United Nations Development Programme

Financial Aggregation for Distributed Renewable Energy in Uganda

Market Assessment and Action Plan

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Financial Aggregation for Distributed Renewable Energy in Uganda

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The CAP seeks to advance and raise awareness for innovative solutions to market barriers for financial aggregation in the small-scale, low-carbon energy sector – with the goal to increase access to low-cost financing for clean energy in emerging markets.
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Foreword

It is with great pleasure that we present this report on Financial Aggregation for Distributed Renewable Energy (DRE) in Uganda, part of a report series on Financial Aggregation for DRE developed by UNDP's Climate Aggregation Platform.

In recent years, Uganda's DRE sector has made significant strides. Commercial solar projects have seen a twelvefold increase in capacity*, †, while off-grid solar sales are slowly getting back to their pre-COVID levels‡ and the more nascent mini-grid market has shown promising potential. Yet, the DRE sector which is poised to play a key role in electrifying the 25 million Ugandans without access to electricity§, still remains underfunded.

Financial aggregation could help unlock new sources of capital to bridge this financing gap by reducing the mismatch between DRE funding needs and investor requirements, but the road is not without obstacles – While innovative financial structures involving some form of aggregation have emerged in Uganda, several market barriers are yet to be addressed if these are to be widely employed and scaled up.

This report identifies the off-grid solar sector as the most mature and promising when it comes to aggregation, while captive power, mini-grids and e-mobility remain nascent. Understanding each sector's unique dynamics is indispensable for tailored interventions.

The report also suggests that multi-jurisdictional financial aggregation (aggregating assets across borders) could be necessary to achieve the scale needed to justify the high costs associated with such complex financial transactions. This pooling of assets calls for cross-border collaboration, dovetailing with regional integration endeavors.

While the report highlights the complexity of financial aggregation instruments and the relative nascency of the market, it presents a possible pathway to unlock its full potential, with insights and advice for policymakers, development practitioners, the energy sector, investors, etc.

This work is the culmination of two years of collaboration and engagements between UNDP and a multitude of stakeholders in Uganda, most notably the Ministry of Energy and Mineral Development. The National Renewable Energy Platform (NREP) provided a launchpad for the Climate Aggregation Platform's work in Uganda, enabling several events and workshops in the country.

We would like to express our sincere appreciation to the authors, researchers, and contributors who have dedicated their expertise and time to produce this report. We also extend our gratitude to the governments, institutions, and individuals who have supported the CAP and other UNDP initiatives in the clean energy, climate and sustainable finance sectors. Your partnership and collaboration are essential as we collectively strive to accelerate a just energy transition and build a resilient, low-emissions future.

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** Africa Solar Industry Association, Annual Solar Outlook, 2023 (link)*
† Magala, J., Essien, J., Sembatya, E., Bhamidipati, P.L. & Pedersen, M.B., Captive solar pv market – Insights from Uganda, 2022 (link)
‡ GOGLA, Global Off-Grid Solar Market Report Semi-Annual Sales and Impact Data, July - December 2022, Public Report, 2023 (link)
§ ESMAP, Tracking SDG7 website, Uganda Country Report, accessed 2023, (link)

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Abbreviations

API	application programming interface
BoU	Bank of Uganda
C&I	commercial and industrial
CAGR	compound annual growth rate
CAP	Climate Aggregation Platform
CMA	Capital Markets Authority
CPIA	Country Policy and Institutional Assessment
DFI	development finance institution
DRC	Democratic Republic of the Congo
DRE	distributed renewable energy
DTA	double tax agreement
EAC	East African Community
ECP	Electricity Connections Policy
EIA	environmental impact assessment
ERA	Electricity Regulatory Authority
EV	electric vehicle
FDI	foreign direct investment
GDP	gross domestic product
GEF	Global Environment Fund
GET FiT	Global Energy Transfer Feed-in Tariff
GOGLA	Global Off-grid Lighting Association
IPP	independent power producer
ktoe	kilotonne of oil equivalent
kWh	kilowatt hour
LCOE	levelized cost of energy
LPG	liquid petroleum gas
LV	low voltage
MEMD	Ministry of Energy and Mineral Development
MFI	microfinance institution
MtCO2e	metric tons of carbon dioxide equivalent
MV	medium voltage
MW	megawatt
NDC	nationally determined contribution
NEMA	National Environment Management Authority
ODA	official development assistance
OGS	off-grid solar
PAYGO	pay-as-you-go
PPA	power purchase agreement
REA	Rural Electrification Agency
SDG(s)	Sustainable Development Goal(s)
SPV	special purpose vehicle
UBOS	Uganda Bureau of Statistics
UECCC	Uganda Energy Credit Capitalization Company
UEGL	Uganda Electricity Generation Company
UEDCL	Uganda Electricity Distribution Company
UETCL	Uganda Electricity Transmission Company
UGX	Ugandan shilling
UIA	Uganda Investment Authority
UK	United Kingdom
UNBS	Uganda National Bureau of Standards
UNCDF	United Nations Capital Development Fund
UNDP	United Nations Development Programme
UNREEA	Uganda National Renewable Energy and Energy Efficiency Alliance
UOMA	Uganda Off-grid Energy Market Accelerator
USEA	Uganda Solar Energy Association
URA	Uganda Revenue Authority
US	United States
VAT	value added tax

Glossary

Application programming interface (API)	A software intermediary comprised of a set of rules that allows two applications to communicate with each other.
Asset-backed securitization (ABS)	Asset-backed securities are securities that derive their value from a pool of underlying assets, such as receivables.
Bridge loan	A short-term, stop-gap loan used to bridge a funding shortfall until long-term financing is obtained.
Collateral	An asset pledged as a security for a loan, for example, land and buildings, stock or accounts receivables.
Distributed renewable energy (DRE)	Small-scale renewable energy usually smaller than 10 MW. Examples include off-grid solar, mini-grids and captive power.
Double tax agreement	An agreement signed between the governments of two countries to avoid the payment of income tax paid in both countries on a single income source.
Due diligence	A process of collecting and analysing information about a prospective investment before the investment is made to limit downside risk.
Financial aggregation	Securitization of DRE assets and the pooling of these into an on-balance sheet or off-balance sheet structure. This report only focuses on the pooling of accounts receivable (or receivables for short).
Fiscal deficit	When the total expenditures incurred by a government exceed the total revenue earned.
Gross domestic product (GDP)	The total value of goods and services produced by a country within a specified time period, typically a year.
Junior debt	Also known as subordinate debt, junior debt is positioned below senior debt on the debt hierarchy. Repayment of junior debt is deprioritized below senior debt.
Levelized cost of energy (LCOE)	The cost of generating energy, calculated by dividing capital expenditure and discounted annual expenses by discounted energy generation. Expenses and generation are discounted using a discount rate.
Limited recourse loan	A form of debt where a lender's claims are limited to the assets to which the debt pertains. In the case of default, the lender does not have recourse over other assets belonging to the borrower. A key example is project finance, where the lender only has recourse over the assets of the project, and not the assets of the company behind the project.
Minimum ticket size	The minimum deal size that an investor is willing to fund.
Multi-jurisdictional aggregation	Aggregation of receivables from assets domiciled across multiple countries.
Official development assistance	Government aid disbursed to developing countries for the purpose of economic development.
Off-balance sheet	Assets or liabilities not included in a company's balance sheet, but instead housed in an off-balance sheet structure, typically a special purpose vehicle. The company might or might not have an ownership stake in the special purpose vehicle.
On-balance sheet	Assets or liabilities included in the company's balance sheet, thus affecting the financial position of the company.
Open source	Typically used in software, open source refers to freely available source code which can be used, modified and distributed by any user. More generally the term is used to denote the public availing of all elements of a design, such as a term sheet or deal structure in the case of finance.
Pay-as-you-go (PAYGO)	Any arrangement between a seller and buyer that involves ongoing payments for the use of an asset. These can be based on a rent-to-own model (see below), or pay-per-use arrangements, where the asset remains under ownership by the seller. In this case, the customer only pays for energy consumed.
Power purchase agreement	A contract signed between an electricity generator and buyer (or off-taker) to agree on the long-term conditions for selling of energy by the generator to the buyer.
Private equity	Equity investment into companies that are not listed on a public stock exchange.
Receivables	In the DRE context, this can be future cash flows of different projects aggregated together into a portfolio to attain a larger deal size or future payments of off-grid solar.
Repo rate	The rate at which the central bank of a country lends money to commercial banks.
Rent-to-own	An arrangement in which the ownership of an asset (e.g., a solar home system) is transferred from the seller to the buyer following the buyer's completion of a pre-defined payment schedule. Payment intervals are usually monthly and instalment amounts are fixed.
Senior debt	Debt that is positioned on top of the repayment hierarchy. Senior debt takes priority over subordinate debt.
Special purpose vehicle (SPV)	A legal entity, usually in the form of a limited liability company or a trust, set up by a corporate entity (typically termed the originator) to serve a specific purpose, for example to hold ownership of certain assets.
Stamp duty	A tax that a government levies on instruments or documents that transfer ownership of assets from one entity to another.

Key highlights

- The distributed renewable energy (DRE) market in Uganda has experienced considerable growth over the past decade. In the captive power market, the installed capacity of commercial and industrial (C&I) solar projects has increased almost twelvefold in five years, from only 0.68 megawatt (MW) in 2017 to 7.92 MW in 2022.[1, 2] Sales of off-grid solar (OGS) products reached a peak of 464,225 units in 2017 and have since maintained similar levels leading up to 2020, when sales dropped significantly because of the COVID-19 pandemic. The mini-grid market, while still small with only 48 mini-grids operating across the country as of 2022, has had success with portfolio financing and 27 additional projects are expected to come online in the near term;[3]

- Despite this growth, the market for small-scale, low-carbon, energy assets in Uganda is still nascent when it comes to financial aggregation. While innovative financial structures involving some form of aggregation have and can take place in Uganda, several market barriers must be addressed if these are to be widely employed and scaled up;

- Looking to the future, we estimate the total annual DRE[i] financial aggregation market opportunity by 2030. Considering an ambitious scenario, the 2030 market opportunity is estimated at $373.4 million. Considering a conservative, and likely more realistic scenario, the market opportunity is estimated at $141.8 million by 2030;

- Our quantified market opportunity assessment shows that the DRE sector with the largest financial aggregation market opportunity in Uganda under both scenarios is OGS, followed by captive power and finally mini-grids. Electric mobility also presents a large potential market opportunity, but this is based on a qualitative assessment;[ii]

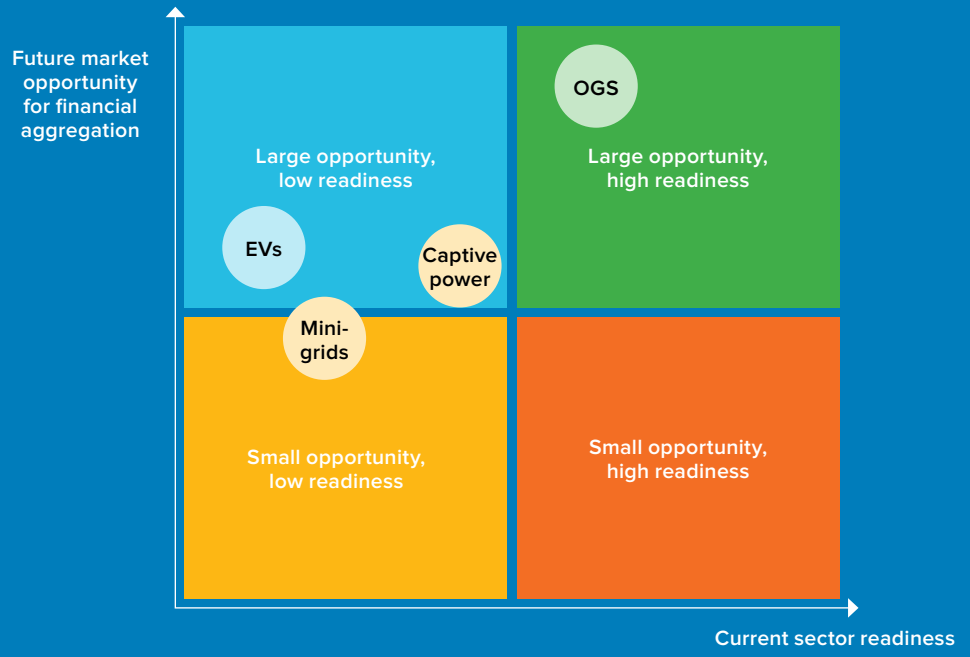


Figure 1: Future financial aggregation market opportunity of DRE sectors vs current readiness[iii]

- The OGS market is the most mature market currently, indicating relatively high readiness for financial aggregation compared to other sub-sectors such as mini-grids and captive power which exhibit low readiness at this stage;

- The estimated total future market size is likely too small to justify the comparatively high costs involved in setting up and operating off-balance sheet securitization and aggregation transactions. Put differently, Uganda alone is unlikely to have the requisite DRE asset base to warrant the setup and operation of off-balance sheet transactions as these are complex and expensive financial instruments. This is however not a Uganda-specific issue – it is highly likely that the majority of countries in sub-Saharan Africa do not have DRE asset bases sufficiently large to warrant financial aggregation by themselves;

i DRE technologies considered in this report include mini-grids, solar home systems and pico-solar products, solar productive use systems, captive power and electric mobility.
ii Due to data availability constraints, the financial aggregation market opportunity for electric mobility could not be quantified.
iii See Figure 14 for quantified assessments of the future financial aggregation market opportunity of OGS, mini-grids and captive power.

- If off-balance sheet securitization and aggregation is to be employed, multi-jurisdictional financial aggregation (aggregation of assets within and beyond Uganda) will likely be required in order to pool together an asset base large enough to warrant the cost of such transactions;

- On-balance sheet receivables financing – a simplified version of off-balance sheet securitization – is, however, viable without needing to aggregate assets across countries because of its lower set-up cost and relative simplicity;

- Bulk procurement – another form of aggregation – can be employed to grow the overall DRE asset base;

- Financial aggregation, off-balance sheet and on-balance sheet alike, faces a wide range of financial, legal, and social barriers. The enabling environment, especially tax legislation, is not yet conducive for off-balance sheet financial aggregation instruments, DRE customer credit portfolios are generally of low quality and most DRE companies are not yet aggregation ready;

- Despite these challenges, there are also positive signs, in particular, high levels of public sector support (domestically as well as regionally in the East African Community) for a more developed capital market. There is also a willingness from existing investors to participate in aggregation transactions when DRE portfolios become aggregation ready;

- Developing the market towards aggregation-readiness will require globally relevant work. This includes open sourcing and standardising term sheets, engaging concessional funders to crowd-in commercial capital, upskilling investors to accept receivables as collateral, compiling a common data reporting framework and more. It will also require working directly with industry in Uganda. This includes creating awareness among less mature DRE companies about financial reporting best practice, data management and customer creditworthiness assessment, communicating necessary DRE regulatory improvements, closing a model securitization transaction and more. These are discussed in Chapter 7.

Photo: Adobe Stock/Martin Barraud/Caia Image

1

Introduction

Photo: UNDP Uganda/Hadijah Nabbale

Attaining universal energy access in Uganda by 2030 will require connecting 6.1 million additional customers, requiring investment of $5.5 billion in both on-grid and off-grid systems.[4] Yet, the distributed renewable energy (DRE) sector, which has experienced unprecedented growth in the last decade and is poised to play a key role in achieving this target, remains underfunded in Uganda.

Financial aggregation, defined in the context of this report as the aggregation of DRE receivables, holds great promise in reducing the mismatch between DRE funding needs and investor requirements and in turn increasing capital deployment in these sectors. When designed correctly and deployed in suitable markets, these instruments can offer faster and more affordable access to capital. However, financial aggregation instruments are complex, and their successful implementation depends on a favourable enabling environment.

This report seeks to assess the market readiness and potential for financial aggregation of the DRE sector in Uganda. It provides an in-depth analysis of the key precursors[iv] to financial aggregation and the barriers that will need to be tackled if the potential addressable market is to be unlocked. Finally, it presents an action plan setting out two pathways with specific barrier-removal activities to systematically address these barriers, enable broader replication and achieve market scale-up.

The report is intended to serve as a reference for policymakers, investors, DRE companies, development finance institutions (DFIs) and other relevant stakeholders interested in the advancement of financial aggregation and other innovative financial solutions to address the DRE financing gap in Uganda and beyond.

The report has been developed as part of the Climate Aggregation Platform (CAP), a Global Environment Facility (GEF)-funded project implemented by UNDP, which, in partnership with the Climate Bonds Initiative, seeks to promote the scale-up of financial aggregation for small-scale, low-carbon energy assets in emerging markets. This document is part of a report series including a similar assessment for Rwanda and for East Africa at large.

The report opens with a brief explanation of DRE financial aggregation and its different manifestations. Chapter 2 follows with an overview of national-level factors that affect the potential of DRE financial aggregation. The chapter is structured according to the PESTLE framework, with an analysis of **P**olitical, **E**conomic, **S**ocial (demographic), **T**echnological, **L**egal and **E**nvironmental factors that are relevant for DRE financial aggregation. Chapter 3 provides a brief overview of the current status of the energy sector in Uganda, while Chapter 4 focuses in more depth on the status of different DRE sub-sectors.

An appraisal of the market's level of readiness in relation to each of these national- and sector-level factors is presented at the beginning of each section in Chapters 2 and 4. This appraisal merely provides a basic indication of current market readiness and should therefore be viewed in conjunction with the detailed discussion of the section that it pertains to. It is based on a financial aggregation market assessment framework developed as part of the CAP project. This framework also served as a guide for all research conducted during the project and therefore this report also follows the same structure – from national-level PESTLE factors down to sector-specific considerations such as sector maturity and size. More details of the market assessment framework and its indicators are presented under appendix G.

Chapter 5 quantifies the market opportunity for financial aggregation in each DRE sub-sector, drawing on a wide range of carefully selected data points. Chapter 6 outlines the key barriers and opportunities for the future of DRE financial aggregation in Uganda, while Chapter 7 concludes with an action plan of activities to address these barriers.

The report brings together insights from an extensive desk-based research effort and insights from more than 50 interviews with DRE companies, investors, independent experts, and government officials. As a result, perspectives from the supply-side (small-scale, low-carbon energy assets seeking financing), demand-side (investors in potential financial aggregation facilities) and the enabling environment for DRE sub-sectors and financial instruments (e.g., macro-economic conditions, regulations, support initiatives and infrastructure) are considered.

iv The report provides insights into a variety of sub-topics to assess the potential of DRE financial aggregation in Uganda. Each sub-topic covered in the report has been selected because it has a considerable effect on the potential for financial aggregation. Each sub-topic is only covered to the extent that is necessary for assessing how it affects DRE financial aggregation potential. Coverage of each sub-topic only includes factors relevant for DRE financial aggregation and is, thus, not in-depth nor exhaustive.

The following DRE industries are considered in the report:[v]

OGS (solar home systems, pico-solar and standalone solar productive uses): Solar home systems are productized systems that include a solar panel, battery, lighting and mobile device charging. The smallest of systems are often termed pico-solar products or solar lanterns. Larger systems also include appliances such as TVs, fans and direct current refrigerators. Pico-solar products are also productized but are typically only used for lighting purposes. These are also referred to as solar lanterns. Standalone solar productive use systems are tailored for specific income-generating activities and include, for example, solar water pumps and solar threshers.

Mini-grids: Mini-grids are isolated grids that generate electricity at a centralized point from one or a combination of sources (e.g., solar, diesel or hydro) and distribute to end-customers through a low- or medium voltage power grid. Installed capacities can vary widely from small DC nano-grids of less than 5 kW to large regional grids in the MW range.

Captive power: Captive power systems are usually isolated power systems with the primary goal of supplying a single residential, commercial or industrial facility. They are also referred to as embedded generation or behind-the-meter systems. These systems can be off-grid or grid-tied. If grid-tied, surplus energy is fed into the grid, typically on a feed-in tariff basis. Rooftop solar systems for commercial and industrial (C&I) facilities is the most common segment in this sector, and therefore the sector is commonly referred to as C&I solar.

Electric mobility: Electric mobility in this report refers to any electric-powered transport. This includes 2-wheelers, 3-wheelers, cars, trucks and boats.

While the report is focused on the aforementioned DRE sub-sectors, many of the findings and recommendations can also be relevant to other sectors such as clean cooking, energy efficiency, or other low-carbon assets.

v The report does not provide a comprehensive assessment of the DRE sector at large. Instead, it is focused specifically on financial aggregation of DRE. Its insights and findings do, however, also provide relevant information on the DRE sector more broadly.

Photo: UNDP Uganda

1.1 DRE financial aggregation

Small-scale energy assets can be aggregated into portfolios to achieve scale and attract larger investment ticket sizes[5] in a process defined as financial aggregation. It can take the form of securitization of future **cash flows** (accounts receivables) and the aggregation of these into pooling structures, typically special purpose vehicles (SPVs). It can also take the form of aggregation of projects into portfolios for **project** finance purposes.

Securitization of receivables is more commonly performed in product-based sectors, for example solar home systems, while project aggregation is more commonly deployed in project-based sectors, mainly mini-grids and captive power.

Financial aggregation in its purest form involves complete transferral of the securitized assets into an off-balance sheet structure, such as an SPV, as Figure 2 indicates. This means that the DRE company, the originator of the assets, effectively sells the assets to the SPV.

In theory, this process reduces the risk of the securitized assets for an investor and ultimately the cost of capital for the originator by effectively separating the risks of securitized assets from that of the originator. Separation of risk also means that if the company who initially sold or developed the asset (the originator) fails and is liquidated, it will have no recourse over the assets held by the SPV.

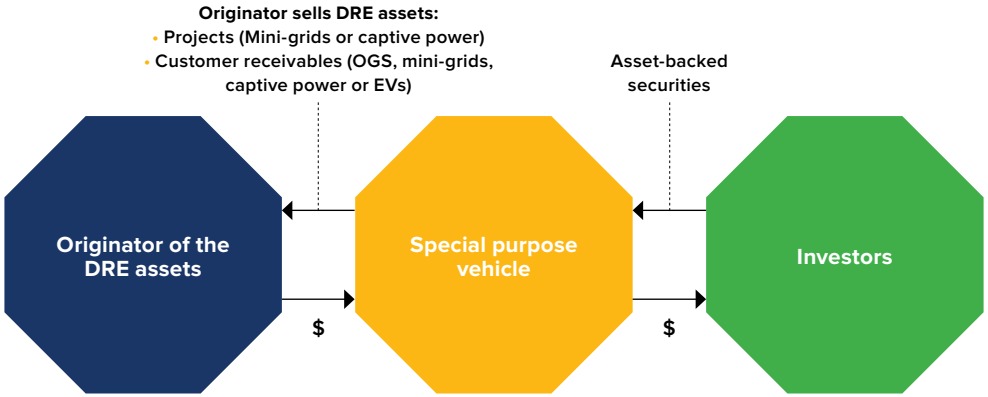
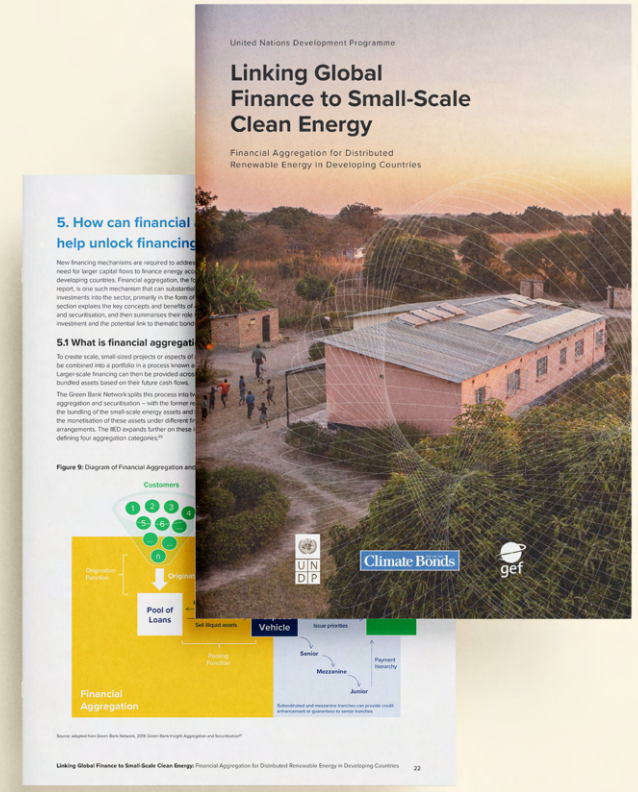


Figure 2: **Basic off-balance sheet securitization structure**



To learn more about financial aggregation please see **UNDP's** and the **Climate Bonds Initiative** report on "Linking Global Finance to Small-Scale Clean Energy".

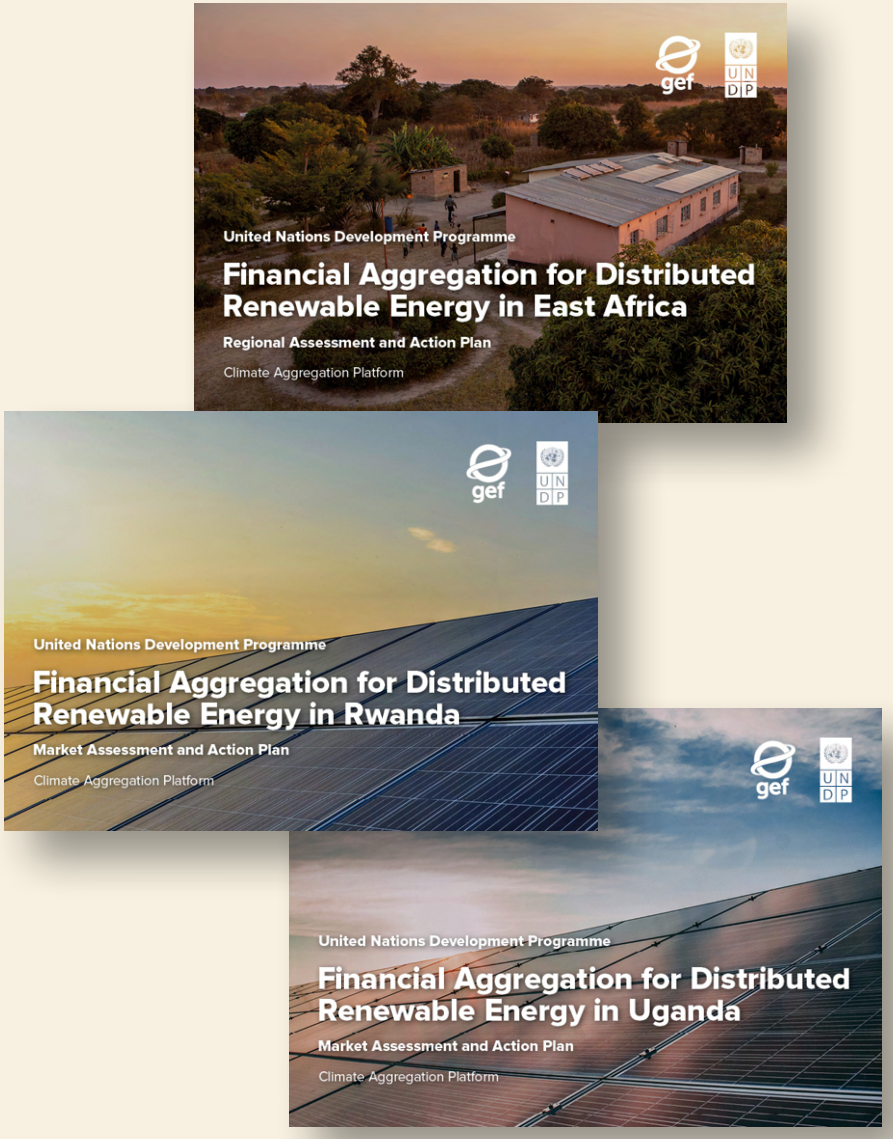
For more information about financial aggregation and other innovative financial instruments for DRE, see the CAP Knowledge Library here. The library aims to be a one-stop-shop for key publications on innovative financing mechanisms for small-scale energy.

Instances of this level of sophistication in DRE transactions are rare, especially in Uganda. Only a handful of pure off-balance sheet transactions have been closed in the DRE sector in sub-Saharan Africa to date and these have mainly been in the OGS sector.[vi] Established players in this sector are relatively mature and are looking to leverage the value of their customer receivables to access debt to fund further growth. In contrast, other DRE sectors are still at a relatively early growth stage. More traditional financing instruments are still most appropriate in these sectors at this stage.

Successful attempts have been made in other markets, notably Kenya, to employ elements of pure off-balance sheet structures in what we term quasi off-balance sheet transactions. In these instances, originators sell their securitized assets to a limited liability partnership, which it co-owns with an entity responsible for arranging the facility.[6] The originator, as a result, still has recourse to the assets. Finally, a more common approach due to the small size of the market, has been to securitize DRE receivables, without aggregating and transferring them to off- or quasi-off balance sheet structures. The assets remain fully on the balance sheet of the company. While not aggregation per se, the quantification of future cash flows improves the company's investor pitch and can be used as part of the collateral requirements for a loan or as the only collateral in cases where more progressive investors are involved. Deals can be smaller as transaction costs are significantly lower than off-balance sheet transactions. Transactions like these have been closed in the Ugandan DRE market, involving local DRE companies, a development finance institution (DFI) and a specialist transaction arranger.

> *"Financial aggregation and receivables sales can really shorten the working capital cycle for companies. The long cycles have kept companies on a hamster wheel of capital raising because the more you grow the more capital you need. The book of receivables needs to be financed up front, but the cash revenues only come in over months or years, so if you can front load the return of cash through the sale of receivables then that is very helpful in terms of cash flow."*
>
> **– Geoff Manley, BII**

vi See for example: African Frontier Capital, D.light and SFC announce industry-leading USD 238 million multi-currency receivable financing facility, 2022 (link)



For the status of DRE financial aggregation in Rwanda and in East Africa more broadly, see a parallel assessment for Rwanda here and East Africa here.

2

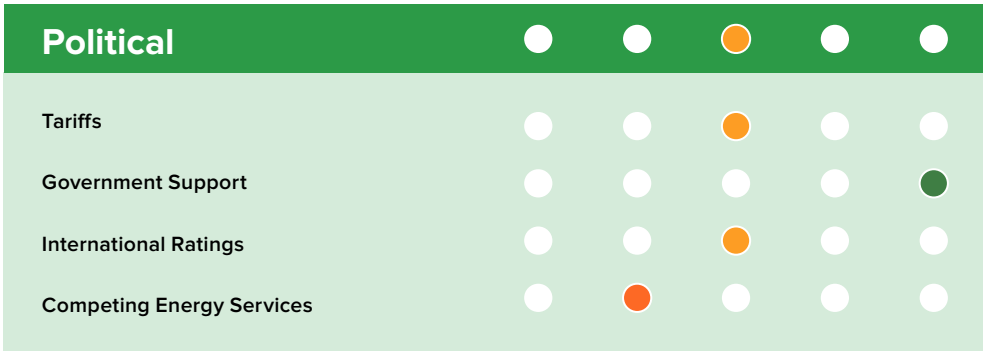
Country overview

Photo: UNDP Uganda

2.1 Political outlook and international relations

At the macro level, countries with effective and accountable governing institutions consistently perform better on a range of development issues from social cohesion to economic growth, sustainable human development and levels of conflict. Peace, inclusiveness and effectiveness of public institutions will determine the ability of countries to achieve the sustainable development goals (SDGs). Conflict, violence and corruption are major threats to sustainable development. More specifically, stable political environments are essential for the growth of DRE markets and successful implementation of financial aggregation facilities.

Uganda political score on CAP market assessment framework:[vii]



Uganda has made significant progress since the reintroduction of multiparty democracy in the 1990s including holding regular elections as provided for in the Constitution. Legal frameworks to foster accountable governance have also been enacted, such as the Administration of Judiciary Act 2020 which will enable the efficient and effective performance of the Judiciary and reinforce the separations of powers.

Uganda is relatively peaceful, with no major internal armed conflicts. The Government has committed to maintaining regional peace and stability by signing treaties such as the Intergovernmental Authority on Development, UNSCR 1325, and the Goma Declaration. As a result of the country's relative peace and stability, Uganda continues to host the largest refugee operation in Africa and has implemented progressive refugee policies.

Despite the above achievements, some challenges remain, including:

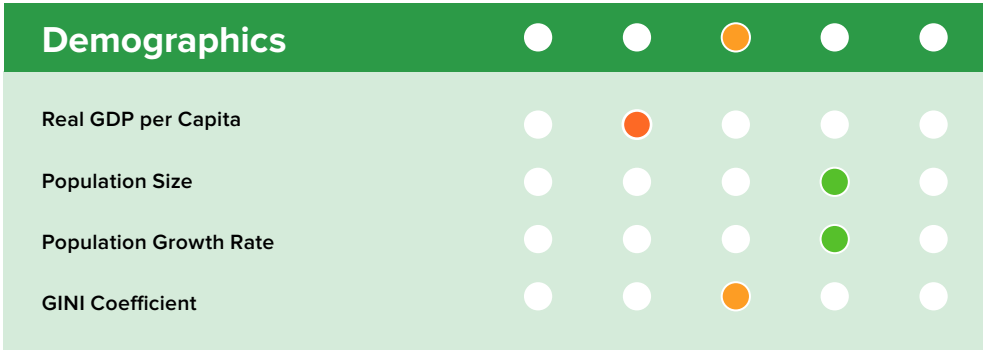
- Existence of laws, policies and practices which some sections of the population including political analysts say are not yet adequately contributing to fairness, inclusion and equity;
- Access to justice among Ugandan citizens is still hampered by limited resources;
- Limited skills and human capital which restrict administrative efficiencies;
- Challenges facing the judiciary in relation to timely and effective case management systems, resulting in case backlogs and 'slow' justice; and
- Limited revenue base for local government structures, with most of them relying on central government support which equates to approximately 97% of their annual revenue.

Uganda's public sector transparency, accountability and corruption rating has a score of 2.5 out of 6 (1 being low and 6 being high), on the Country Policy and Institutional Assessment (CPIA) scale.[7]

2.2 Demographic considerations

Countries with positive demographic trends tend to be poised for faster DRE market growth and increased likelihood of DRE financial aggregation.

Uganda demographic score on CAP market assessment framework:



vii Details of the financial aggregation market assessment framework employed in this study are provided in appendix G.

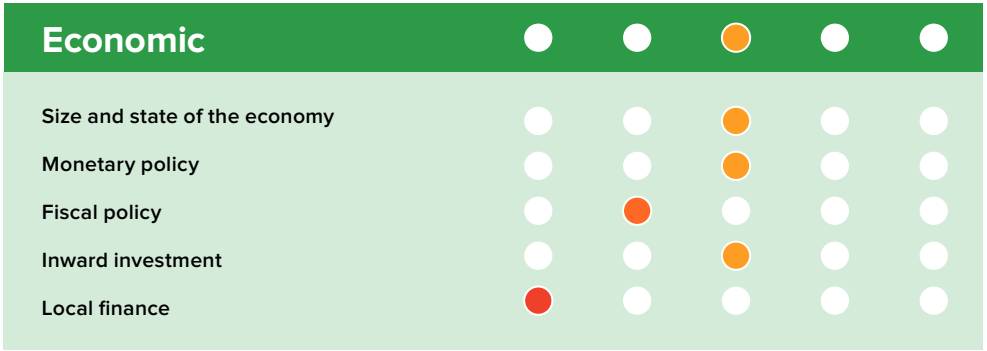
Uganda's socioeconomic levels remain low due to high poverty rates, rising income inequalities and poor social risk management. The most recent Uganda National Household Survey conducted by the Uganda Bureau of Statistics (UBOS) reports that 8.3 million people live below the national poverty line of $1 a day.[8] This represents 20% of the total population, which is estimated at 40.9 million in the same survey.[viii] Using the national upper poverty line of $1.77 per day, the number of people living in poverty increases to 12.3 million.[9]

The country has a score of 0.525 on the UNDP's 2021 Human Development Index, and is ranked 166th out of 191 countries which places it in the category for low human development.[10] World Bank data indicates that Uganda's gross domestic product (GDP) per capita was only $858 in 2021, compared to the sub-Saharan African average of $1645.[11] UBOS reports the country's GDP per capita in 2021 at $1,042, which is still lower than the sub-Saharan African average.[12] This low demographic performance signifies low purchasing power. This creates an affordability gap, which in turn hampers growth of the DRE market.[ix]

2.3 Economic status and outlook

Above-average GDP growth contributes indirectly to the growth of DRE markets, as it indicates an increase in consumer spending power, among other considerations.

Uganda economic score on CAP market assessment framework:



Real GDP in Uganda contracted by 1.5% in 2020 but experienced 6% growth in 2021.[13] The first half of 2022 saw 4.3% growth, as a result of increased public expenditure, household consumption, and a newly signed oil sector investment.[14] The ongoing war in Ukraine has been slowing investments due to trade disruptions and increased commodity prices.

> *"Governments and households continue to face immense pressure from the once-in-a-generation cost-of-living crisis, including skyrocketing and volatile energy prices, due to the war in Ukraine."*
> **– UN Global Crisis Response Group**

2.3.1 Monetary policy

DRE revenues are typically generated in local currency while investments in DRE assets are typically made in hard currencies. It follows that financial aggregation favours stable currencies, as this minimizes foreign exchange risk.

The Bank of Uganda (BoU) implements a free-floating interbank foreign exchange market and there are no foreign exchange controls in place.[15] The Ugandan shilling (UGX) has however experienced relatively high volatility against the US dollar, considering monthly data from January 2017 to June 2022. Standard deviation in monthly fluctuations over this period amounts to 0.05. This is the third highest in East Africa – only the DRC Congolese franc and the South Sudanese pound are more volatile (see Figure 3 for the uneven lines representing the DRC, South Sudan and Uganda). The UGX strengthened 2.2% against the US dollar between 2017 and 2021, followed by an 8% decline in 2022 (January - September). The currency is however still far less volatile than the continent's more developed economies South Africa and Nigeria.[16]

viii More recent data indicates that the population has since increased to approximately 48 million.
ix For a detailed and practical explanation of the effect of affordability gaps on DRE markets see: ESMAP, GOGLA, Efficiency for Access and Open Capital Advisors, Off-grid solar market trends report, 2022 (link)

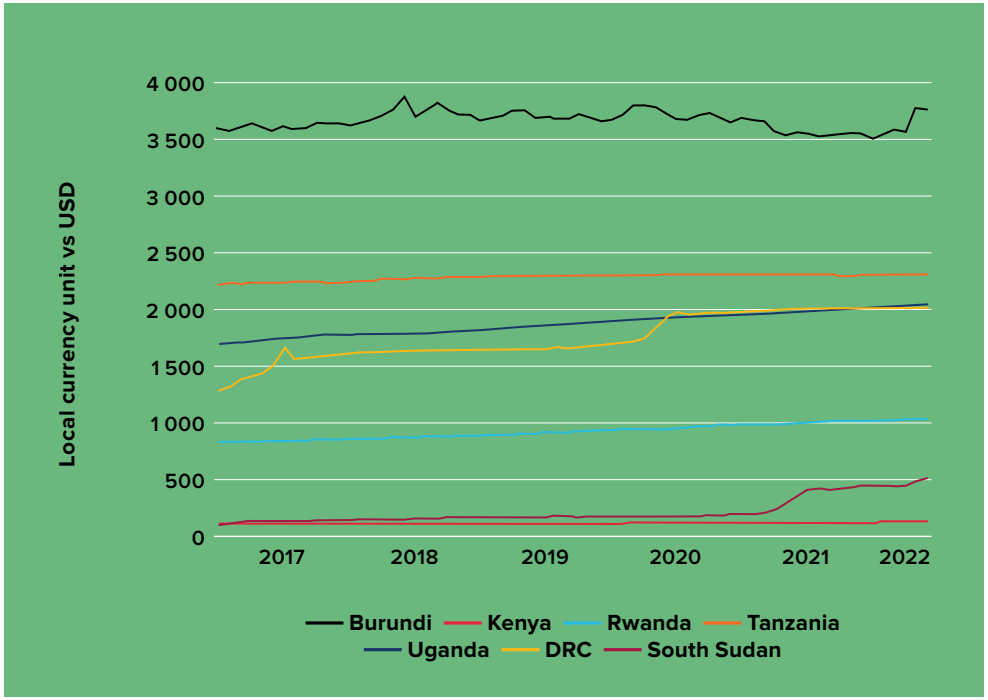


Figure 3: **Exchange rate volatility of UGX vs USD, compared to East African currencies**[17]

BoU's repo rate has been steady in the 6.5-10% band over the past few years, as inflation levels have also been relatively low. Repo rates have progressively decreased from 10% to 6.5% over this period. However, June 2022 saw the first rate increase since 2018, followed by a number of additional increases back up to 10% by October 2022.[18] By February 2023, the repo rate remained stable at 10%.[19] This was done to tame inflation that has risen from 2.2% in 2019 to 10.4% by January 2023.[20,21]

High inflation environments have a negative effect on the potential for DRE financial aggregation. It reduces the purchasing power of consumers, and in turn their ability to pay for energy services. Inflationary pressures also cause investment uncertainty, which ultimately leads to a decline in DRE investments.

To bring inflation down to acceptable levels, central banks have to increase repo rates, which generally increases the cost of capital in a country. Elevated repo rates could translate to both positive and negative consequences for financial aggregation. A higher repo rate means that the rate at which local financial institutions lend to DRE companies will also increase. Financial aggregation facilities could thus be more competitive against an elevated local rate, provided that capital is raised from institutions that are not affected by the domestic central bank rate. Conversely, an elevated repo rate could reduce the likelihood of local financial institutions investing in financial aggregation facilities as a result of higher return expectations.

2.3.2 Fiscal policy

High fiscal deficits could limit a government's ability to support the DRE sector and can also create difficult operating conditions for financial aggregation facilities and other private sector bonds and securities.

Governments need to fund their fiscal deficits, which is typically done through borrowing. Widening fiscal deficits would lead governments to borrow more, which increases government debt. Faced with the need to curb spending, governments need to make difficult policy choices and compromises. Subsidies and incentives towards DRE sectors may not always be prioritized, ultimately affecting the growth prospects of these sectors. On the other side of the coin, fiscal deficits could force governments to curb costly fossil fuel subsidies, which could indirectly benefit the DRE sector.

A widening fiscal deficit can also reduce lender confidence in a government's ability to repay. It follows that lenders will expect higher rates of return on government bonds to account for this elevated risk. This further increases expected rates of return on government bonds, which ultimately crowds out private sector bonds and securities such as DRE financial aggregation facilities that are not able to offer ever-increasing rates of return and that remain high risk.

Uganda' fiscal deficit in the 2022 financial year is estimated at 7.3% of GDP – an improvement from 9% of GDP during the previous year.[22] With Uganda's economy, like many economies, continuing its trajectory towards normality following COVID-19 lockdowns, the deficit is projected to decline further to 5.4% of GDP in 2023.[23] Despite relatively high levels of government debt (52% of GDP in 2022),[24] the 2022 government budget plans for an increase of 8.8% in government spending compared to the 2021 budget. Sustainable energy development constitutes a major share in this increased spending, with a budget increase of 43.8% compared to 2021 (see Box 1).[25]

Taxation

A resident Ugandan entity is subject to tax on its worldwide income, while non-resident entities are subject to tax only on their income sourced in Uganda. Uganda has double tax agreements (DTAs) in place with Denmark, India, Italy, Mauritius, the Netherlands, Norway, South Africa, the UK and Zambia.[26] **DTAs are important for cost-effective financial aggregation in cases where the parties make use of off-balance sheet securitization and where the SPV is domiciled in an offshore jurisdiction. The DTA ensures that tax payment in both countries is avoided.**

Excessive taxation of DRE technologies generally reduces the financial viability of projects and products as it increases the cost base. While taxation is an important source of revenue for governments, experts generally advise governments to reduce or remove taxes on DRE businesses to enable these sectors to scale up.

Table 1 provides a summary of the status of taxes in Uganda with a particular focus on policies relevant to the DRE sector.[x] Taxation of renewable energy in Uganda is relatively favourable – most technologies are exempt from value added tax (VAT) and import duties and a reduced withholding tax rate applies. Financial instruments, however, enjoy less favourable tax arrangements as sections 2.3.4 and 2.5.2 point out.

Despite the close correlation between Uganda's corporate tax rate and the average rate in sub-Saharan Africa, the Uganda Revenue Authority (URA) collects the least amount of corporate tax of 30 countries across sub-Saharan Africa, at approximately 0.8% of GDP.[27] Average corporate tax income as a percentage of GDP in sub-Saharan Africa stands at 2.9%. While many factors can play a role in this poor performance, a recent study found that the poor usability of URA's online tax filing platforms and digital payment platforms mean these systems are underused by taxpayers.[28]

TAX	RATE	NOTES
Corporate tax	• Standard rate: 30%	• Governed by Income Tax Act Cap 340 • In line with sub-Saharan Africa average of 28%
Withholding tax	• Standard rate: 15% (interest, dividends and royalties) • All payments of more than UGX 1,000,000 (approximately $270) for goods and services are subject to a reduced rate of 6%. This covers most renewable energy products and related appliances. • Unless exempted, and unless imported from EAC member countries, all imported goods are subject to a reduced withholding tax rate of 6%.[29]	• In line with sub-Saharan Africa average of 15% • All withheld amounts payable to the URA within 15 days after a payment subject to withholding tax has been made.
VAT	• Standard rate: 18% • Most solar products, including panels or assembled into products like solar home systems and batteries are exempt in Uganda. • Certain pico-solar units are charged at 18%.	• In line with sub-Saharan Africa average of 15% • VAT returns are due after each calendar month and any payable VAT is due 15 days after the end of that month.
Import duties	• Standard import duty depends on type of goods. • Most solar products are exempt (pico-solar products are charged at 10%) • Batteries are charged at a 25% duty	

Table 1: Uganda tax summary[30,31,32]

x For more information on Uganda's DRE taxation policies, refer to: BDO East Africa Advisory Services, The East African Regional Handbook on Solar Taxation, 2022 (link)

2.3.3 Inward investment

Uganda is politically well represented in the international community. It is a member of the Intergovernmental Authority on Development, African Continental Free Trade Agreement, the EAC, COMESA and the African Union Abuja agreement. The country has bilateral investment treaties with Denmark, France, Germany, the Netherlands, Switzerland and the United Kingdom.

Investors tend to shy away from countries where operating conditions are unstable and where credit risk is high. High levels of inward investment can thus provide an indication that a country has been successful in creating a stable environment for investors to operate in. It follows that countries and regions that attract high levels of investment are better candidates for financial aggregation facilities.

Foreign direct investment

Foreign direct investment (FDI) into Uganda has consistently been above average in recent years. In 2020, FDI accounted for 2.32% of GDP, compared to the sub-Saharan African average of 1.76%. For each of the preceding few years, FDI flows into Uganda also reached levels that exceeded the regional average by at least 1%. FDI recovered strongly from $460 million in 2021 to $682 million in the first half of 2022.[33] A relatively high ease of doing business (rating of 6.3 out of 10 on the BTI Transformation Index)[34] has played an important role in attracting international investors.

Official development assistance

Uganda receives approximately $2 billion in official development assistance (ODA) from development partners every year. Notable donor organizations that provided ODA to Uganda are presented in Figure 4. Figure 5 presents total ODA flows to Uganda's energy sector. Trends have been relatively stable, barring large inflows in 2018 and reduced inflows in 2020. The latter is likely a result of interruptions to normal funding cycles caused by the COVID-19 pandemic.

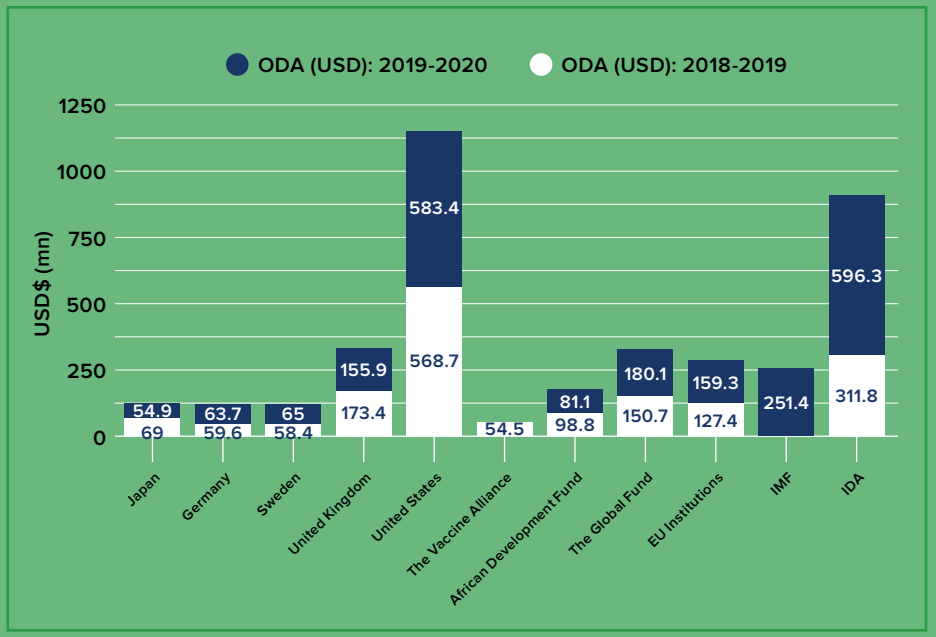


Figure 4: Top 10 ODA donors disbursing funds in Uganda[35]

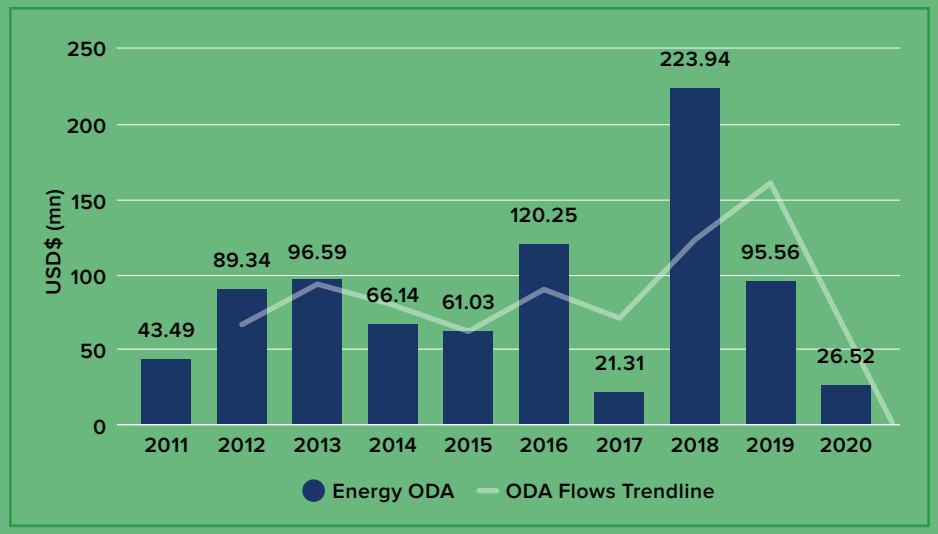


Figure 5: Total ODA funding into the Ugandan energy sector (2011-2020)[36]

2.3.4 Financial market trends

Successful closing of financial aggregation transactions requires a relatively mature financial sector, especially if off-balance sheet structures are being used. It follows that an overview of the financial sector is necessary for assessing DRE financial aggregation potential. Upward trends in financial sub-sectors such as banking and capital markets including bond and asset-backed securitization markets are a positive indication for the prospects of financial aggregation transactions.

Banking

The Ugandan banking sector comprises multinational, foreign-owned banks such as Stanbic, Citibank, Barclays and Standard Chartered as well as an increased local presence from Opportunity Bank, Post Bank and DFCU. Commercial banks are generally seen as reliable and liquid. They account for 95% of private sector lending.[37] Banks also hold 83% of assets in the financial sector.[38] Customer deposits have increased by 18.6% from 2020 to 2021.[39] However, a large proportion of the population remains unserved by the banking sector. In 2020, there were only approximately two bank branches for every 100,000 adults, compared to five in Rwanda and five in Kenya.[40] 70% of branches are estimated to be located in urban areas.[41] There are approximately four ATMs for every 100,000 adults, compared to four in Rwanda and seven in Kenya. To increase the reach of banks, agency banking was launched in 2017 – an extension of bank services whereby agents offer banking services on the behalf of banks. By June 2022, the number of third-party banking agents has grown to 26,800, indicating a large uptake of the service.[42] Local commercial banks have also been active in DRE but account only for a small portion of funding in the sector – see chapter 4 for more details.

Private equity

Private equity is an underdeveloped investor segment in Uganda, in contrast to the dominance of commercial banks. Yet, the funding gap left by the limited risk appetite (high interest rates and short tenors) of commercial banks is substantial, and one that private equity can readily fill, if provided the appropriate enabling environment. Private equity is particularly well suited to offer SMEs more flexible and longer-term equity financing alongside assistance with management and growth strategies.

Between 2010 and 2019, only 78 private equity deals were closed in Uganda.[43] The country only attracted 11% of total private equity investments made in East Africa between 2017 and 2018, most of which went to healthcare and agribusiness. The lack of a clear regulatory framework alongside a generally unfavourable commercial tax regime have been key barriers impeding the growth of the private equity sector.[44]

The outlook is, however, relatively positive. Uganda has been ranked as the ninth most attractive country for private equity investments over the next three years (2022-2025) in a recent Africa-wide private equity partner survey (and second most attractive in East Africa).[45] Major institutional investors, notably the National Social Security Fund (NSSF), have also expressed interest in investing in private equity.[46] Uganda has an estimated total pension savings pool of $5 billion,[47] so funds such as the NSSF can facilitate a major capital injection into the growth of Ugandan SMEs. Improved macroeconomic conditions and moves to improve the regulatory environment seem to be key reasons for the growing interest in Ugandan private equity. The Capital Markets Authority (CMA) of Uganda has made considerable progress by publishing the draft Capital Markets Authority (Licensing and Approval) Regulations of 2021, which seeks to govern the operations of private equity funds.[48]

Bond market

The Ugandan corporate bond market is still in its infancy, compared to an active government-issued bond market. Past corporate bond issuances have mostly come from the commercial banking and housing sectors.[49] By 2021, only 2 of the 26 bonds listed on the Uganda Securities Exchange were corporate bonds.[50] Private, non-listed issuances are negligible. There are several reasons for the underdeveloped corporate bond market:

- **Treasury bonds in Uganda offer attractive returns, at approximately 10-18% annually, depending on maturation period.**[51] Given the relatively low risk of government bonds, investors would be more inclined to invest in these, compared to higher risk private sector bonds with potentially lower returns. DRE assets with their relatively high-risk profiles are no exception to this rule. For commercially minded investors with no impact mandate to be attracted to DRE assets, returns would need to outcompete that of government bonds considerably. Failure to outcompete government bonds will make it difficult to attract a new class of investors to DRE.
- **Commercial banks in East Africa dominate private capital markets.** They account for 95% of total private sector lending and have an interest in remaining incumbent. This can often lead to attempts to reduce the incentives for private sector players to borrow elsewhere.
- **The investor base, retail and institutional alike, can benefit from further growth.** In Uganda, only approximately 100,000 retail investors participate in the capital markets. The institutional investor segment, a key investor segment for corporate bonds, also needs to grow further.[52]

Green bonds

To date, there have been no explicit green bond issuances in Uganda. The closest example was the $30 million 10-year bond issued by Kakira Sugar in 2013. The bond is listed on the Ugandan Stock Exchange and is due to mature by December 2023. Proceeds are being used by the sugar manufacturer to expand its processing facilities as well as its bagasse cogeneration plant. The plant's installed capacity is 51 MW, 32 MW of which is being used to generate electricity to be sold to the grid. The transaction was brokered by Stanbic Bank Group Securities and the bond trustee is Deloitte Uganda.

The underdeveloped nature of this segment follows the overall trend in sub-Saharan Africa – the value of green bonds issued across the region only amounts to 0.3% of the value of green bonds issued globally.[53] As of 2021, there have only been 16 issuances. These have been deployed in South Africa, Namibia, Seychelles, Nigeria and Kenya.

Asset-backed securitization

Securitization deals are rare in Uganda. This is despite a law on asset-backed securitization that permits the use of these financial instruments (see section 2.5.2). Securitization in Uganda is hampered by an absence of the requisite support structures that are typically present in developed markets. It has an unfavourable tax regime (see section on securitization tax legislation in section 2.5.2) and lacks a network of skilled service providers that can arrange transactions. As of February 2022, only 30 companies were registered to conduct securities business. Of these 30, only four are registered to offer custodian/trustee services and only seven are registered as fund managers/arrangers.[54] Other barriers, notably high government bond rates outcompeting rates that securitization deals can offer, are more universal and affect the securitization market in the same way that they affect the bond market.

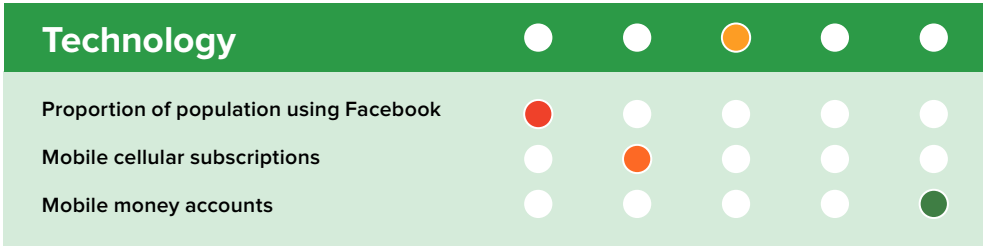
Photo: Adobe Stock/Thongsuk

2.4 Technological considerations

2.4.1 The mobile economy

Mobile cellular subscriptions and mobile money accounts are key enablers for pay-as-you-go (PAYGO) business models. Without these technologies, PAYGO would need to depend on scratch cards and other paper-based systems, reducing scalability. PAYGO (including both pay-per-use and rent-to-own models), in turn, is central to financial aggregation facilities as it creates the basis for future customer receivables. The alternative is outright sales of DRE assets, in which case there are no ongoing transactions with the customer, and thus no receivables to securitize.

Uganda technological score on CAP market assessment framework:



Thanks to the growth of mobile cellular services, Uganda, like many other countries in sub-Saharan Africa, is experiencing an unprecedented increase in the number of people participating in the formal economy. The mobile phone has become the gateway for previously unserved parts of the population to access financial services, connectivity, knowledge, skills, information, goods and services. However, in 2021 there were only 66 mobile cellular subscriptions for every 100 people in Uganda, compared to the sub-Saharan African average of 93.[55] It follows that more work can be done to increase the deployment of mobile telecommunication infrastructure.

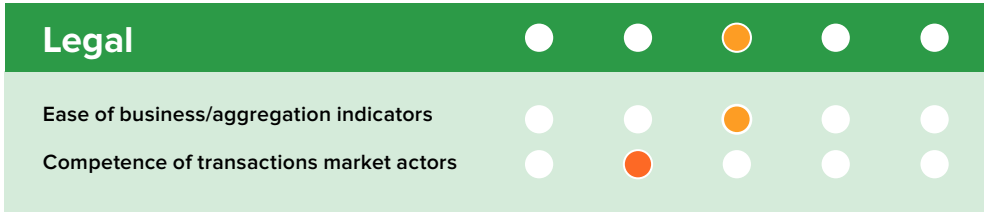
The speed of Uganda's mobile network is ranked 98th out of 141 countries. Of sub-Saharan African countries, it is only outperformed by South Africa, Togo, Angola and Mauritius.[56] Fixed broadband speed performs less well. The country is ranked 147th out of 182 countries. Within sub-Saharan Africa it is ranked 17th out of 36 countries.[57] As of 2021, 49% of Uganda's area was reached by the fibre optic network.[58]

Despite comparatively low penetration of mobile cellular subscriptions, Uganda's mobile money market is one of the more developed markets in the world, having reached a total transaction value of $36.7 billion in 2021.[59] The market is, however, still significantly smaller than that of neighbouring Kenya, which had a total market value of approximately $118.5 billion in 2021.[60] Mobile money fills a large gap in access to financial services for the Ugandan population, especially the rural population. In 2021, there were 1,276 registered mobile money accounts per 1,000 adults, which exceeds the global average of 924 accounts.[61] This signifies increasing levels of competition between mobile money service providers and commercial banks. It also signifies that PAYGO transactions can likely be readily digitized through mobile money payments. The 0.5% mobile money tax on cash withdrawals that was instituted by the government in 2018 did however lead to a slowdown in mobile money use, with 38% of respondents in a recent survey indicating that they use mobile money less frequently due to the increased transaction costs.[62] The tax is only applied to withdrawals, so should not affect DRE transactions.

2.5 Legal considerations

DRE financial aggregation potential increases in countries where general business operating conditions are favourable. Clear operating conditions lead to increased business activity, which increases the rate at which DRE industries can grow and reach scale.

Uganda legal score on CAP market assessment framework:



Uganda's legal system is based on statute, in conjunction with common law, customary law and Islamic law.[63] The legal framework enforces no requirement for local shareholding of companies, nor local directorship. Foreign investors are only allowed to enter into long-term land leases, for up to a maximum of 99 years.[xi]

xi Long term land leasing is common practice and is generally accepted as land security when seeking financing.

2.5.1 Ease of doing business

It takes 24 days on average to open a business in Uganda, compared to the sub-Saharan Africa average of 21. Companies are required to apply for a variety of licenses and to complete registrations. With no shelf companies sold in the country,[64] all investors or multinational companies wishing to open for business in Uganda need to apply for the following licenses and registrations:

- Foreign companies wishing to operate a business in Uganda are required to apply for an investment license from the Ugandan Investment Authority (UIA);
- Companies operating in select industries, of which energy generation is one, must first apply for a primary licence from the relevant ministry, before a general investment licence can be applied for from the UIA;
- Company registration needs to be done with the Ugandan Registration Services Bureau;
- Companies must apply for a trading license from the relevant local government authority that governs the municipal area in which the company is located;
- In terms of tax, companies must register with URA and obtain a tax identification number and a VAT number. Companies are only expected to register for VAT if their taxable income over a three-month period exceeds a quarter of the annual threshold of UGX 150 million.[65]

2.5.2 Regulations affecting asset-backed securitization

Asset-backed securitization, like many other capital market instruments, needs a clear regulatory framework to provide guidance to arrangers and investors on practices that are allowed and not allowed when it comes to structuring and closing transactions. Securitization transactions, especially off-balance sheet ones, are unlikely to take place in markets where governments do not provide clear regulatory guidance.

Securitization transactions in Uganda are regulated by the CMA under the Asset-Backed Securities Law of 2011/2, the Asset Backed Securities Amendment Law of 2016 and the Fixed Income Securities regulations. Given the infancy of Uganda's market for asset-backed securities, these regulations have not yet been extensively tested. Asset-backed securities can be issued publicly or by means of private placements. Disclosure requirements for private placements are not as onerous as for public listing (the CMA must only be notified about the private placement transaction), however both must be in compliance with the ABS law.

In Uganda, SPVs can be set up either as a trust or a limited liability company. An originator is obliged to transfer all its rights, titles, interests and obligations related to the assets to the SPV and may not retain any beneficial interest or liability. This does not impede any potential off-balance sheet DRE securitization transaction, given the bankruptcy remoteness characteristic of off-balance sheet transactions.

The Asset-Backed Securities Law of 2011/2 regards asset-backed securities as characteristic of fixed income securities. Issuances in Uganda would hence need to have characteristics of fixed income securities, which prioritize the need for clear off-taker agreements and payments of fixed, as opposed to variable returns. This means that customer contracts between DRE companies and their customers should specify that payments be fixed fees at predefined intervals, e.g., monthly flat fees.

The ABS law permits the use of credit enhancement instruments, which is an important consideration for DRE securitization as guarantees and first loss facilities will be indispensable parts of the capital stack.

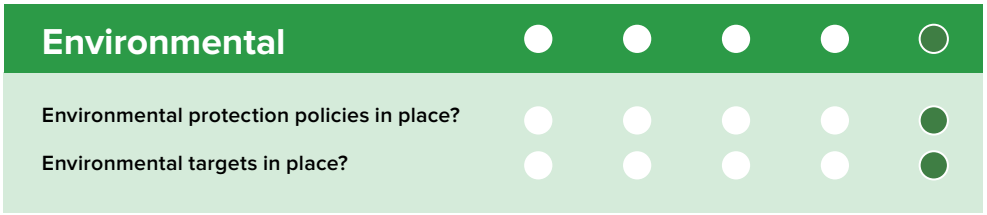
Securitization tax legislation in Uganda

Investment facilities using securitization are expensive to set up and operate. For these instruments to be cost-effective, minimal taxation is advised. SPVs should ideally be seen as pass-through vehicles, meaning that the buying and selling of assets to and from the SPV are seen as a mere transfer, instead of as a normal transaction that would be liable for tax.

The current tax structure for securitization instruments in Uganda can be improved to incentivize the growth of capital markets, as tax exemptions are uncommon. SPVs are not seen as pass-through structures in Uganda, which means that they do not benefit from any tax incentives. Asset transfers from originators to SPVs are levied a 1.5% stamp duty and the standard 15% withholding tax rate applies to all interest payments affecting SPVs.[66] This includes interest payments by SPVs to investors and interest accrued from incoming receivables. The CMA is lobbying to reduce the withholding tax rate applicable to SPVs to 10%.[67] Public sector stakeholders in Uganda have noted that these tax rates, especially the stamp duty, is a barrier to securitization and work is underway between the Capital Markets Authority and the Ministry of Finance to reduce or eliminate this tax.[68]

2.6 Environmental considerations

An overall progressive stance towards climate change mitigation in a country bodes well for the development of low-carbon industries as it is likely that support initiatives for such technologies will be in place. It follows that countries that have supportive environments for low-carbon technologies in place are preferred destinations for DRE financial aggregation facilities.



2.6.1 National climate targets

In Uganda, the main policy dedicated to addressing climate change issues is the National Climate Change Policy (NCCP) adopted in 2015, along with its actionable implementation strategies, some of which have resulted in the enactment of the National Climate Act in August 2021. The act gives effect and force of law to the UN Framework for Convention on Climate Change (UNFCCC), the Kyoto Protocol, and the Paris Agreement. In 2018, the government also launched Africa's first nationally determined contribution (NDC) Partnership Plan, which sets near-term goals that support Uganda's Vision 2040 policy. **In September 2022, the government submitted its updated NDC, with the following main goals:**

- 24.7% reduction in total greenhouse gas emissions below business-as-usual scenario (from 148.8 MtCO2e to 112.1 MtCO2e);
- 18.8% reduction in energy sector-related greenhouse gas emissions compared to 2030 business as usual scenario enabled by:
  - 4,200 MW renewable energy installed capacity;
  - Share of biomass energy used for cooking reduced to 40% from a baseline of 88%;
- 12% wetland coverage from 8.9% baseline figure;
- Area covered by forests increased from baseline 107,607km^2 to 407,608km^2.

Total cost of adaptation, mitigation, coordination, monitoring and reporting actions outlined in the updated NDC is estimated at $28.1 billion, 15% of which will be funded by the Ugandan government.[69] International climate finance from funders such as the Green Climate Fund and the Global Environment Facility will likely be a key source of funding and financial aggregation could serve as a vehicle through which this funding is secured. This would require quantifying, reporting and monetising positive environmental impacts of low-carbon energy, for example carbon emissions avoided. Renewable energy certificates such as those developed by the D-REC Initiative and others could also be key in channelling climate finance to Uganda.[70] DRE assets, low carbon by nature, can be a key asset to channel much-needed climate finance to Uganda. The overall environmental impact of DRE assets can be further increased through the increased investment that aggregation facilities offer, in turn leading to the scaling of the sector.

2.6.2 Environmental protection policies and targets

Uganda's environmental targets in the Land Use, Land Use Change and Forestry sector are reflected in the 2022 updated NDC as stated above. The country's management and governance of environmental and social issues, which range from soil degradation, deforestation, loss of biodiversity, increasing pollution and environmentally related diseases, are inscribed in the National Environment Act of 2019.[71] NEMP also outlines the mandate of the National Environmental Management Authority (NEMA), tasked with the responsibility of coordinating, monitoring, regulating and supervising environmental management in the country. Since its inception, NEMA has developed the Environmental Impact Assessment (EIA) guidelines, and have played a key role in reviewing EIAs, Environmental Audits and Overseeing Environmental Restoration activities. The Electricity (Isolated Grid Systems) Regulations of 2020 stipulate that mini-grid sites must undergo EIAs in accordance with the National Environment Act. Approval must be obtained from NEMA.

3 Energy sector snapshot

Photo: UNDP Uganda/Steven Goldfinch

Uganda has implemented some of the most comprehensive power sector reforms in Sub-Saharan Africa. This included the unbundling of the national utility into separate generation, transmission and distribution entities, the establishment of a regulator and maintaining the ability to charge near-cost reflective tariffs. As a result of these reforms, installed capacity quadrupled between 2002 and 2020 (reaching 1,346 MW in 2021[72]), distribution system losses declined from 38% in 2005 to 16.9% in 2019[73] and private sector participation in energy generation increased to 60% of installed capacity by 2021.[74] Costly thermal power has been reduced to 2% from 24% of installed capacity, being replaced by hydro, biomass co-generation and solar.

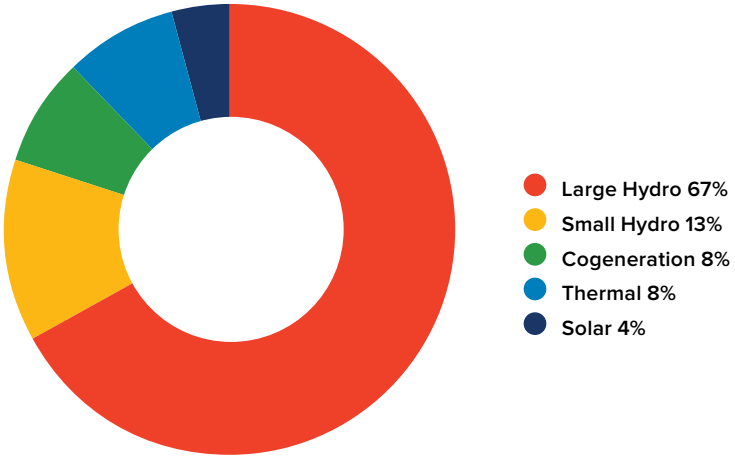


Figure 6: **Energy mix of Uganda[75]**

Two major reforms in various stages of implementation include the re-merging of the Uganda Electricity Generation Company (UEGL), the Uganda Electricity Transmission Company (UETCL) and the Uganda Electricity Distribution Company (UEDCL) into one company; the Uganda National Electricity Company, and the merging of the Rural Electrification Authority (REA) into the Ministry of Energy and Mineral Development (MEMD).[76,xii] These reforms are being instituted to reduce wastage of government resources, but they raise concern around the potential return to inefficiencies that created the need for the separation of the companies in the first place. In particular, there is a fear that the merger could lead to reduced levels of specialization in generation, transmission and distribution respectively. Government maintains that these reforms are necessary, especially in light of ambitious plans for the development of the sector indicated in Box 1 below.

Box 1:

Government's prioritization of sustainable energy development

Sustainable energy development received a 43.8% increase in funding in the government's 2022 budget compared to the 2021 contribution. **Key expected results include:**[77]

1. Increase in primary energy consumption (21 million tonnes of oil equivalent by 2025)
2. Increase in the proportion of the population accessing electricity (80% of households by 2025)[xiii]
3. Increase in per capita electricity consumption (200 kWh per capita by 2025)
4. Reduction in the share of biomass energy used for cooking (50% by 2025)
5. Increase the share of clean energy used for cooking (50% by 2025)
6. Increase in transmission capacity (4,700 km high voltage lines by 2025)
7. Enhanced grid reliability (98% by 2025)
8. Increased national LPG uptake (15% of households by 2025)

Key activities planned for the 2022/2023 period include:

· Design EV incentive schemes
· Finalize studies to develop 200 mini-grids
· Develop a net metering framework
· Construct 10,000 km MV grid lines and 15,000 km LV lines
· Review national grid tariffs
· Review the 1999 Electricity Act

xii Details of the existing legal framework of the Ugandan energy sector can be accessed at: Electricity Regulatory Authority, Renewable Investment Guide, 2022 (link)
xiii The 2022 budget does not specify a target for the share of the population gaining access to off-grid energy. The Electricity Connections Policy has a less ambitious target of 60% electrification by 2027, 33% of which is intended to be off-grid.

4 Status of DRE sectors

Photo: Adobe Stock/Rabizo Anatoli

A key requirement for successful DRE financial aggregation is that DRE industries need to be mature. They need a large existing asset base, an extensive pipeline, and should already have attracted substantial levels of standard debt and equity. Conversely, industries that are nascent and still relying on grant funding are less suitable for financial aggregation. Developers and operators also need a minimum level of sophistication concerning PAYGO operations, data management, fundraising experience, and financial reporting.

4.1 Key takeaways across DRE sectors

In Uganda, it is estimated that multinational DRE companies raise approximately five times more funding than local ones.[78] Small, locally owned companies represent the largest share of companies in the market by number. They typically employ less than 50 people, and generate, on average, an annual turnover of $320,000.[79] These companies tend to raise more grants and debt compared to equity. Investors note that local DRE companies often lack adequate financial management systems and fundraising experience.[80]

> *"There is a general lack of good financial reporting. We can't take audited financial statements at face value, and that's the very start of any due diligence. Companies also struggle to articulate to us what they want. Projections are often not there."*
> **– Anonymous DRE investor**

Debt in Uganda comes at a high cost, with collateral requirements often reaching 100% of loan value and UGX-denominated interest rates of about 15%-25%. Concessional interest rates, denominated in UGX, from impact and development partners typically range between 15% and 17%.[81] On-lending facilities from the state-owned Uganda Energy Credit Capitalization Company (UECCC)[xiv] have facilitated more local commercial bank participation, but interest rates have not been reduced below 15%.[82] Local banks account for a small proportion of total DRE funding in Uganda. For example, local banks are estimated to account for only 20% of total OGS funding.[83] For debt denominated in US Dollar, interest rates are in the range of 6-12% as exchange rate risk is then borne by the borrower.

> *"A lot of the solar companies do not have the collateral that the financial institutions need. Our guarantees assist in assuring the banks that they will get their money back if the loan does not work out."*
> **– Anonymous DRE concessional funder**

High customer default is a common occurrence across DRE sectors in Uganda. Customer defaults adversely affect the potential for DRE financial aggregation as it reduces the quality of receivables. Customer non-payment was a key theme that emerged from interviews with DRE stakeholders in Uganda, with many interviewees mentioning that it is an issue especially in Uganda. Anecdotal data from these interviews suggests that roughly 25% of customers default on their financial obligations to DRE companies. It should be noted, however, that non-payment data is highly company specific and as such it could be that customer payment behaviour data from Uganda performs better against regional and global averages than what this anecdotal data suggests. For example, ESMAP data for the OGS sector suggests that the global write-off ratio of OGS customers in 2021 amounted to 32%.[84]

> *"Banks are generally hesitant to invest in DRE in Uganda. They have stringent requirements of companies, especially in terms of collateral. Companies don't always have hard assets as DRE business is generally quite lean. Banks are sometimes not willing to take inventory as collateral, and definitely not receivables. There needs to be a top-down strategy from directorship level to increase activity in DRE."*
> **– Anonymous DRE expert**

xiv The Uganda Energy Credit Capitalization Company is responsible for channelling government funds to renewable energy companies in Uganda. The organization on-lends to renewable energy companies via commercial banks, with 50% of the loan guaranteed.

Deal sizes that DRE companies in Uganda can meet continue to be too small to be appealing to the average DRE investor. Minimum deal sizes vary between DRE sub-sectors, but averages reported by investors range from $1 million to $10 million, which only more mature DRE companies are able to absorb. Investors tend to be more comfortable with levels of around $25 million, while real interest is generated at ticket levels exceeding $50 million.[85] Pipelines that meet ticket sizes above $50 million are hard to come by. The seemingly high minimum ticket sizes are, however, understandable. Investors' due diligence costs are relatively fixed irrespective of deal size. Minimum ticket sizes represent transaction values that enable investors to cover their due diligence costs and to make an acceptable return on investment. Figure 7 presents the average size of deals that have been made in the DRE sector.

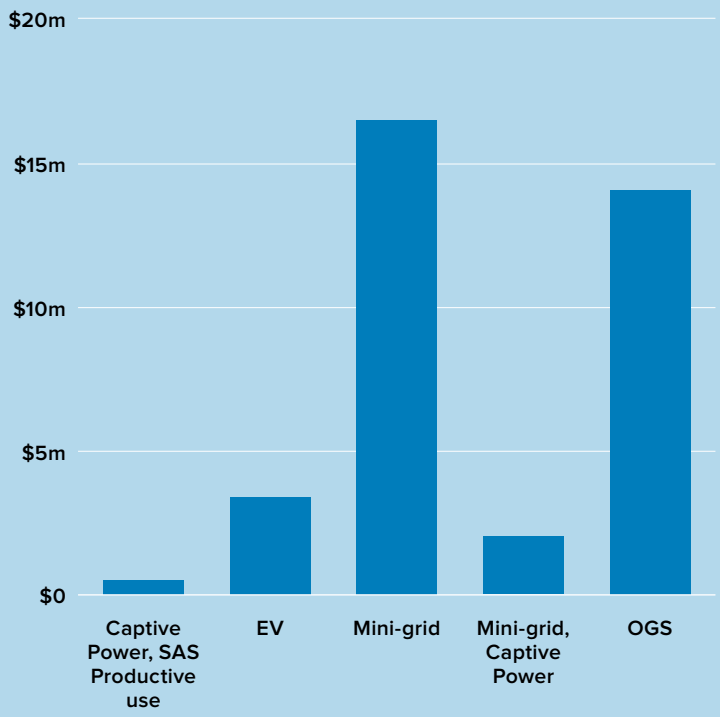


Figure 7: **Average deal size in Uganda per sub-sector type[86]**

The average mini-grid deal size in Uganda is uncharacteristically high due to a handful of high value deals for large mini-grids. These are listed in Table 2.

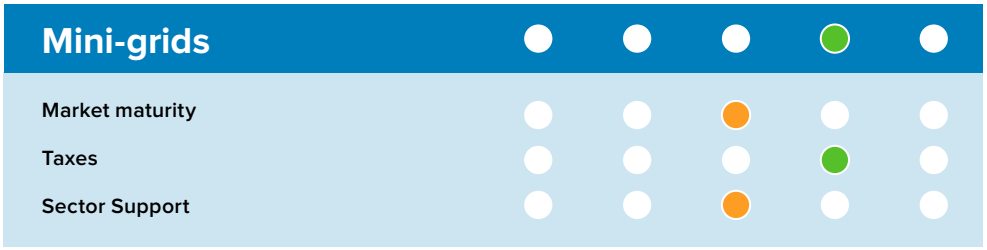
PROJECT NAME	TECHNICAL DETAILS	COMPANY	FINANCIER	DEAL TYPE	VALUE
ORIO hydro mini-grid	9 hydro plants equalling 3.3 MW and a grid	ORIO Infrastructure Fund	Emerging Africa Infrastructure Fund, FMO	Grant	$14.5 million
Bugala Island mini-grid	1.6 MW installed capacity	Kalangala Infrastructure Services	Uganda Development Cooperation, Industrial Development Corporation of South Africa, Nedbank, Emerging Africa Infrastructure Fund, GuarantCo	Debt, Equity, Grant	$54 million
Kabalega hydro mini-grid	9 MW	Hydromax Limited	Hydromax, Norwegian government, AFD	Debt, Equity, Grant	$77.4 million

Table 2: **Selected high value mini-grid deals from Uganda[87]**

Figure 8 presents average DRE deal sizes according to investment type. A key takeaway from this graph is that blended deals (any combination of debt, equity and/or grants) make up the largest deals, instead of any of those investment types alone. The most common type of blended deal identified in Uganda is a combination of debt and grants.

As Figure 9 indicates, deal sizes spiked in 2018 and dropped off from 2019 onwards. 2018 saw a great deal of positive investor sentiment towards PAYGO technologies, while the largest DRE sector, OGS, was affected negatively by the insolvency of one of the largest OGS players, Mobisol. Smaller deal sizes continued from 2020 as a consequence of a general tumultuous investment climate brought on by the COVID 19 pandemic.

4.2 Mini-grids



4.2.1 Overview

By the end of 2022, 48 mini-grids have been operating in Uganda, while another 27 projects are planned for the near-term.[88] 12 private sector players operating in the Ugandan mini-grid sector have been identified as part of this assessment, which indicates that the sector is still relatively small. Uganda does not have ambitious mini-grid targets. The Electricity Connections Policy (ECP) states that only 2% of the 2027 target of 60% electrification is planned to come from mini-grids. This is equal to a total of only approximately 126,000 connections.[89] The ECP does not plan for a further increase in mini-grid connections leading up to universal electrification by 2030.[xv] A separate government document, the third National Development Plan (2020/21 - 2024/25) has set a target of 200 mini-grids.[90] Policy documents aside, there are an estimated 2,700 sites that can be viably powered by mini-grids in Uganda.[91]

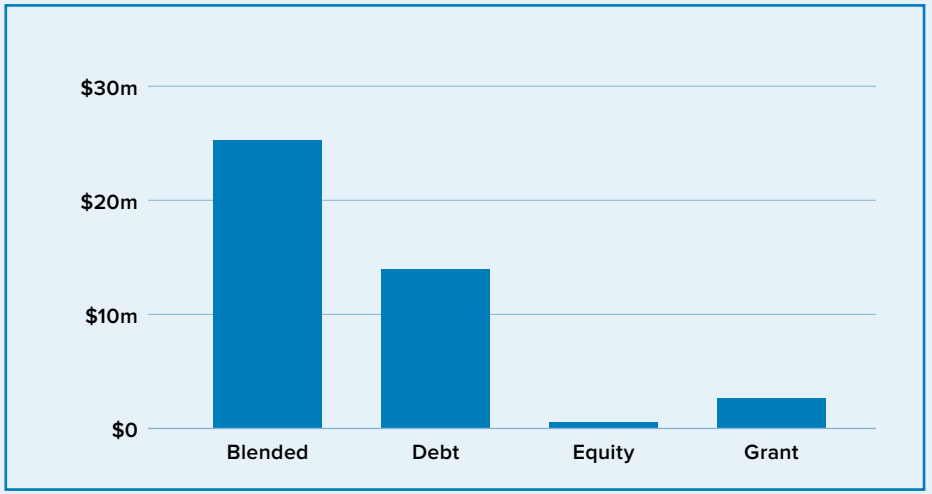


Figure 8: Average DRE deal size per capital type[xvi,92]

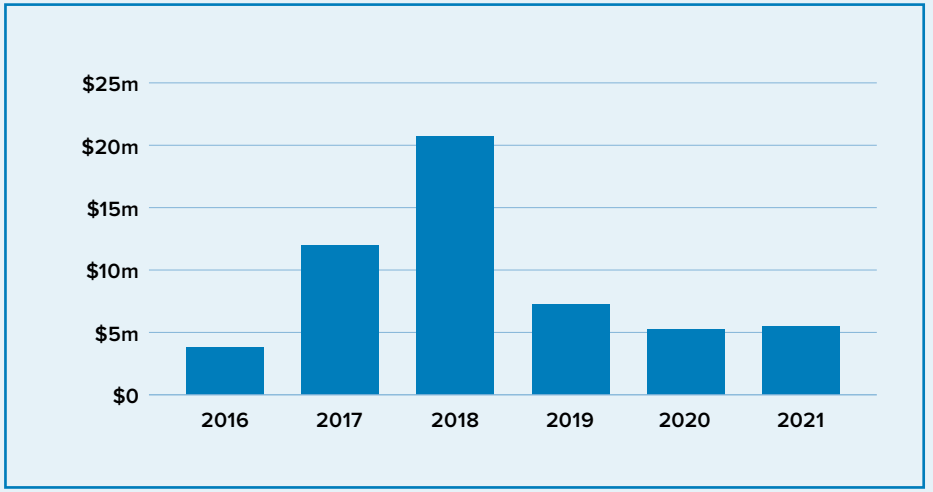


Figure 9: Average deal sizes for DRE transactions in Uganda over time[93]

xv The ECP was suspended in 2020 following exhaustion of funds. Since then, the ECP has been resumed following government commitment to avail funds and the approval of a new World Bank funding programme that has been planned to commence in November 2022. 60% of the funding is expected to be earmarked for the on-grid component managed by REA. 40% is expected to be allocated to off-grid electrification, which is managed by UECCC.
xvi Blended is defined here as any combination of debt, equity and/or grants.

Isolated mini-grid regulations were enacted in 2020 and the market is generally closely regulated. Mini-grids with installed capacities of less than 2 MW are exempt from licensing regulations. This benefit is however often moot due to the requirement to obtain a certificate of exemption, which often takes longer than a year.[94] Tariffs are reviewed by the regulator and are generally only approved if not exceeding $0.30/kWh.[95,96] Interviews with developers in Uganda have indicated that in most cases cost recovery at this tariff is not possible, which in turn weakens the investment case. Mini-grid levelized cost of energy (LCOE) naturally varies widely, but a wide-range estimate for Uganda amounted to between $0.70/kWh and $1.20/kWh in 2020.[97] Global average LCOE across a variety of load factors in 2022 equate to $0.39/kWh.[98]

> *"Tariffs are negotiated on a case by case basis. The further away you are from the cap, the less likely you are to receive a license."*
> **– Manuel Falciatori, Equatorial Power**

4.2.2 Investment trends and financing needs

Grants remain a key funding avenue for mini-grids in Uganda. All deals assessed as part of this research included some proportion of grant funding. This suggests that the mini-grid sector remains unprofitable and will likely remain driven by concessionary capital in the near term. The majority of transactions involved only grant funding with only a handful of transactions having debt and/or equity components. Large deals presented in Table 2 and the Winch Energy portfolio deal (see Box 2 below), however, have been able to attract debt. More debt-based transactions in the future will be an indication of growing market maturity.

Figure 10, on the next page, presents a network map of funders, intermediaries and companies in the Ugandan mini-grid sector. The map shows that a handful of companies – Winch Energy, Equatorial Power, Mandulis Energy and Kalangala Infrastructure Services – have been able to raise funds from a variety of funders and are thus adept at fundraising. The map also indicates that the majority of funders remain concessional and thus confirms the statement that commercial capital has not entered the Ugandan mini-grid market in any meaningful way.

Deal sizes in this sub-sector are small, at an average of $700,000, excluding notable outliers listed in Table 2. These projects involved a combination of hydro and solar hybrid technologies and were led by large established construction firms rather than mini-grid start-ups. Likewise, the projects were financed by large established financiers alongside development banks. The Bugala Island mini-grid is the only identified example of domestic investment in the mini-grid sector. Another notable higher-value deal is the Winch Energy limited recourse loan (see Box 2 below).

Box 2:

Financial aggregation example in Uganda: Winch achieving the largest mini-grid financing portfolio to date

Winch stands out as the only mini-grid start-up in Uganda that has managed to raise debt at scale. The company secured a limited recourse loan for an aggregated portfolio of mini-grid projects across 25 villages in Uganda and 24 villages in Sierra Leone.[99] This project exemplifies the value of aggregation in increasing ticket sizes and ultimately reducing costs. The deal represents the largest mini-grid financing portfolio to date, globally.

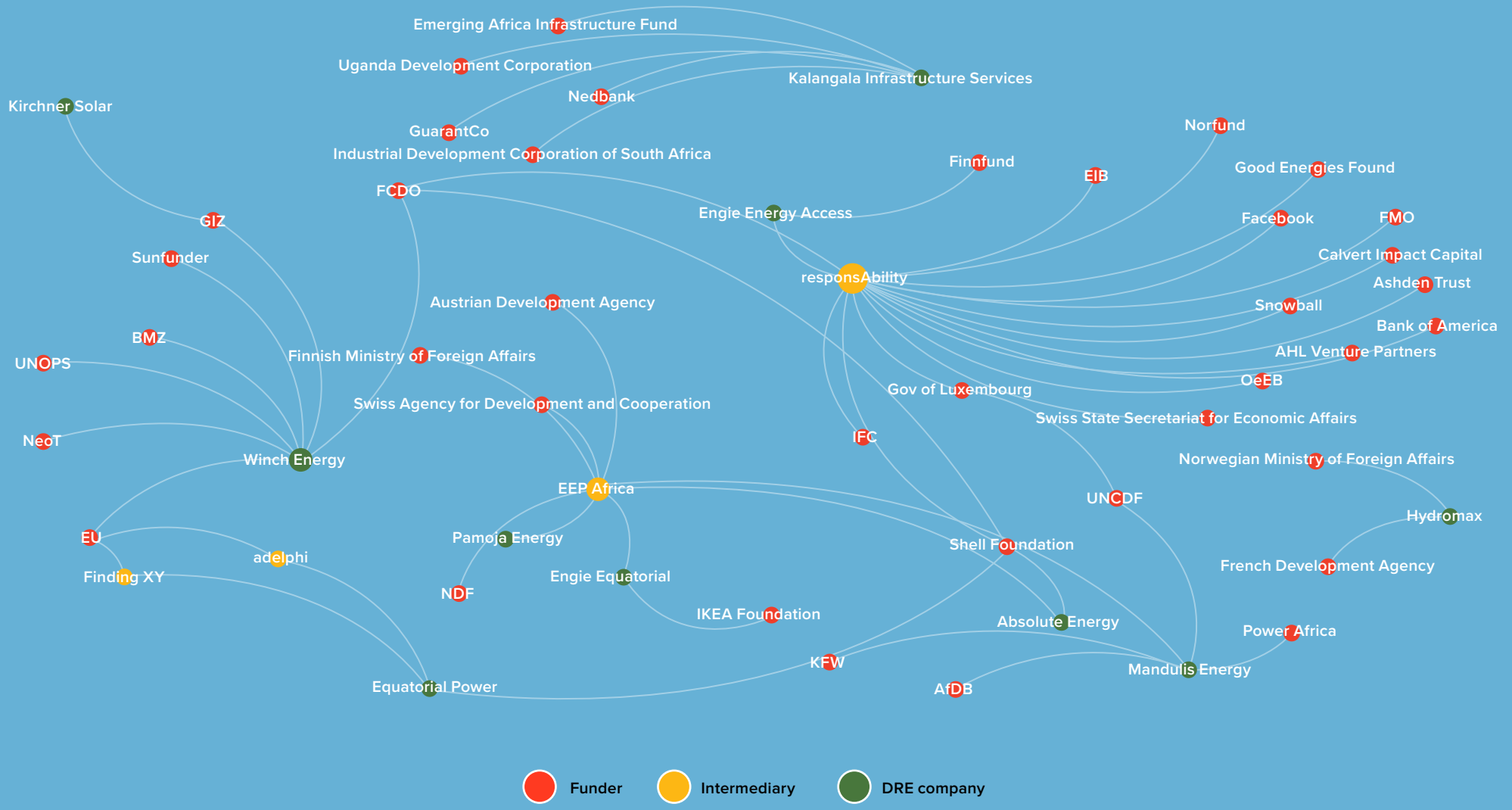
The first $16 million phase will connect more than 6,500 customers in the Lamwo district of Uganda and three districts in Sierra Leone. A further 6,000 portable batteries, charged by solar kiosks, will also be installed to provide electricity beyond the mini-grid catchment area.

The investment comes from Winch Energy Limited in partnership with NEoT Offgrid Africa, which is backed by Meridian, EDF and Mitsubishi Corporation. Together, the Winch Energy and NEoT investment vehicle, Winch independent power producer (IPP) Holdings Limited, expects to expand operations into more countries, with ambitions to reach some $100 million of operating projects in the next 24 months.

Sunfunder is providing a $2 million construction loan, which is included in the $16 million total value of the first phase. Subsidies are provided by the German Development Ministry (BMZ) and European Union in support of the Ugandan projects. Additional support is provided by GIZ in Uganda.

Figure 10:

Funding flows to mini-grid companies in Uganda[100]



4.3 SHS and standalone solar productive use

SHS/SAS					
Market maturity			●		
Taxes					●
Sector Support			●		

4.3.1 Overview

Uganda has developed a successful market for off-grid standalone solar systems, driven by a suite of initiatives and considerable donor support. By February 2022, approximately 3.3 million households and businesses were using solar home systems.[101] 64 companies operating in the OGS sub-sector were identified in Uganda through this assessment (covering solar home systems and standalone solar productive use systems).[102] Companies specialize in either of these technologies or include both in their offerings. There are also a large number of companies operating in both the OGS and captive power markets.

Off-grid companies (mini-grids and OGS) in Uganda raised $52 million in 2021. These investments were however concentrated in a handful of (mostly) multinational OGS companies such as M-KOPA and SunCulture, a trend that continued into 2022.[103] This reflects a common theme across most DRE markets worldwide.

The COVID-19 pandemic severely impacted sales, as total GOGLA-affiliated sales in 2020 decreased significantly compared to 2019 and 2018 (see Figure 11). Post-pandemic recovery is still ongoing – 2021 sales remained below pre-pandemic sales levels. Between January and July 2022, 123,098 SHS and pico-solar products were sold by GOGLA-affiliated companies. Forthcoming data from GOGLA for the second half of 2022 will indicate whether sales have recovered to pre-pandemic levels.

PAYGO, a key requirement for securitization, tends to attract more investment than cash sales. From 2010 to 2018, 91% of global investments into energy access technologies went to companies leveraging PAYGO business models.[104] Yet, its market share has been fluctuating in Uganda and in other countries. In 2020, PAYGO sales accounted for 49% of total sales, down from 65% of total sales in 2019, and 60% of total sales in 2018.[xvii] It is hypothesized that the share of PAYGO is in reality even lower than these figures, as the majority of non-affiliated sales are likely outright sales.

Available data on standalone solar productive use systems is less granular. In 2020, a total of 527 GOGLA-affiliated solar water pumps were sold, which signifies a decrease from 829 units sold in 2019. The first half of 2022 saw 826 solar water pumps sold, which indicates that data on annual sales in 2022 will likely exhibit improved performance compared to previous years.[105] It is not clear how many of these products have been sold using PAYGO business models.

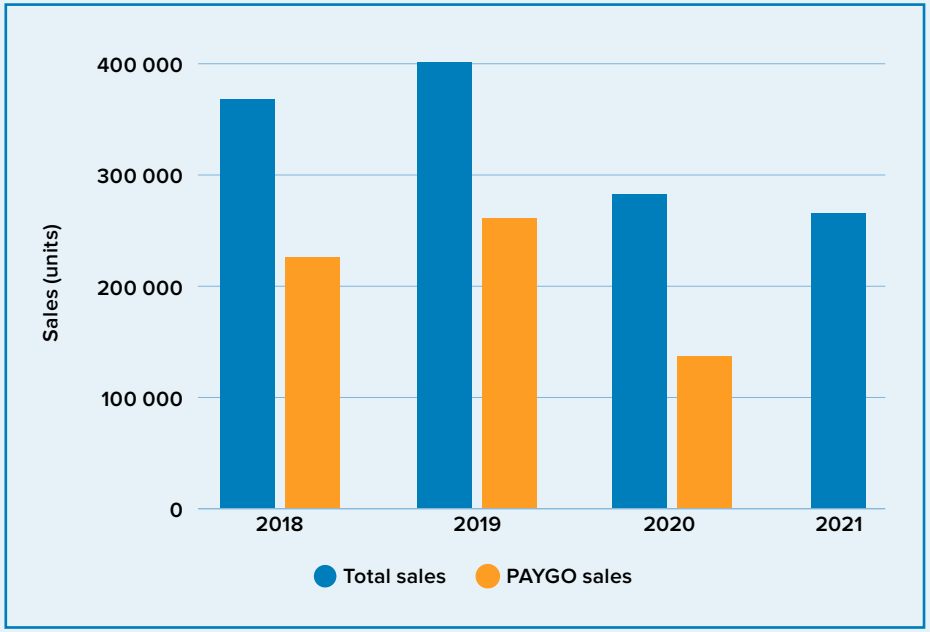


Figure 11: GOGLA-affiliated total sales and PAYGO sales in Uganda[106,107,108,109,110,111,112,113]

xvii GOGLA did not report data on PAYGO sales for 2021 and 2022.

4.3.2 Investment trends and financing needs

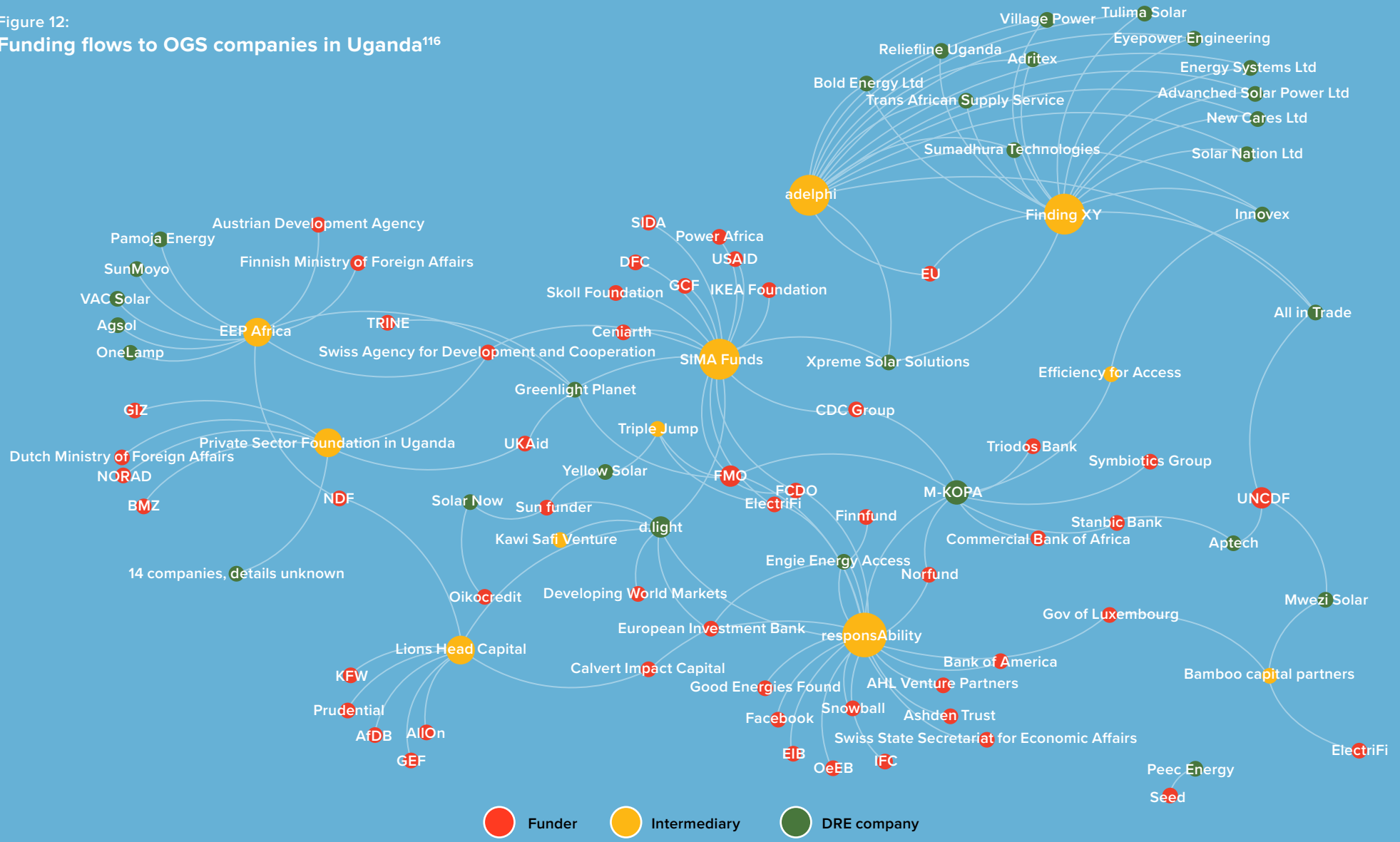
OGS companies in Uganda have been uniquely successful in their ability to raise debt. Between 2013 and 2019, companies operating in Uganda have disclosed $182 million in debt financing raised, with over 70% of this capital being invested in 2017 and 2018 (see Figure 9).[114] The spike in 2017 was the result of one of the largest debt financing deals in the history of the sector – a syndicate of DFIs and a regional bank investing $80 million in M-KOPA to finance their regional operations. Note that these values apply to cross-country operations of companies operating in Uganda.[xviii] Multinationals in Uganda have executed transactions with an average value of $18.4 million, according to the database compiled as part of this study. This average is almost four times higher than that of local businesses who had an average transaction value of $5 million.

Funders have provided both local and hard currency denominated debt, both as individual lenders and as part of syndicates. DFIs and funds have invested 80% of the debt capital in OGS businesses in Uganda to date, with regional and local banks responsible for less than 20%.[115] Figure 12 illustrates funding flows from funders to OGS companies in Uganda, both directly and indirectly via intermediaries.

Photo: Adobe Stock/Stockadrik

xviii Delineating the proportions of funds earmarked for Ugandan operations specifically across all companies has not been conducted in this study.

Figure 12:
Funding flows to OGS companies in Uganda[116]



The map (see Figure 12) shows that a handful of companies – d.light, M-KOPA, Greenlight Planet and Engie Energy Access – have been able to raise funds from a variety of funders and are thus adept at fundraising. The map further indicates that despite some diversity in funder type, concessional funders still dominate the funding landscape – a phenomenon not too dissimilar to the mini-grid case.

The dominance of DFIs and other international funds, while commendable, unfortunately also poses some issues. Firstly, while some of the debt invested by DFIs and funds has been in local currency equivalent facilities (see M-KOPA deal in Box 3), the majority has been invested in hard currency, which creates exposure to foreign exchange risk. Secondly, funds from impact investors and DFIs will not continue indefinitely and there is a need for local commercial banks to lend more to the sector to ensure scale and sustainability. A third issue is that new entrant businesses in Uganda have struggled to access debt, with the majority of the investment going to established businesses. The Uganda Off-Grid Energy Market Accelerator (UOMA) estimates that over 95% of debt investment in the sector to date has gone to established businesses. While many new entrants are still at an early stage and have received grant and equity funding, in order to achieve SDG7 in Uganda these businesses will soon need to raise substantial debt capital – ideally from local or regional banks – in order to scale.

Still, the ability to raise debt at scale and the presence of multiple indigenous players in the market point to a maturing market which is an important precursor for financial aggregation. It also bodes well for achieving the planned government target of 31% of households gaining access to electricity with standalone solar systems, equating to approximately 1.9 million connections.[117]

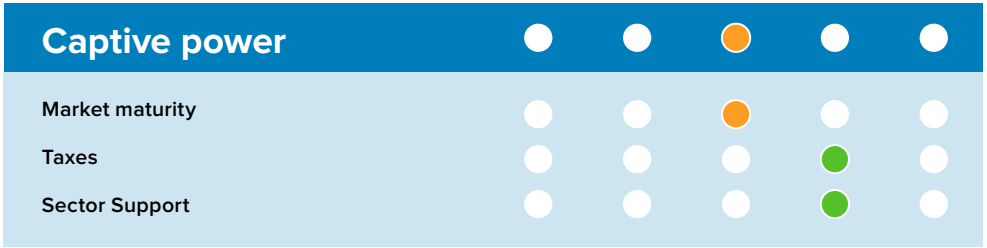
Box 3:

M-KOPA: Success with receivables financing and transitions into new markets

In 2017, M-KOPA secured a $80 million debt facility to expand its PAYGO operations. Stanbic Bank led the round with a $55 million local currency equivalent debt facility. Stanbic was joined by DFIs CDC with $20 million, FMO with $13 million and Norfund with $13 million in USD denominated debt. The DFIs were joined by private sector lenders responsAbility, Symbiotics and Triodos Investment Management who provided an additional $25 million debt facility. What was noteworthy about this deal was that it included a local debt component denominated in Kenyan and Ugandan Shillings and that it was backed by M-KOPA's customer receivables based on mobile money payment plans.[118] Receivables financing in local currency eliminates foreign exchange risk as OGS customer payments are in local currency.

M-KOPA's ability to raise debt at scale has been linked to its diversification into other consumer asset markets beyond SHS and into urban markets. Today the company describes itself as "a connected asset financing platform that offers millions of underbanked customers access to life-enhancing products and services." This anecdotal example demonstrates how diversified OGS businesses have greater growth potential and by extension are better suited for raising capital at scale. M-KOPA are transitioning to other markets to the extent where OGS has only become one of many business lines.

4.4 Captive power



4.4.1 Overview

This study identified 50 suppliers and installers operating in the Ugandan captive power market. A large number of these are local companies. Installations range from less than 100 kW to more than 10 MW, and rely on different sources of energy depending on their use and location. C&I users comprise most of the captive power installations and include farming operations of various sizes, office blocks and larger sugar processing plants. As of January 2023, total installed capacity of solar installations for C&I facilities stood at 7.92 MW.[119,xix] Commercial facilities are estimated to account for 90% of capacity and industrial facilities 10%.[120]

The regulatory environment for captive power systems is largely unclear and fragmented.[xx] No specific regulations govern the sector, which means that self-generators need to comply with the high-level 1999 Electricity Act and the recently passed isolated mini-grid regulations where relevant. There are, however, regulations that allow for the wheeling of electricity by licensed generators, in addition to a renewable energy feed-in tariff (REFIT) scheme.[121] Feed-in tariffs only apply to IPP projects that operate under the Global Energy Transfer Feed-in Tariff (GET FiT) scheme on a Power Purchase Agreement (PPA).[122] Uganda is one of only about 14 countries on the continent that have successfully implemented feed-in tariffs.[123] It is hoped that the experience gained through the GET FiT scheme will create impetus for the development of a dynamic grid-tied captive power market.

There is vast potential for future growth as captive power systems have a critically important role to play in Uganda, both in grid-connected settings and off-grid settings. More than 30% of households in Uganda report never having electricity services despite being connected to the grid.[124] Residential customers pay on average $0.18/kWh (excluding lifeline tariffs), commercial customers $0.17/kWh and industrial customers $0.10/kWh.[125] These tariffs are among the highest in East Africa (see Figure 13 below). In addition, the residential and commercial tariffs are higher than the estimated levelized cost of electricity (LCOE) of grid-connected solar captive power systems in Uganda, which can range from $0.06/kWh to $0.14/kWh.[126,127] Captive power systems can therefore play an important role in ensuring reliable electricity supply for grid-connected customers and also reduce energy bills.

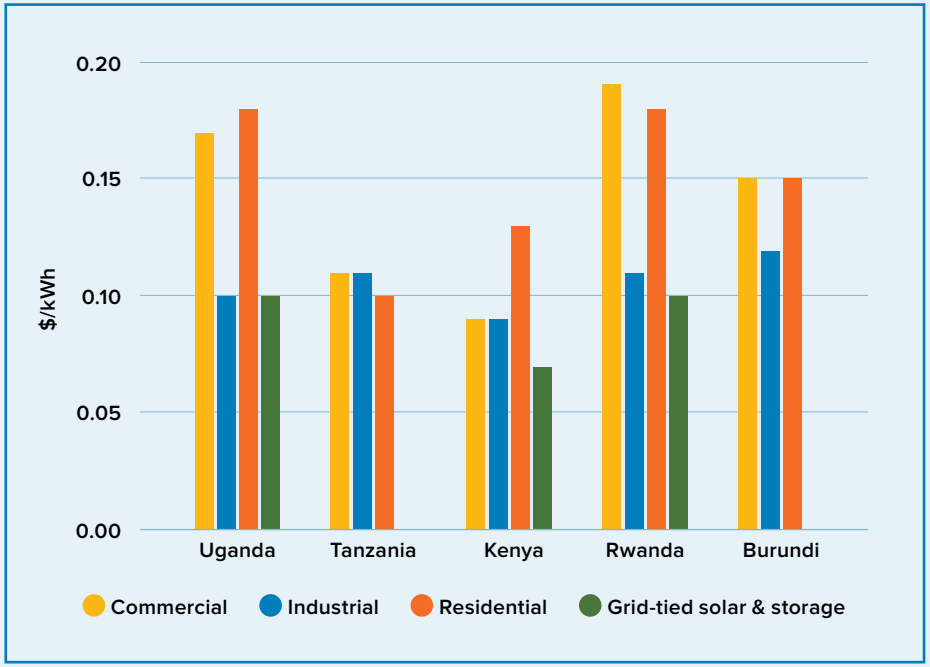


Figure 13: Uganda grid tariffs compared to regional tariffs and grid-tied captive power[128,129,130,131,132,133]

xix Note that this installed capacity only refers to C&I solar. It excludes other forms of captive power.
xx A net metering code for Uganda is currently under development.

4.4.2 Investment trends and financing needs

61% of C&I solar projects in Uganda are sold through rent-to-own models, 1% through PPAs and 38% are sold outright to the customer.[134] Rent-to-own and PPA-based systems are mainly financed through impact-focused funders, with limited participation from commercial banks. Ticket size and collateral mismatch, unclear regulations and limited knowledge of how to assess DRE deals are the main reasons for local commercial banks' limited participation in the captive power market.[135]

Both types of financial aggregation considered in this report (securitization of receivables and project aggregation) are relevant to the captive power sector. Firstly, a number of captive power companies expressed interest in using rent-to-own and PPA models more frequently but noted that financing required for these business models is difficult to access. This is a key reason for the low number of systems that are operated through PPA models. There is a consensus among interviewees that securitization of receivables can be useful for financing rent-to-own and PPA models. Such an approach would provide immediate access to cash flows that would otherwise be spread over the duration of PPA/lease contracts which typically stretch over 5-20 years in Uganda.[136] This can free up capital for operators which can be redeployed and greatly improve the status quo of captive power financing.

Secondly, the average value of identified transactions in the captive power sector is notably smaller than that of the SHS and mini-grid sectors. This is because the average deal size that captive power companies can currently absorb is relatively small. Kenyan companies, for example, typically do not have working capital needs exceeding $1 million,[137] and it is highly likely that the same applies to Ugandan companies. Investors generally avoid funding small capital needs as due diligence costs tend to be fixed, irrespective of potential returns involved, and are therefore high relative to the total deal size. It follows that investors are more interested in larger projects where transaction costs like due diligence account for a smaller proportion of total project costs. **This observation adds impetus for an aggregation facility that pools projects and borrows at the portfolio level, and investment transactions costs can therefore be spread across several smaller projects.**

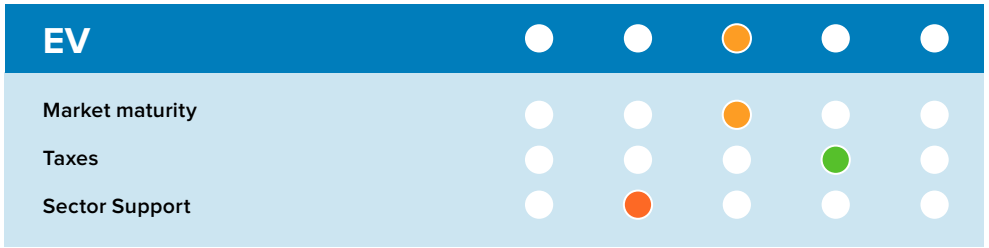
Development organizations such as the United Nations Capital Development Fund (UNCDF) have been working on activating the local captive power market as evidenced in the case study below (see Box 4). Beyond this example, there is no other evidence of local development or commercial bank participation.

Box 4:

Pan African Bank Stanbic providing debt to Aptech for productive use of power appliances

Aptech is a Ugandan renewable energy company that distributes, installs and maintains solar water pumps and captive power systems for diverse applications. In 2018, UNCDF through its LDC Investment Platform provided a $250,000 loan to Aptech as a working capital facility for inventory financing. At the time, insufficient collateral in the eyes of traditional lenders and limited track record proved to be barriers for Aptech's efforts to raise growth finance from traditional lenders. UNCDF acted as an external lender to Aptech with an unsecured 2-year term loan. In 2019, following Aptech's timely repayment of four instalments to UNCDF, Stanbic Bank offered Aptech a $800,000 loan, which included invoice discounting ($550,000), bid guarantees ($100,000) and an import loan ($150,000). This was a success as UNCDF's intervention sequentially achieved a 3.2x leverage.[138]

4.5 Electric vehicles



4.5.1 Overview

While very promising, the e-mobility sector is still nascent in Uganda. Initial signs of ramp-up are however starting to surface. A majority state-owned company, Kiira Motors, built the continent's first electric-powered bus. Five other companies have also set up shop. These are local privately-owned companies Zembo, Modjo Energies, ASOBO, Feying Electric Vehicles and

Bodawerk. Electric motorcycles are the most common electric vehicle (EV) type in Uganda, followed by electric bicycles and three-wheelers.

The Kampala Capital City Authority is prioritising the development of EV charging infrastructure, and is working on setting 2030 targets for EV deployment.[139] The presidency of Uganda has voiced its support for the transition to EVs multiple times and the government is now planning to publish a policy document on e-mobility alongside a wide array of incentives. These are likely to include industrial tariffs for EV charging (currently set at $0.10/kWh), reduced/removed import taxes and VAT on EV components and rent-free land for battery swap stations and charging facilities.[140] By Q3 2022, a policy draft was due to be handed over to the presidency.[141]

At the moment, the market in Uganda is mainly constrained by a lack of infrastructure (charging stations, underdeveloped road networks and limited local assembly capacity) and an underdeveloped supply side. Indeed, first mover companies must often operate a vertically integrated model due to the lack of ancillary services offered by specialist service providers. The Renewable Energy and Energy Efficiency Programme of GIZ, in partnership with Zembo and the Powering Renewable Energy Opportunities programme is addressing infrastructural issues by installing charging stations, four of which have been successfully installed on the Kampala-Masaka highway.[142]

Consistent with the global EV market, the sector in Uganda holds considerable potential. There are an estimated 750,000 petrol-powered motorcycle taxis (boda-bodas) in Uganda,[143] which signifies a large addressable market for converting petrol engines to electric, or replacing them with new electric-powered motorcycles. Yet, as of 2021, there were only an estimated 500 electric motorcycles in the country.[144]

Table 3 shows the variety of EV uses and business models employed in Uganda and across Africa more generally – these apply to a variety of technologies (e.g., electric vehicles, electric motorcycles or bicycles, electric boats, etc.). These can be further delineated by inter and intracity, by rural and urban focus and by charging and battery swapping technologies. The wide array of business models in use represents a challenge for financial aggregation, which requires uniform and standardized receivables as a basis for transparency and modelling. As the sector matures and grows, there will likely be a convergence towards the most promising business models as observed in other sectors. This convergence is required to improve the viability of financial aggregation in this sub-sector.

BUSINESS MODEL / USE	Lease to own	Mobility as a service	Outright sale
Logistics (Delivery of goods)	X	X	X
Taxi service	X	X	X
Personal transport	X	X	X

Table 3: EV uses and business models

4.5.2 Investment trends and financing needs

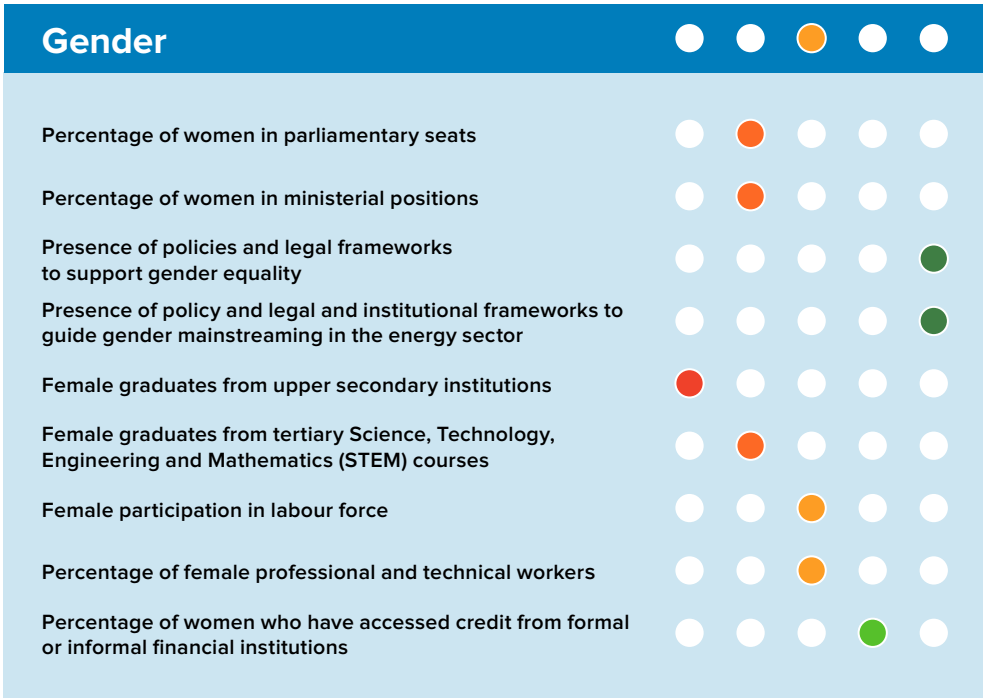
To date, only a handful of equity investments have been made by venture capital investors in the EV sector, with no debt disbursed to date (see Box 5 below for an equity investment example). Debt financing will be necessary to enable the growth of this sector, which is particularly capital intensive. It is likely, however, that debt will only become a standard funding route for EV companies once they can generate sufficient cash flows to service this debt. This is not only the case in Uganda but across EV sectors in developing markets worldwide.

Box 5:
Zembo equity fundraising round

Zembo is a French startup founded in 2018 that sells electric motorcycles through a lease-to-own scheme in Uganda. It also operates the associated network of solar charging and battery swapping stations in the country. In late 2021, Mobility 54 Investment SAS, a corporate venture capital subsidiary of Toyota Tsusho Corporation and CFAO group, DOB Equity and InfraCo Africa invested $3.4 million (€3 million) in equity to acquire a stake in Zembo to help it grow its business.[145]

4.6 Applying a gender lens to DRE and financial aggregation

Uganda gender score on CAP market assessment framework:



Uganda has made significant progress in terms of legal frameworks for gender equality. The Equal Opportunities Commission Act of 2007 created the legal framework for the establishment of the Equal Opportunities Commission, which has a mandate of ensuring that all laws, policies and programmes in Uganda are compliant with equal opportunity and affirmative action requirements on the basis of gender, race, tribe, religion and others.[146] 75% of legal frameworks promote, enforce or monitor gender equality with a focus on violence against women.[147]

Women comprise nearly 40% of business owners in Uganda and also fare relatively well in terms of financial inclusion: In 2019/2020, 49% of Ugandan women had access to some form of financial service, compared to 57% of Ugandan men.[148] Reducing women's barriers to accessing financial services is one of the key priority areas in Uganda's 2017-2022 National Financial Inclusion Strategy.[149] Despite these impressive numbers, Ugandan women tend to be excluded from the most productive sectors of the economy, operating predominantly in less lucrative and vulnerable sectors. A World Bank study from 2019 showed that women-owned enterprises in Uganda generate 30% lower profits than their male counterparts, have 50% less capital and are 37% less likely to have introduced a new product over the previous 12 months compared to men.[150]

4.6.1 Gender issues in the energy sector

Women's representation in the energy sector remains low and the same is true for low carbon sectors. This is mainly a result of a limited number of women graduating from STEM courses, women's limited access to larger finance and socio-cultural gender norms which sees technical sectors as inherently 'male'. Women are however making inroads into the management of the energy sector with an increasing number of women taking up positions in the higher echelons of Uganda's governing institutions.[151] For example, the heads of REA and the Electricity Regulatory Authority (ERA), the Minister and Permanent Secretary of MEMD and the Managing Director of the UECCC are all female.[152] More women in decision making positions in the energy sector ministries and agencies will facilitate a more enabling environment for women in the low carbon sectors.

As noted in Energia's Gender & Energy brief on Uganda from 2020, gender disaggregated data from private companies in the energy sector is not readily available and the same is true for the low carbon sectors.[153] A report by the Africa Clean Energy Technical Assistance Facility on Women in Solar Energy from 2021 notes that men hold around 60% of positions in the energy sector and tend to have higher positions as owners or top management. Women tend to be more located in middle management and sales. Out of 200 renewable energy companies in Uganda, the study found only three female chief executive officers.[154] Of all companies interviewed for this research, only one company was fully owned by a woman.

4.6.2 Addressing gender mainstreaming barriers

Because gender, unlike other social status characteristics, operates across all levels of engagement, from the internalized attitudes that women have of themselves, to attitudes within the household and in society at large, any initiative or policy aimed at enhancing women's active and meaningful participation in the sector needs to proactively seek to shift gender dynamics in order to see actual transformative change. In other words, structural enabling and inhibiting factors to gender equality need to be considered at all levels to create an enabling environment for female energy entrepreneurs. This includes both shifts in energy and entrepreneurship policies and the implementation of affirmative actions, as well as shifts in mindsets at the individual and household level to promote shifts in the restrictive gender norms that are holding women back.

4.6.3 Gender mainstreaming action points for financial aggregation in the DRE sector

Build more enabling environments for women within DRE enterprises:

- Implement gender quotas within DRE enterprises to encourage employment of women;
- Raise awareness using female role models in technical and leadership roles;
- Train entrepreneurs on the business case for employing women and train female entrepreneurs;
- Carry out in-house training on gender awareness for both male and female staff in energy enterprises;
- Implement programmes to support a gender inclusive environment, for example human resources policies that go beyond basic regulatory requirements such as provision of childcare or flexible working hours;
- Apply a gender lens in after-sales service to ensure both female and male end-users remain satisfied;
- Use gender scoring tools for companies to assess the level of their gender equity, for example the *ICRW Gender Scoring Tool*.


Photo: UNDP Uganda

Build a more enabling institutional environment for women:

- Identify alternative ways to provide guarantees/collateral for loans that are accessible to women;
- Deploy subsidies for female-owned low carbon enterprises;
- Design strong gender policies for financial institutions to guide institutions in ensuring equity and financial inclusion;
- Design strong gender policies specifically for the energy sector, including the low carbon sectors institutions, to guide gender mainstreaming;
- Recommend gender screening for investors to ensure gender smart investment, for example: *British International Investment Gender Toolkit*.

5 Quantifying the market opportunity for financial aggregation

Photo: Adobe Stock/Lightfield Studios

In an effort to estimate the market opportunity for DRE financial aggregation in Uganda, we present the total estimated financial aggregation investment opportunity for mini-grids, OGS and captive power in Uganda.[xxi] Two scenarios, the conservative scenario and ambitious scenario, are modelled across three different time frames; base case (2022), mid-term (2025) and long term (2030). Market size is determined by assessing the estimated total annual cash flows generated by each of these sectors in 2022, 2025 and 2030. These cash flows represent all DRE revenues that can be aggregated in theory. The base case market size is derived from historic market performance in 2022 and as such the aggregatable market size in this time frame is uniform across the two scenarios. Conversely, the market size in the mid-term and long-term time frames differ vastly between the two scenarios as the sections below explain.

Note that this market size quantification assumes that DRE cash flows are used to pay off debt secured to develop projects (in the case of mini-grids and captive power) or to buy or manufacture stock and incur related upfront expenses (in the case of OGS). Yet, in cases where equity or grants are used to finance upfront expenditure, the methodology to quantify the market size would be different. In such cases, the value of upfront expenditure would be the suitable metric. We note, however, that this report considers financial aggregation as debt secured against future asset cash flows and that this is also the funding direction that the sector should increasingly take. It is for these reasons that annual cash flows generated by DRE assets is the most suitable metric of future financial aggregation market value.

5.1 Ambitious scenario

This scenario is ambitious as it considers that government-set targets for OGS and mini-grids are successfully reached in the long term and that progress is well on track by 2025. Long term electrification targets tend to be ambitious and aspirational, especially compared to current progress. This is true in Uganda as well as other markets. It follows that the market size illustrated in this scenario is considered as the upper-most bound.

The total annual DRE aggregatable asset base across the assessed subsectors in the ambitious scenario is $25.9 million in the baseline period (2022) (see Appendix C for methodology followed in calculating each DRE subsector's aggregation market size). Assuming the best-case scenario (full coordination and sufficient standardization between DRE companies, a sufficiently developed capital market and a pipeline that grows consistent with expectations), the total aggregatable asset base could grow to $135 million per annum by 2025 and $373.4 million by 2030. Naturally these estimations are based on a number of assumptions[xxii] and as a consequence the results can only be used as a high-level opportunity assessment. The estimates include the value of all DRE assets that could possibly be aggregated in theory. Yet, in reality the aggregatable asset base is likely to be smaller due to practical constraints impeding the precursors for the best-case scenario from being realized.

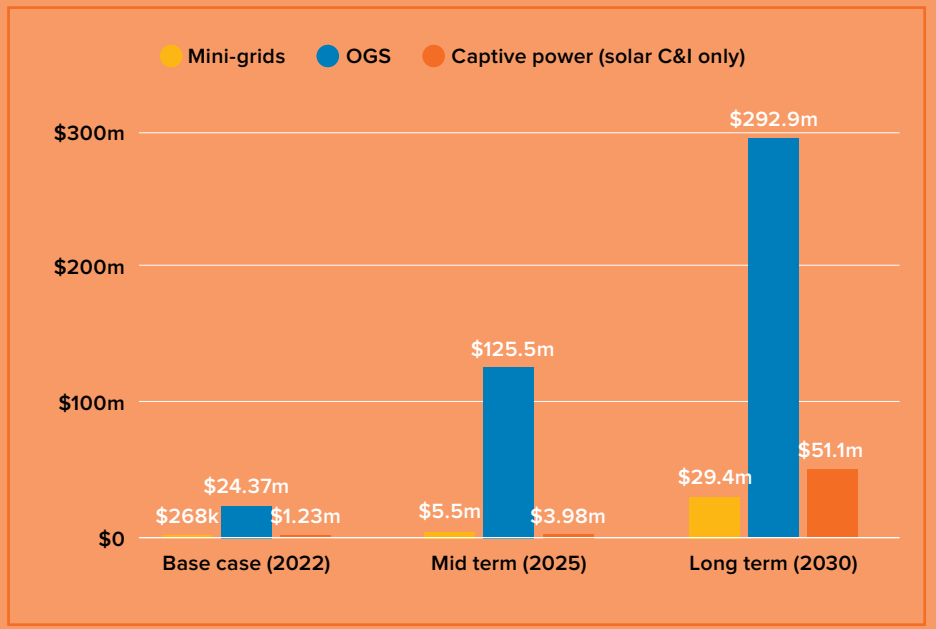


Figure 14: Estimated annual aggregatable revenue per DRE technology in Uganda (ambitious scenario)[155]

xxi The EV market is the most nascent of all DRE industries studied in this report and there is very little data to base any projections on. As a result, the projected aggregatable revenue base has not been quantified.
xxii Assumptions provided in Appendix C.

5.1.1 Mini-grids – ambitious scenario

Our results indicate that the Ugandan mini-grid market currently only has a total annual aggregatable revenue base of $268,000. This is estimated to increase under the ambitious scenario to $5.5 million by 2025 and $29.4 million by 2030. The calculation takes into consideration the estimated number of mini-grid connections in each time period and the average revenue per user (ARPU). It assumes that progress towards reaching the 2027 ECP target of 126,078 connections is on track in 2025 and that the 2,700 sites set out in the draft national electrification strategy will be operational by 2030.

Translating into practical terms, this ambitious scenario suggests that by 2025 there would be 756 operational mini-grids, assuming 100 connections per mini-grid. This is equal to 30 portfolios of 25 mini-grids each. Each portfolio would be worth $3.6 million, which is the total aggregated revenue potential of 25 mini-grids stretched over 20 years. If the 2030 target of 2,700 mini-grids is to be reached, this would require the addition of 1944 more mini-grids. This is equal to approximately 78 portfolios of approximately 25 mini-grids each. Each portfolio would be worth $5.4 million.

5.1.2 Off-grid solar – ambitious scenario

The aggregation potential for OGS is orders of magnitude larger than other DRE markets, due to its existing relative maturity. Baseline annual aggregatable revenue is estimated to be $24.4 million based on estimated GOGLA-affiliated PAYGO sales for 2022. The medium-term annual aggregatable revenue base is $125.5 million. This assumes that progress towards the total number of standalone solar connections as stated in the ECP (1.95 million connections) is well on track by 2025 and it assumes that 58% of all OGS solar connections are PAYGO-based. Assuming that all connections as stated in the ECP is attained by 2030 and maintaining a 58% PAYGO share, annual aggregatable revenue by 2030 amounts to $293 million.

5.1.3 Captive power – ambitious scenario

Our projections indicate a comparatively small market opportunity for aggregation in the captive power market in the short- and medium-term, acknowledging that only C&I solar systems have been considered.[xxiv] Our calculations indicate baseline annual aggregatable customer receivables with a value of $1.2 million. This is estimated to grow to $4 million per annum by 2025, followed by a significant ramp-up to $51.1 million by 2030. Projected cash flows in 2025 and 2030 are not based on any government-set targets (as is the case with mini-grid and OGS estimations). Given that Uganda has no targets for captive power systems in place, projections have been calculated by applying the current compound annual growth rate (CAGR) for the Ugandan solar C&I sub-sector to the existing installed capacity of 7.92 MW. The ambitious scenario considers, optimistically, that the sector's historic 5-year CAGR of 62.45% continues year-on-year up to 2030.[xxv]

Translating into practical terms, assuming that the average size per project is 100kW in 2025, the ambitious scenario suggests that by 2025 there would be 146 C&I solar projects operating on an energy-as-a-service model.[xxvi] This is equal to 10 portfolios of just under 15 projects each. Each portfolio would be worth $8.2 million, which is the total aggregated revenue potential of 15 projects stretched over 20 years. If the projected ramp-up in projects does occur between 2025 and 2030, there would be an additional 1,036 projects operating on energy-as-a-service models by 2030 (with an increased average capacity of 150kW). This is equal to approximately 69 portfolios of 15 projects each. Each portfolio would be worth $13 million.

xxiv Data on current country-wide installed capacity of all captive power technologies (e.g. standalone hydro, bagasse cogeneration etc.) in Uganda is unavailable.
xxv See Appendix C for details.
xxvi 100kW was selected as a suitable average project size in 2025 as it would be an approximate doubling of current average capacity per project in Uganda. By 2021 there were 89 operational C&I solar projects in Uganda (all types). See more at: Magala, J., Essien, J., Sembatya, E., Bhamidipati, P.L. & Pedersen, M.B., Captive solar pv market – Insights from Uganda, 2022 (link)

5.2 Conservative scenario

The conservative scenario does not consider any government-set targets, leading to a significantly smaller estimated aggregatable market size in the future. This scenario is also arguably more realistic considering the large gaps that exist between current market penetration and future targets. It is unlikely that the market will reach the targets set out by the government considering current growth rates.

The total annual DRE aggregatable asset base across assessed sectors in the conservative scenario is the same as the ambitious scenario in the baseline period: $25.9 million. Assuming the best-case scenario (full coordination and sufficient standardization between DRE companies, a sufficiently developed capital market and a pipeline that grows consistent with expectations), the total aggregatable asset base could grow to $49 million per annum by 2025 and $141.8 million by 2030. As is the case with the ambitious scenario, these estimations are based on a number of assumptions[xxvii] and as a consequence the results can only be used as a high-level opportunity assessment. These estimates also include the value of all DRE assets that could possibly be aggregated in theory. Thus, while this scenario aims to be more conservative, it is still likely that the aggregatable asset base will in reality be smaller due to practical constraints impeding the precursors for the best-case scenario from being realized.

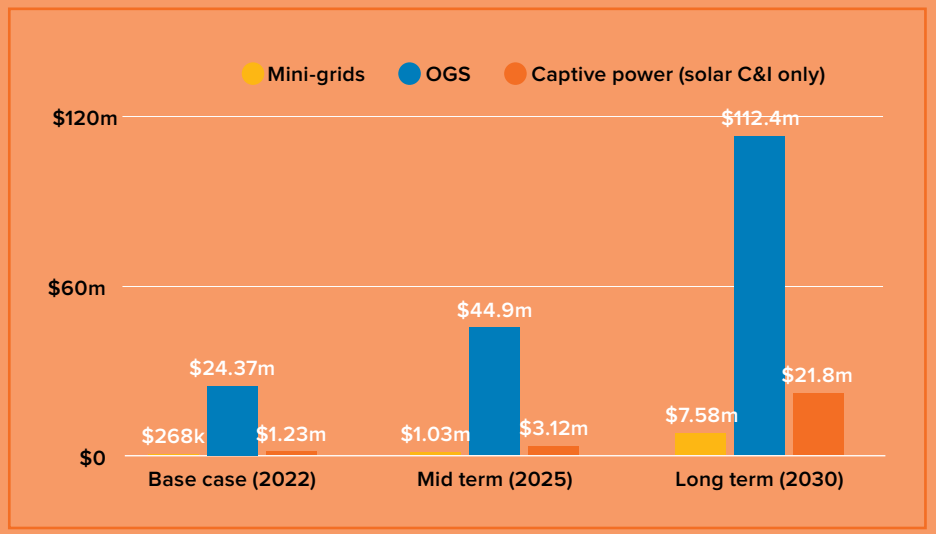


Figure 15: Estimated annual aggregatable revenue per DRE technology in Uganda (conservative scenario)[156]

5.2.1 Mini-grids – conservative scenario

The current total annual aggregatable mini-grid revenue base of $268,000 is estimated to increase under the conservative scenario to $1 million by 2025 and $7.6 million by 2030. The calculation assumes that the current asset base (48 operational mini-grids) increases to 75 mini-grids (as per near-term projections),[157] after which growth continues at a similar rate at which mini-grids have grown from 2020 to 2022.

Translating into practical terms, the conservative scenario suggests that by 2025 there would be 142 operational mini-grids. This is equal to just over 5 portfolios of 25 mini-grids each. Each portfolio would be worth $3.6 million, which is the total aggregated revenue potential of 25 mini-grids stretched over 20 years. If the same growth rate continues up to 2030, there would be 555 more mini-grids operating in 2030. This is equal to approximately 22 portfolios of 25 mini-grids each. Each portfolio would be worth $5.4 million.

5.2.2 Off-grid solar – conservative scenario

The aggregation potential for OGS in the conservative scenario remains orders of magnitude larger than other DRE markets due to its existing relative maturity. Baseline annual aggregatable revenue of $24.4 million is estimated to grow to $44.9 million by 2025 and $112.4 million by 2030. Under this scenario, we estimate a year-on-year growth rate of 12.3% in PAYGO connections up to 2030. We assume that the current share of PAYGO units in total units (58%) will remain intact up to 2030.[xxviii]

xxvii Assumptions provided in Appendix C.
xxviii TFE analysis. See Appendix C for details.

5.2.3 Captive power – conservative scenario

The market opportunity for aggregation in the captive power market remains comparatively small in the near- and mid-term in the conservative scenario. This scenario also only considers C&I solar systems. Baseline annual aggregatable customer receivables of $1.2 million is estimated to grow to $3.1 million per annum by 2025 following a significant ramp-up to $21.8 million by 2030. As is the case under the ambitious scenario, projected cash flows in 2025 and 2030 are not based on any government-set targets. Under the conservative scenario, the Ugandan C&I solar CAGR of 62.45% has been adjusted downwards to 43.88%. Projections have been calculated by applying the adjusted CAGR to the existing installed capacity of 7.92 MW. The conservative scenario assumes that this CAGR continues year-on-year up to 2030.[xxix]

Translating into practical terms, assuming that the average size per project is 100kW in 2025, the conservative scenario suggests that by 2025 there would be 114 C&I solar projects operating on an energy-as-a-service model.[xxx] This is equal to 8 portfolios of just under 15 projects each. Each portfolio would be worth $8.2 million, which is the total aggregated revenue potential of 15 projects stretched over 20 years. If the projected ramp-up in projects does occur between 2025 and 2030, there would be an additional 391 projects operating on energy-as-a-service models by 2030 (with an increased average capacity of 150kW). This is equal to approximately 26 portfolios of 15 projects each. Each portfolio would be worth $13 million.

xxix See Appendix C for details.
xxx 100kW was selected as a suitable average project size in 2025 as it would be an approximate doubling of current average capacity per project in Uganda. By 2021 there were 89 operational C&I solar projects in Uganda (all types). See more at: Magala, J. et al., Captive solar pv market – Insights from Uganda, 2022 (link)

Box 6:

A note on the market potential of EV financial aggregation

The projected aggregatable revenue base from the EV segment cannot be quantified due to a lack of data. The Ugandan government has not yet set any targets for electric mobility and it is currently not possible to estimate the share of PAYGO business models versus outright sales.

It is useful to note, however, that as of 2020, there were 2.3 million motor vehicles on Uganda's roads.[158] The automotive sector across the continent is projected to grow at a CAGR of 5.55%[159] and Uganda will likely aim to increase the share of EVs in annual vehicle sales. Most ambitious targets would be 22% of vehicle sales by 2030 and 35% of sales by 2040, in line with the Paris Agreement. As a result, the theoretical addressable market could be substantial.

Photo: Adobe Stock/Dennis

6 Looking ahead: Aggregation transactions in Uganda

Photo: Adobe Stock/Alfotokunst

6.1 Barriers

DRE financial aggregation in Uganda faces a number of barriers. Some of these are more general barriers that manifest across countries while others are specific to the Ugandan context.

6.1.1 General barriers

Commercial investors perceive DRE investments as high risk. Financial aggregation instruments can only reduce overall risk to a limited extent, which necessitates additional risk mitigation measures: It is well known that DRE investments carry high systemic and non-systemic risk. The creditworthiness of end-customers, especially energy access customers, can be questionable, DRE companies often lack the necessary infrastructure to run efficient operations, macroeconomic conditions remain challenging and DRE operations tend to be exposed to negative regulatory shifts. While financial aggregation can isolate these risks and in turn reduce risk overall, there is still substantial risk that remains. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

The current DRE asset base is too small to warrant financial aggregation: Aggregation deals should at the very least be $10 million to account for costs. This is the lower end of the spectrum – where costs are cut using securitization structures that are not fully off-balance sheet. A high proportion of concessional capital in the capital stack can also enable deal sizes on the lower end of the spectrum as these investors' minimum required ticket sizes tend to be smaller. However, if fully off-balance sheet structures are to be used and a larger proportion of commercial investors are to invest, deal sizes should preferably be higher – from $50 million to $100 million and upward. Uganda's current total estimated aggregatable DRE asset base is worth $25.9 million per annum,[xxxi] which means that the current asset base is insufficient to warrant financial aggregation at scale. The small asset base and future pipeline are underpinned by a series of related supply-side barriers, as Figure 16 indicates. Each of these barriers as well as other unrelated barriers are discussed in the remainder of this section.

> *"At times, projects have to be aggregated across multiple developers to create portfolios that meet threshold investment sizes of larger investors."*
> **– Piyush Mathur, Odyssey Energy Solutions**

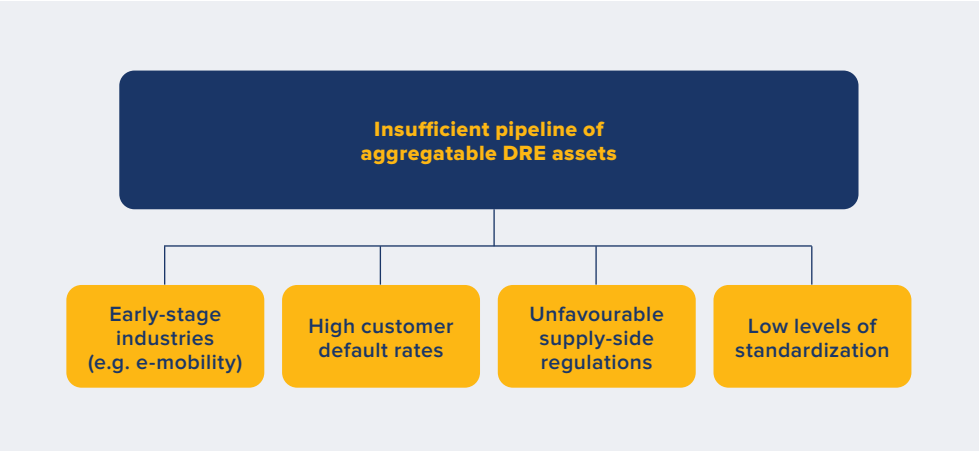


Figure 16: **Linkages between supply-side barriers**[160]

High cost of setting up and operating off-balance sheet securitization structures: Our research into past off-balance sheet securitization transactions indicates that the transaction costs of setting up these deals vary widely, from approximately $250,000 to $2 million. In order to cover these costs, running costs and to account for investment returns, off-balance sheet securitization deals should be $10 million at the very least, but ideally significantly larger. While there might be sufficient assets to aggregate across countries to meet these deal sizes, it is the general perception of the market that Uganda alone does not have enough assets on the ground or in the near-term pipeline to meet them. This is certainly the case for facilities that only aggregate assets from a single originator. Multi-originator aggregation can, however, enable such portfolio sizes in the best-case scenario in select DRE industries.

xxxi Note that this value accounts for all DRE assets that could possibly be aggregated in theory. In reality the aggregatable asset base is likely to be smaller due to practical limitations such as coordination between originators of DRE assets. An asset is regarded as aggregatable if there are future payments associated with it. An asset that is sold outright is, for example, not aggregatable, while assets monetized through PPAs, PAYGO or other energy-as-a-service models are regarded as aggregatable.

> *Full scale securitization needs to be an 8-figure USD transaction just to justify all the costs. But this can only work when the sector is mature. It can be a great way of ensuring regular access to capital in a capital-intensive industry, such as this one.*
> **– Avi Jacobson, Sunfunder**

Lack of data: DRE is perceived as a risky sector from an investment perspective, but there are a number of other industries that are equally risky, yet they are still able to successfully attract the requisite investment levels. One key differentiating factor is data to showcase a track record and better understand and assess risk. The paucity of data in DRE sectors in sub-Saharan Africa is well documented but the challenge remains pervasive on the ground. This can be attributed, in part, to the sector's relative youth. The average DRE company, including the most established market leaders, have only been operating for a few years. As such, many lack the historical customer data needed to make future projections. It is also worth noting that off-the-shelf digital data collection and management systems have only entered the market over the past few years. Many young and growing companies also have to juggle between pursuing sales pipelines and reinvesting in data management infrastructure. Overlooking the latter often results in self-reported and unregulated data, which jeopardizes fundraising efforts.[161]

Low levels of standardization: Standardization is a key enabler of aggregation as it reduces the cost and time required to conduct necessary due diligence research.[xxxii] There needs to be a minimum level of homogeneity between assets if they are to be aggregated together into portfolios. However, achieving this homogeneity is a challenging endeavour as the DRE industry consists of a diverse set of products and services, from standalone OGS systems to C&I solar energy-as-a-service packages. Most DRE technologies are vastly different from each other in their technical make up, deployment approaches and business models.

Consequently, aggregation of assets across DRE sectors is challenging. Conversely, aggregation within single DRE sectors is more achievable in theory, as there is comparatively less variability between assets. In practice, however, even within a given sector, there tends to be substantial variation between companies.

The lack of cross-company standardization within the same DRE industry is a critical challenge that needs to be addressed if aggregation of assets across companies is to be achieved. While some companies are mature enough to aggregate their own assets into viable portfolios, most will only be able to participate in aggregation facilities if their portfolios are aggregated together with portfolios of other originators.

The lack of standardization within a given sector also makes it difficult for investors to assess opportunities or benchmark prospective investments.

> *There is an opportunity to aggregate receivables from a pool of companies to diversify risk and be able to provide off-balance sheet financing to companies that do not have sufficient scale to carry the legal costs associated with this financing structure on their own.*
> **– Kristoffer Valvik, Norfund**

6.1.2 Uganda-specific barriers

Improvements to be made in supply-side regulations: Despite Uganda's history of progressive power sector reforms, DRE industries could still benefit from improved regulatory frameworks. These are indispensable to allow for a clearer operating environment, which will in turn lead to more assets deployed, and finally a larger base of DRE revenues that can be securitized.

xxxii The definition of standardization includes both "doing things the same way" as well as standards in terms of quality. While enforcement of quality standards is important, the argument presented here refers to standardized operations.

Mini-grids: The isolated grid regulations enacted by ERA in 2020 is a step in the right direction. Yet, while there is merit to the tariff cap at approximately $0.30/kWh, the general sentiment among developers is that this does not enable cost recovery.

Captive power: There is no regulatory framework that governs the captive power sector, which creates an unclear operating environment. The government's intention to publish a net metering framework by 2023 is a step in the right direction.

EVs: While the EV sector is likely still too nascent to warrant a specific regulatory framework, it would be useful for the government to start thinking about the targets and incentives that it can put in place to bolster the growth of this sub-sector. Rwanda offers a good example.

Inconsistent granting of subsidies: In most cases throughout history across the world, rural electrification projects have needed subsidies. This is because electricity infrastructure becomes more expensive the further away from urban centres it is deployed. When combined with the relatively smaller loads (and lower energy sales) that rural areas are characterized by, it becomes very difficult for infrastructure such as distribution grids and mini-grids to function with revenues from electricity sales alone. The operations of distribution utilities are consequently subsidized, such as the case of Umeme in Uganda.[162] Subsidies to privately-operated mini-grids are however granted inconsistently in Uganda. Some developers have indicated waiting times of more than two years to receive the connection subsidy that was offered when project planning was underway.[163] This forces developers to take out bridge loans to continue funding operations, which drives the mini-grid towards being a loss-making project.

Unfavourable securitization tax framework: The 1.5% stamp duty on asset transfers to SPVs and 15% withholding tax on interest payments are major impediments to the domiciling of off-balance sheet securitization facilities in Uganda. These taxes make deals financially unviable. SPVs must be seen as pass-through structures so that they can be exempted from stamp duties and withholding taxes.

East African government bonds, with their relatively high returns and low risk, are crowding out private bonds and securities: In Uganda, government bonds offer returns of 14%. It becomes difficult for private entities to offer bonds and securities that can compete with that level or return on investment and low risk level.

Low repayment rates causing low quality receivables streams. Based on data from interviews with DRE companies, roughly 25% of customers default on their financial obligations to DRE companies in Uganda. High default rates tend to be a result of entering into contracts with customers that are not creditworthy. This especially happens when companies do not have the means to accurately assess the creditworthiness of customers or when companies knowingly take on too much risk.[164] Pandemic-induced payment shocks also play a role.

> *"OGS companies sometimes expand their portfolios very quickly and then they don't spend that much effort on studying customers. They are more interested in achieving their specific sales targets. As a consequence, there are a lot of receivables at risk. The portfolio might then be at risk and the default rates increase."*
> **– Marsida Rada, EnDev Uganda**

High exchange rate volatility creates high levels of foreign exchange risk. The high volatility of the UGX against the USD makes hard currency lending challenging, both for existing debt instruments as well as future aggregation facilities. It increases the cost of foreign exchange hedging, which adds to the ultimate cost of setting up an aggregation facility.

> *"Currency volatility is a barrier. Hedging is expensive and it makes smaller deals unbankable. Hedging costs can be around 20% of the deal (dependent on deal size. The smaller the deal, the more the percentage cost). This was in Kenya. In Nigeria we've seen about 18.2%. So the average is around there."*
> **– Anonymous DRE investor**

6.2 Opportunities

6.2.1 General opportunities

The securities market is still nascent, but there is substantial public sector support for asset-backed securitization. The Ugandan government, along with other East African governments, wants to grow their financial markets and support securitization transactions. DRE aggregation will benefit if these intentions translate into improved regulatory and tax frameworks.

Aggregation facilities can bridge the gap between DRE companies and investors. This research has identified a large demand for suitable debt facilities from DRE companies, as well as a large demand among institutional investors (banks, pension funds, insurance funds) for assets where they can deploy debt funding, especially environmental, social and governance-compliant assets.

The processing times between applying for debt and accessing that debt is notoriously long in the DRE sector. Aggregation facilities, when setup and operational, can offer quicker access to capital in the future: DRE companies report waiting times between three months and more than a year. First-mover aggregation facilities that have already been deployed in the DRE space have not yet shortened these timeframes. The time it took for existing aggregation facilities to be fully set up and operational varied widely, from one to two years.[165] Stakeholders however mentioned that the target is to reduce this to at least six months through increased standardized processes and as learnings accrue over time.

Off-the-shelf digital solutions geared to the DRE sector are readily available and can support the data backbone that financial aggregation needs: Beyond that, they can also support DRE market growth at large by increasing scalability and reducing cost and risk. They can be categorized into four categories:[166]

Digital planning tools consist of least cost electrification planning tools, site selection software and site design software. They use geospatial data to gather intelligence on unelectrified areas. Least cost electrification planning tools analyse the national level to inform national electrification plans, while site selection platforms assess predefined areas of interest for selecting a prioritized list of suitable sites for project deployment. Site design tools zoom in on a specific site to plan project design and layout;

Photo: Adobe Stock/Dennis

Digital platforms include project aggregation platforms that are designed to house data from project portfolios and are consequently directly beneficial to financial aggregation. There are also platforms that facilitate aggregation on the investor side, commonly known as crowdfunding platforms;

Digital operations enable remote monitoring and control. This reduces cost of operations as they provide operators with the ability to remotely diagnose, troubleshoot and solve operational problems. Many of these platforms also enable remote data collection, which is indispensable for creating a data trail of customer performance;

Digital payments streamline transactions between DRE operators and customers. They leverage mobile connectivity, mobile devices, mobile money, PAYGO software and are critical for scaled operations of PAYGO business models.

East African countries like Uganda have growing levels of mobile penetration and a growing "tech savvy" middle class. Mobile-based retail investment assets targeting the growing middle class offer a possible new investor base in the long term. In recent years, the number of retail investing app users grew to over 150 million in 2021 globally.[167] In the same vein, the global digital asset management market size is projected to grow from $4.2 billion in 2022 to $8 billion by 2027.[168] UNCTAD estimates that the value of sustainability-themed investment products in global capital markets amounted to $3.2 trillion in 2020, which represented a more than 80% increase from 2019.[169] Following these trends, there is potential to develop smart, blockchain-based DRE assets for local and international retail investors. Whilst there are no examples of smart contracts and blockchain in use for financial aggregation in the DRE sector in Africa, there have been instances of financial aggregation assets marketed to retail investors. One such example is M-Akiba, a retail infrastructure bond issued by the Government of Kenya and sold to retail investors through the mobile money wallet M-PESA. Future work would involve a continuation of expanding access to mobile technology and financial services in Uganda. As sections 2.4.1 and 2.3.4 respectively show, penetration of mobile cellular subscriptions in Uganda is below the sub-Saharan Africa average, while banking services have not yet reached large parts of the population.

6.2.2 Uganda-specific opportunities

Debt is expensive in the DRE sector. Aggregation facilities can offer cheaper access to capital: DRE companies in Uganda report sourcing local currency debt at rates of 15-20% on average and hard currency at 6-15% (concessional debt at the lower end and commercial debt at the higher end). These rates are seen to be too high by most DRE companies interviewed. Aggregation facilities can offer lower financing rates to DRE companies. Hard currency rates are estimated at approximately 8% if there is extensive involvement from concessional funders. Pure commercial rates would be 11-12% at the minimum.[170]

Aggregation structures involving in-country asset companies linked with offshore holding companies can benefit from international tax treaties: Uganda's DTAs with tax-efficient economies such as Mauritius means that double taxation will be avoided. This is an opportunity for aggregation, despite Uganda's unfavourable securitization tax framework.

Multi-jurisdictional aggregation, while inherently complex, could be facilitated by Uganda's EAC membership: Multi-jurisdictional aggregation offers the benefits of cross-country diversification and access to an asset base larger than what a single country can offer. Implementing financial instruments across countries is, however, inherently complex due to diverse sets of regulations and requirements. Yet, organizations such as the East Africa Securities Regulatory Authority and the East Africa Securities Exchange Association have a mandate to attain harmonization across the securities markets of EAC member states. The capital markets authorities of the different countries also collaborate to achieve harmonization and cross-pollinate best practices. Under the East African common market protocol, East African investors are considered domestic investors by individual country regulations – rather than as foreign investors.

While limited, there is prior experience with DRE financial aggregation in Uganda: As shown in Box 2, Winch Energy closed a project aggregation transaction by pooling 23 mini-grid projects into a portfolio along with projects from Sierra Leone. There is also experience with on-balance sheet receivables financing in Uganda, with the likes of UNCDF supporting transaction arrangers to close local currency-denominated receivables financing with local Ugandan companies. These experiences create a foundational knowledge base of how to approach future DRE financial aggregation transactions in Uganda.

7 An action plan for DRE financial aggregation in Uganda

Photo: Adobe Stock/Mathias

The barriers to DRE financial aggregation outlined in the market assessment section of this report will need to be tackled if the potential addressable market is to be unlocked one day. This section provides an action plan setting out two pathways with specific barrier-removal activities to systematically address the barriers holding back the financial aggregation market in Uganda and to enable broader replication and market scale-up. It provides a menu of possible market development activities as well as the resources, partnerships and time needed to implement them – recognising that many barriers identified in this report will require substantial time and the involvement of a multitude of stakeholders to be addressed. Each market development activity discussed in this section is designed to partially or completely address specific barriers over different time frames. **Such activities and associated barriers are categorized into two distinct pathways:**

1. The low hanging fruit, quick wins pathway: A mostly short-term (0-5 years) oriented pathway that aims to leverage existing strengths in the market, thereby focusing on barriers that affect players and technologies that are already considered to be aggregation-ready. This pathway includes market development activities that can enable existing mature and aggregation-ready companies to more easily close financial aggregation transactions;

2. Structural Transformation, long-term pathway: A long-term (0-10 years) oriented pathway that addresses fundamental barriers, irrespective of time frames involved. These barriers are seen as fundamental in that they impede financial aggregation as well as market growth at large. This is a more holistic approach that aims to strengthen multiple facets of the market from regulations to company maturity, to help build a pipeline of aggregation-ready assets and an enabling environment. These market development activities target less mature and missing middle companies primarily. This pathway looks to position financial aggregation as an instrument that changes the status quo of established multinational companies attracting the majority of funding to a future where smaller (and more numerous) companies are also successful at attracting funding, especially debt, at scale.

The market development activities contained in this action plan were developed in response to the financial aggregation barriers identified through consultation with more than 50 interviewees and contributors in this project. Participants also contributed to designing activities that can be undertaken to address these barriers. The plan was finally validated through consultation with contributors. The focus of the plan is on areas that are most relevant to financial aggregation in the DRE sector in Uganda. As such, it excludes wider market barriers that affect the DRE sector's development more broadly. These wider barriers might also have some relevance to DRE financial aggregation but are less critical compared to barriers addressed in this report. At the same time, it should be noted that the activities proposed here could also help address barriers to the broader sector's development.

Finally, while a wide range of possible interventions are presented here, this list is by no means exhaustive. This remains a complex and multifaceted issue and the DRE sector is ever evolving, hence the market gaps and needs are likely to evolve, and various other interventions are likely necessary. Table 4 below provides an overview of key market development activities and the financial aggregation barriers that they are designed to address.

The sections below provide a detailed account of the two pathways and the respective market development activities. Each activity is discussed in detail, including steps involved in the activity, stakeholders that could ideally be involved, high level timelines and more. Some activities, especially those with shorter timelines, form part of the CAP's own market development work. The action plan however also includes longer term activities that serve as a roadmap to inform the design of future interventions to help develop the financial aggregation market in Uganda and further afield.

Table 4:

Overview of financial aggregation barriers and associated market development activities

MARKET DEVELOPMENT PATHWAY	MARKET DEVELOPMENT ACTIVITY	BARRIER TARGETED	GENERAL / UGANDA- SPECIFIC
Quick wins	7.1.1 Open source and standardize term sheets	High cost of setting up and operating off-balance sheet structures	General
	7.1.2 Explore approaches to reduce legal fees		
	7.1.3 Streamline structuring of transactions that involve Ugandan DRE assets and offshore holding facilities		
	7.1.4 Explore cost-effective hedging strategies and local currency lending	High exchange rate volatility	Uganda- specific
	7.1.5 Open source details of successful DRE financial aggregation transactions and standardize recommended approaches	Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector	General
	7.1.6 Engage concessional funders to crowd in commercial capital		
	7.1.7 Upskill investors on accepting credit-assessed receivables as collateral		
	7.1.8 Appoint backup service providers as a contingency in case of O&M provider insolvency		
	7.1.9 Engage credit rating agencies to rate the credit quality of DRE assets		
Long-term	7.2.1 Less mature companies: Raise awareness about good financial reporting, data management and creditworthiness assessment and offer technical assistance to improve in these areas	Majority of DRE companies in Uganda are not investment ready, while “missing middle” companies lack access to scaling capital	Uganda- specific
	7.2.2 Missing middle companies: Bridge the gap between seed funding and late-stage funding		
	7.2.3 Employ bulk procurement to grow the market		
	7.2.4 Test approaches to remedy low payment rates	High customer default rates	
	7.2.5 Communicate necessary regulatory improvements to ERA and MEMD	Supply-side regulations and policies that are in place are generally well-formulated, but amendments are recommended. Unregulated DRE sectors would benefit from policy and regulatory guidance	
	7.2.6 Motivate for a consistent subsidy for off-grid and mini-grid connections		
	7.2.7 Compile a common data reporting framework with input from investors and developers	Lack of data and low levels of standardization	General
	7.2.8 Raise awareness about shared application programming interfaces to standardize mobile money payment flows		
	7.2.9 Raise awareness about standardization of customer contracts		
	7.2.10 Reduce or remove stamp duties on asset transfers and withholding tax on interest payments	Unfavourable environment in Uganda for domiciling aggregation facilities	Uganda- specific
	7.2.11 Involve the CMA and Ministry of Finance in executing a model securitization transaction		

7.1 The low hanging fruit, quick wins pathway

Figure 17: Recommended phasing of market development activities in low hanging fruit pathway[171]

7.1.1 Open source and standardize term sheets

Barrier targeted: High cost of setting up and operating securitization transactions

One strategy to reduce the cost of setting up securitization transactions is to open source best practice term sheets. A handful of securitization and other financial aggregation transactions have already taken place in the DRE sector in Uganda and further afield. These however occur in siloes with little knowledge exchange emanating from these experiences.

Given that term sheets typically contain commercially sensitive information there could be value in a non-profit, non-competitive organization to request access to term sheets from arrangers of past transactions and compile an anonymous best practice term sheet for the industry to learn from. This will allow each new arranger of a financial aggregation transaction to avoid starting from scratch and trying to "reinvent the wheel." It will greatly reduce the cost of setting up transactions given that costly mistakes can be avoided. Standardising a best practice term sheet will also increase the scalability of a financial aggregation facility given that transactions with originators will be faster and more cost effective.

Steps involved in this market development activity:	1. Reach out to arrangers of past transactions, test appetite for participation in the endeavour and discuss conditions for participation; 2. Conduct one-on-one consultations with participating arrangers to discuss the term sheets and lessons learnt that are not evident on paper; 3. Compile best practices into a single, standardized and anonymous term sheet document and send for peer-review by participating arrangers; 4. Publish the term sheet template in the public domain alongside awareness building workshops.
Stakeholders involved:	DRE companies, arrangers and investors of previous successful aggregation transactions (e.g. NeOT, Sunfunder, Norfund, CrossBoundary, Solar Frontier Capital).
Existing initiatives:	• The Open Sourcing Infrastructure Investing initiative by CrossBoundary;[xxxiii] • Open-sourced PPAs availed by the World Bank as part of the Public-Private Partnership Legal Resource Centre;[172] • The Open Solar Contracts initiative by IRENA and the Terrawatt Institute, which published various generic term sheets and agreements for solar projects.[173]
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 year.
Budget items:	Time-based research, publishing costs

Table 5: **Overview of open sourcing and standardising term sheets**

xxxiii CrossBoundary have expressed intention to publish term sheets that were used in mini-grid project financing deals closed in the past. This is not specific to Uganda but remains relevant nevertheless. More details available here: CrossBoundary Energy Access, Open sourcing infrastructure investing for mini-grids, 2020 (link)

7.1.2 Explore approaches to reduce legal fees

Barrier targeted: High cost of setting up and operating securitization transactions

Legal fees are renowned to be one of the largest costs of setting up and operating financial aggregation facilities. Costs are especially prohibitive for smaller deals, as these costs are mostly fixed. Legal fees as a percentage of total deal size thus decreases as deal size increases. Nevertheless, there would be value in reducing legal fees for first mover financial aggregation deals that are not yet able to raise large investments.

One strategy could be to explore the feasibility of an initiative that partially or fully funds legal fees. This should be preceded by a detailed understanding of how legal fees are structured, which would require input from a legal services provider – ideally one that has supplied legal counsel to one of the past DRE financial aggregation transactions. Norton Rose Fullbright is an example of a firm that has provided legal counsel to OGS players to set up securitization transactions, enabled by funding from Power Africa.[174] Other legal firms that have been involved with DRE securitization transactions in the past include Allen & Overy LLP, Walkers LLP, Hogan Lovells, Field Fischer and Clarkson Wright & Jakes.[175,176,177] A second strategy could be to reduce costs from the legal provider side by involving an impact-driven legal service provider.

Steps involved in this market development activity:	1. Consult with legal counsel on cost components of arranging aggregation transactions in varying degrees of sophistication (on-balance sheet to off-balance sheet, single originator to multi originator and single jurisdiction to multi jurisdiction); 2. Carry out market research into the existence of impact-driven legal counsel; 3. With knowledge of legal counsel cost components, involve a catalytic funder to explore the possibility of legal cost funding.
Stakeholders involved:	Financial sector development agencies (e.g. FSD Africa[xxxiv]), legal service providers (e.g. Norton Rose Fulbright), catalytic funders (e.g. Power Africa)
Existing initiatives/ resources:	Power Africa's funding support for legal counsel on deal structuring.
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 to 3 years.
Budget items:	Consultation with legal teams, time-based research for market assessment

Table 6: **Overview of exploring approaches to reduce legal fees**

xxxiv FSD Africa has a mandate to deepen financial markets in sub-Saharan Africa and could thus carry knowledge of how to approach legal counsel for sophisticated financial transactions in resource-constrained settings.

7.1.3 Streamline structuring of transactions that involve Ugandan DRE assets and offshore holding facilities

Barrier targeted: High cost of setting up and operating securitization transactions

The unfavourable securitization tax framework in Uganda inhibits the domiciliation of financial aggregation facilities in Uganda itself. Nonetheless, offshore transactions are still possible. DRE assets from Uganda can be securitized and aggregated into facilities that are domiciled in jurisdictions with tax efficient economies such as Rwanda and Mauritius. Future work would need to focus on determining exactly how such facilities could be structured and executed, borrowing from previous experiences of transferring DRE assets to holding facilities domiciled abroad.

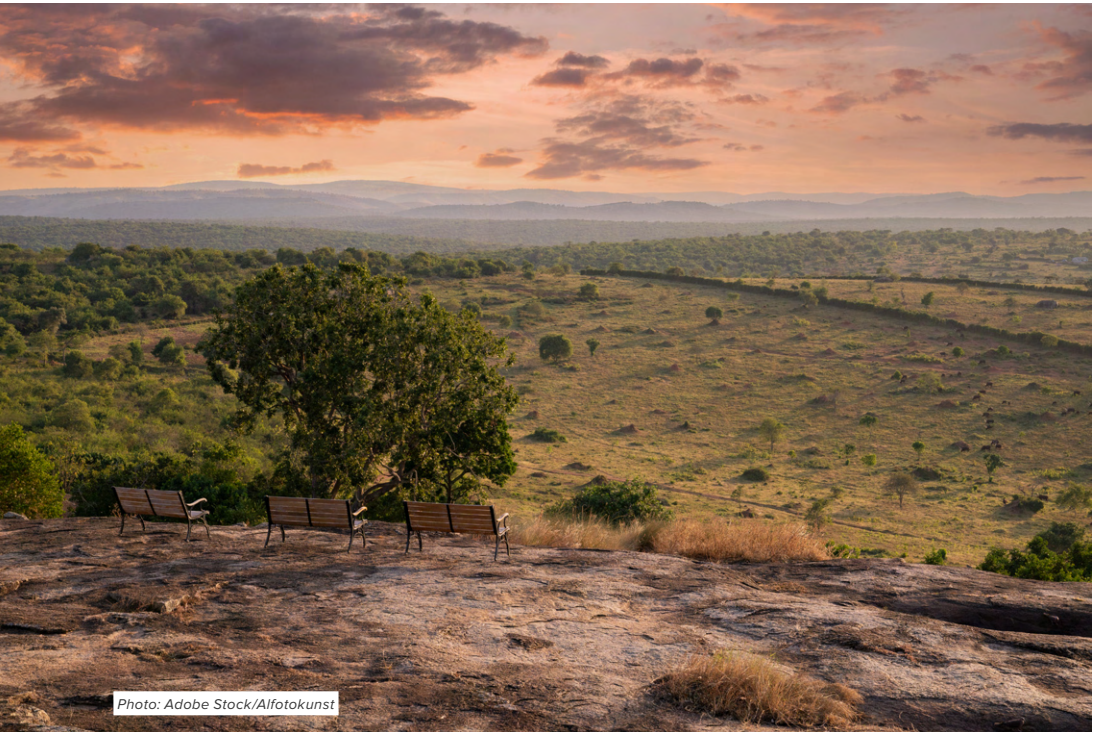


Photo: Adobe Stock/Alfotokunst

Steps involved in this market development activity:	1. Identify preferred jurisdictions to domicile aggregation facilities, keeping in mind that Uganda should ideally have a DTA in place with the country; 2. Garner input from stakeholders that were involved in successful offshore asset transfers; 3. Obtain quotes from the necessary service providers to determine the cost structure; 4. Appoint legal counsel to assist with navigating through cross-country regulatory requirements.
Stakeholders involved:	Transaction arrangers, legal counsel, DRE companies with experience in transferring DRE assets abroad.
Existing initiatives/ resources:	There are various transaction advisory services on offer in the market from organizations including but not limited to Power Africa, GET.invest and the Private Infrastructure Development Group.[xxxv] These services invariably include advice on offshore structuring if a transaction requires it.
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 to 3 years.
Budget items:	Legal fees, time-based research costs, accounting costs

Table 7: **Overview of streamlining offshore structuring of transactions**

xxxv See for example the Finance Catalyst programme implemented by GET.invest: GET.invest, Finance Catalyst, 2023 (link)

7.1.4 Explore cost-effective hedging strategies and local currency lending

Barrier targeted: High exchange rate volatility

Exposure to high exchange rate volatility is likely to be a key challenge for DRE financial aggregation facilities that raise investment in hard currency while cash flows are typically denominated in Ugandan shillings. This risk is pronounced in Uganda due to the high volatility of the Ugandan shilling. While hedging against such risks is possible, the associated costs are greater for highly volatile currencies or when hedging against fluctuations far into the future. Consequently, hedging in the Ugandan context becomes particularly expensive. Future work can explore possible avenues for reducing hedging costs with input from hedging providers and development partners.

A second, more long-term oriented strategy could be to remove currency risk altogether by raising funds in local currency. This would however require an increase in domestic investments, as local financial institutions are best placed to deploy local currency investments.

Steps involved in this market development activity:	1. Consult with hedging providers to determine the cost structure of hedging facilities and the extent to which each cost component increases as volatility and hedging time period increase; 2. Consult with hedging providers on opportunities for cost reduction; 3. Consult with catalytic funders to explore opportunities for funding hedging costs.
Stakeholders involved:	FOREX hedging providers (e.g. TCX Fund and MFX Solutions), DFIs
Existing initiatives/ resources:	• The Africa Local Currency Bond Fund, sponsored by KfW and BMZ and managed by Lion's Head Asset Management, acts as an anchor investor for local currency bond issuances. The fund also offers technical assistance to share knowledge around local currency issuances;[178] • The Off-Grid Energy Access Fund, funded by various DFIs and managed by Lion's Head Asset Management, offers local currency financing solutions to off-grid companies;[179] • The IFC has considerable experience in local currency investments and foreign currency hedging through initiatives such as the Local Currency Facility;[180] • GuarantCo offers local currency credit solutions.
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 to 2 years. Successfully implementing strategies will however require more time.[181]
Budget items:	Time-based research costs

Table 8: **Overview of exploring cost-effective hedging strategies and local currency lending**

7.1.5 Open source details of successful DRE financial aggregation transactions and standardize recommended approaches

Barrier targeted: Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

The benefits of term sheet open sourcing and standardization for reducing transaction costs have already been discussed. Beyond term sheets, open sourcing as many details and lessons from past successful transactions as possible will lead to a widening of the knowledge base for the sector and in turn demystify how financial aggregation transactions are structured and closed. Greater familiarity with DRE financial aggregation among investors can, in turn, help reduce investors' risk perception and ultimately attract investments.

Naturally, a key challenge lies in the extent to which arrangers, originators and investors of past aggregation transactions would be willing to share information – to date, there is limited information on past transactions that have been shared in this way. Such information is largely commercially sensitive, so approaches to address concerns should be explored. **These could include:**

Anonymising names of organizations and mixing findings across multiple transaction experiences to reduce possible linkages to specific organizations;

Extracting key lessons learnt and omitting details of past transactions that are considered sensitive by originators, arrangers and investors;

Attracting originators, arrangers and investors of past transactions to this endeavour by offering arrangers opportunities to arrange future aggregation transactions and offering originators and investors first options in future aggregation transactions.

Steps involved in this market development activity:	1. Approach originators, arrangers and investors of successful past financial aggregation transactions to test appetite and identify conditions and concerns; 2. Implement approaches to address concerns as necessary (from the list above or beyond); 3. Publish outputs in white paper format.
Stakeholders involved:	Originators, arrangers and investors of previous successful aggregation transactions (e.g. NeOT, Sunfunder, Norfund, CrossBoundary, Solar Frontier Capital).
Existing initiatives/ resources:	• The Open Sourcing Infrastructure Investing initiative by CrossBoundary.[xxxvi] • The CAP Financial Innovation Challenge invited proposals in 2022 for financial aggregation models that innovate and improve on existing approaches – UNDP will develop knowledge products to share key details and lessons learnt from these innovations.[182]
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 year.
Budget items:	Time-based remuneration for researching previous transactions and writing up findings in white paper format.

Table 9: **Overview of open sourcing details of successful DRE financial aggregation transactions**

xxxvi CrossBoundary have open sourced some details of their mini-grid project financing approach and have expressed intention to publish term sheets that were used in these transactions. This is not specific to Uganda but remains relevant nevertheless. More details available here: CrossBoundary Energy Access, Open sourcing infrastructure investing for mini-grids, 2020 (link)

7.1.6 Engage concessional funders to crowd in commercial capital

Barrier targeted: Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

Most commercial investors interviewed as part of this research have expressed interest to invest in financial aggregation facilities provided that appropriate risk mitigation measures are put in place. To this effect, the recommendation is to engage concessional funders (e.g. DFIs, etc.) to take up guarantee and junior debt positions in the capital stack. Guarantees are important as they effectively underwrite the assets in the portfolio. Should the senior lender's return expectations not be met, or the investment lost entirely, a guarantee will compensate the lender for their losses. A junior debt position would be suitable for a concessional funder that expects some return instead of donating funds but is still playing a catalytic role by taking losses before the senior lender. In so doing, the concessional funder taking up the junior debt position can crowd in senior lenders and leverage private, commercial capital.

Care should be taken to ensure that concessional funds do in fact crowd in commercial capital. Poorly designed concessional facilities can lead to market distortion if funds are allocated to lower risk DRE assets, in which case they effectively compete with commercial capital. Concessional funds should exclusively be applied to lower risk for commercial capital.

Steps involved in this market development activity:	1. Convene a group of concessional funders to discuss conditions for participation in guarantee and junior debt positions of financial aggregation facilities; 2. Consult with senior lenders to exactly determine the preferred structure of risk mitigation measures in the capital stack; 3. Offer technical assistance to local banks who might not be fully skilled in assessing DRE investments; 4. Raise funds from interested concessional and commercial investors when the financial aggregation facility is set up and ready for fundraising.
Stakeholders involved:	Concessional funders (see longlist in Appendix E), commercial investors (see longlist in Appendix E), DRE companies
Existing initiatives/ resources:	• The $16 million limited recourse loan received by Winch Energy for development of mini-grid projects in Uganda and Sierra Leone offers a good example of concessional and commercial fund blending in a financial aggregation transaction. Commercial funders included NEoT Offgrid Africa and Sunfunder, while FCDO and BMZ disbursed grant funding (see Box 2); • Another example is a receivables securitization loan facility closed between NeOT Offgrid Africa and Zola Electric in Cote d'Ivoire, which has been guaranteed by the African Development Bank to crowd in investment from local banks;[183] • Multiple examples of standard transactions involving capital blending exist, and lessons from these experiences are also relevant. Often guarantee facilities from organizations such as GuarantCo are in place. For example, in Uganda, the $50 million investment into the Bugala Island mini-grid was made by Nedbank, GuarantCo, the Uganda Development Corporation, Emerging Africa Instructure Fund and the Industrial Development Corporation of South Africa; • The European Fund for Sustainable Development Plus offers guarantees and EU grants blended with bank loans. It is a global programme that runs from 2021 and 2027 with a total of €53.5 billion;[184] • The Swedish International Development Agency offers guarantees to encourage commercial lending. By the end of 2021, approximately $975 million has been disbursed globally. The programme has made contributions to DRE investments including the COVID-19 Off-Grid Relief Fund, TRINE and Lendahand crowdfunding deals and more.[185]
Timeframe:	Medium term commencement, following confirmation of ideal transaction structure/best practice approaches.
Budget items:	Time-based research costs

Table 10: **Overview of engaging concessional funders to crowd-in commercial capital**

7.1.7 Upskill investors to accept credit-assessed receivables as collateral

Barrier targeted: Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

While knowledge of previous successful aggregation transactions is useful to increase investor confidence, work is also needed to train investors on some of the practicalities of financial aggregation facilities. More specifically, investors would need to be comfortable with accepting receivables as collateral. Research however indicates that this is a challenge for investors.[186] Most established investors in the DRE sector have a preference for the conventional types of collateral; land and buildings, equipment and stock. At the very best, some are willing to accept receivables as one component of collateral together with the more conventional types, but not receivables exclusively. Strategies for increasing investor confidence in receivables could include:

- Adding measures to the transaction to limit potential downside from receivables as collateral:
  - Ensure that an O&M agreement is in place with the originator (to ensure ongoing servicing of the assets);
  - Appoint a backup service provider to service the assets in case of originator insolvency;
  - Adding risk mitigation measures as discussed in section 7.1.6 above;
  - Making use of credit enhancement techniques as described in Box 7 below.
- Improving the quality of the receivables in order to increase its collateral value:
  - Implement methodologies to accurately estimate the creditworthiness of DRE end-customers, so as to increase investors' confidence that end-customers will continue paying for the service and that receivables will perform as expected. Lessons on how to best standardize customer credit scoring can be derived from the FICO scoring model in the US.[187] This standardized credit scoring model is used by more than 90% of US-based lending institutions and forms the backbone of mortgages and other types of asset financing in the country. The methodologies of local service providers of creditworthiness assessments in East Africa such as Nithio and Gnugrid will also be useful, as well as those used by microfinance institutions.

Steps involved in this market development activity:	1. Convene a group of DRE investors interested in financial aggregation; 2. Arrange training days/webinars on DRE financial aggregation with a focus on receivables as collateral; 3. Garner input from investors on the difficulties inherent in accepting only receivables as collateral; 4. Embark on brainstorming exercises in an attempt to address investors' concerns (such as mentioning strategies listed above); 5. Road test real-world scenarios – showcase receivables data from operational DRE companies.
Stakeholders involved:	DRE investors (especially new ones with limited experience),[xxxvii] financial sector development agencies (e.g. FSD Africa, UNCDF).[xxxviii]
Existing initiatives/ resources:	• Since its founding in 2017, UOMA has raised awareness for DRE investments among Ugandan banks and offered technical assistance to invest in DRE;[188] • UNCDF in Uganda has previously offered training to local banks on receivables as collateral for DRE investments; • The Renewables Academy (RENAC) offers training programmes directed at local financial institutions to scale up lending to DRE companies in Uganda.[189]
Timeframe:	Medium term commencement, following confirmation of ideal transaction structure/best practice approaches.
Budget items:	Venue costs for in-person workshop(s)

Table 11: **Overview of upskilling investors to accept receivables as collateral**

xxxvii Local commercial banks can especially benefit from such inputs. Interviews have shown that especially Centenary Bank and Equity Bank are open to exploring new approaches. There is also an appetite for smaller ticket sizes among these banks.
xxxviii FSD Africa have in the past made efforts to sensitize investors and issuers on the opportunities provided by securitization. UNCDF has held capacity building events with local banks on receivables as DRE collateral.

Photo: Adobe Stock/Mathias

Box 7:

Credit enhancement techniques to increase receivables quality and limit downside risk

Credit enhancement is a valuable tool that arrangers of aggregation transactions can use to mitigate against downside risk. **Various techniques exist:**

- **Tranching** involves the categorization and securitization of receivables based on quality. As a result, only the receivables of the best performing customers are selected. This is especially relevant if commercial capital is involved, as this capital is more risk averse than concessional capital;
- **Over-collateralization** and **factoring** go hand in hand. **Factoring** means that only a portion of the total value of receivables are paid by the facility. Yet while less than 100% of the total value of the receivables is paid for, the facility has the right of ownership for more than 100% of the value of the receivables, referred to as over-collateralization. The facility can dip into this excess value if certain unfavourable events occur, for example:
    - If a system crash occurs on the DRE asset and the facility loses visibility on critical digital data to assess performance of the asset, such as payment data;
    - If customer payments fall behind schedule. In this case, the facility can swap out the problematic account receivable with another one that has been included in the over-collateralized group;
- **Appliance financing and business support** can be offered to DRE customers to grow their energy consumption, which ultimately reduces customer default rates.[xxxix]

Standard guarantees and first loss facilities are also useful risk mitigation instruments given that they shield investors against complete or partial capital loss in a bad debt scenario. They are, however, not designed to enhance the credit quality of the underlying receivables.

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xxxix See for example: EnerGrow, About us, 2023 (link)

7.1.8 Appoint backup service providers as a contingency in case of O&M provider insolvency

Barrier targeted: Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

A backup servicer is an entity that is appointed to take over the operations ("servicing duties") of an originator in the event of insolvency or any other reason the originator cannot perform its duties. The backup servicer acts as an insurance policy for investors in an asset-backed security. The servicer is mandated to ensure that customer services and payments are uninterrupted, thus insulating investors from risk associated with possible bankruptcy of the originator.

A large proportion of investors interviewed have expressed the need for backup servicing as a condition for investing in off-balance sheet aggregation facilities. Given the limited track record of financial aggregation transactions in the DRE space, there is a lack of established back-up service providers in the market.[190] Some investors noted having to act as both an investor and backup servicer which goes beyond the traditional scope of an investor and has the effect of concentrating risk. In the future, a backup servicer can be arranged by the originator or arranger of the transaction.

> *"In order to have a bankruptcy remote structure with no recourse to the originator you need to have a backup servicing solution. We found that some of the earlier off balance sheet approaches did not adequately address this issue. More recently, we've seen structures that have taken backup servicing more seriously and started to implement some solutions, albeit imperfect. But you won't have a perfect solution from the start, and there has to be a journey and learning curve. We are willing to work with companies as long as they take it seriously and are willing to work with us towards solutions."*
> **– Geoff Manley, BII**

Steps involved in this market development activity:	1. Consult with mature, reputable DRE companies to determine conditions for backup servicing; 2. Develop standardized backup servicing contract templates; 3. Present potential investors with a proposed backup servicing structure and the track record of appointed backup servicers.
Stakeholders involved:	Leading DRE companies (as backup servicers), potential investors
Existing initiatives/ resources:	No initiatives exist, but a leading multinational OGS company consulted as part of this project expressed interest in offering backup services to off-balance sheet facilities. Several investors, such as BII mentioned above, have also considered how backup servicing could be arranged.
Timeframe:	Medium- to longer-term term commencement, following confirmation of ideal transaction structure/best practice approaches and when off-balance transactions become more likely.
Budget items:	Legal fees for setup of backup servicing contracts

Table 12: **Overview of backup servicing**

7.1.9 Engage credit rating agencies to rate the credit quality of DRE assets

Barrier targeted: Commercial investors attach high risk perceptions to DRE investments. Risk is amplified further due to the limited track record of aggregation instruments in the DRE sector.

An asset credit rating agency is an independent third party who is employed to assess the underlying risk of financial assets. Moody's, Standard and Poor's (S&P) and Fitch Ratings are trusted market leaders. Beyond the big household names, there are a multitude of trusted, locally based rating agencies. These agencies reduce the level of due diligence required by investors and provide legitimacy to an asset. Having credit rating agencies actively participating in the DRE sector will go a long way in strengthening the legitimacy of DRE receivables as a bankable asset. It will, in particular, help attract risk averse investors such as pension funds and insurance companies, as these can only invest in assets that are credit-rated.

There is potential for development agencies to engage with and support credit rating agencies as a measure to activate the financial aggregation market in Africa. Smaller organizations such as Nithio and Gnugrid offer services related to creditworthiness assessment of DRE customers. These players already have an understanding of the DRE market, especially DRE customer behaviour, and could thus be good candidates for developing methodologies for credit rating receivables and cash flow assets.

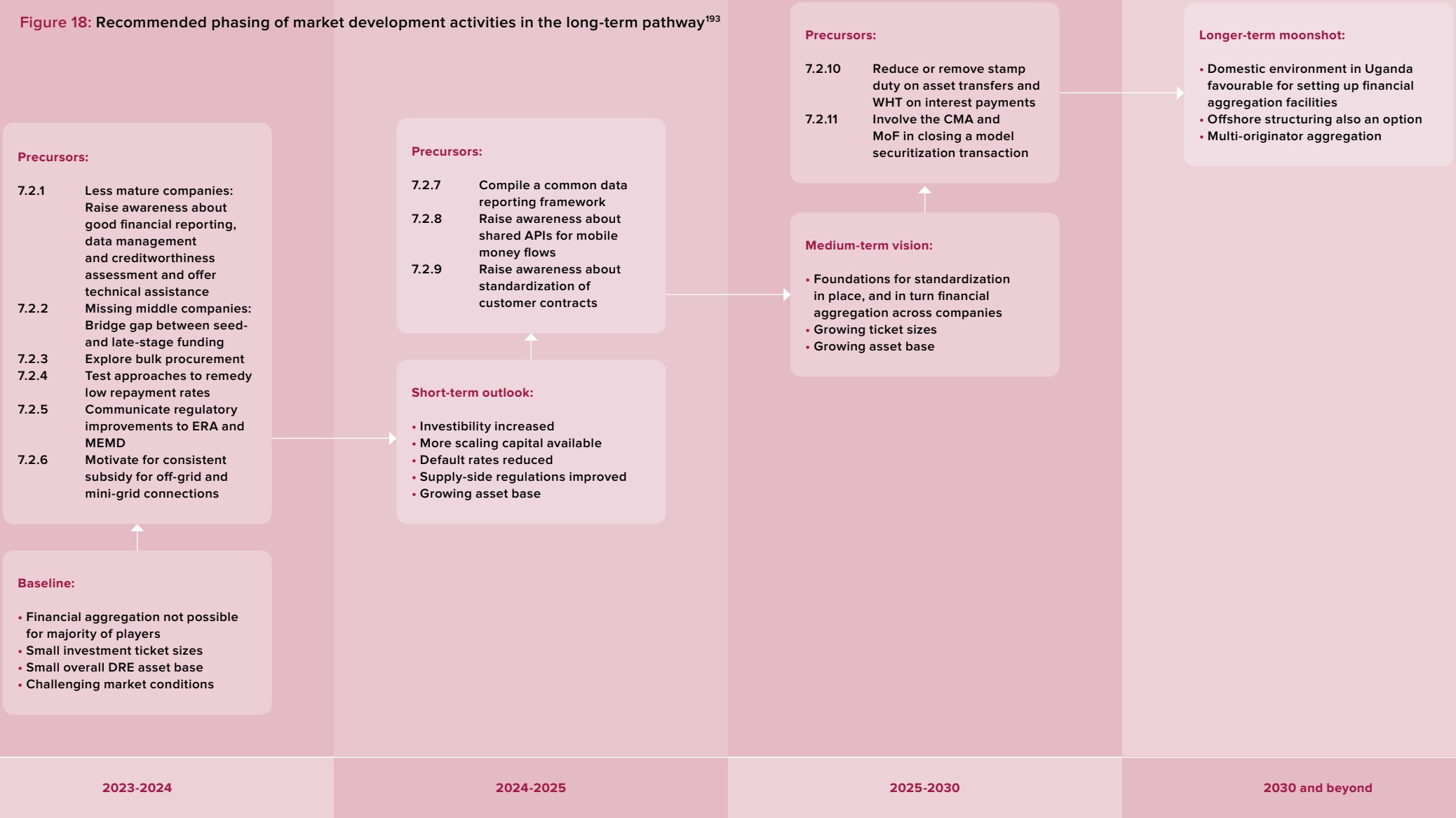
> *"With standardized credit risk assessments you understand more fully what the risk of repayment from different customers in a borrower's portfolio is. This enables accurate pricing of debt collateralized by receivables. Different pools of capital with different return expectations and impact mandates can then be deployed to fund receivables which match their mandate. DFI funding can be used to fund risky receivables, philanthropic capital to fund parts of the portfolio which are unlikely to repay and commercial capital to fund parts of the portfolio which can produce a commercial return. Nithio works on facilitating this blending of capital driven by data to unlock the flow of capital into DRE assets."*
> **– Chris Woolhouse, Nithio**

Steps involved in this market development activity:	1. Determine the qualifying requirements for assets to be credit assessed by Moody's, S&P and Fitch; 2. Assess costs involved for abovementioned rating agencies to rate DRE assets; 3. Consult with established DRE customer creditworthiness assessment providers on the possible transferability of knowledge and skills to credit rating receivables as assets; 4. Consult with institutional investors on information to be included in credit ratings of assets and what the minimum credit rating should be.
Stakeholders involved:	Credit rating agencies, DRE creditworthiness assessment service providers, institutional investors.
Existing initiatives/ resources:	• EnDev works with OGS companies in Uganda to link information of their customers' credit track records to a central credit reference bureau;[191] • Gnugrid is a Uganda-based company that collects credit data on individuals and provides credit reports to lenders.[192]
Timeframe:	Only to be commenced in the long term when there is a sufficient DRE asset pool and the market is ready for institutional investment.
Budget items:	Time-based research costs

Table 13: **Overview of rating the credit quality of DRE assets**

7.2 Structural transformation, long-term pathway

Figure 18: Recommended phasing of market development activities in the long-term pathway[193]



7.2.1 Less mature companies: Raise awareness about good financial reporting, data management and creditworthiness assessment and offer technical assistance to improve in these areas

Barrier targeted: Majority of DRE companies in Uganda are not investment ready while "missing middle" companies lack access to scaling capital.

Less mature companies require assistance to increase their investability. The status quo for the majority of small Ugandan companies is that they do not meet the due diligence requirements of most investors, development funders included. Financial reporting, data management and customer creditworthiness assessment have been cited by a wide range of stakeholders as the main areas where companies lack knowledge and skills. These shortcomings affect general investability as well as prospects for participation in financial aggregation facilities. Good data management, for example, shows that company management is in the position to make informed business decisions. At the same time, it enables a company to participate in future data pooling initiatives and, in turn, raise capital through financial aggregation facilities.

Training on how to improve in these areas would be a valuable next step. Key would also be to identify and demonstrate the link between such improvements and an increase in investability and deal flow. This could be done in a series of bootcamps and workshops or through ongoing company-specific technical assistance. Technical assistance could either take the form of external support with regular check-ins or embedded assistance, where a technical assistance provider is embedded within the DRE company for a prolonged period of time as a quasi-staff member.

> *"We can support companies on improving the aspects where they are currently lacking (e.g., business development, credit risk analysis) so that they can grow to get to a point where they are at a suitable maturity level to qualify for aggregation transactions."*
> **– Marsida Rada, EnDev Uganda**

Steps involved in this market development activity:	1. Appoint a technical assistance expert in the field of SME financial reporting and data management; 2. Alternatively, coordinate with existing technical assistance initiatives (see examples below) to incorporate investment readiness content for financial aggregation into their offers; 3. Convene Ugandan DRE companies in a bootcamp format to upskill in the areas of financial reporting, data management and customer creditworthiness assessment; 4. Follow workshops and bootcamps up with continued technical assistance, either through external check-ins or internal, embedded assistance as described above.[xl]
Stakeholders involved:	DRE companies, technical assistance providers (e.g. OCA, EnDev, etc.), technical assistance funders (e.g. Power Africa), industry associations (USEA, UNREEA, Sendea).
Existing initiatives/ resources:	• Power Africa's open-sourced financial modelling tools for PAYGO energy access companies (in partnership with Persistent Energy);[194] • Power Africa's business development resources for OGS companies including distribution best practices, microfinancing approaches and more;[195] • The Uganda Green Enterprise Finance Accelerator, funded by the EU, offers business development assistance to green small- and medium-sized enterprises;[196] • The Renewable Energy Business Incubator offers business development services and skills development to renewable energy companies in Uganda;[197] • The Uganda National Renewable Energy and Energy Efficiency (UNREEA) and Uganda Solar Energy Association (USEA) offer capacity building to their members;[198,199] • The Green Mini-Grid Helpdesk, implemented by Energy 4 Impact and Inensus on behalf of the African Development Bank offers practical information on mini-grid business operations;[200] • Odyssey Energy Solutions offers an end-to-end platform for development of DRE projects;[201] • PROSPECT, an open-source data platform developed by the Access to Energy Institute and GET.invest, collects, harmonizes, analyses and visualizes renewable energy system data;[202] • UOMA offers investment readiness support for Ugandan DRE companies;[203] • Solar Power Europe, in partnership with GET.invest published best practice guidelines for engineering, procurement and construction of solar projects.[204]
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 year.
Budget items:	Technical assistance budget, workshop convening costs, time-based remuneration for preparation of materials.

Table 14: Overview of raising awareness about areas for improvement among DRE companies

xl Continued support is important because one or two workshops are unlikely to achieve tangible impact alone.

7.2.2 Missing middle companies: Bridge the gap between seed funding and late-stage funding

Barrier targeted: Majority of DRE companies in Uganda are not investment ready while "missing middle" companies lack access to scaling capital.

Small, less mature companies still have a long growth path ahead before reaching a stage where they are mature enough to qualify for financial aggregation instruments. A second category of companies, missing middle companies, are defined as those that have already graduated from early-stage, seed-funding stages to having a strong track record but are not fully mature yet. These companies are in need of capital to take their operations to the next level, which is to reach large scale operations.

Options for missing middle financing would include working capital facilities, convertible loans and on-balance sheet receivables-based financing. The latter is an entry-level version of debt-based financial aggregation as it is based on the principle of securitization of customer receivables but avoids the complex aspects associated with off-balance sheet transactions. An additional strategy to simplify the closing of these transactions is to focus on financing of fixed receivables – whereby customers pay a fixed monthly fee instead of variable PAYGO payments. The former enables more clarity on future cash flows, which greatly reduces the complexity involved in estimating the value of future receivables.

Steps involved in this market development activity:	1. Explore, with input from missing middle companies, appropriate funding options e.g. convertible loans, on-balance sheet receivables financing, mezzanine finance, longer tenor debt, etc. 2. Identify and involve appropriate providers of these financing instruments; 3. Identify and involve a guarantee provider if deemed a necessary precondition for involvement from above-mentioned financiers; 4. Consider supporting further development of existing initiatives such as the UECCC on-lending facility, which should ideally facilitate UGX interest rates below 15%. Assess MFIs and SACCOs as on-lenders instead of commercial banks; 5. Link missing middle companies with financiers by curating deals to suit both investor and investee; 6. Package these deals as building blocks towards eventual financial aggregation. Create awareness of this strategic direction among investors and investees to create added impetus for closing of deals.
Stakeholders involved:	DRE companies, return-seeking patient investors, guarantee providers, investment matchmakers (e.g. GETinvest)[205]
Existing initiatives/ resources:	• The BUILD Fund is an impact fund managed by Bamboo Capital Partners and UNCDF that seeks to disburse missing middle finance to small- and medium-sized enterprises in least developed countries;[206] • EEP Africa, managed by the Nordic Development Fund, offers early stage and catalytic grant finance to innovative clean energy companies across Southern- and East Africa;[207] • The Beyond the Grid Fund for Africa, managed by NEFCO, offers results-based financing to off-grid companies in Uganda, Burkina Faso, Liberia, Zambia and Mozambique.[208] To date, the fund has had four rounds of funding. • The Renewable Energy Performance Platform, managed by Camco, offers development phase capital, gap financing and long-term loans to small-scale projects below 25 MW;[209] • The ElectriFI Uganda country window, launched in November 2022, will invest a total of EUR 5 million (debt and equity) in early-stage renewable energy companies;[210] • The World Bank, as part of its Electricity Access Scale Up Project, will support the UECCC to further expand its on-lending programme via financial institutions.[211] MFIs will also be able to participate; • The AfDB Leveraging Energy Access Finance Framework is a $800 million programme that offers concessional capital, credit enhancement instruments and technical assistance to facilitate local currency DRE investments in Ghana, Guinea, Ethiopia, Kenya, Nigeria and Tunisia.[212] The programme is looking to expand to more countries.
Timeframe:	Short term commencement, no preparatory actions needed. Duration estimated to be 1 to 3 years.
Budget items:	Time-based research costs, investment matchmaking services.

Table 15: **Overview of bridging the gap between seed funding and late-stage funding**

7.2.3 Explore bulk procurement to grow the market

Barrier targeted: Majority of DRE companies in Uganda are not investment ready while "missing middle" companies lack access to scaling capital.

Less mature and missing middle companies may not yet be ready for financial aggregation, but they can benefit from a different type of aggregation – bulk procurement. Aggregating equipment orders across companies enables large orders, which reduces unit costs. The challenge that bulk procurement faces, however, is two-fold. Firstly, standardization of equipment is a necessary precondition for bulk procurement but developers do not necessarily use the same equipment. Second is timing. To place a large order, demand for a given equipment or product from multiple companies must be aligned. This only happens occasionally, as mini-grid developers are not necessarily at the same stage of site development. For this to happen, mini-grid sites would need to be allocated through lots, concessions or tenders with preselected sites through a central entity. Similarly, captive power developers interested in aggregating their equipment orders would each need to have contracts or purchase orders signed with one or more clients and each site should be more or less in the same stage of the development cycle. The same applies to companies in the OGS and e-mobility sectors – there should be alignment when different companies need stock or inputs.

Steps involved in this market development activity:	1. Consult with DRE companies on which hardware can be standardized; 2. Explore opportunities with central procurement agencies to allocate lots and/or concessions of sites; 3. Identify any other approaches to harmonize timing when developers need equipment.
Stakeholders involved:	DRE companies, equipment manufacturers (e.g. Victron, SMA, Steamaco, Sparkmeter, etc.).
Existing initiatives/ resources:	• The Demand Aggregation for Renewable Technology programme, implemented by the Global Energy Alliance for People and Planet, in partnership with All On and Odyssey Energy Solutions, aims to aggregate demand, standardize equipment and ultimately enable bulk procurement of renewable energy components among DRE companies.[213] The programme is currently being piloted in Nigeria and is supported by a $10 million funding facility;[214] • The Mini-Grid Innovation Lab, implemented by CrossBoundary, launched a study on the impact of bulk procurement on mini-grid procurement costs in 2020.[215]
Timeframe:	Short term commencement. Successfully implementing bulk procurement across companies is likely to only occur in the medium term.
Budget items:	Time based research costs

Table 16: **Overview of exploring bulk procurement**

7.2.4 Test approaches to remedy low repayment rates

Barrier targeted: High customer default rates

Low repayment rates constitute a key barrier not only from a financial aggregation perspective, but also for the financial viability of companies and the growth of the industry at large. Addressing this barrier is thus of utmost importance and it has been the subject of various initiatives to date (see Table 17). This starts with determining all possible reasons for default. Possible ideas for facilitating more on-time payment could include:

- Only enter into customer contracts with those that are less likely to default, by accurately assessing creditworthiness beforehand;[xli]
- Institute a small financial penalty for running out of credit;
- Institute a reward for paying before credit runs out, e.g. free electricity for a short period of time during the day;
- Account for seasonality in payment plans (e.g. if useful for the customer, allow one payment for the year's worth of electricity);
- Involve an agri partner e.g. SunCulture, FuturePump or One Acre Fund to obtain insights into smallholder farmers' money flows (given that many mini-grid and off-grid customers are smallholder farmers);
- Institute payment reminders.

> *"The high default rates in Uganda are especially on the higher end products with TVs and all those additions. But default rates on the more basic systems are lower. People use it more than the other additional products."*
> **– David Opio, Gnugrid**

Steps involved in this market development activity:	1. Circulate a note or brief paper to relevant stakeholders on the status quo of DRE customer defaults in Uganda and its effects on industry growth and portfolio quality; 2. Convene Ugandan DRE companies (especially those working with mini-grids and off-grid systems) in a workshop format to test out possible remedies such as those outlined above; 3. Explore the possibility of technical assistance to implement remedies and to generally improve data management systems for better customer insights.
Stakeholders involved:	DRE companies (especially mini-grids and off-grid), industry associations (e.g. USEA, UNREEA and Sendea).
Existing initiatives/ resources:	• Power Africa's guide on off-grid PAYGO credit risk management;[216] • Persistent Energy's PAYGO Business Analytics Toolkit that include, amongst others, metrics and calculations for determining the value of receivables;[217] • The Consultative Group to Assist the Poor (CGAP) published a guide on credit risk management approaches for asset finance companies in 2021;[218] • EnerGrow offers appliance financing and training to grow energy consumption and, in turn, profitability of small- and medium-sized enterprises.[219] This ultimately reduces default rates among productive use customers; • 60 Decibels offers open-sourced data on off-grid energy performance benchmarks including repayment rates;[220] • The Access to Energy Institute is a research and development organization that is focused on in-field experimentation and could thus be interested in running repayment experiments.[221]
Timeframe:	Short term commencement. Duration estimated to be 1 to 2 years.
Budget items:	Research and writing costs, workshop convening costs, technical assistance budget

Table 17: **Overview of testing approaches to remedy low repayment rates**

xli A key existing initiative is work done by EnDev to support OGS companies in Uganda to link data on credit track records of customers to credit reference bureaus. More details available from: EnDev, Improving sustainability in Uganda's solar market – Linking OGS energy companies to a credit reference system, 2020 (link)

7.2.5 Communicate necessary regulatory improvements to ERA and MEMD

Barrier targeted: Supply-side regulations and policies that are in place are generally well-formulated, but some amendments are recommended. Unregulated DRE sectors would benefit from policy and regulatory guidance.

Regulations play an extremely important role in catalysing DRE markets. To attain an extensive operating base and pipeline of DRE assets, regulations need to be as favourable to DRE companies as possible. **The following improvements are recommended in Uganda:**

- **Mini-grids:** The Electricity (Isolated Grid Systems) Regulations published in 2020 is a well-formulated regulatory framework.[222] It can, however, benefit from the following amendments:
  - The regulations do not prescribe a tariff cap, but reports indicate that developers are not able to obtain the necessary approvals for tariffs higher than $0.30/kWh. This is regarded by most as below cost recovery levels, let alone "reasonable return on equity" as stated in the act. A clear approach on how ERA handles tariffs would be useful in the regulatory framework;

- **Captive power:** Continue with plans to publish a net metering framework by 2023;

- **EVs:** Continue with plans to publish government policy and incentives in the short term.

Beyond mere communication of these necessary ad-hoc improvements, there is also a need for ongoing advocacy and dialogue to continue advancing the sector. Multi-disciplinary platforms that bring together DRE companies, industry associations, investors, policymakers and independent experts such as the Uganda National Renewable Energy Platform are key in facilitating these dialogues.

Steps involved in this market development activity:	1. Share data with ERA and MEMD on the socio-economic impact that mini-grids have had on communities in Uganda; 2. Liaise with ERA on the negative consequences of not instituting a willing buyer-willing seller model for private sector mini-grids; 3. Launch ongoing dialogues to continue advancing all DRE sectors.
Stakeholders involved:	ERA, MEMD, industry associations (e.g. USEA, UNREEA or Sendea), DRE companies
Existing initiatives/ resources:	• 60 Decibels collect performance and socio-economic impact data from the off-grid solar sector across the world and presents this data on an online dashboard;[223] • The African Forum for Utility Regulators' recent project, Mainstreaming Mini-Grid Tariff Settlement Tools and Methodologies Across African Regulators, assists national regulators to use best practice tariff setting approaches for mini-grids;[224] • The Africa Mini-Grid Developers Association offers advisory on designing and implementing optimal policies and regulations for mini-grids;[225] • UOMA previously advised the public sector in Uganda on designing effective policies for DRE;[226] • The Uganda National Renewable Energy Platform has been established to coordinate policy development for a flourishing renewable energy sector.[227]
Timeframe:	Commencement in the short term. Duration estimated to be 1 to 3 years.
Budget items:	Time-based costs related to convening a group of developers, compiling a data pool and liaising with ERA

Table 18: **Overview of communicating necessary regulatory improvements**

7.2.6 Motivate for a consistent subsidy for off-grid and mini-grid connections

Barrier targeted: Supply-side regulations and policies that are in place are generally well-formulated, but some amendments are recommended. Unregulated DRE sectors would benefit from policy and regulatory guidance.

Subsidies reduce the overall cost of a mini-grid and in turn the tariff charged to the end-user. Granting subsidies to privately-operated mini-grids could be an effective way to reduce tariffs while ensuring the commercial viability of projects, as opposed to imposing a maximum tariff (e.g., $0.30/kWh) with no financial support for the developer. Such an approach would be beneficial to both the developer and the regulator, as it enables the developer to recover its costs and generate a reasonable return on investment while the regulator is able to approve an affordable tariff for Ugandan citizens. As stated in section 7.2.5, ad-hoc improvements in the regulatory environment should be followed up with continued multi-disciplinary dialogues on how DRE sectors can further be developed.

Photo: Adobe Stock/Alfotokunst

Steps involved in this market development activity:	1. Compile data-based evidence for the need for DRE technologies in the national energy mix (socio-economic impact, quality of supply, time taken to commission projects, contribution to energy security); 2. Perform a cost-benefit assessment of a MEMD subsidy for off-grid and mini-grid connections; 3. Explore demand-side subsidies in parallel to supply-side subsidies mentioned above. Link up with existing initiatives such as UECCC's end-user financing programme.
Stakeholders involved:	ERA, MEMD, UECCC, mini-grid developers
Existing initiatives/ resources:	Initiatives listed under 7.2.5 are equally relevant here. In addition: • The ESMAP End-User Subsidy Lab is currently developing a demand-side subsidy for Uganda (among other countries);[228] • The GET ACCESS Mini-Grid Programme, launched in December 2022, will catalyse EUR 35 million into development, construction and operation of 120 mini-grids across Uganda. The programme is funded by the EU, BMZ, the Ugandan government and private investors.[229]
Timeframe:	Commencement in the short term. Duration estimated to be 1 to 3 years.
Budget items:	Time-based costs

Table 19: **Overview of motivating for a consistent subsidy for off-grid and mini-grid connections**

7.2.7 Compile a common data reporting framework with input from investors and DRE companies

Barrier targeted: Lack of data and low levels of standardization

Standardization of data reporting between companies within their respective DRE subsectors is essential for achieving aggregation of assets across companies. This is needed to ensure comparability between assets, which will in turn ease due diligence at the portfolio level. As it stands however, there is substantial variability between companies in terms of how data is reported. While there is a general consensus of what to report, the metrics that are used for reporting, especially for financial reporting, often differ. Furthermore, there is variability in terms of the granularity and frequency with which companies report. Some companies use in-house software while others make use of one or more of the various digital operating data platforms on the market (e.g. AMMP, Odyssey, Solaris Offgrid, Sparkmeter, SteamaCo and New Sun Road).

A commonly adopted standardized data reporting framework is a key enabler for aggregating assets across companies as it facilitates comparability in how each asset performs. If a common data framework is adopted by companies, the need for translating cross-company data into a standardized format will be substantially reduced. At the sector level, a common data reporting framework also serves as an advocacy tool because it enables the communication of overall performance and impact.

Creating awareness about these data reporting frameworks platforms is a key market development activity in building towards a future where DRE assets can easily be aggregated across companies. This should be followed by determining barriers to broad adoption across the sector. This research might point to a possible need for improving the utility of data reporting frameworks with input from DRE companies, investors and data hosting. If it is indeed found that there is a need to improve the utility of existing data reporting frameworks and associated reporting platforms for the needs of financial aggregation, the following topics would need to be discussed:

- What data potential investors in the aggregation facility would want to see when conducting due diligence on the portfolio;
- What data DRE companies can currently report considering hardware and software limitations;
- What data DRE companies will realistically be able to report considering commercial sensitivity as well as cost and time limitations;
- What data hosting platforms are designed to ingest and present.

Steps involved in this market development activity:	1. Arrange virtual consultations and/or webinars to create awareness of the importance of data standardization, its relevance for aggregation and the existing frameworks; 2. Determine barriers to adoption of existing frameworks during consultations; 3. Garner input from different angles of the spectrum by stakeholders listed below and if necessary, refine an existing framework so that it becomes a mutually agreed standardized data reporting framework. In sectors where there are no existing frameworks, for example electric mobility, compile a new framework for broad adoption; 4. Assist companies, where necessary, to commence with data collection and cloud hosting to create an evidence base for receivables financing. Explore the utility of the database in identifying consumption patterns so as to estimate the value of receivables; 5. Explore the possibility of a reporting framework with standardized metrics across DRE sectors.
Stakeholders involved:	DRE companies, data standardization experts, data hosting platforms (e.g. Odyssey, AMMP, New Sun Road, PayGops etc), investors, data reporting framework developers.
Existing initiatives/ resources:	• The PAYGO Performance, Reporting and Measurement Framework (PAYGO PERFORM) developed by CGAP, GOGLA and Lighting Global, in consultation with 600 investors, PAYGO executives, and energy and finance experts, which outlines financial and operational key performance indicators (KPIs) for the PAYGO OGS industry. The initiative started in 2022 and will collect, analyse and share semi-annual data on abovementioned KPIs from participating companies;[230] • GOGLA's Standardized Impact Metrics for the OGS Sector;[231] • The mini-grid quality assurance framework developed by NREL and adapted by TFE;[232, 233] • Solaris Offgrid's PayGops Disruptive Receivables Finance Project is a receivables-based financing facility that uses standardized flows of asset and payment information through the company's last-mile operation management software PayGops. [234]
Timeframe:	Medium term commencement, by which time smaller companies are anticipated to have basic capacity in place.
Budget items:	Webinar facilitation, time-based research and liaison, data hosting, hardware retrofitting where necessary.

Table 20: **Overview of creating a common data reporting framework**

7.2.8 Raise awareness about shared application programming interfaces to standardize mobile money payment flows

Barrier targeted: Lack of data and low levels of standardization

Digital transactions between end customers and the asset operator is a necessary requirement for financial aggregation, especially off-balance sheet securitization. When securitized receivables are transferred to a SPV, the actual cash flows must flow directly from the end customer to the SPV. For this to happen, the SPV must link with the originator's mobile money operator (or other payment platform) through an application programming interface (API). DRE operators use different mobile money operators so there is currently no common API that a financial aggregation facility can link up with to facilitate streamlined payment flows from end customers to the SPV. There could be value in encouraging operators to make use of mobile money aggregators and then link up with the aggregator's API.

This market development activity is not of high importance in the short term given that off-balance sheet multi-originator securitization will only be achievable in the long-term future when the DRE sector and local capital markets are more mature. However, initial scoping research would bode well for guiding future work.

Steps involved in this market development activity:	1. Perform a scoping assessment of the current status of digital transaction formats used by DRE companies (relationships with mobile money providers and/or aggregators, API designs); 2. Determine the precursors for redirecting payment flows from DRE companies to SPVs.
Stakeholders involved:	DRE companies, mobile money providers, mobile money aggregators, software experts (e.g. Solaris Offgrid/PayGops)
Existing initiatives/ resources:	• OpenPAYGO Metrics is an initiative by PaygOps that offers a standard API for PAYGO devices to transmit various data metrics to a server. The API is free, open-source and interoperable with all types of PAYGO devices and management platforms;[235] • Stitch offers a standard API integration to streamline the processing of online payments.[236]
Timeframe:	Medium term commencement
Budget items:	Time-based remuneration for research and convening of workshops and/or webinars

Table 21: **Overview of raising awareness about shared APIs**

7.2.9 Raise awareness about standardization of customer contracts

Barrier targeted: Lack of data and low levels of standardization

Each DRE operator naturally has diverse arrangements in place with their respective customers, all of which are reflected in customer contracts. While not all sections of customer contracts can practically be standardized, there is a subset of sections that should ideally be standardized, chief of which is considerations that relate to the frequency and structure (e.g. flat subscription fee or per kWh) of payments. This is important because standardized contracts can enable an apple-to-apple comparison of receivables. Secondly, contracts that do not bind customers to on-time payment will lead to low repayment rates and negatively affect the likelihood of receivables flowing to SPVs on time. Interviews conducted during this research have shown that DRE companies generally agree that certain sections of customer contracts should be standardized and that it would be possible.

> *"There is a lot of variance across companies in terms of customer contracts and credit scoring. A lot of companies don't do credit scoring at all. On customer contracts, you're not able to fully standardize this across countries because of different laws."*
> **– Siten Mandalia, Solaris Offgrid**

Steps involved in this market development activity:	1. In a workshop format, communicate the value of contract standardization; 2. Determine the conditions and practicalities of which sections can be standardized and how this can be done (considering variability between assets and between developers/operators); 3. Draw up a standardized customer contract template and garner post-workshop input from participating developers.
Stakeholders involved:	DRE companies
Existing initiatives/ resources:	• NREL offers a set of published customer agreement considerations for mini-grids in sub-Saharan Africa;[237] • GOGLA's Consumer Protection Code advocates for consumer protection standards in the OGS sector. Consumer protection clauses should ideally be standardized to ensure that all customers enjoy the same protection in terms of considerations such as data privacy. [238]
Timeframe:	Medium term commencement
Budget items:	Research, workshop costs

Table 22: **Overview of raising awareness about standardization of customer contracts**

7.2.10 Reduce or remove stamp duties on asset transfers and withholding tax on interest payments

Barrier targeted: Unfavourable environment for domiciling aggregation facilities

If DRE aggregation facilities are to be domiciled in Uganda, the stamp duty on asset transfers to SPVs and withholding taxes on interest payments to investors must be reduced or ideally removed. The CMA is a key organization to involve as it carries the responsibility of promoting and facilitating the development of an efficient capital markets industry in Uganda.

Steps involved in this market development activity:	1. Consult with the CMA on additional measures that need to be in place for the Ministry of Finance to reduce the stamp duty and withholding tax rate; 2. Ensure that work on improving the enabling environment for aggregation facilities is followed up with ongoing dialogue and advocacy towards attaining a mature and developed capital market in Uganda.
Stakeholders involved:	CMA Uganda, Ministry of Finance
Existing initiatives/ resources:	• The CMA has already been engaging the Ministry of Finance to reduce the stamp duty on asset transfers.[239] The Ministry agrees that the stamp duty is a disincentive for off-balance sheet transactions, but this has not translated into action yet;[240] • The CMA is also in talks with the Ministry to reduce the withholding tax rate applicable to private securities from 15% to 10%.[241]
Timeframe:	Commencement in the long term. The DRE market first needs to grow to aggregation-readiness to warrant regulatory changes.
Budget items:	Time-based costs

Table 23: **Overview of reducing stamp duties and withholding taxes**

Photo: UNDP Uganda

7.2.11 Involve the CMA and Ministry of Finance in executing a model securitization transaction

Barrier targeted: Unfavourable environment for domiciling aggregation facilities

To date, no private placements of securities have been conducted in Uganda. This is despite the CMA's past successful efforts to promulgate laws on asset-backed securitization. Consequently, the laws that are in place remain largely untested. Involving the CMA and the Ministry of Finance along with an originator and an arranger in closing a model transaction will go a long way in road testing the regulations and inform policymakers whether the law needs any updates.

The CMA is considering making use of regulatory sandboxes to test governance approaches to asset-backed securitization in Uganda.[242] Regulatory sandboxes are frameworks put in place by a regulator to allow industry practitioners to road test financial innovations under supervision of the regulator. Lessons from these road tests often inform subsequent regulations. A model securitization transaction will likely require regulatory sandbox treatment. Efforts by the CMA to use regulatory sandboxes should be relatively easier following the passing of the National Payment Systems Regulatory Sandbox Framework by the Bank of Uganda in 2021.[243]

Steps involved in this market development activity:	1. Confirm progress currently being made by the CMA board in writing and publishing regulatory sandbox guidelines; 2. Involve financial sector regulatory sandbox experts if necessary, e.g. CGAP; 3. Determine the availability of local and/or international arrangers to structure a model transaction; 4. Select an appropriate originator (ideally in the DRE sector, but not a requirement).
Stakeholders involved:	CMA Uganda, Ministry of Finance, originators (DRE companies) and arrangers, securitization experts in developing markets (e.g. FSD Africa and the Milken Institute)
Existing initiatives/ resources:	As part of its capital markets development programme, FSD Africa provides technical and financial support to originators, arrangers and investors to close demonstration transactions.[244]
Timeframe:	Commencement in the long term. The DRE market first needs to grow to aggregation-readiness before a locally domiciled transaction can be closed.
Budget items:	Time-based costs, development of regulatory sandbox and transaction costs related to origination and structuring of the model transaction.

Table 24: **Overview of model securitization transaction**

Appendices

Photo: Adobe Stock/Reidar Johannessen

Appendix A: Environmental and social risk assessment

The UNDP's social and environmental standards[245] will guide the design and implementation of UNDP market development activities to grow the market towards financial aggregation readiness, any supported financial aggregation transactions and any participating DRE projects, products and companies. This is to ensure mitigation against environmental and social risks.

1. **Ensure biodiversity conservation and sustainable natural resource management:** Due to the small scale of DRE projects, risks related to natural resource depletion are not foreseen. However, any hydro-based project participating in a financial aggregation facility or transaction would need to be assessed for any hydrological changes such as damming of rivers.

2. **Mitigate against climate change and disaster risks:** While possible financial aggregation facilities and transactions considered in the context of this market assessment and action plan will target low-carbon assets, care still needs to be taken to assess the level of carbon emissions in assets that generate electricity from fossil fuels, such as solar-diesel hybrid mini-grids. More DRE projects, irrespective of generation technology, would also lead to increased carbon emissions through the transport of supplies and the development of any supporting infrastructure.

3. **Ensure community health, safety and security:** Community buy-in is essential both at project level and within the wider renewable energy industry in Uganda. At the project level, the following risk is foreseen:
    a. Construction of projects funded through a financial aggregation facility or transaction leading to an influx of construction personnel in the local community.

4. **Preserve cultural heritage:** This applies to:
    a. Projects located close to cultural sites (risk will vary depending on site location);
    b. Projects involving excavations or demolitions (risk will vary depending on site plan);
    c. DRE companies, or the financial aggregation facility itself proposing to use tangible or intangible forms of cultural heritage (participating companies to be screened, with no risk foreseen pertaining to facility design).

5. **Avoid displacement and resettlement:** No displacement or resettlement of communities are envisaged as a consequence of the implementation of financial aggregation facilities.

6. **Incorporate the needs of indigenous peoples:** To ensure land of participating projects do not encroach on indigenous lands. This requires consultation with community leaders.

7. **Ensure dignified labour and working conditions:** This will require an assessment of working conditions in companies prior to funding disbursement.

8. **Prevent pollution and ensure resource efficiency:**
    a. Project construction or distribution of solar products can cause pollution in the local environment. Companies and projects funded through financial aggregation facilities would need to ensure that sites are cleaned when construction is completed and that all hazardous materials are removed;
    b. OGS companies must ensure that quality-verified (e.g., GOGLA or Verasol) systems are being used so as to reduce the likelihood of premature obsolescence. Systems must also adhere to the 2021 Uganda National Bureau of Standards Solar Quality Standards;[246]
    c. A financial aggregation facility would need to incorporate recycling and other "after life" considerations in programme design.

Appendix B: Data privacy risk assessment

The Data Protection and Privacy Act of 2019 is the foundational legislation on digital data privacy in Uganda. It sets out guidelines for personal data collection and processing in Uganda. **It stipulates the following:**

- Personal data may only be collected or processed subject to consent from the data subject;
- Personal data should be protected;
- Data should be complete, up-to-date and accurate;
- Data may not be stored for periods longer than it is required for;
- Processing of personal data outside Uganda is allowed as long as it is done in a jurisdiction where data privacy laws provide protection at least at the equivalent of the Uganda act.[247]

The Data Protection and Privacy Regulations of 2021 have been published to implement the 2019 Act.[248] The regulations establish the National Information Technology Authority, which is responsible for personal data protection and privacy matters in Uganda. Entities collecting, processing and controlling data should register with the authority.[xlii] Information about registered data collections, processors and controllers will be maintained in the Authority's data protection register. Each entity that processes or controls personal data must appoint a data protection officer. The regulations also state the conditions under which data subjects can request data processors and collectors to amend data about the subject, for example in cases where data is incorrect, incomplete or inaccurate. Data subjects may also object to participation in data collection efforts under specific conditions.

DRE operations depend heavily on collection, processing and storing of digital data about customers. **This includes:**

- Data on energy consumption and payments, typically from smart meters and mobile money payments;
- This is often accompanied by demographic data about each customer, and the demographic data is linked to the customer's consumption and payment behaviour. This would include age, gender, nature of business (in the case of a productive user), etc;
- Names and contact details of data subjects;
- Location of data subjects.

Data is also very important for financial aggregation facilities, due to the importance of granular energy consumption and payment data in estimating the value of receivables and assessing the creditworthiness of customers. In addition to the data points listed above, financial aggregation facilities will likely also make use of credit profiles of DRE customers in order to assess creditworthiness. This would include payment performance related to other accounts such as mobile cellular subscriptions. **Financial aggregation facilities can reduce data privacy risks by employing the following strategies:**

- Closely following the act and regulations specified above;
- Redacting private data from data types that will be stored, to further increase the privacy of data subjects. This includes names, ID numbers, contact details and sensitive account details.

xlii Application forms are provided in the regulations. A certificate of registration is valid for 12 months from the date of registration.

Appendix C: Methodology for estimating DRE financial aggregation market size

Mini-grids

Short term time frame (ambitious & conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Sites currently operating:**[249] 48
- **Estimated connections per village:**[250] 100
- **ARPU per month:**[251] $4.65 per connection

Calculation:

1. **Total estimated current connections:** 48 sites x 100 connections = 4800 connections
2. **Total aggregatable revenue per annum:** 4800 connections x $4.65 x 12 months = $267,840

Medium term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- **Targeted connections by 2027 as per ECP:**[252] 126078
- **Estimated share of 2027 target reached by 2025:** 60%
- **ARPU per month:**[xliii] $6.05 per connection
- **Estimated connections per village:** 100
- **Estimated number of projects per portfolio:** 25
- **Estimated years that a mini-grid will operate:** 20

Calculation for annual aggregatable revenue:

1. **Estimated operational connections by 2025:** 126078 x 60% = 75647 connections
2. **Total aggregatable revenue per annum:** 75647 connections x $6.05 x 12 months = $5.49 million

Calculation for portfolio financing case:

1. **Estimated number of operational sites by 2025:** 75647 total connections / 100 connections per site = 756 sites
2. **Estimated number of portfolios:** 756 sites / 25 sites per portfolio = 30 portfolios
3. **Estimated deal size per portfolio:** 25 sites x 100 connections x $6.05 x 12 months x 20 years = $3.6 million

Long term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- **Mini-grid allocation in draft national electrification strategy:**[253] 2700 sites
- **ARPU per month:**[xliv] $9.07 per connection
- **Estimated connections per village:** 100
- **Estimated number of projects per portfolio:** 25
- **Estimated years that a mini-grid will operate:** 20

Calculation for annual aggregatable revenue:

1. **Total estimated connections by 2030:** 2700 sites x 100 connections = 270000 connections
2. **Total aggregatable revenue per annum:** 270000 connections x $9.07 x 12 months = $29.4 million

Calculation for portfolio financing case:

1. **Number of mini-grids added to reach target:** 2700 sites – 756 sites = 1944 sites
2. **Estimated number of portfolios:** 1944 sites / 25 sites per portfolio = 78 portfolios
3. **Estimated deal size per portfolio:** 25 sites x 100 connections x $9.07 x 12 months x 20 years = $5.4 million

Medium term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Estimated operational mini-grids by 2025:**[xlv] 142
- **ARPU per month:** $6.05 per connection
- **Estimated connections per village:** 100
- **Estimated number of projects per portfolio:** 25

Calculation for annual aggregatable revenue:

1. **Estimated operational connections by 2025:** 142 sites x 100 connections = 14200 connections
2. **Total aggregatable revenue per annum:** 14200 connections x $6.05 x 12 months = $1 million

Calculation for portfolio financing case:

1. **Estimated number of portfolios:** 142 sites / 25 sites per portfolio = 5 portfolios
2. **Deal size remains the same as ambitious scenario.**

Long term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Estimated operational mini-grids by 2030:**[xlvi] 697
- **ARPU per month:** [xlvii] $9.07 per connection
- **Estimated connections per village:** 100
- **Estimated number of projects per portfolio:** 25

Calculation for annual aggregatable revenue:

1. **Estimated operational connections by 2025:** 697 sites x 100 connections = 69,700 connections
2. **Total aggregatable revenue per annum:** 69,700 connections x $9.07 x 12 months = $7.6 million

Calculation for portfolio financing case:

1. **Number of mini-grids added to reach target:** 697 sites – 142 sites = 555 sites
2. **Estimated number of portfolios:** 555 sites / 25 sites per portfolio = 22 portfolios
3. **Deal size remains the same as ambitious scenario.**

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xliii 30% growth from current ARPU as an estimate of medium term ARPU growth based on AMDA data
xliv 50% growth from current ARPU as an estimate of long term ARPU growth based on AMDA data
xlv Calculated by applying current mini-grid site growth rate (37.5%) to projected number of operational sites in 2023 (75 sites) for 2024 estimation and then 2025 estimation. Growth rate is the average of recent year-on-year growth rates (2020-2022), with exclusion of one outlier growth rate.
xlvi Year-on-year growth up to 2030 follows the same rate (37.5%).
xlvii 30% growth from current ARPU as an estimate of medium term ARPU growth based on AMDA data.

Off-grid solar

Short term time frame (ambitious & conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Projected number of PAYGO units sold in 2022:**[xlviii] 171605
- **Estimated current average PAYGO revenue per unit per year:**[xlix] $142

Calculation:

Estimated total value of PAYGO market in 2022: 171605 units x $142 = $24.4 million

Medium term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- **Targeted connections by 2027 as per ECP:**[254] 1954216
- **Estimated share of 2027 target reached by 2025:** 60%
- **Share of PAYGO in total sales:**[l] 58%
- **Estimated mid-term average PAYGO revenue per unit per year:**[li] $185

Calculation:

1. **Estimated operational connections by 2025:** 1954216 x 60% = 1172530 connections
2. **Estimated number of PAYGO connections in 2025:** 1172530 x 58% = 680067 connections
3. **Estimated total value of PAYGO market in 2025:** 680067 connections x $185 = $125.5 million

Long term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- **Targeted connections by 2027 as per ECP:**[255] 1954216
- **Share of PAYGO in total sales:**[lii] 58%
- **Estimated long-term average PAYGO revenue per unit per year:**[liii] $258

Calculation:

1. **Estimated number of PAYGO connections in 2027:** 1954216 x 58% = 1133445 connections
2. **Estimated total value of PAYGO market in 2027:** 1133445 connections x $258 = $293 million

Medium term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Projected number of PAYGO units sold in 2025:**[liv] 243228
- **Estimated mid-term average PAYGO revenue per unit per year:** $185

Calculation:

1. **Estimated total value of PAYGO market in 2025:** 243228 connections x $185 = $45 million

Long term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- **Projected number of PAYGO units sold in 2030:**[lv] 434999
- **Estimated long-term average PAYGO revenue per unit per year:** $258

Calculation:

1. **Estimated total value of PAYGO market in 2030:** 434999 connections x $258 = $112.4 million

Photo: Adobe Stock/U. J. Alexander

xlviii Calculated by applying annual growth rate of 12.3% to 2021 PAYGO semi-annual sales data from GOGLA.
xlix This metric represents the average revenue that a single PAYGO OGS unit generates in a year. The average is based on 2018 and 2019 GOGLA data. Annual PAYGO revenue per unit for each year was calculated by dividing total value of the PAYGO market in that year by the total number of units sold on PAYGO in the same year.
l Calculated by dividing PAYGO sales (units) by total sales (units) from 2018-2020 GOGLA data.
li Factors in a 30% escalation from the baseline value to account for growing consumer purchasing power.
lii Calculated by dividing PAYGO sales (units) by total sales (units) from 2018-2020 GOGLA data.
liii Factors in a 40% escalation from the baseline value to account for growing consumer purchasing power.
liv Calculated by applying current PAYGO sales growth rate (12.3%) to number of PAYGO units sold in 2021 (152,769 units) for 2022 estimation, 2023 estimation and so forth up until 2025. Growth rate used is the most recent year-on-year growth rate in PAYGO units sold (2020-2021).
lv Year-on-year growth up to 2030 follows the same rate (12.3%).

Captive power (C&I solar only)

Short term time frame (ambitious & conservative scenario):

Inputs (data sources and assumptions in footnotes):

- Baseline installed capacity:[256] 7.92 MW
- Share of installed capacity on rent to own/PPA model:[257] 62%
- General PV performance ratio: 78%
- Rainy days per year (Entebbe as assumption): 128
- Average sun hours per day in Uganda: 9
- Estimated PPA tariff:[lvi] $0.15/kWh

Calculation:

1. Sun hours per year: 9 x (365 days - 128 days) = 2133 hours
2. Total installed capacity on rent to own/PPAs: (7.92 MW x 62%) x 1000 = 4910 kW
3. Annual kWhs (assuming everything is consumed): 4910 kW x 78% x 2133 hrs = 8169629 kWh
4. Total aggregatable revenue per annum: 8169629 kWh x $0.15/kWh = $1.2 million

Medium term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- Estimated installed capacity by 2025:[lvii] 20.9 MW
- Share of installed capacity on ESCO models by 2025: [lviii] 70%
- Estimated PV performance ratio by 2025:[lix] 85%
- Sun hours per year: 2133 hours (calculated above)
- Estimated number of projects per portfolio: 15
- Estimated years that a C&I project will operate: 20
- Average installed capacity per project: 100 kW

Calculation for annual aggregatable revenue:

1. Total installed capacity on rent to own/PPAs by 2025: (20.9 MW x 70%) x 1000 = 14631 kW
2. Annual kWhs (assuming everything is consumed): 14631 kW x 85% x 2133 hrs =26526739 kWh
3. Total aggregatable revenue per annum: 26526739 kWh x $0.15/kWh = $4 million

Calculation for portfolio financing case:

1. Estimated number of operational C&I sites: 14631 kW / 100 kW = 146 sites
2. Estimated energy generated per year per project: 100 kW x 85% x 2133 hrs = 181305 kWh
3. Estimated number of portfolios: 146 projects / 15 projects per portfolio = 10 portfolios
4. Estimated deal size per portfolio: 181305 kWh x 15 projects x $0.15 x 20 yrs = $8.2 million

Long term time frame (ambitious scenario):

Inputs (data sources and assumptions in footnotes):

- Total installed capacity by 2030:[lx] 236.5 MW
- Share of installed capacity on ESCO models by 2030:[lxi] 75%
- Estimated PV performance ratio by 2030:[lxii] 90%
- Sun hours per year: 2133 hours (calculated above)
- Estimated number of projects per portfolio: 15
- Estimated years that a C&I project will operate: 20
- Average installed capacity per project: 150 kW

Calculation for annual aggregatable revenue:

1. Total installed capacity on ESCO models by 2030: (236.5 MW x 75%) x 1000 = 177364 kW
2. Annual kWhs (assuming everything is consumed): 177364 kW x 90% x 2133 hrs =340484862 kWh
3. Total aggregatable revenue per annum: 340484862 kWh x $0.15/kWh =$51.1 million

Calculation for portfolio financing case:

1. Estimated number of new ESCO C&I sites: (177364 kW / 150 kW) – 146 sites = 1036 sites
2. Estimated energy generated per year per project: 150 kW x 90% x 2133 hrs = 287955 kWh
3. Estimated number of portfolios: 1036 projects / 15 projects per portfolio = 69 portfolios
4. Estimated deal size per portfolio: 287955 kWh x 15 projects x $0.15 x 20 yrs = $13 million

Medium term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- Estimated installed capacity by 2025:[lxiii] 16.4 MW
- Share of installed capacity on ESCO models by 2025: 70%
- Estimated PV performance ratio by 2025: 85%
- Sun hours per year: 2133 hours (calculated above)
- Estimated number of projects per portfolio: 15
- Estimated years that a C&I project will operate: 20
- Average installed capacity per project: 100 kW

Calculation for annual aggregatable revenue:

1. Total installed capacity on rent to own/PPAs by 2025: (16.4 MW x 70%) x 1000 = 11477 kW
2. Annual kWhs (assuming everything is consumed): 11477 kW x 85% x 2133 hrs =20808684 kWh
3. Total aggregatable revenue per annum: 20808684 kWh x $0.15/kWh = $3.1 million

Calculation for portfolio financing case:

1. Estimated number of operational ESCO C&I sites: 11477 kW / 100 kW = 115 sites
2. Estimated energy generated per year per project: 100 kW x 85% x 2133 hrs = 181305 kWh
3. Estimated number of portfolios: 115 projects / 15 projects per portfolio = 8 portfolios
4. Estimated deal size per portfolio: 181305 kWh x 15 projects x $0.15 x 20 yrs = $8.2 million

Long term time frame (conservative scenario):

Inputs (data sources and assumptions in footnotes):

- Total installed capacity by 2030:[lxiv] 101.1 MW
- Share of installed capacity on ESCO models by 2030: 75%
- Estimated PV performance ratio by 2030: 90%
- Sun hours per year: 2133 hours (calculated above)
- Estimated number of projects per portfolio: 15
- Estimated years that a C&I project will operate: 20
- Average installed capacity per project: 150 kW

Calculation for annual aggregatable revenue:

1. Total installed capacity on ESCO models by 2030: (101.1 MW x 75%) x 1000 = 75828 kW
2. Annual kWhs (assuming everything is consumed): 75828 kW x 90% x 2133 hrs =145566163 kWh
3. Total aggregatable revenue per annum: 145566163kWh x $0.15/kWh =$21.8 million

Calculation for portfolio financing case:

1. Estimated number of new ESCO C&I sites: (75828 kW / 150 kW) – 114 sites = 391 sites
2. Estimated energy generated per year per project: 150 kW x 90% x 2133 hrs = 287955 kWh
3. Estimated number of portfolios: 391 projects / 15 projects per portfolio = 26 portfolios
4. Estimated deal size per portfolio: 287955 kWh x 15 projects x $0.15 x 20 yrs = $13 million

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lvi Based on LCOE values from Magala, J. et al.
lvii Calculated by applying current C&I solar CAGR (62.45%) to 2023 installed capacity (7.92 MW) for 2024 estimation and then 2025 estimation. Rate represents 5-year CAGR in installed capacity from 2018 to 2023.
lviii Assuming growth as the rent to own/PPA market matures over time
lix Considering improvements in solar PV technology
lx CAGR up to 2030 follows the same rate (62.45%).
lxi Assuming growth as the rent to own/PPA market matures over time
lxii Considering improvements in solar PV technology
lxiii Calculated by applying downwards-adjusted C&I solar CAGR (43.88%) to 2023 installed capacity (7.92 MW) for 2024 estimation and then 2025 estimation.
lxiv CAGR up to 2030 follows the same downwards-adjusted rate (43.88%).

Appendix D: DRE companies in Uganda

COMPANY NAME	TECHNOLOGY
AB Matra	SHS, Captive power
Absolute Energy	Mini-grid, Captive power
Access to Solar Technologies	SHS
ADH Group Uganda	SAS productive use, Captive power
Adritex	SAS productive use, Captive power
Advanced Solar Power	Captive power
African Energy	Captive power, SAS productive use
African Power	Captive power, SHS, SAS productive use
Africorp solar solutions	Captive power
Agsol	SAS productive use
All Africa Ultimate Solar Energy	Captive power
All in Trade	SAS productive use, Captive power, SHS
Ambition Renewable Energy	Captive power
Anuel Energy	SHS, SAS productive use, Captive power
Aptech Africa	Captive power, SAS productive use
ARED SMC	SAS productive use, SHS
Ase Solar Ltd	SHS, Captive power
ASOBO	EV
Assen Ventures	SAS productive use, Captive power
Azuri Technologies	SHS
Barefoot Power	SHS
Basal Solutions	Captive power, SAS productive use, SHS, Solar Thermal
Baseline Africa	SHS

COMPANY NAME	TECHNOLOGY
Baseline Africa Ltd	Captive power
Battery Plus Ltd	Captive power
Bitcom Delta EA	Captive power
Bob Eco	EV
Bodawerk	EV, SAS productive use
Bold Energy Ltd	Captive power, SAS productive use
BrightLife Uganda	SHS
Chloride Exide	Captive power, SAS productive use
Copx Solar Company-SMC	Captive power
Crown Energy	Captive power, SAS productive use
d.light	SHS
Davis & Shirtliff	SHS, SAS productive use, Captive power
East African Power	Captive power
Ekorn Solar Ltd	Captive power, SAS productive use, SHS, Solar Thermal
Energy Systems Ltd	Captive power
Engie Energy Access	Mini-grid, SHS
EnGreen	Mini-grid
Epicenter Africa	SAS productive use, Captive power
Equator Energy	Captive power
Equator Solar Systems	Captive power
Equatorial Power	Mini-grid
Eyepower Engineering	Captive power
Feiying Electric Vehicles Uganda	EV
Futurepump	SAS productive use
Greenlight Planet	SHS

COMPANY NAME	TECHNOLOGY
Innovex	SHS
Ital Trade Solar Power	Captive power, SAS productive use
Kakira Sugar	Captive power
Kalangala Infrastructure	Mini-grid
Kambasco Technologies	SHS, SAS productive use
Kiira Motors	EV
Kirchner Solar	Mini-grid, SHS, Captive power
Luk Solar	SHS, SAS productive use
M-KOPA	SHS, SAS productive use
Mandulis Energy	Mini-grid
MeshPower	Mini-grid, Captive power
Mwezi Solar	SHS
New Cares Ltd.	SHS
New Sun Ltd	Captive power
OFGEN	Captive power, Mini-grid
One Acre Fund	SHS
OneLamp	SAS productive use
Pamoja Energy	Mini-grid
Peec Energy	Captive power
Power Trust	SAS productive use, Captive power
Premier Solar Group	Captive power
Remergy	Mini-grid
Rural Spark	SHS
Solantis Solar	SHS
Solar Energy for Africa	Captive power, SAS productive use
Solar First Uganda	SHS, Captive power, SAS productive use

COMPANY NAME	TECHNOLOGY
Solar Links	SHS
Solar Nation Uganda	Captive power
Solar Pipo	Captive power
Solar Point Uganda	Captive power, SHS
Solar Sisters	SHS
Solar Today	SHS, SAS productive use, Captive power
SolarConnect	Captive power
SolarNow	SHS, SAS productive use
SolarWave Uganda	SAS productive use
SoloGrid	SHS, SAS productive use
Sostap	Captive power, SAS productive use
Sumadhura Technologies	Captive power
Sunami Solar	SHS, SAS productive use
Sunmoyo	Captive power
SunTap	Captive power
Trans African Supply Services	Captive power
Tulima Solar	SAS productive use
UltraTec	SHS, Captive power, SAS productive use
Village Energy	SAS productive use, Captive power
Village Power	SHS
W. Water Works	Captive power, SAS productive use
WakaWaka Power	SHS
Water & Pumps International	SHS,SAS productive use
Winch Energy	Mini-grid
Xpreme Solar Solutions	SHS
Yellow Solar	SHS
Zembo	EV

Appendix E: Relevant DRE investors

INVESTOR NAME	INVESTOR ARCHETYPE	TARGETED SECTOR	COUNTRY / REGION
Acumen	Concessional	Sector agnostic, Mini-grids, Captive power, SHS	Global
Africa Enterprise Challenge Fund	Concessional, Grant funder	agribusiness, Mini-grids, SHS,SAS productive use	sub-Saharan Africa
African Development Bank	Grant funder	Mini-grids, SHS, SAS productive use, Sector agnostic	sub-Saharan Africa
African Frontier Capital	Concessional	SHS, SAS productive use	sub-Saharan Africa
Alpha Mundi	Concessional	Sector agnostic	sub-Saharan Africa
Ashden Trust	Grant funder	Climate change, agribusiness, renewable energy	Global
Bamboo Capital Partners	Concessional	Sector agnostic	Global
Bank of America	Foreign commercial	Mini-grids, SHS,SAS productive use, Captive power, Sector agnostic	Global
Belgian Investment Corporation (BIO)	Grant funder	Mini-grids, SHS, SAS productive use, Sector agnostic	Global
BMZ	Grant funder	SHS, SAS productive use, Sector agnostic	Global
Calvert Impact Capital	Grant funder	Mini-grids, SHS, SAS productive use, consumer financing, agribusiness	Global
CAMCO	Fund manager	Mini-grids, Captive power, SHS, SAS productive use, Utility scale RE	Global
British International Investment	Concessional	Sector agnostic	sub-Saharan Africa,Asia
Ceniarth	Concessional	Sector agnostic	Global
Centenary Bank Uganda	Local commercial	Captive power, Sector agnostic	Uganda
CrossBoundary	Fund manager	Mini-grids, Captive power	sub-Saharan Africa
DANIDA	Concessional	Mini-grids, SHS, SAS productive use, Sector agnostic	Global
Developing World Markets	Concessional	Sector agnostic, SHS	Global
Development Bank of Southern Africa	Concessional	Utility scale RE, Health, Education, Transport	sub-Saharan Africa
DFC	Concessional	Sector agnostic	Global
E3 Capital (formerly Energy Access Ventures)	Concessional	Captive power, Mini-grids, SHS, SAS productive use	sub-Saharan Africa
Ecoligo	Crowdfunding platform	Captive power	Global
EEP Africa	Grant funder	Mini-grids, Captive power, SHS, SAS productive use	sub-Saharan Africa
Efficiency for Access	Concessional	SAS productive use, Energy efficiency	Global
ElectriFi	Concessional	Mini-grids, SHS, Captive power	Global

INVESTOR NAME	INVESTOR ARCHETYPE	TARGETED SECTOR	COUNTRY / REGION
EnDev	Grant funder	Mini-grids, SHS, SAS productive use	Global
Energise Africa	Crowdfunding platform	Mini-grids, Captive power, SHS, SAS productive use, agribusiness	sub-Saharan Africa
Energy for Impact	Fund manager	SAS productive use, Mini-grids, SHS	sub-Saharan Africa
European Investment Bank	Foreign commercial	Sector agnostic	Global
FCDO	Concessional	Mini-grids, Captive power, SHS, SAS productive use, Sector agnostic	Global
Finnfund	Concessional	Mini-grids, Captive power, SHS,SAS productive use, agribusiness, consumer financing	Global
FMO	Concessional	Mini-grids, Captive power, SHS, SAS productive use, Sector agnostic	Global
GIZ	Grant funder	Mini-grids, Captive power, SHS, SAS productive use, Sector agnostic	Global
Good Energies Foundation	Concessional	Mini-grids, Captive power, SHS, SAS productive use	Global
Greenmax Capital	Fund manager	Captive power, Mini-grids, SHS,SAS productive use, Utility scale RE	Global
IFC	Concessional	Sector agnostic	Global
IKEA Foundation	Grant funder	Mini-grids, SHS, SAS productive use	Global
Inspired Evolution	Foreign commercial	SHS, Captive power	sub-Saharan Africa
KawiSafi Ventures	Concessional	SHS, SAS productive use	sub-Saharan Africa
KfW	Grant funder,Concessional	Sector agnostic	Global
Lendable	Foreign commercial	Fintech, SHS	Global
Lion's Head Global Partners	Fund manager	Mini-grids, SHS, SAS productive use	sub-Saharan Africa
Maris Africa	Foreign commercial	Captive power, EVs	sub-Saharan Africa
Mercy Investment Services	Grant funder	Sector agnostic	Global
NEFCO	Fund manager,Concessional	Mini-grids, SHS, SAS productive use, Sector agnostic	Global
NeoT	Fund manager	Mini-grids, SHS, EVs, SAS productive use	Global
Nithio	Fund manager	Mini-grids, SHS, SAS productive use	sub-Saharan Africa
NORAD	Grant funder	Climate change, renewable energy, Education, Health	Global
Norfund	Concessional	Sector agnostic	Global
OeEB	Concessional	renewable energy, Sector agnostic	Global

INVESTOR NAME	INVESTOR ARCHETYPE	TARGETED SECTOR	COUNTRY / REGION
OFID	Concessional funder,Grant funder	SAS productive use, Sector agnostic	Global
Oikocredit	Concessional	Mini-grids, SHS, SAS productive use, consumer financing, agribusiness	Global
Persistent Energy	Fund manager	Mini-grids, SHS, SAS productive use	sub-Saharan Africa
PFAN	Concessional	Sector agnostic	Global
REEEP (Renewable Energy and Energy Efficiency Partnership)	Concessional	Utility scale RE, Mini-grids, Captive power, SHS, SAS productive use	Global
responsAbility	Fund manager	Mini-grids, Captive power, SHS, SAS productive use, consumer financing, agribusiness	Global
Rockefeller Foundation	Grant funder	agribusiness, Health, Mini-grids, SHS, SAS productive use	Global
Shell Foundation	Grant funder	Mini-grids, Captive power, SHS, SAS productive use	Global
SIDA	Concessional	Sector agnostic	Global
SIMA Funds	Fund manager	SHS, SAS productive use, consumer financing	Global
Stanbic Bank East Africa	Local commercial	SHS	East Africa
Stanbic Bank Uganda Ltd	Local commercial	SHS, Sector agnostic	Uganda
SunFunder	Concessional,Fund manager	Mini-grids, Captive power, SHS, SAS productive use	Global
Swedfund	Concessional	Mini-grids, SHS,SAS productive use, Utility scale RE, Health, consumer financing	Global
Swiss Agency for Development and Cooperation	Concessional	Mini-grids, SHS, SAS productive use, Sector agnostic	Global
Symbiotics Group	Fund manager,Concessional	Sector agnostic, SHS	Global
TRINE	Crowdfunding platform	Mini-grids, Captive power, SHS, SAS productive use	Global
Triodos Bank	Concessional	SHS, SAS productive use, Utility scale RE,Sector agnostic	Global
Triple Jump	Fund manager	Mini-grids, Captive power, SHS, SAS productive use, consumer financing	Global
Uganda Energy Credit Capitalization Company	Concessional	Mini-grids, SHS, SAS productive use	Uganda
UNCDF	Grant funder	Sector agnostic	Global
USAID / Power Africa	Grant funder	Mini-grids, Captive power, SHS, SAS productive use, Sector agnostic	Global
Venture South (.net)	Concessional	SHS, SAS productive use	sub-Saharan Africa

Appendix F: Relevant investment funds

NAME	COUNTRY / REGION	PROGRAMME TYPE	FUND SIZE (IF RELEVANT)	MANAGING ORGANIZATION	FUNDERS
Nithio clean energy fund (first close)	Kenya, Uganda, Nigeria	Debt fund	$24 million (20% earmarked for Uganda)	Nithio	DFC, FSD Africa, ElectriFi, Shell Foun, UKAid
Uganda Green Enterprise Finance Accelerator	Uganda	Loan facility, Technical assistance		Finding XY, adelphi	EU
EnDev Uganda COVID Relief Fund	Uganda	Grant support	$1.1 million	Private Sector Foundation in Uganda	GIZ, BMZ, NORAD, UKAid, Swiss Agency for Development and Cooperation, Dutch Ministry of Foreign Affairs
UNCDF COVID Working capital facility	Uganda	Grant support		UNCDF	UNCDF
AlphaJiri Fund	SubSahara africa	Debt fund, Technical assistance, Mezzanine debt, Commercial equity		AlphaMundi, Triodos Investment Management	Stiftung Abendrot
The Build fund	Uganda, East Africa	Debt fund, Technical assistance		UNCDF, Bamboo capital partners	Gov of Luxembourg
KawiSafi Ventures (KSV) fund	East Africa	Commercial equity		KawiSafi Ventures	
E3 Low Carbon Economy Fund I	SubSahara africa, East Africa	Commercial equity, early stage		E3 Capital, Lions Head Capital	
Efficiency for Access R&D fund (First call)	Uganda, Global	Grant support	$1.3 million	Efficiency for Access	
SunFunder Solar Transformation Fund	East Africa, West Africa	Debt fund	$70 million	Sunfunder	Calvert Impact Capital, DFC, IKEA Foundation, Swedfund, Bank of America, Mercy Investment Services, Schmidt Family Foundation, OeEB
SIMA Off-Grid Solar & Financial Access Senior Debt Fund I	SubSahara africa, Uganda, South Asia	Senior Debt	$90 million	SIMA Funds	USAID, OeEB, OPIC, FMO, AXA, Belgian Investment Corporation, Wallace Global Fund, Heifer International, Church Pension Group, GLS, Impact Assets, MetLife, PCG, Portico, Netri Found, Bank of Luxembourg, Mercy Investment Services, Arthur Schultz Found, CommonSense Fund, O'Niell Found, Proaltus Capital Partners, Sisters of Charity
ResponsAbility access to clean power fund	SubSahara africa, South Asia	Debt fund	$151 million	responsAbility	FMO, FCDO, OeEB, IFC, Norfund, AHL Venture Partners, Ashden Trust, Bank of America, Calvert Impact Capital, EIB, Facebook, Good Energies Found, Gov of Luxembourg, Shell Foun, Snowball, Swiss State Secretariat for Economic Affairs
Pioneer Energy Investment Initiative	SubSahara africa	Convertible debt, Preferred equity	$22.5 million	Acumen	FMO, FCDO, IKEA Foundation, Signify Foundation, Autodesk Foundation
Energy Entrepreneur Growth Fund	SubSahara africa	Mezzanine debt	$120 million (targeted)	Triple Jump, Persistent Energy	FCDO, FMO, Shell Foun
Africa Renewable Energy Fund II	SubSahara africa	Commercial equity	$300 million (targeted)	Berkeley Energy	AfDB, FMO, Swedfund, CDC Group, CDP, Proparco
Bamboo Energy Access Mutiplier	SubSahara africa	Commercial equity	$25 million	Bamboo capital partners	ElectriFi

NAME	COUNTRY / REGION	PROGRAMME TYPE	FUND SIZE (IF RELEVANT)	MANAGING ORGANIZATION	FUNDERS
EEP Africa trust fund	SubSahara africa	Grant support	EUR 28 million	EEP Africa	NDF, Austrian Development Agency, Swiss Agency for Development and Cooperation, Finnish Ministry of Foreign Affairs
SIMA Angaza Distributor Financing Fund	SubSahara africa	Debt fund		SIMA Funds,Angaza	Shell Foun, UKAid, USAID, Power Africa, Skoll Foundation, Ceniarth
Climate Investor 1	Global	Commercial equity, Senior Debt, TA	$1.65 billion	Climate Fund Managers	GCF, FMO, Swedfund, Triodos Bank, AEGON, AfDB, KLP, Dutch Ministry of Foreign Affairs, NDF, NWB Bank,Sanlam, USAID
Climate Investor 2	Global		$2.1 billion	Climate Fund Managers	GCF, FMO, Swedfund, FMOKLP, Dutch Ministry of Foreign Affairs, NDF, Sanlam, Triodos Bank, USAID, AEGON, AfDB
ARCH Africa Renewable Power Fund	SubSahara africa	Ordinary equity	$250 million	ARCH Emerging Markets Partners	AfDB, Africa Rainbow Capital, EU
Universal Green Energy Access Programme	Uganda, Ethiopia, Kenya, Tanzania, Namibia, Benin	Commercial equity	$300 million		GCF
Beyond the Grid Fund for Africa Window 3	Uganda, DRC, Mozambique, Burkina Faso, Zambia, Liberia	Grant support	EUR 20 million	NEFCO	Swedfund, DANIDA, KFW, Power Africa, NEFCO, REEEP
SIMA Energy Access Relief Fund	Global	Debt fund	$80 million (target), currently $68 million	SIMA Funds	CDC Group, DFC, FMO, GCF, Shell Foun, IKEA Foundation, SIDA,Swiss Agency for Development and Cooperation, FCDO, USAID, Power Africa
Renewable Energy Performance Platform (REPP)	SubSahara africa	Debt fund		CAMCO	DFC, FMO, EDFI ElectriFi, Empower New Energy, Finnfund, Trade & Development Bank, Sunfunder, Oikocredit, GuarantCo, Global Climate Partnership Fund, West African Development Bank
FMO Infrastructure Development Fund	Global	Debt fund, Direct equity, Mezzanine	$355 million		
Africa50 Venture Fund	SubSahara africa	Commercial equity, Quasi equity			
Investment Fund for Developing Countries (IFU)	Kenya, SubSahara africa	Commercial equity, Debt fund			
UNCDF LDC investment platform	Uganda, Global	Debt fund, Grant support			UNCDF
Sustainable Energy Fund for Africa	SubSahara africa	Technical assistance, Grant support		AfDB	AfDB
SUNREF	SubSahara africa	Debt fund		AFD	GCF
Transforming Energy Access programme	Global	TA, Grant support	GBP 225 million	Shell Found.	FCDO

Appendix G: Market assessment framework indicators

Country level

Political

Tariffs

Tariffs and the processes governing how they are determined have a significant impact on several of the sectors considered by the CAP. The sector most exposed to this is the mini-grid sector. In some countries, a 'universal tariff' is applied to any electricity sold. This is often artificially below the cost of production and the regulation surrounding it is commonly manipulated by political aspirants looking to gain national popularity. Countries with a universal tariff are often difficult markets for mini-grid operators. Delivering rural energy is often more expensive than the national electricity tariff (which is often heavily subsidized). If mini-grid developers are allowed to charge **a cost reflective tariff** they are much more likely to be able to run a profitable operation. A lack of regulation or a specific willing-buyer-willing seller approach to tariffs can be beneficial for a mini-grid developer, but in a regularity vacuum or if there is regulatory uncertainty, this will often be perceived to be an added risk from the perspective of any potential investors.

The indicators included here for 'mandated tariff revision cycle' and 'volatility in national grid tariffs over the last 5 years' are proxies for regulatory stability and will have a bearing on perceived risk.

National grid tariff affects the low carbon sectors included in the CAP differently. Because mini-grids and captive power business models are arguably competing against the national grid, a market with high grid tariffs will be advantageous to these businesses. Conversely as the 'fuel' for EVs, cheap electricity (low grid tariffs) is advantageous to the EV sector in a country. For this reason national tariffs are not included in the **Country Level** indicators. Separate indicators have been included for each sector within the **Sector Specific** section and certain indicators are included in multiple sectors but occasionally with different scoring rules.

Taxes

Taxes can affect the expenses of a company as well as the profits that can be extracted by third parties from that company. As such they are relevant when discussing investment. Indeed, **this section, including both low carbon asset company-targeted taxes and investor-targeted taxes, was rated extremely important by the stakeholders interviewed.**

Different sectors and different financial aggregation instruments will be exposed to the different taxes to varying degrees. For example, C&I and mini-grid companies are significantly exposed to import duties on renewable energy components whereas EV companies will be more exposed to VAT and taxes specific to that sector.

Indicators in this section include: VAT on renewable energy components, import duties on renewable energy components, tax rate on asset transfers between originators and SPVs, withholding tax rate and corporate tax rate.

Government support

The extent to which a government is supportive of an industry can make a huge impact on its commercial viability. There are a great number of indicators that could be included as proxies for this including the existence of actual or planned regulation for specific sectors. Related indicators might include details of any industry lobby groups. For the sake of this work however and with the selection criteria in mind, only one indicator has been included at the Country Level. Others, including the presence of a functional rural electrification agency have been included in the Sector Specific section as appropriate.

International ratings

There are many global KPI frameworks and country ratings that have been developed and continue to be developed. For the purposes of this aggregation-based framework the long list of potentially useful systems was reduced to six simplified indicators.

These cover national level investor and operational risks based on a country's credit worthiness and levels of corruption (including Transparency International's Corruption Index and sovereign credit ratings by Fitch, S&P and Moody's). These are useful to investors regardless of the sector. They also include more industry specific indicators that provide some insight into market dynamics affecting the specific business models covered by the CAP. For example, ESMAP's Regulatory Indicators for Sustainable Energy (RISE) provides an excellent consolidated score

for how supportive a country's policy landscape is for renewable energy projects. The PAYGO Market Attractiveness Index is designed largely for PAYGO business models but many of the indicators used are relevant to any **digitally enabled business**. Virtually every company and start-up considered during the course of this work, from all the sectors including EV and C&I can be classified as being digitally enabled businesses.

There were numerous other frameworks suggested by stakeholders during our interviews that were considered and not included. The principal reason being the uncertainty and in some cases openly doubted lack of credibility of the sources. One of these is the World Bank Ease of Doing Business index, which has suffered from inaccurate and falsified data.[258]

Competing energy services

The cost of incumbent energy services has a significant bearing on the commercial viability of all of the sectors under consideration for CAP. In the case of C&I, any proposed solar energy system will be competing against large diesel generators, the biggest cost of which is the ongoing diesel fuel expense. In countries where there is a significant subsidy on diesel and other fossil fuels, solar C&I projects will have tougher competition. Although the same is true between kerosene and solar home systems, there are immediate benefits (not least of all to improved safety in the home) with using SHS systems that are generally obvious to consumers and will be valued beyond a simple kerosene/SHS price comparison.

Government subsidies on petrol, kerosene and other 'essentials' are often very politicized; manipulated to increase political popularity as elections draw near for example. This can, as we've seen in several African markets, make and break nascent national industries. As such, we have included price volatility here. Greater stability leads to lower risk.

This indicator is calculated as a percentage change in price over a five-year period. Because prices are naturally expected to increase over time, the scoring is more tolerant to a small upward variance in price.

Table G1:

Political-related indicators in the financial aggregation market assessment framework

POLITICAL
Tariffs
Mandated national grid tariff revision cycle? (Y/N)
Change in residential grid tariffs over five years (%)
Change in C&I grid tariffs over five years (%)
Taxes
VAT on RE components (Solar modules)
VAT on RE components (Solar products)
VAT on RE components (Batteries)
Import duties on RE components (Solar modules)
Import duties on RE components (Solar products)
Import duties on RE components (Batteries)
Tax rate on initial asset transfers between originator and SPV
Tax rate on interest payment from SPVs to investors
Tax rate on interest payments from originators to SPVs
Withholding tax rate
Corporate tax rate
Government support
No. of government credit guarantee schemes for RE sector
International ratings
Corruption Index (Transparency International)
Big Three Sovereign Credit' rating (Fitch, S&P, Moody's)
Regulatory indicators for Sustainable Energy (RISE) Score
Regulatory indicators for Sustainable Energy (RISE) Ranking
PAYGO Market Attractiveness Index Overall Score
PAYGO Market Attractiveness Index Ranking
Competing energy services
Diesel price ($/l)
Change in diesel price over five years (%)
Petrol price ($/l)
Change in petrol price over five years (%)
Kerosene price ($/l)

Economic

The headline indicators in this section include standard indicators of the size and vibrancy of a national economy as well as its growth and the stability of this growth. Within the context of CAP, countries in Africa with a larger GDP will generally be more conducive to starting, growing and investing in businesses in any of the sectors under consideration.

These indicators are, however, simple and do not capture the complex and multifaceted nature of a healthy economy or a well-developed financial infrastructure. To address this, the IMF developed the Financial Institutions Index[259] that quantifies the 'depth' (size and liquidity) of financial institutions and markets, the access that people have to financial services and the efficiency with which institutions can provide these services (measured by costs and sustainable revenues).

Monetary policy

The indicators included in this section are designed to provide visibility on factors specific to international investment. Currency risk is a standard metric for any international investor and this was echoed by the results of our stakeholder interviews; **the entire cross section of respondents considered this indicator to be very important.** To capture this risk in a measurable and comparable metric we have used currency volatility, measured as a standard deviation variance against the dollar over 5 years.

Fiscal policy

A government's fiscal policy will be a good measure of how well the national finances are managed. Poor management is a clear risk indicator for investing in a country. There are numerous qualitative indicators that provide necessary nuance on these issues, but some quantitative data has also been gathered to allow comparison between countries.

Table G2:

Economic-related indicators in the financial aggregation market assessment framework

ECONOMIC
Size and state of the economy
Annual % GDP growth rate (5-year data)
GDP ($ billion)
Rolling 5-year GDP average ($ billion)
Financial Markets Index
Monetary policy
Currency volatility against USD over five years (standard deviation)
Inflation rate (%)
Risk free rate (%)
Article 14 Country (Y/N)
Fiscal policy
Balance of Payments (% of GDP)
National budget deficit (% of GDP)
Inward investment
Total foreign direct investment in RE sectors (% GDP)
Total international investment in RE sectors ($ million) (5-year data)
Total foreign direct investment (% GDP)
Local finance
Financial Institutions Index
Size of Finance Sector -assets held ($B)
Domestic credit to private sector (% of GDP)
Domestic credit to private sector by banks (% of GDP)

Social

The social indicators included in this section provide visibility on the spending power of a population as well as the size of the population and equality with which the wealth is distributed among them.

Table G3:

Social-related indicators in the financial aggregation market assessment framework

SOCIAL
Demographics
Real GDP per capita ($ PPP) -2020 (5-year data)
Population size (millions)
Population growth rate (%) -2020 (5-year data)
Gini coefficient

Technological

The indicators describing access to digital services are included to provide insight on the viability of business models relying on digital technologies such as PAYGO or mobile phone apps. These can be seen as technological enabling environment indicators.

Table G4:

Technological-related indicators in the financial aggregation market assessment framework

TECHNOLOGICAL
Access to digital services
Proportion of population using Facebook -2020
Mobile cellular subscriptions per 100 people (5-year data)
Mobile money accounts per 1000 people -2020 (5-year data)

Legal

Enabling environment indicators also include factors relating to the ease of doing business generally as well as those more relevant to an aggregation platform. Many aggregation models, particularly those built on recurring revenues, benefit from having a local SPV to receive ongoing receivables. Likewise, the costs and ease with which money can be periodically transferred from a country where operations are taking place to investors is of vital importance to a long term, receivables-based engagement.

Strength of Legal Rights Index

Strength of Legal Rights Index is a World Bank metric that measures the degree to which collateral and bankruptcy laws protect the rights of borrowers and lenders and thus facilitate lending. The data used in this index measure business regulation, regulatory outcomes, and the extent of legal protection of property. They also measure the flexibility of employment regulation and the tax burden on businesses. The fundamental premise of this indicator is that healthy economic activity requires good rules and regulations that are efficient, accessible to all who need to use them, and simple to implement. The index ranges from 0 to 12, with higher scores indicating that these laws are better designed to expand access to credit.

Table G5:

Legal-related indicators in the financial aggregation market assessment framework

LEGAL
Ease of business/aggregation indicators
Time taken to register a company (days)
Time taken to open a bank account (days)
Cost of setting up a business/special purpose vehicle (SPV) ($)
Competence of transaction market actors
Strength of Legal Rights Index

Impact

The data included in this section is of particular importance to investors with an interest in the social and environmental impact of an investment. These could include private foundation-type impact investors as well as ethical funds with a mandate to invest solely in ethically sound portfolios. The existence of well thought through policies on factors like gender and the environment **also provide an indirect measure of the governance of a country and the degree to which a government might want to come into line with international norms.** Therefore they also provide some indication of a more investor friendly environment.

Table G6:
Environment and gender-related indicators in the financial aggregation market assessment framework

IMPACT
Environmental
Environmental protection policies in place?
Environmental targets in place?
Gender
Percentage of women in parliamentary seats
Percentage of women in ministerial positions
Presence of policies and legal frameworks to support gender equality Y/N
Presence of policy and legal and institutional frameworks to guide gender mainstreaming in the energy sector Y/N
Female graduates from Upper Secondary %
Female graduates from tertiary in Science, Technology, Engineering and Mathematics (STEM) %
Female participation in labour force %
Percentage of female professional and technical workers %
Percentage of women who have accessed credit from formal or informal financial institutions %

Detailed sector level indicators

Sector level indicators are a mix of factors relevant to all sectors (mini-grids, OGS, captive power and EVs) as well as those unique to specific sectors. For example the importance of 'Number of players in the market' should be considered whether one is investing into EVs or mini-grids whereas 'Number of charging stations across the country' will only be relevant to EVs. Tables G7 to G10 show what these indicators are.

At the start of every sector specific section in this report, each sector is rated according to three macro categories; Market maturity, Taxes and Sector Support (see for example Figure G1). The indicators that make up each category differ depending on the sector to which they are relevant. As an example, Figure G2 shows the indicators that are used in the calculation of the "market maturity" macro categories for mini-grids, as well as the weighting given to each of those indicators.

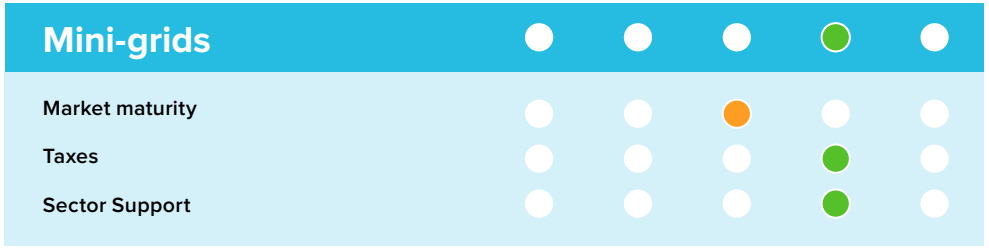

Figure G1: **Example of macro categories used to score a DRE sector**

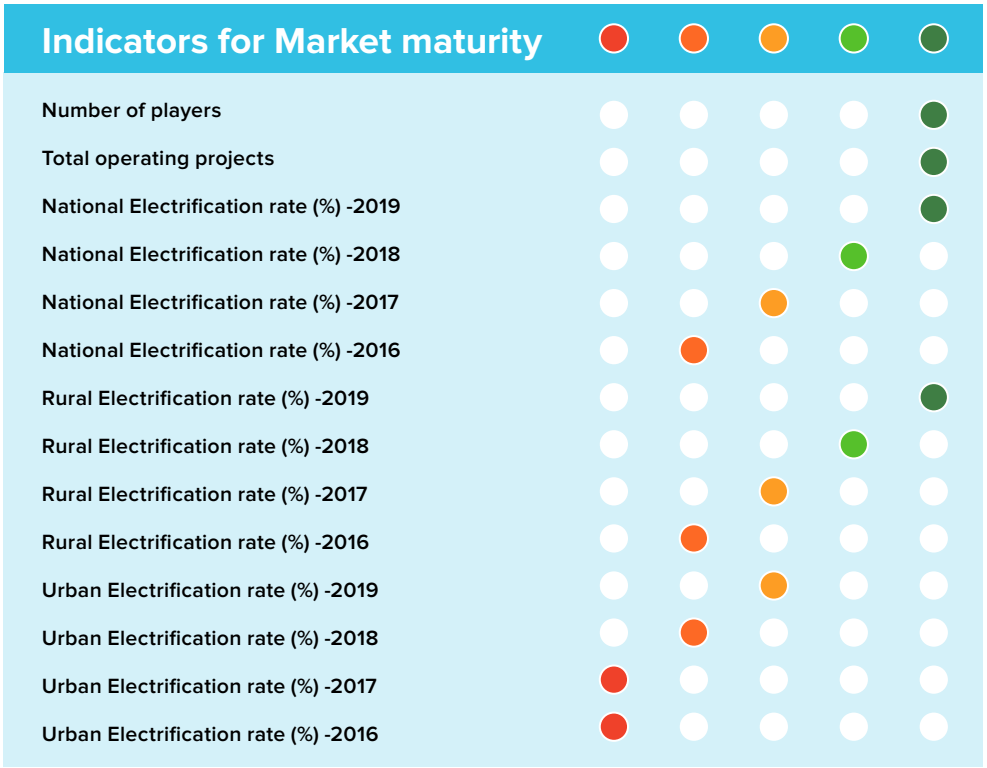

Figure G2: Indicators used to calculate the market maturity category for mini-grids

Table G7:

OGS-related indicators in the financial aggregation market assessment framework

SHS AND SAS

Market
Number of players
CAGR 3 years (%)
Cumulative total sales -2020
Cumulative total sales -2019
Cumulative total sales -2018
PAYGO share (%) -2020
PAYGO share (%) -2019
PAYGO share (%) -2018
Average ticket sizes of investment in SHS and SAS sectors ($)
Social
National Electrification rate (%) -2019
National Electrification rate (%) -2018
National Electrification rate (%) -2017
National Electrification rate (%) -2016
Rural Electrification rate (%) -2019
Rural Electrification rate (%) -2018
Rural Electrification rate (%) -2017
Rural Electrification rate (%) -2016
Regulatory
Presence of a subsidy programme?
Dedicated regulations (Y/N)
Quality standards (Y/N)

Table G8:

Mini-grid-related indicators in the financial aggregation market assessment framework

MINIGRIDS

Market
Number of players
Total operating projects
Total projects commissioned over past year
CAGR 3 years (%)
Average ticket sizes of investment in Minigrids sector ($)
Social
National Electrification rate (%) -2019
National Electrification rate (%) -2018
National Electrification rate (%) -2017
National Electrification rate (%) -2016
Rural Electrification rate (%) -2019
Rural Electrification rate (%) -2018
Rural Electrification rate (%) -2017
Rural Electrification rate (%) -2016
Urban Electrification rate (%) -2019
Urban Electrification rate (%) -2018
Urban Electrification rate (%) -2017
Urban Electrification rate (%) -2016
Political
Clear national policies specifically for Minigrids (Y/N)
Presence of a functional rural electrification agency
Presence of an industry association (Y/N)
Cost reflective tariffs allowed? (Y/N)
Grid tariffs for Households ($/kWh)
Grid tariffs for Businesses ($/kWh)
Feed-in-tariff ($/kWh) - solar
Regulatory
Presence of a grid encroachment policy? (Y/N)
National technical assistance programme for companies? (Y/N)
Presence of subsidy programmes? (Y/N)
Dedicated regulations (Y/N)
Quality standards (Y/N)

Table G9:

Captive power-related indicators in the financial aggregation market assessment framework

CAPTIVE POWER

Market
Number of players
Total known installed capacity (MW)
Total projects commissioned over past year
CAGR 3 years (%)
Average ticket sizes of investment in captive power sector ($)
Social
National Electrification rate (%) -2019
National Electrification rate (%) -2018
National Electrification rate (%) -2017
National Electrification rate (%) -2016
Rural Electrification rate (%) -2019
Rural Electrification rate (%) -2018
Rural Electrification rate (%) -2017
Rural Electrification rate (%) -2016
Urban Electrification rate (%) -2019
Urban Electrification rate (%) -2018
Urban Electrification rate (%) -2017
Urban Electrification rate (%) -2016
Political
Clear national policies specifically for captive power?
Grid tariffs for Households -2021 ($/kWh)
Grid tariffs for Businesses -2021 ($/kWh)
Feed-in-tariff ($/kWh) - solar
Regulatory
Is grid interconnection allowed?
Is wheeling allowed?
Dedicated regulations (Y/N)
Quality standards (Y/N)

Table G10:

EV-related indicators in the financial aggregation market assessment framework

EVS

Market
Number of players
Estimated number of registered EVs
Number of registered motor vehicles
Total sales over the past year ($)
Average ticket sizes of investment in EV sector ($)
Social
National Electrification rate (%) -2019
National Electrification rate (%) -2018
National Electrification rate (%) -2017
National Electrification rate (%) -2016
Rural Electrification rate (%) -2019
Rural Electrification rate (%) -2018
Rural Electrification rate (%) -2017
Rural Electrification rate (%) -2016
Urban Electrification rate (%) -2019
Urban Electrification rate (%) -2018
Urban Electrification rate (%) -2017
Urban Electrification rate (%) -2016
Political
Grid tariffs for Households -2021 ($/kWh)
Grid tariffs for Businesses -2021 ($/kWh)
Regulatory
Dedicated regulations (Y/N)
Quality standards (Y/N)

Feed-in tariffs have the most relevance to the C&I sector and if well designed can make a significant difference to the commercial viability of C&I business models. Feed-in tariffs provide an additional revenue stream for C&I models and means there is less penalty for over-sizing generation capacity as additional electricity generated can be sold into the grid. Without them, C&I models are forced to be either islanded (not connected to the grid) or one-way (only buying power from the grid). As they will typically be servicing a single customer, this makes them more exposed to off-taker risk.

Additionally, the national grid tariff affects the specific low carbon sectors included in the CAP differently. Because mini-grids and captive power business models are arguably competing against the national grid, a market with high grid tariffs will be advantageous to these businesses. Conversely as the ‘fuel’ for EVs, low grid tariffs are advantageous to the EV sector in a country. For this reason separate indicators have been included for each sector and certain indicators are included in multiple sectors but occasionally with different scoring implications.

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