacity.

Introduce streamlined procurement mechanisms, drawing on best practices from across Africa. Many countries throughout Africa have already held successful auctions for solar power. Draw on these experiences while also learning from failures, including from auctions with low project completion rates.

Expand the involvement of local banks in financing solar projects on the continent. All African generation infrastructure projects will benefit from having local banks and investors providing capital, preferably in local currency. This should be encouraged and can be advanced through education and creating awareness among financial institutions of project case studies, understanding of project loan documents and power purchase agreements.

Conclusion

In early 2022, the global installed capacity of solar PV surpassed 1,000 GW. If the rate of growth of 40% per year since 1976 is sustained, solar power output would be on track to match total global electricity demand by the mid-2030s.

Africa is the world's sunniest continent. However, realities on the ground in many countries have hindered progress in harnessing this resource potential. Solar resources in Africa are excellent, with large areas receiving as much as 7 kWh/m² per day. Moreover, across the width of the continent, Africa can harness 15 hours of productive daylight. If combined with bankable policy and regulatory frameworks, and supported with storage, solar can provide nearly limitless and affordable power for all within a short delivery timeframe.

Massive cost reductions over the recent two decades have made solar the lowest cost electricity source in history. Emerging applications – such as Agri-PV and floating solar – and hybrid solutions combining wind and energy storage are opening further opportunities to advance socio-economic development objectives while progressing electrification targets. Significant market potential and interest in the commercial, industrial and mining sectors can leverage private sector investment to grow installed generation capacity and support the power system.

With this perspective in mind, solar is confirmed as a critical part of a diversified energy future for the African continent. Exploiting this resource for the benefit for the many underserved areas and people of the continent is within easy reach provided a suitable context and conducive environment can be created. The findings of this investigation and the recommendations included here clearly point to the required interventions being achievable.

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