Introducing Auction-Based Procurement and Battery Energy Storage Systems to Kenya’s Electricity Sector

In 2021, a Presidential Taskforce on the Review of Power Purchase Agreements (henceforth PPA Taskforce) was created to assess Kenya’s current power procurement process in a bid to reduce end-user electricity tariffs by 30%. The findings and recommendations of the Taskforce ushered in a period of change for the country’s power sector. Of the Taskforce’s many recommendations, the ones which stood out the most were related to power purchase agreements - both existing and under discussion. In order to adhere to the new procurement guidelines recommended by the PPA Taskforce and reduce tariffs, most PPAs under discussion were cancelled, and existing PPAs became the subject of renegotiations, which are in many cases still ongoing.

The need for PPA renegotiation was made evident by the disparity between the percentage of power supplied to KPLC by independent power producers (IPPs) and the proportion of KPLC purchase costs which went to these producers. While IPPs supplied 25% of KPLC’s power they accounted for 47% of KPLC’s power purchase costs. In comparison, the costs of power supplied by KenGen amounted to only 48% of total costs, despite representing 72% of KPLC’s power supply (PPA Taskforce, 2021). The premiums on IPP power supply are the result of directly negotiated PPAs under a Feed-in-Tariff system with a Take-or-Pay approach, Consequently, the PPA Taskforce recommended adopting a Pay-when-Taken approach for new PPAs, and transitioning to auction-based procurement.
As variable renewable energy deployment and electrification increases so too does the complexity of grid management. In particular, balancing the non-programmable nature of wind and solar generation with current and future grid capacity is fundamental in limiting the occurrence of blackouts and brownouts, which have been affecting businesses and residences significantly. Battery Energy Storage Systems (BESS) offer a solution, through energy and capacity services, ancillary services, and investment deferral, to help integrate greater amounts of renewable energy, manage the grid effectively, while simultaneously creating economic opportunities.

The benefits of auction procurement and of BESS are widely acknowledged. The former creates competition; competition leads to lower prices, technological innovation, greater transparency, and attracts investment. The latter is a useful instrument for increasing generation capacity and grid reliability. The question, therefore, is not so much whether Kenya should adopt an auction system or introduce BESS but rather how best to do so.

1 Renewable Energy Auction Procurement Programmes

Brief introduction

1.1 Renewable Energy Independent Power Producer Procurement Programme - South Africa

The Renewable Energy Independent Power Producer Procurement Programme (REIPPPP) is South Africa’s flagship tender program for renewable energy capacity. The origin of the program dates back to the early 2010s when, after a brief attempt at introducing a renewable energy feed-in-tariff (REFIT), the South African government launched a competitive bidding process for renewable energy. The aim of the REIPPPP tender program was the same as the REFIT - attracting private investments into large-scale renewable energy plants in the country.

As of April 2022, 6323 MW of large-scale renewable capacity has been contracted from 92 IPPs across four main bid windows and an additional technology-specific window for concentrated solar power (DMRE, 2022). Preferred bidders for an additional 2583 MW capacity have been announced for Bid Window 5, and Bid Window 6 has opened to procure another 2600 MW. A separate technology neutral tender, the Risk Mitigation IPP Procurement Program, was issued in 2021 and 11 projects were selected including gas plants, RES, and RES + BESS technologies.
Seven categories of technology have been admitted to the tender programme: wind, photovoltaic, concentrated solar, small hydro, landfill gas, biomass, and biogas. For each technology, a different capacity cap, as well as a price cap have been set. Tenders for each technology are held simultaneously, with the possibility to make an offer for multiple projects and different technologies, with minimum capacity for each project set at 1MW.

Selected bidders are offered a standard 20-year power purchase agreement (PPA) denominated in South African rand. The PPA designates Eskom as the single off-taker, and is complemented by an implementation agreement between the generator and the Department of Energy as a form of sovereign guarantee in case of Eskom’s default. All the contracts awarded through the REIPPPP are non-negotiable, thus limiting flexibility.

Bids are evaluated through a two-step process. First, bidders must demonstrate that they meet predefined economic, legal, financial, technical, environmental and socio-economic criteria, and post a bond or guarantee of $12,500 per MW of nameplate capacity. In the second step, bidders are evaluated based on their bid price and contribution to socioeconomic development with a 70-30 weighting.

1.2 Scaling Solar

The IFC’s Scaling Solar initiative aims to deliver competitively priced solar energy from private IPPs in a period of as little as two years from project launch (IFC, n. d.). The program connects several World Bank Group services into a single engagement to support the selection of the correct size and location for solar PV power plants, as well as offering competitive financing, delivering
competitive bidding and ensuring certain and rapid financial close to increase competition and reduce transaction costs (Kruger et al., 2019). Certainty is achieved by having balanced and bankable documents that are proposed on a non-negotiable basis with a pre-approved financing to the tender that is available to all bidders.

Three countries stand out for their use of the Scaling Solar instrument: Zambia, Senegal, and Ethiopia, with varying degrees of success. A brief overview of each country offers important insights into the drivers of the success or failure of such an auction programme.

**Zambia**

In October 2015, the Industrial Development Corporation of Zambia (IDC) - in close cooperation with IFC - launched a tender for two 50 MW solar PV projects under the auspices of the Scaling Solar programme. 11 bidders pre-qualified successfully, of which 2 were then selected offering the lowest non-indexed prices in sub-Saharan Africa at the time with $0.06015/kWh and $0.0784/kWh. Following the success of this tender, a second one was attempted in 2017. A second round of permits were signed with the IDC to provide up to 500 MW of generating capacity in multiple rounds of auctions. 12 bidders pre-qualified for the round in May 2017. However, the financial instability of the off-taker ZESCO led to the cancellation of these projects.

**Senegal**

In February 2016, IFC signed an agreement with the country’s Electricity Regulatory Commission (CRSE) for a target capacity of 200 MW. CRSE launched the program with a tender for 60 MW of capacity from two solar plants, awarding them to the same bidders for €0.038/kWh and €0.0398/kWh. This was another breakthrough for the program, as the winning bids offered prices about 60% lower than previous solar contracts negotiated in Senegal, providing one of the cheapest sources of electricity in sub-Saharan Africa at the time (IFC, 2018).

**Ethiopia**

Ethiopia’s engagement with Scaling Solar began in 2016 and was designed to consist of two phases, an initial round tendering two 125 MW projects (250 MW total), and a second round for an additional 750 MW (IFC, n. d.). After some delay, a request for proposals for the first two projects was issued in 2019 to the 12 prequalified bidders. However, a day before the awarding, the National Bank of Ethiopia refused to guarantee the convertibility of the birr, causing IFC to withdraw its financial support. As a result, four out of five bidders were disqualified, with the two projects ultimately going to the single remaining bidder. As a result of the controversy, the second round of Scaling Solar in Ethiopia was never initiated.

1.3 Analysis
Both Scaling Solar and the REIPPPP can be viewed as initiatives successful in increasing RE generation capacity whilst decreasing price and attracting private investments. Although the approach is different - the former using a standardised approach, with important backing to roll-out small-scale solar PV plants in countries with a difficult investment climate and the latter a national program to procure renewable energy in line with decarbonization targets - the fundamentals of each country's national plans, investment climate, and the auction programme have been the root of success or failure of the program.

National Energy Plans

The lack of a comprehensive, dynamic, long-term, and rational plan that provides clear capacity addition milestones and targets greatly limits predictability and certainty for investors and other stakeholders. This undermines a country's ambition to diversify its energy mix and increase generation capacity on a least-cost basis.

South Africa's Integrated Resource Plan (IRP) 2019 details planned capacity additions per energy source per year up until 2030. These additions are in line with wider decarbonization targets and the country's wider energy transition goals. Although procurement has not always been smooth sailing, with delays to bid windows, grid capacity constraints and others, the certainty provided by a long-running program which offers certainty of a subsequent round has maintained investor interest in the REIPPPP. Conversely, Ethiopian targets have been frequently adjusted and there has been little communication between the government and other stakeholders affected by these decisions (Hebert, 2019), which created confusion and generated a lack of interest in the first scaling solar round even before the IFC was forced to pull out due to convertibility issues.

At present, Kenya has no clear strategy for renewable energy procurement. Kenya Vision 2030 sets a wider target of 100% RES in the energy mix by 2030 and for 100% electrification within the same timeframe. To create and maintain investor interest in a procurement program, a similar approach to the South African IRP should be taken. Year-on-year capacity procurement targets divided by technology, including procurement of BESS.

Investment Climate

The causes of the failure of the scaling solar programme in Ethiopia and for a second round in Zambia can be distilled into the inability to create an attractive investment climate. Diametrically, South Africa, which has a long-running tender programme with low political risk, extensive experience with IPPs and PPAs, and local financial intermediaries, and Senegal which has enjoyed stable macroeconomic conditions which allowed the strong support of multiple DFIs, have reaped the benefits of an auction programme.
As a form of private sector involvement, countries must ensure that there is a regulatory and political environment which enables private investments. A recent RES4Africa report which assessed the risks to renewable energy investments in six sub-Saharan countries (including Kenya) identified some of the key risks faced by investors in renewable energy. Indeed, in Ethiopia, capital transfer and convertibility, political risk, and inflation and currency risk were viewed as the highest barriers to investment (RES4Africa, 2021). Kenya resulted as one of the more attractive environments for investment due to its massive RES potential, economic and political stability, and the long experience with private sector participation in the electricity sector.

Land rights and the transparency of market mechanisms were the two areas which more than 50% of respondents rated as a high or very high risk. The adoption of a auction-based procurement programme was highlighted as the best manner to reduce the latter risk, whilst adopting the scaling solar approach of a greater number of smaller plants may help in reducing the land rights issues which in the past have caused delays and disruptions to larger plants.

**Auction Structure**

According to IRENA (2015), there are 4 key elements to consider in the auction structure:

1. The auction demand will greatly depend on the intended use of the procured capacity. For the development of a specific type of technology, it is natural that a technology-specific auction is used, as in the case of scaling solar. If the goal is to minimise costs and add generation capacity, a technology-neutral auction creates greater competition, as with the REIPPPP. Furthermore, if the auction’s purpose is to meet urgent capacity demands, as occurred in 2021 with South Africa’s Risk Mitigation IPPP Program (RMIPPPP), a standalone auction will suffice whereas a recurrent auctioning program is fundamental for the creation of investor interest.
2. Qualification requirements set the characteristics which a bidder must have to be pre-qualified. Reducing the entry barriers increases competition but at the risk of sacrificing the quality of proposals. Requirements can include the track record and experience of bidding parties, technological requirements, operational requirements, project size or location, or local content requirements. The South African REIPPPP places greater emphasis on bidders with the lowest price - 70% of the decisional weight - with socio-economic requirements, most notably local content.

3. The winning bidder may be selected either through lowest-price criteria or through a price ceiling. Both can be combined with aforementioned non-monetary criteria although this tends to increase the final price. Lowest-price criteria is adopted for the vast majority of auctions.

4. Seller's liabilities refer to the manner in which risk is allocated between parties. Finding the right balance of risk between developers and off-takers can be difficult. Overloading risk on to the developers may improve the quality of bidders, but may limit participation and result in a price increase. With many utilities in Africa in a financially precarious situation, allocating risk to the off-taker could be particularly damaging and lead to underbidding. Scaling solar aims to circumvent these issues by having the backing of the IFC’s financing, a World Bank guarantee or even a Multilateral Investment Guarantee Agency (MIGA) political risk insurance.

Following President Kenyatta’s recent announcements, it is clear that the primary objective for the possible adoption of an auction-based procurement system is to reduce end-user tariffs. Based on these four categories of auction design, a rough outline of an ideal auction system to achieve this goal can be made. Given the wider aim of 100% RES in the electricity mix by 2030 auctions should be focused on renewable energy technologies. However, as Kenya has a large geothermal resource which, in a neutral auction with wind and solar, would lose out given the higher capital costs, separate technology-specific auctions should be adopted for this source of power. Similarly, to promote the early adoption of BESS in Kenya, storage-specific auctions could be adopted, with RES + BESS auctions used once the market has matured.

Following a lowest-priced approach is most suited given the goal of a 30% decrease in end-user tariff, although it should not be the sole determinant. The success of the country’s transition towards renewables will hinge upon the creation of a local secondary and tertiary workforce and introducing socio-economic conditions to project proposals can act as a catalyst for this. Priority must be placed on reaching financial close and the likelihood of this increases when stringent rules are enforced on the developer to reduce the overall risk. However, risk must be allocated in a transparent, clear, and quantifiable manner to facilitate the procurement process.
Battery Energy Storage Systems (BESS) are crucial for an effective and efficient energy transition. In creating the opportunity to stock and deliver electricity when needed, BESS provides solutions to the intermittency of electricity flows which accompanies the widespread penetration of renewables. Furthermore, BESS offers increased flexibility and capacity to grid networks unable to handle the growing demand for electricity driven by economic and demographic growth and the expected increasing share of renewable generators in the energy mix.

The prominence of BESS in electricity networks worldwide has been steadily increasing in the past decade, due to their versatile uses, ranging from ancillary services (e.g. frequency control) to peaking capacity, as well as decreasing costs. Whether as standalone installations, coupled with RES plants, or as behind-the-metre applications, BESS can be exploited in all segments of the electricity value chain from generation through to final consumption.

The 2019 Least Cost Power Development Plan 2021-2030 (LCPDP) outlines a “Reference Generation Expansion Plan Capacity and Forecast Demand” which foresees 250 MW of BESS capacity up to 2030 to support the development of renewable energy sources. However, regulation necessary for this growth is lacking. Kenya has published updated transmission grid codes and distribution codes in 2020 and 2021, respectively, but these do not make specific reference to the role of BESS.

2.1 BESS Uses

In any given market, BESS can provide different types of services which vary depending on the market design and specific needs of the electricity sector in which they develop:

- **Energy and capacity services.** This can include:
  - arbitrage and smoothing RES generation via wholesale market trading, i.e. purchasing and BESS charging when RE supply is high and prices are low, and selling and discharging at peak demand times when prices are high, typically in wholesale markets to cash in on price volatility.
  - capacity provision, i.e. providing energy capacity to meet peak demand, reduce price spikes associated with ramping shortfall, and maintain reliability of the system

- **Provision of ancillary services.** These are necessary for the balanced and stable operations of a transmission or distribution system and are typically procured by transmission system operators (TSOs). They can be clustered into two main categories:
  - Frequency ancillary services, including frequency containment reserve, which are very fast-response services used to balance momentary unpredictable variations between electricity demand and supply; frequency restoration reserve, used to
respond to short-term changes in demand and generation provided by automatic generation control (up to 5 minutes, also called secondary reserves) or manually by generating units at the regional level (5 to 15 minutes, also called tertiary reserves) to restore primary frequency capacity; replacement reserve, used to restore the required level of reserves to be prepared for a system imbalance.

- Non-frequency ancillary services, including voltage control, related to the injection of reactive power to maintain system voltage within a prescribed range; and black-start, referring to the service of getting the system back online in case of a large-scale shutdown.

- **Grid investment deferral.** This is where BESS is used as a transmission asset to defer grid reinforcements investments. BESS can be deployed at different points in the distribution and transmission network, avoiding transmission constraints and congestion costs.

### 2.2 BESS integration

An upcoming RES4Africa study in which a regulatory assessment of BESS is carried out identifies three markets to be used as global benchmarks for decision makers in those sectors yet to integrate a widespread use of BESS. An overview of the rationale behind BESS integration is shown below:

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<th>Main drivers of BESS deployment</th>
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The LCPDP 2021-2030 makes clear the intention to introduce BESS for all three of the use cases identified in section 2.1. To reach the 250 MW of BESS capacity by 2026 hypothesised in the LCPDP, IPPs must be incentivised to develop and operate storage installations. In the 3 benchmark countries for BESS deployment identified in the forthcoming RES4Africa study, various approaches were taken to this end. For capacity and energy services, California state law requires generators to install batteries in their systems. The UK and Chile, on the other hand, provide implicit incentives for RES + BESS bids in technology-neutral auctions such as the possibility for arbitrage and trading of energy on a wholesale market. In all three cases, there is some form of ancillary services market which creates a further revenue stream for IPPs with storage applications, financially incentivising storage applications and simultaneously creating competition which allows for a reduction of ancillary service costs.

In order to incentivise the development of BESS capacity in Kenya, as foreseen by the LCPDP, the services these systems can provide must be adequately regulated and remunerated. Although Kenya’s Transmission Grid Code makes reference to ancillary service agreements between the TSO and generation licensees, the country’s regulatory framework does not explicitly make reference to the use of storage systems for either ancillary services or other applications. As such, there is also no standard publicly available remuneration scheme for any of the three battery use cases detailed in section 2.1. Analysis by RES4Africa (forthcoming) shows that BESS remuneration models can differ vastly depending on the use case and the country. A common remuneration structure sees BESS receive a fixed (€/ MW) long-term payment thus reducing investment risk and stimulating bankability in combination with a variable (€ /MWh) payment to create a more attractive economic case. The economic case for BESS was also found attractive with only the variable component (without long-term certainty) but only in cases where the variable component is highly lucrative, typically in the ancillary services market. Investment deferral offers a different approach to remunerating BESS, based on regulated asset returns and without any exposure to market pricing mechanisms.

The ability to stack different revenue streams can further incentivise BESS deployment. For example, an IPP providing capacity services through BESS can technically supplement revenues through energy arbitrage, transmission congestion relief and ancillary services, depending on which of these streams is more economically attractive in any given moment through the pertinent
market. The UK provides an interesting example as BESS capacity contracted in the capacity market can also participate in the ancillary services market, thus allowing it to maximise the value of their assets.

Kenya currently lacks the wholesale and ancillary services markets which have contributed to the success of BESS deployment elsewhere and have allowed for revenue stacking. Until these markets are established and become functional, the procurement of BESS capacity in Kenya will remain limited to bilateral negotiations and auctions. Of the two, the latter represents the more transparent and competitive option, beneficial for both governments and bidders.

2.3 BESS auctions

BESS procurement is well suited to an auction programme for three main reasons. The first is that a more attractive auction is created as IPPs are able to sell electricity even in periods of low production. Secondly, the possibility of continuous supply allows the procuring entity to adopt more stringent technical and operational requirements (active hours of production, production thresholds etc), improving the overall quality of projects and electricity supply. Lastly, BESS technologies are still highly priced and including them in technology neutral auctions or holding auctions of RES + BESS projects stimulates competition and can accelerate the price drop of BESS as well as the final overall price.

Of the three benchmark markets, the UK and Chile adopt an auction process for the procurement of BESS for energy and capacity services. Chile adopts an auction based on hourly or quarterly time blocks whereas the UK uses auctions to procure capacity either for the year ahead or for deployment in four years’ time. Both schemes adopt technology neutral auctions with implicit incentives for bidders to present combined RES + BESS or BESS bids. With the possible adoption of an auction programme in Kenya, RES procurement moving forward should make space for the procurement of battery storage for the benefits it brings to supply and grid management. To promote BESS and RES + BESS bids up to 2030 and beyond, there is a need for a comprehensive storage regulatory framework, which effectively incentivises and adequately remunerates storage applications.