Learning Brief

February 2022

Increasing the cost effectiveness of distributed energy projects through aggregated procurement mechanisms

Insights from Odyssey Energy Solution's pilot in Nigeria

Contents

Executive Summary

Distributed renewable energy (DRE) solutions have strong potential to contribute to advancing access to reliable electricity in Sub-Saharan Africa. Aggregated procurement presents enormous opportunity to facilitate access to this technology by improving supply chains within the sector and increasing cost-effectiveness for distributed energy projects.

Odyssey Energy Solutions, an investment and asset management platform focused on the DRE sector, in partnership with Shell Foundation and The Rockefeller Foundation, developed a pilot program to test the hypothesis that aggregated procurement mechanisms for mini-grid developers could reduce system component costs and lead times in Nigeria. The pilot specifically targeted procurement for mini-grid healthcare electrification projects, given the urgency to deploy low-cost, high-performing systems to increase health facility electrification in response to the COVID-19 pandemic. Odyssey focused on procurement of two key components of distributed solar systems: photovoltaic panels and integrated storage solutions. The pilot included eight mini-grid developers procuring roughly $1.8M of solar equipment for community mini-grid and health electrification projects.

The pilot enabled Odyssey to confirm that aggregated procurement could lead to cost-savings of up to 40% for some components, both by unlocking better prices from suppliers and reducing logistics cost. The pilot also demonstrated the potential for aggregated procurement to facilitate faster delivery of goods. Furthermore, the pilot highlighted key lessons on good practices for rolling out aggregated procurement mechanisms for distributed energy solutions. Developing the right type of payments mechanism was identified as a critical aspect of facility design as well as building workflow management tools to expedite the aggregated process. Finally, the set-up of a legal framework with the supplier was also key to streamlining the procurement process.

To drive fundamental impact in the distributed renewable energy sector, the aggregated procurement mechanisms proven out in the pilot should thus be expanded geographically and across a wider variety of equipment, including meters and other types of battery technologies. Further research is needed to understand how aggregated procurement impacts different categories of developers (e.g. commercial and industrial developers), and how the cost-savings generated benefit end beneficiaries of distributed energy projects.

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1 Introduction

1.1 Context

Distributed renewable energy solutions have strong potential to contribute to the sustainable development of Sub-Saharan Africa, which, with 13 countries having less than 25% access to energy, are considered the lowest rate of energy access.[1] The technology has been recognized as part of the solution to achieve the UN's Sustainable Development Goal 7, to "ensure access to affordable, reliable, sustainable and modern energy for all." The need to eradicate energy poverty and increase access to clean energy across the continent is also a key target for the Paris Agreement and the 2030 Agenda for Sustainable Development. Indeed, it is also linked to other positive development goals such as poverty reduction, climate action, as well as access to education and healthcare.[2] For instance, it is estimated that distributed renewable energy projects could improve clean energy access for the nearly 60% of health facilities in sub-Saharan Africa that lack reliable electricity.[3]

However, scaling access to distributed energy systems has historically been difficult in part because project developers in Africa are often paying 30-50% more for solar equipment than utility-scale developers, in part due to smaller order sizes.[4] Aggregated procurement -- or the practice to bundle equipment orders across many projects and multiple developers -- presents enormous opportunity to improve supply chains within the sector and increase cost effectiveness for distributed energy projects. Aggregated ordering of system components can drive down the cost of goods and reduce supply chain inefficiencies by centralizing these functions and leveraging economies of scale. The

[1] Jan Corfee-Morlot *et.al*, (2019), 'Achieving clean energy access in Sub-Saharan Africa', *Financing climate futures: Rethinking infrastructure*, Available at https://www.oecd.org/environment/cc/climate-futures/case-study-achieving-clean-energy-access-in-sub-saharan-africa.pdf

[2] ibid

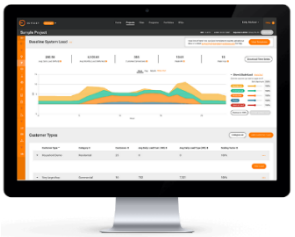
[3] Cronk, Ryan, and Jamie Bartram. "Environmental Conditions in Health Care Facilities in Low- and Middle-Income Countries: Coverage and Inequalities." International Journal of Hygiene and Environmental Health, vol. 221, no. 3, Apr. 2018

[4] Internal analysis conducted by The Rockefeller Foundation

ability to drive down supply cost for investors has a high potential of increasing clean energy access for businesses, hard-to-reach communities, and citizens across Sub-Saharan Africa.

In 2020, COVID-19 added a new level of urgency to the electrification needs of health care facilities in sub-Saharan Africa. In the wake of the pandemic, health facilities have been required to extend their hours of operation, increase their use of refrigeration for vaccines and testing kits, and provide electricity-powered ventilators in the most critical cases. At the same time, the scale of the pandemic has disrupted supply chains across the world and increased lead times and costs of mini-grid components, making it even more critical to find an alternative for more efficient, cost-effective sourcing.

In partnership with The Rockefeller Foundation and the Shell Foundation (UK Registered Charity), Odyssey Energy Solutions, an end-to-end investment and asset management platform for distributed infrastructure, launched a pilot to test the hypothesis that demand aggregation can improve costs and efficiencies for project developers, with a focus on serving healthcare facilities. The main objective of the pilot was to test the mechanics of two logistics models and to identify how software could support and scale ordering processes. This learning brief summarizes the key lessons learned from this pilot.



1.2 Odyssey's aggregated procurement pilot

Odyssey is an end-to-end asset management and analytics platform, with a specific focus on managing all phases of distributed energy project development. The Odyssey platform is facilitating nearly $1 Billion of financing for the DRE sector, including a significant amount supporting health facility electrification.

With this in mind, Odyssey is also well positioned to support the ongoing monitoring, data analytics, and workflow management aggregated procurement requires.

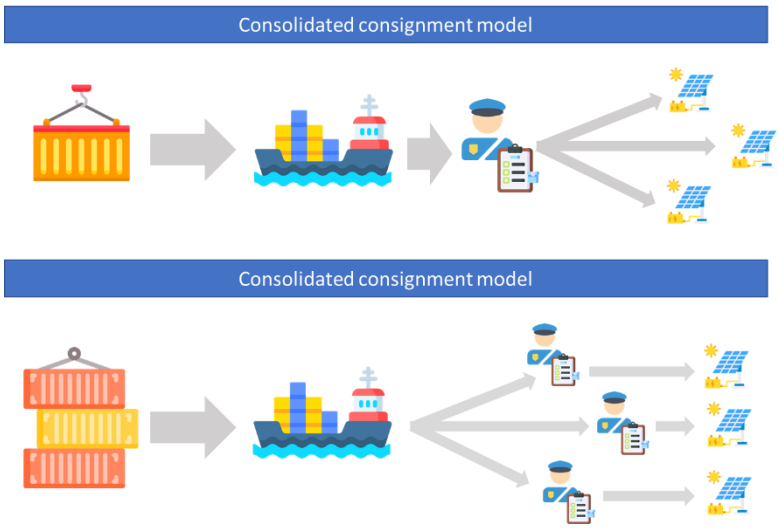
Starting in April 2021, Odyssey ran a programme in Nigeria to pilot an approach to aggregating procurement services aimed at driving down cost, reducing delivery inefficiencies for project developers and enhancing access to clean energy for health care facilities and communities in the country. The pilot built on CrossBoundary's Innovation Lab initial testing of the bulk procurement mechanism. Results from the Lab's initial pilot showed that bulk procurement could deliver cost savings: two OEMs offered lead acid batteries at prices 35% cheaper than the best price paid by developers today. The pilot included three phases:

1 **Needs assessment:** The pilot began with intensive needs assessment activities with suppliers and mini-grid developers in the country. Odyssey conducted a series of surveys and workshops to understand developers' perspectives on preferred product suppliers and specifications, pricing, projected volumes, and challenges experienced in the procurement process. Suppliers of photovoltaic (PV) modules and lithium-ion batteries were also interviewed. Odyssey sought to understand the current state of price volatility, impact of purchasing volumes on pricing, lead times for battery systems versus PV, and common manufacturing and performance warranties.

2 **Design:** Following these intensive interviews, the Odyssey team, in collaboration with The Rockefeller Foundation, completed the initial aggregated procurement mechanism design. This design underwent numerous iterations based on feedback from key stakeholders, including developers, suppliers, The Rockefeller Foundation's finance team, and other sector stakeholders. The mechanism design was oriented around addressing the most salient procurement-related issues identified by the market as barriers to rapid project development. After completing the initial facility design, Odyssey finalized the technical specifications of the standardized solar components that would initially be procured, including solar PV modules and energy storage systems. As illustrated in Figure 1, Odyssey also identified two feasible logistics models that could accommodate single or multiple consignee shipments:

- **Free Trade Zone model** - Within this model, a full container is shipped as one consignment and consigned to the Free Trade Zone (FTZ) operator. Upon arrival at the destination, the FTZ operator takes the container to the FTZ and begins the clearance process. The container can be unpacked directly and upon payment of both duties and taxes, the goods can be sent for delivery. The FTZ operator can also handle delivery of the goods to the final destination at the developer's site.
- **Consolidated shipment model** - At origin, the supplier prepares a set of consignments as per the orders provided. At destination, each consignment is cleared separately. Duties and taxes are paid separately for each shipment. From there, developers can pick up their shipments. Adopting a strategy where developers took responsibility for clearing their orders was used to strengthen ownership and participation in the procurement system.

Figure 1. Logistics models for aggregated procurement



In parallel, a comprehensive request for quotation (RFQ) was carried out in order to test the hypothesis that if buyers can aggregate their demand for mini-grid components they will collectively be able to secure lower purchase prices for those components than they would be able to on their own. Odyssey reached out to five shortlisted solar panel manufacturers in China, Dubai, and Hong Kong to identify the most economically viable bids for a subsequent framework agreement, and three suppliers were selected. From here, Odyssey, with the support of local Nigerian and US-based law firms, created legal contracts to be leveraged during the procurement process.

3 **Pilot order:** In parallel to the development of an equipment financing facility, Odyssey embarked on initiating the first pilot order of the aggregated procurement mechanism in Nigeria. The Odyssey team reached out to mini-grid developers on the platform, offering them the opportunity to participate in the pilot order. In response, six developers in Nigeria placed PV and integrated battery systems orders with an initial combined order value of $1.8 million (two of the six orders were ultimately cancelled). About 40% of the initial orders in the pilot were for health electrification projects.

2 Findings

The pilot enabled Odyssey to gather insights both on aggregated procurement mechanisms' potential to increase cost-effectiveness, and on how to best implement such systems.

2.1 Evidence of impact on cost-effectiveness

The pilot demonstrated that by aggregating their orders, companies were able to unlock better price per unit from suppliers. In addition, there was anecdotal evidence that aggregated procurement can help mitigate delays in goods delivery.

2.1.1 Aggregated procurement can lead to cost savings

The pilot confirmed that aggregated procurement can unlock lower landed costs for equipment through negotiated volume-based supplier pricing and centralized logistics operations that allow for economies of scale.

Supplier Pricing: Prior to participating in the pilot, most of the project developers were not able to meet supplier minimum order quantities (MOQs) and were therefore required to pay higher unit prices. By consolidating the demand from the companies, the aggregated order enabled Odyssey to meet supplier MOQs and therefore run a competitive Request for Quotation (RFQ) process with top-tier international suppliers. Comparing the final landed price achieved through supplier negotiations with the standard price of the same equipment that was be available to developers who could not meet the international suppliers' MOQs, Odyssey was able to achieve a 24% price reduction for PV and a 40% reduction for batteries. In addition, the high-volume order attracted bids from five different suppliers, enabling Odyssey to achieve a 5% price reductions in the course of the negotiations (for both PV and storage equipment). Odyssey was also able to negotiate that prices be held constant for 8 months, while the supplier's standard agreement for developers was only two weeks.

Table 1. Cost savings on batteries and inverters as a result of the aggregated procurement system

Equipment	Order Placed	Cost savings per order to developers through pilot (%)
PV (MW)	**3.6**	**24%**
Storage (MWh)	**2.8**	**40%**

Logistics Savings: Similarly, the pilot showed that both the free trade zone and consolidated shipment models have the potential to drive down costs and decrease lead teams by creating economies of scale and centralizing operations. For example, the FTZ model demonstrated potential for the following cost and delivery benefits through economies of scale:

- Opportunity to optimize the loading of a container if a developer's order is not already a full container load, providing the developer a lower freight cost for that shipment.
- Reduction of the clearance lead time from the normal 21-28 days to 10-15 days.
- Volume-based discounts for clearing of up to $1,000 per container (~15%) for larger shipment volumes of at least five containers, as the logistics operator can spread its cost of operations across a greater number of containers.

2.1.2 Aggregated procurement can lead to faster delivery of goods

Fulfilling imports documentation requirements is a key procurement challenge faced by project developers. Since many of the distributed energy products and components are new to the Nigerian market, there can be complications at customs, especially if the materials imported are not recognised or specified in official clearing documents. Incomplete or inadequate documentation can result in significant delays in the clearing process. Individual project developers do not always have specific knowledge of these administrative processes, or dedicated supply chain personnel on staff to handle supply planning and operations. As procurement agent, Odyssey played a key role by overseeing the entire import documentation process and systemizing the process, thus ensuring the accuracy and completeness of the shipping documents and reducing the likelihood of delays. By leveraging a standard framework for the import documentation process, the two logistics models tested both demonstrated potential for more efficient delivery of goods.

2.2 Lessons on the roll-out of aggregated procurement mechanisms

2.2.1 Developing the right type of payments mechanism for the facility is a critical aspect of facility design

One of the most significant obstacles in the pilot order was payment management. For the pilot, payments were collected separately from each developer for the aggregated order. At the start of Odyssey's engagement with project developers, Odyssey initially received orders from eight distinct developers for integrated battery systems and PV but eventually procured equipment for four of these developers as half of the developers were unable to make payments at the agreed-upon deadlines. Some of the factors that led to challenges coordinating payments included:

- **Developers' lack of working capital:** Generally, this may be attributed to a number of economic challenges, including the difference in value between the Nigerian Naira (NGN) and the dollar (USD).
- **Difficulties securing foreign currency:** Current government policies mandates only a limited number of authorised lenders to sell foreign currency to end users. Several project developers reported that they were not able to access authorised lenders, and were subject to expensive exchange rates determined by money traders in the parallel market.
- **Different modes of payment by developers, such as telegraphic transfers or lines of credit**: For instance, developers had different payment timelines due to their various methods of financing their orders.

Failure to meet payment deadlines caused challenges in coordinating order placement. Odyssey was not able to follow the timeline agreed with suppliers, and the size of the orders had to be reduced after the purchase order was issued. This not only jeopardised relationships with suppliers and third party logistics providers, but also increased costs for the pilot participants since they had to bear the full cost of the container.

2.2.2 The most appropriate logistic model is contextual

By testing two different logistic models, Odyssey was able to identify the advantages and disadvantages of each, which are summed up in Table 2. The pilot did not find one model to be more efficient than the other, but showed that each one was best suited to different settings. For instance, the FTZ model has a higher potential to lead to cost-savings through economies of scale and to optimise clearance lead time, since it only requires one set of documents. However, this model requires complex contractual arrangements, which takes time to set up, and makes it difficult to

switch logistics providers in case the service or price of the chosen provider is not satisfactory. As a result, it is not well suited to smaller or medium-sized order volumes, for which the time investment and associated risk are not justified. Conversely, the consolidated shipment model requires more documents. It makes delivery more complex, and does not address port congestion challenges. But it does provide more flexibility, and is thus more appropriate when orders are small or when consignees are subject to different importation rules or benefits. These considerations should thus guide the choice of logistic model.

Table 2. Advantages and disadvantages of aggregated procurement logistic models

Model	Advantages	Disadvantages
Free Trade Zone (FTZ) model	⊕ Only one set of documents and one importer of all records ⊕ Better unit price in transport through optimized loading of a full container ⊕ Less cumbersome administrative process with the potential to Clearance Lead Time ⊕ Economies of scale to be achieved for larger volumes ⊕ Potential to develop a local stock of products, in turn reducing shipping lead times	⊖ Contractual arrangement with the FTZ operator is required ⊖ Contractual arrangements take longer to set up and are less flexible once in place ⊖ Less adapted to smaller or medium-sized order volumes ⊖ Difficult to switch logistics provider once started
Consolidated shipment model	⊕ Flexible for separating out orders and submitting orders based on demand ⊕ Opportunity to switch logistics provider if need be once started ⊕ Suitable when consignees have various importation rules or benefits (duty waivers)	⊖ More documents required ⊖ Does not alleviate port congestion challenges ⊖ Delivery can be more complicated and collection more complex to coordinate ⊖ Lack of coordination among consignees can lead to delays in clearance time

2.2.3 Building out workflow management tools within the data platform has enormous potential to expedite the aggregated procurement process

The pilot demonstrated the need for detailed workflow management to ensure smooth interactions across suppliers and developers. All participants in the procurement process need a flexible way to set up and manage workflows, since they have various needs, systems and ways of working. Participants also need to seamlessly track data, like pricing, order quantities, and timelines. Toward this end, Odyssey identified the following software features to develop in its technology platform:

- **Workflow management:** A software tool needs to securely enable a variety of actions at each stage in the process, like uploading required documents, signing attached agreements, and entering specific order details. Developers and administrators alike must also be able to see status updates and next steps at each stage and receive automated, actionable notifications when items are due.
- **Data aggregation and visualization:** Dashboards, built from metrics collected throughout the entire procurement process, can make information transparent and accessible.
- **Ongoing monitoring**: Procurement data can even be combined with data post-commissioning and presented on dashboards to help visualize site performance and to track a project's impact.

2.2.4 A contractual framework anchored around the procurement agent streamlines the process and helps to secure consensus between all parties

A key element of the pilot was the development of a contractual framework that was partially tested during implementation. This was designed to ensure that all parties understood their roles, responsibilities and rights throughout the life cycle of project implementation. Three legal contracts with harmonised contractual terms were developed between (1) Odyssey and the developer, (2) Odyssey and the supplier, and (3) Odyssey and the logistics service provider. As the procurement agent, Odyssey committed to monitor developers' orders and their payments, which gave suppliers confidence in dealing with many small developers with whom they may not have dealt before. By coordinating the procurement process, the company is also able to bring in additional developers to fill orders that are cancelled, thus managing the demand side on behalf of the suppliers. Similarly, these contractual arrangements also had advantages for developers, as Odyssey was well positioned to advocate on their behalf to make warranty claims, and holding the suppliers to their prices, payment and delivery terms in a very volatile market environment. Overall, the contractual set up enabled Odyssey to impose high ethical standards on all parties by requiring adherence to a comprehensive Code of Conduct and monitor adherence to those standards, thus increasing the confidence of all parties in the bulk procurement process.

3 Conclusion and recommendations

Odyssey's aggregated procurement pilot demonstrated how aggregating equipment purchases across companies has enormous value for the distributed renewable energy sector, including for projects focused on providing energy access to health facilities.

For developers, the pilot proved that logistics costs and lead times could be significantly reduced by developing centralized partnerships with third party logistics providers that are processing higher volumes of shipments.

Furthermore, the pilot explored the use of a centralized platform and its importance for managing competitive supply tenders, streamlining workflows, securely organizing documents, and aggregating data for ongoing monitoring and analytics. In the longer run, this will support both parties and allow aggregated procurement mechanisms to scale.

In order to drive fundamental impact in the distributed renewable energy sector, the aggregated procurement mechanisms proven out in the pilot will need to expand geographically and across a wider variety of equipment. Scaling will require:

- **Designing a payment mechanism that appropriately aligns with the financing facility**: For example, project developers could apply for a credit facility that pays for the equipment on behalf of the developer. Alternatively, a payments aggregator, such as a commercial bank, could accept deposits from multiple cash developers and make consolidated payments to suppliers on their behalf. Ability to make timely payments should be set as a selection criteria to include developers in the aggregated order, and the procurement agent should ensure financial due diligence to ensure that they do have projects in pipeline. A penalty clause should be included in the contractual agreement between the procurement agent and the developer, placing an obligation on the later in case of cancellation.

- **Streamlining third-party logistics:** Logistics models should be decided upon depending on the specific context, as there are advantages and disadvantages of each. The FTZ logistics model can lead to more efficient procurement through work with a single operator and allows for better control and monitoring of the clearing agent. Nevertheless, the FTZ model may be too specialized for some developers, too expensive, or infeasible for developers that require individual consignments. The consolidated shipping model can be more flexible, especially in situations when consignees have varying importation rules or benefits. Regardless of the logistics model, the third-party logistics provider should have high financial and operational capacity.

- Adapting workflow management tools: Odyssey's software features that facilitated various aspects of the pilot order will also need to accommodate higher order volumes and more diverse geographies and equipment types.

In addition, further research is needed to understand how the impact of aggregated procurement differs across markets and categories of project developers. This includes assessing if and how different categories of project developers benefit more than others, and identify barriers faced by project developers in accessing aggregated procurement in different geographies. Furthermore, given the recent volatility of equipment pricing in the market, further research is required to fully understand how aggregated procurement can influence pricing and reduce shipping and other logistics costs. The ultimate goal of aggregated procurement is to accelerate project development and hasten access to electricity through DRE; continued measurement of progress toward this goal will be essential.

Finally, to truly understand the impact of aggregated procurement of distributed energy solutions on SDGs, additional studies should also focus assessing how the benefit generated is passed on to end beneficiaries. For instance, it would be crucial to understand who the users of the distributed energy systems are, whether the cost-savings allow for energy projects that would otherwise not have been financially sustainable, and to what extent they translate in lower energy costs for end customers. This would enable procurement agents to gain useful insights on how to design and scale inclusive aggregated procurement mechanisms, and donors to identify ways to support both procurement agents and project developers to develop and use aggregate procurement mechanisms.