

FUNDING THE SUN

New Paradigms for Financing Off-Grid Solar Companies



Cambridge
**Centre
for Alternative
Finance**



WORLD BANK GROUP

THE WORLD BANK
IBRD • IDA



International
Finance Corporation



UNIVERSITY OF
CAMBRIDGE
Judge Business School

FUNDING THE SUN

New Paradigms for Financing Off-Grid Solar Companies

ABOUT ESMAP

ESMAP is a multi-donor trust fund administered by the World Bank, anchored in the Energy & Extractives Global Practice in Washington, DC. As a long-standing partnership between the World Bank and bilateral partners, ESMAP helps low- and middle-income countries reduce poverty and boost growth through environmentally sustainable energy solutions. ESMAP's analytical and advisory services are fully integrated within the World Bank Group's country policy dialogue and lending programs in the energy sector. Through the WBG, ESMAP works to accelerate the energy transition required to achieve Sustainable Development Goal 7 (SDG7) to ensure access to affordable, reliable, sustainable and modern energy for all. It helps to shape WBG strategies and programs to achieve International Development Association (IDA) policy commitments and the WBG's Climate Change Action Plan targets.

Copyright © February 2020

The International Bank for Reconstruction and Development/THE WORLD BANK
1818 H Street, NW | Washington DC 20433 | USA

This work is a product of the staff of the World Bank with external contributions. The findings, interpretations, and conclusions expressed in this work do not necessarily reflect the views of the World Bank, its Board of Executive Directors, or the governments they represent. The World Bank does not guarantee the accuracy of the data included in this work. The boundaries, colors, denominations, and other information shown on any map in this work do not imply any judgment on the part of the World Bank concerning the legal status of any territory or the endorsement or acceptance of such boundaries.

RIGHTS AND PERMISSIONS

The material in this work is subject to copyright. Because the World Bank encourages dissemination of its knowledge, this work may be reproduced, in whole or in part, for noncommercial purposes as long as full attribution to this work is given.

Any queries on rights and licenses, including subsidiary rights, should be addressed to World Bank Publications, World Bank Group, 1818 H Street NW, Washington, DC 20433, USA; fax: 202-522-2625; pubrights@worldbank.org. ESMAP would appreciate a copy of or link to the publication that uses this publication for its source, addressed to ESMAP Manager, World Bank, 1818 H Street NW, Washington, DC, 20433 USA; esmap@worldbank.org.

All images remain the sole property of their source and may not be used for any purpose without written permission from the source.

Attribution—Please cite the work as follows:

ESMAP. 2020. Funding the Sun: New Paradigms for Financing Off-Grid Solar Companies. Washington, DC: World Bank.

Full page versions of the maps provided in this report are available for download on the ESMAP website: <https://esmap.org/offshore-wind>

Front cover: © Solar Aid.

In Memoriam
Tibor Kludovacz

Tibor Kludovacz, one of this report's authors and main driving forces, passed away during the production of the report. This report is dedicated to the memory of our dear friend and colleague.

Tibor was a regional climate specialist in Africa when the project concept was incubated. He had long been a strong believer in the possibility of turning Africa's abundant sunlight into productive energy for the benefit of Africa's people and a consistent advocate for financial innovations and collaborative efforts to support investments in the solar photovoltaic industry.

Tibor first joined the International Finance Corporation (IFC) in 2002. He was a member of IFC's Energy Efficiency Program team in Hungary before the program was expanded to Central and Eastern Europe and eventually became a global program, paving the way for IFC's climate business through financial intermediaries. He remained passionate about climate business throughout his 15 years with IFC's Financial Institutions Group.

Growing up in Hungary and Cuba, Tibor was multilingual, speaking Hungarian, Spanish, and English fluently. His career allowed him to follow the sun to many parts of the world, including Latin America, Asia, and Africa. His last duty station was Johannesburg, where he engaged in his passion for music when he was not performing his day job as a climate finance professional. He died in Johannesburg in June 2018, right before his field mission to Nigeria for this project.

This research project was one of Tibor's last projects. He is now over the rainbow, with the sun, but his spirit and passion remain with all of us every day. Thank you, Tibor, for your generosity and dedication.



CAMBRIDGE CENTRE FOR ALTERNATIVE FINANCE FOREWORD

Financial innovation is an integral component of economic development and improvements in quality of life. Low- and middle-income countries, which are home to more than 80 percent of the world's population, provide enormous opportunities to apply financial innovation. Financial and technological innovation is already shaping the delivery of basic human needs globally—in education, energy, and financial services.

This report focuses on off-grid solar energy and its financing. The evolution of pay-as-you-go (PAYG) technology has revolutionized energy delivery to people living without modern energy access. But the dominant PAYG off-grid solar business model represents unique financing challenges: how do off-grid solar companies maximize growth with substantial capital tied up in receivables? Which innovative financing instruments and channels are suitable for off-grid solar companies, and at which points during the company's lifecycle? The nature of these vertically integrated business models, operating across a range of countries, adds to the complexity.

This report elucidates the role of financial innovation in the off-grid solar sector and provides a roadmap for practitioners, financiers, and entrepreneurs navigating capital raises for companies active in the sector. It examines a full range of established and frontier financing options. It illustrates that some technology-enabled financial innovations, such as peer-to-peer business lending, are already playing an important role in the sector. In some cases, existing off-grid solar technologies have a natural synergy with innovative financing instruments. For example, PAYG companies already collect a lot of data that could be utilized for algorithm-based credit assessments alongside more traditional due diligence.

We are grateful for the opportunity to collaborate with the World Bank to examine new paradigms for financing off-grid solar companies and to explore the potential interplay of innovative financing channels and instruments with more established methods. We are particularly thankful for the leadership of and contribution by Jonathan Coony, Dana Rysankova, and the late Tibor Kludovacz of the World Bank Group, and Davinia Cogan of the Cambridge Centre for Alternative Finance.

Bryan Zhang
Co-founder and Executive Director
Cambridge Centre for Alternative Finance
Judge Business School, University of Cambridge



WORLD BANK FOREWORD

Despite substantial progress, insufficient access to energy remains a major impediment to economic development and a fact of daily hardship for millions of people around the world. Although the number of people living without electricity fell between 2010 and 2017—from 1.2 billion to 840 million—the current figure is still too high and obscures pockets where access remains stubbornly low. In rural Sub-Saharan Africa, for example, only 22 percent of the population has access to electricity—and many countries fall far below even this meager average.

The World Bank has a long track record of supporting energy access, both on- and off-grid, and rural and urban electrification. Between FY14 and FY18, it committed \$5 billion to energy access programs. Financing for mini grid and off-grid electrification, in particular, has accelerated in recent years, accounting now for about half of annual energy access financing commitments.

New and innovative approaches to electrification will be crucial to increase energy access. Advances in photovoltaic solar technology have already shown the impact innovation can have in delivering electricity to people without access. All stakeholders—public and private, from the fields of finance, policy, and technology—must continue to test novel approaches to access if the world hopes to achieve Sustainable Development Goal 7, which seeks to provide affordable, reliable, sustainable, and modern energy for all by 2030.

It is in this spirit of seeking innovative solutions to address energy access that the World Bank partnered with the Cambridge Centre for Alternative Finance on this report. Adequate financing for off-grid solar companies is necessary to expand solar power for those who need it most. A range of financing options—including frontier concepts coming from the “fintech” revolution—are applicable to this field. This report provides a useful overview of current finance options for off-grid solar as well as a blueprint for next-generation financial solutions to help this sector continue its impressive growth.

Rohit Khanna
Practice Manager
Energy Sector Management Assistance Program (ESMAP)
World Bank Group

ACKNOWLEDGMENTS

PARTNERSHIP AND SUPPORT

This report represents a combined effort by the World Bank Group and the Cambridge Centre for Alternative Finance, the University of Cambridge Judge Business School. Each contributed in its area of expertise.

The report was prepared as part of the World Bank Group's Small and Medium-Size Launchpad initiative. Its publication was supported in part by funding from the United Kingdom's Department for International Development (DFID), the funding donor of the Global SME Finance Facility, a multidonor blended finance facility managed by the International Finance Corporation (IFC).

The financial and technical support of the Energy Sector Management Assistance Program (ESMAP) is gratefully acknowledged. ESMAP—a global knowledge and technical assistance program administered by the World Bank—assists low- and middle-income countries in raising their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. It is funded by Australia, Austria, Canada, Denmark, the European Commission, Finland, France, Germany, Iceland, Italy, Japan, Lithuania, Luxembourg, the Netherlands, Norway, the Rockefeller Foundation, Sweden, Switzerland, the United Kingdom, and the World Bank.

PROJECT MANAGEMENT AND AUTHORSHIP

This report was prepared under the overall guidance of Jonathan Coony, the late Tibor Kludovacz, and Dana Rysankova. The project team is grateful for the strategic guidance provided by Bryan Zhang, Malcom Cosgrove-Davies, and Simon Bell, as well as the expertise of Daniel Murphy, Quyen Nguyen, Natalia Agapitova, Margaret Miller, Raihan Elahi, Andrej Popovic, Besnik Hyseni, and Jon Exel.

Davinia Cogan is the lead author of the report. Jonathan Coony, Alex Hazoury, Dana Rysankova, Malcolm Cosgrove-Davies, Michel Rauchs, the late Tibor Kludovacz, Tania Ziegler, Bryan Zhang, Robert Wardrop, Kieran Garvey, Raghavendra Rau, Martino Recanatini, and François Rostand made important contributions to the report as co-authors.

REVIEW, CONSULTATION, AND STAKEHOLDER ENGAGEMENT

The report team is extremely grateful to the following peer reviewers for their time, expertise, and thoughtful comments: David Loew, Richard Claudet, Miguel Soriano, Lindsay Umalla, and Christine Eibs Singer. Barbara Karni very capably copyedited the report. The knowledge and information in the report was enhanced tremendously by engagement with stakeholders in the Nigerian off-grid solar sector gathered through roundtables and meetings with off-grid solar companies, technology providers, financiers, development partners, and civil society organizations.

CONTENTS

Cambridge Centre for Alternative Finance Foreword	iv
World Bank Foreword	v
Acknowledgments	vi
Abbreviations	xi
Executive Summary	xii
The Massive Need for Financing	xii
Unique Financing Challenges of Off-Grid Solar Businesses	xii
The Need for a Tailored Approach	xv
Audience for and Scope of Report	xv
Chapter 1: Introduction	1
1.1 The Potential of Off-Grid Solar Solutions	1
1.2 Lack of Financing as an Obstacle to Development	4
1.3 Unique Financing Challenges of OGS Businesses	6
1.4 Organization of the Report	8
Chapter 2: Grant Instruments	10
2.1 Grant Window	10
2.2 Results-Based Financing	12
2.3 Reward-Based Crowdfunding	15
Chapter 3: Debt Instruments	19
3.1 Purpose and Types of Debt Financing	20
3.2 Capital Structure	20
3.3 Term Loan	21
3.4 Line of Credit	23
3.5 Venture Debt and Bridge Round	26
3.6 Accounts receivable financing	28
3.7 Securitization	31

3.8	Convertible Note	34
3.9	Revenue-Based Mezzanine Debt	36
3.10	Development Impact Bond	38
3.11	Peer-to-Peer Business Lending	40
3.12	Online Debt-Based Securities	44
3.13	Data-Enabled Short-Term Loan	47
3.14	Government-Issued Mobile Bond	49
Chapter 4: Equity Instruments		51
4.1	Common Stock	51
4.2	Preferred Stock	53
4.3	Equity Crowdfunding	56
Chapter 5: Catalytic Tools		59
5.1	Match Funding	59
5.2	First-Loss Guarantee	61
5.3	Foreign Exchange Hedge	64
5.4	Tax Incentives	65
5.5	Collateral Buy-Back Facility	67
5.6	Pooling of Solar Home System Units Across Companies	68
Chapter 6: Blockchain, Distributed Ledger Technology, and Cryptocurrencies		71
6.1	What Is Distributed Ledger Technology?	72
6.2	What Are Cryptocurrencies and Tokens?	72
6.3	Distributed Ledger Technology–Based Fundraising Channels	73
6.4	Distributed Ledger Technology–Based Payment Systems	75
6.5	Distributed Ledger Technology–Based Energy Trading Platform	78
References		80

List of Figures

Figure ES.1: Financing Instruments Across Company Lifecycle.....	xvi
Figure 1.1: Estimated Grant, Debt, and Equity Financing of Off-Grid Solar Required to Meet Sustainable Development Goal 7 by 2030	1
Figure 1.2: New Connections for Power Access Needed to Provide Energy for All by 2030, by Connection Type and Fuel Source	3
Figure 1.3: Tracks for Commercialization and Scaling of a New Technology.....	4
Figure 1.4: “Valley of Death” in Financing of Emerging Technology Paradigms.....	5
Figure 1.5: The Pay-As-You-Go Value Chain.....	6
Figure 1.6: Financing Instruments Across the Business Lifecycle	8
Figure 3.1: Capital Structure Pyramid	21
Figure 6.1: Illustrative Example of Electric Vehicle-Charging Station.....	76

List of Tables

Table ES.1: Summary of Instruments and Catalytic Tools That Can Be Used to Finance Off-Grid Solutions for Electrification	xvii
Table 1.1: Differences between Traditional Electricity and Off-Grid Solar Markets.....	5
Table 3.1: Differences between Online Debt-Based Securities and Peer-to-Peer Lending	45

List of Boxes

Box 2.1: What Is Donation Crowdfunding?	16
Box 4.1: What Is a Vesting Schedule?	52
Box 4.2: What Is a Liquidation Preference?.....	54

Map

Map 1.1: Planned and Existing Transmission Lines and New Connections in Sub-Saharan Africa.....	2
--	---

List of Case Studies

Case Study 2.1: Grant window: Solarworks! (Mozambique)	12
Case Study 2.2: Results-based financing: Energising Development (Tanzania).....	14
Case Study 2.3: Results-based financing: World Bank facility for solar home systems under the Kenya Off-Grid Solar Access Project (KOSAP)	14
Case Study 2.4: Results-based financing: The Renewable Heat Initiative (United Kingdom)	15
Case Study 2.5: Reward-based crowdfunding: GravityLight (Kenya).....	17
Case Study 2.6: Reward-based crowdfunding: Okra Solar (Cambodia).....	17
Case Study 3.1: Term loan: BBOX (Rwanda)	23
Case Study 3.2: Line of credit: M-Kopa (Kenya and Uganda).....	25
Case Study 3.3: Line of credit: The Market Development Credit Line (Ethiopia)	25
Case Study 3.4: Venture debt and bridge round: The European Investment Bank (Luxembourg).....	28
Case Study 3.5: Accounts receivable financing: SunFunder (Uganda).....	30

Case Study 3.6: Accounts receivable financing: MarketInvoice (United Kingdom).....	31
Case Study 3.7: Securitization: BBOXX (Kenya)	33
Case Study 3.8: Convertible note: SunCulture (Kenya)	35
Case Study 3.9: Revenue-based mezzanine debt: Adobe Capital (Mexico).....	38
Case Study 3.10: Development impact bond: Cardano Development (Zambia).....	40
Case Study 3.11: Peer-to-peer business lending: BBOXX (Kenya)	43
Case Study 3.12: Syndicated peer-to-peer lending: Azuri Technologies SPV (Kenya, Tanzania, Uganda, and Zambia).....	44
Case Study 3.13: Online debt-based security: Energise Africa (Democratic Republic of Congo, Kenya, Mozambique, Rwanda, and Uganda)	46
Case Study 3.14: Data-enabled short-term loan: KopoKopo (Kenya)	48
Case Study 3.15: Data-enabled short-term loan: Branch (Kenya and Nigeria)	48
Case Study 3.16: Government-issued mobile bond: M-Akiba (Kenya)	50
Case Study 4.1: Preferred stock: PEG Africa (Côte d'Ivoire and Ghana)	55
Case Study 4.2: Equity crowdfunding: BuffaloGrid (United Kingdom)	58
Case Study 5.1: Match funding: Energise Africa (Democratic Republic of Congo, Kenya, Mozambique, and Rwanda).....	61
Case Study 5.2: Match funding: Kiva Direct to Social Enterprise pilot (Kenya, Myanmar, Pakistan, Sierra Leone, and Tanzania)	61
Case Study 5.3: First-loss guarantee: Pawame (Kenya)	63
Case Study 5.4: First-loss guarantee: SIDA portfolio guarantee (Kenya, Rwanda, Tanzania, Uganda, and Zambia).....	63
Case Study 5.5: Foreign exchange hedge: BBOXX (Rwanda)	65
Case Study 5.6: Tax incentives: Venture capital schemes (United Kingdom)	66
Case Study 5.7: Collateral buy-back facility: Azuri Technologies (Rwanda)	68
Case Study 5.8: Pooling assets: The Tamil Nadu Water and Sanitation Pooled Fund (India)	69
Case Study 6.1: Distributed ledger technology-based fundraising channels: Powerhive and Sun Exchange (Kenya)	75
Case Study 6.2: Distributed ledger technology-based fundraising channels: WePower (Lithuania)	75
Case Study 6.3: Distributed ledger technology-based payment system: Bankymoon (South Africa).....	77
Case Study 6.4: Distributed ledger technology-based energy trading platform: PowerLedger (Australia)	79
Case Study 6.5: Distributed ledger technology-based energy trading platform: SOLshare (Bangladesh)	79

ABBREVIATIONS

All currency is in U.S. dollars (\$) unless otherwise indicated.

B2B	business-to-business
DIB	development impact bond
DLT	distributed ledger technology
EIB	European Investment Bank
EU	European Union
ICO	initial coin offering
IEA	International Energy Agency
IFC	International Finance Corporation
IPO	initial public offering
kWh	kilowatt hour
MoU	Memorandum of Understanding
OGS	off-grid solar
P2P	peer-to-peer
PAYG	pay-as-you-go
PV	photovoltaic
RBF	results-based financing
SAFI	Structured Asset Finance Instrument
SDG	Sustainable Development Goal
SHS	solar home system
SIB	social impact bond
SME	small and medium enterprise
SPV	special purpose vehicle
USAID	U.S. Agency for International Development

EXECUTIVE SUMMARY

Globally, about 840 million people lack access to electricity, most of them in Sub-Saharan Africa, where three in five persons still live without electricity (Tracking SDG7 Report 2019). Their lack of access hampers economic development, which holds back improvements in quality of life. More than 80 percent of Nigerian companies cite electrification challenges as the most significant obstacle to doing business, for example (World Bank 2017).

Sustainable Development Goal 7 (SDG7) calls for “access to affordable, reliable, sustainable and modern energy for all” by 2030. Given current and expected progress, this goal will not be reached. Advances in energy access have been impressive in some regions, such as South Asia, and recently accelerated in Sub-Saharan Africa, where for the first time in this century, electrification efforts have outpaced population growth. Nevertheless, according to the latest forecasts, the pace of progress is still insufficient to achieve universal electricity access by 2030. As a result, 650 million people globally, and 570 million in Sub-Saharan Africa, are expected to remain without electricity access by 2030 (Tracking SDG7 Report 2019).

Off-grid solar (OGS) energy provides an opportunity to increase energy access. Technology costs have fallen dramatically, and new business models, such as pay-as-you-go (PAYG), are addressing longstanding issues of affordability. More than 130 million OGS devices were sold between 2010 and 2018, with sales increasing at a compound annual rate of about 60 percent. Geospatial modeling by the International Energy Agency (IEA) suggests that 54 percent of Africans currently lacking electricity access could best be served by off-grid solutions, primarily solar (IEA 2017).

THE MASSIVE NEED FOR FINANCING

Substantial new financing sources will need to be identified, sourced, and advanced to allow OGS companies to increase energy access. Over 200 million people globally are estimated to benefit from the OGS products, and the sector has generated almost \$4 billion in sales as of 2018 (World Bank Group 2018). To achieve SDG7, however, the sector is estimated to need almost \$26 billion in financing (Shell Foundation 2018).

Established financing channels are not acting quickly enough to address the financing gaps in the OGS market, largely because of a mismatch between the structure of these instruments and the underlying business models of companies in the sector. Although some established financing channels, such as bank finance, remain important to the sector—particularly as OGS companies reach scale—they fail to address the nuanced financing needs of OGS companies across the business lifecycle.

UNIQUE FINANCING CHALLENGES OF OFF-GRID SOLAR BUSINESSES

The OGS sector and its value chain bring unusual financing challenges. Unlike traditional retail business models, the dominant OGS business model is asset-heavy, service-heavy, and consumer finance-heavy. The vertically integrated PAYG model has added consumer finance to off-grid company functions. The

PAYG business model essentially rolls four business functions—product design/assembly, distribution, platform software, and banking—into one business (World Bank Group 2018). In this model, therefore, OGS companies provide not only technology and products but also finance.

The model introduces unique financing requirements, as companies must source capital for product development, manufacturing, and operations while juggling intense working capital and accounts receivable financing needs. In the OGS sector, the process of converting inventory into cash may take more than three years. The long cash conversion cycle, which runs from product manufacturing through the customer's final loan repayment, can create a mismatch of credit terms and capital needs and/or restrict participation of financiers to those that are well acquainted with the sector.

The OGS sector presents additional complexity to financiers because of the limited liquidity of OGS assets, which limits their use as loan collateral. In addition to the credit term mismatch outlined above, transactions may be complicated by a currency mismatch between input costs and revenues, as customer repayments are usually fixed in local currency, while working capital and accounts receivable financing may be in hard currency. Transactions are also complicated by a currency mismatch between input costs and revenues, as customer repayments are usually fixed in local currency whereas working capital and accounts receivable financing are often in hard currency.

From a traditional financiers' perspective, the OGS market represents a relatively risky investment. The market is relatively new and untested, comprising start-ups and growth-phase companies, and companies serve an untested customer base of remote, low-income households without credit histories.

Another complicating factor is the triple-bottom-line (social, environmental, financial) nature of investment in the sector. Different financiers may prioritize one type of return over another, which can be a problem for loan syndication or blended financing.

OGS sector, therefore, faces unique financing challenges. Finance for the sector has traditionally been provided by grant makers, impact investors, and development finance institutions (mostly in the form of grant and debt facilities). These sources of financing have been essential to nurture and launch the sector. They will be insufficient to scale the sector to its potential. Bringing the sector to scale will require greater participation from commercial equity and debt investors. Some commercial finance sources, such as local banks with specialized units for small and medium enterprises (SMEs), have made some investments in OGS firms, but they have yet to fully embrace the sector.

New financing opportunities are emerging now. The characteristics of OGS markets—distributed, data driven, based on novel technology—match new developments in the finance sector, often termed *fintech*. Although definitions of fintech differ, the term generally refers to applications, processes, products, and business models in the financial services industry that use technological advancements, often tied to the Internet, to provide improved financial services and activities.

These innovative financing tools build on the role of established financing instruments to broaden financial access, reach underserved markets, increase time efficiencies, and reduce the cost of capital.

This report provides a comprehensive overview of financing instruments in the OGS market for the full range of company investment needs, from pre-revenue start-ups to established commercial players.

The focus is on company-level financing. The report does not look at other forms of financing, such as consumer financing, which may also be relevant for the development of OGS markets.

The report examines both established financing instruments with clear application and growing track records in the OGS context and innovative instruments that are in early stages of development or have yet to be fully applied to this market (innovations developed and tested in other sectors with potential application to the OGS context). It covers different funding channels and modalities (grants, debt, and equity) as well as complementary tools that address barriers or catalyze funding (such as foreign exchange hedging). The report also reviews the potential for distributed ledger (blockchain) technology and cryptocurrencies in the OGS sector. Case studies provide real-world examples of how all of these tools have been applied. Table ES.1, on page xvii, provides a summary of the instruments and catalytic tools that can be used to finance off-grid solutions for electrification.

Grants

Grants are nonrepayable funds, products, or services gifted by a government agency, foundation, corporation, or individual to a pre-seed or seed company to formalize proof of concept or scale operations. Grants have been and continue to be important for early-stage OGS companies unable to secure commercial financing. They can also be combined with debt and equity.

Grants are normally given to finance specific activities. They can come in the form of matching grants, results-based financing (RBF), and crowdfunding. RBF has been increasingly used in the off-grid electricity sector to accelerate market expansion and facilitate geographic targeting. Catalytic grants and RBF are the most common grant instruments in the sector.

Grants play an important role, especially in early stages of market (and individual business) development and for opening up new markets, especially more difficult ones. They should be used with caution, however, so that they leverage rather than displace other forms of financing, such as debt and equity.

Debt

Growth-phase companies (Series A–C) use debt to raise working and/or investment capital. In secured debt financing, the borrower pledges collateral (such as land or inventory) that may be repossessed by the lender in the event of default. In unsecured debt financing, a loan is issued based only on the borrower's creditworthiness. One of the greatest challenges for OGS companies raising debt is the untraditional nature of the assets that can be used to collateralize loans, although commercial lenders are growing more accustomed to the sector as they gain experience.

Debt can come in many forms, from traditional instruments, such as term loans and lines of credit, to more novel variations, such as securitization of accounts receivable and peer-to-peer (P2P) business lending, often raised on crowdfunding platforms. These novel forms of lending have been expanding rapidly, filling the gap left by more traditional lenders, which often perceive the nascent off-grid electricity markets as risky. Their use requires that companies have a certain level of sophistication and maturity, however.

Equity

Equity financing involves the purchase of the underlying company itself. It comes in three forms—common stock, preferred stock, and equity crowdfunding—depending on the growth stage of the company seeking

investment. As equity funding results in company ownership, it is both the riskiest form of financing and the form with the greatest potential financial upside.

Catalytic tools

Catalytic tools include devices and structures that can be used alongside grant, debt, and equity financing. These tools help attract funding in the OGS sector by providing incentives or reducing risk to investors, thereby mitigating some of the major barriers to investment.

The tools are structured in a variety of ways. Some provide incentives directly to investors; others provide capital to OGS companies, with the goal of improving the financial health of the underlying investees. Catalytic tools covered in this report include tax incentives, collateral buy-back facilities, structures to reduce foreign exchange exposure, and first-loss facilities to reduce the risks faced by commercial investors. These tools are specialized and usually used to address a very specific financing barrier.

Blockchain, distributed ledger technology, and cryptocurrencies

Distributed ledger technology (DLT) is an umbrella term that describes shared database systems that are collectively maintained and updated by a set of entities rather than a singular entity. DLT is still nascent for the sector, but OGS has many traits that make it attractive, including numerous, diverse participants; the lack of established financial infrastructure; and the need for multiple transactions with little friction. This report looks at three categories of DLT applications for OGS: payment systems, energy trading platforms, and fundraising channels. Most of them are very recent innovations, which have not yet been used extensively in the OGS sector but are worth keeping an eye on for the future.

THE NEED FOR A TAILORED APPROACH

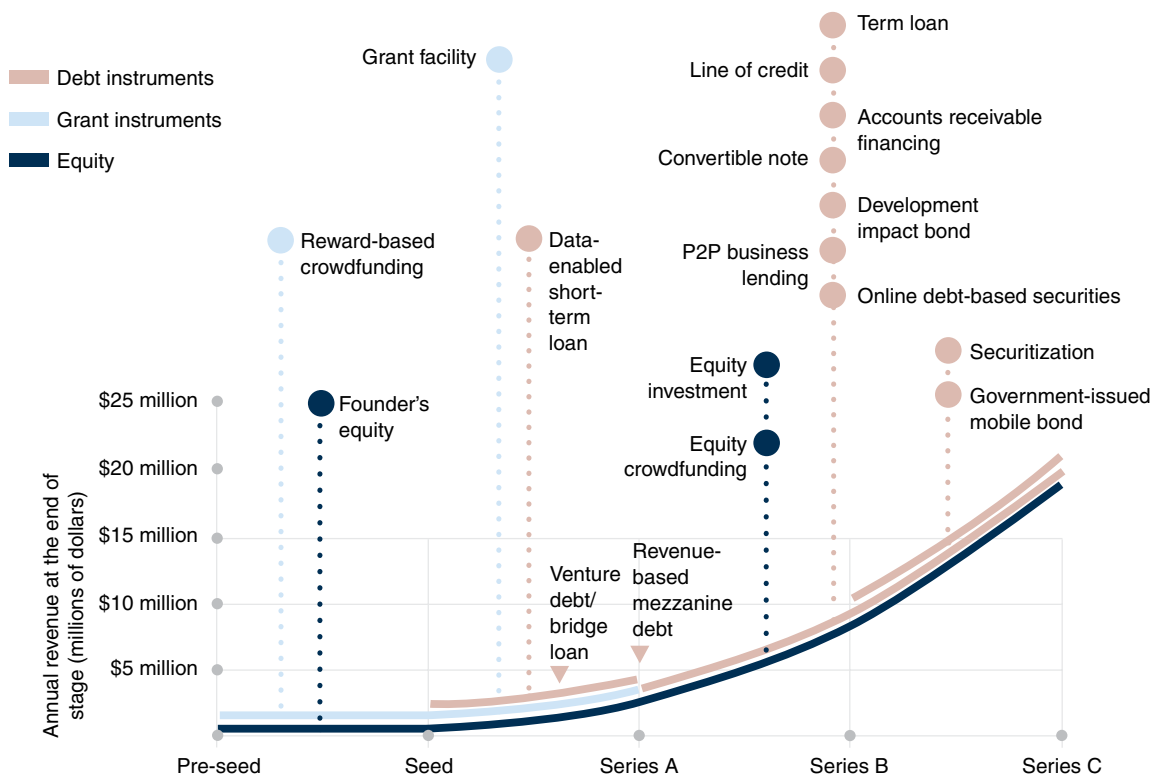
The diversity of OGS companies in terms of the stage of maturation, company capacity, enabling environment, customer needs, and purchasing power means a one-size-fits-all approach to financing will not succeed. Financiers, companies, governments, and development partners must assess the suitability of financing instruments in the context in which they are working. The taxonomy of finance models for OGS included in this report can provide guidance and information to make that selection based on the latest experiences and information. Figure ES.1 provides an overview of instruments mapped at each stage of development.

AUDIENCE FOR AND SCOPE OF REPORT

This report serves multiple audiences: OGS companies seeking to grow, commercial investors that see the sector as novel but with a potentially attractive risk/return profile, foundations and other noncommercial funders seeking to increase energy access and co-benefits, and development finance institutions that see OGS as an important tool to address the long-standing development challenge of energy access. By bringing together all available options—and highlighting emerging innovations—the report should help stakeholders understand the full range of financing options available to them.

The report provides a comprehensive inventory of financing options. It does not attempt to analyze financing trends or rank the financing options in terms of transaction size or potential. Other publications are better suited to capture higher-level financing trends. For example, every two years the off-grid solar industry association (GOGLA) and the World Bank Group's Lighting Global program publish the *Global*

Figure ES.1: Financing instruments across company lifecycle



Off-Grid Solar Market Trends Report, a market intelligence series on the sales and impact of off-grid solar products. These reports capture volumes and trends in OGS sector financing, by instruments and type of financier. *Early-Stage Financing in Green Sectors in Sub-Saharan Africa* (World Bank 2019) provides a deep dive into patterns of early-stage financing in green firms (including OGS companies) in Sub-Saharan Africa. These studies focus on broader trends and investment volumes, but they do not provide a comprehensive and nuanced overview of available financing options.

This report fills this gap. In addition to describing financing options, it provides guidance on the types of companies that best suit each option, the preconditions for using these options, and opportunities and challenges for applying each instrument and catalytic tool. The report provides useful guidance for both OGS companies that seek financing and potential financiers and development partners that seek the best way of supporting the OGS sector.

Many promising financing options exist in the OGS sector. Nearly all would benefit from ongoing support that enhances their maturity as well as the capacity of relevant actors. It took nearly 25 years of refinement before microfinance found the right formulation to allow billions of dollars to flow to the world's poor. Given the nascent stage of the OGS market, continued support for the instruments in this report will be necessary if they are to achieve their potential. This support must be both patient and charged with a drive for innovation; it must cover regulatory environments, capacity building, and piloting to demonstrate proof points. Each instrument covered in this report includes the conditions required for its successful implementation and thus provides guidance on what can be done to develop this market further.

Table ES.1: Summary of instruments and catalytic tools that can be used to finance off-grid solutions for electrification

Description	Key benefit	Key challenges
2. Grants		
<i>2.1 Grant window</i>		
Grants are nonrepayable funds, products, or services gifted by a government agency, foundation, corporation, or individual. A grant window awards funds to a company or consortium to achieve a specific set of objectives. It typically operates for a set time period, with predetermined open and close dates. Grants are often used during the pre-seed and seed phases of the business lifecycle, to formalize a proof of concept or scale up operations.	Grants fill a gap by providing the funds necessary to develop viable and sustainable business models. They are suitable for early-stage companies not ready to accept the larger amounts provided by debt and equity sources.	Grants are generally too small to make a material and sustainable impact. They are not normally reusable, so they are not a reliable source of continuous and sustainable financing. They can fail to encourage financial rigor in companies compared to debt and equity investments.
<i>2.2 Results-based financing</i>		
Results-based financing (RBF) refers to incentive structures in which payments are made to companies triggered ex post by the delivery or installation of a given quota of an output. Governments in both developed and developing countries have used RBF to encourage the uptake of renewable energy and energy-efficient technologies.	RBF schemes can incentivize faster development of the targeted OGS market. They can benefit a range of companies operating in the targeted market, irrespective of their size or growth stage, and provide a flexible source of funding. RBF schemes can allow development institutions to target their financing to the areas or consumer groups they want to support.	RBF can introduce market distortions. Businesses that emerge to take advantage of this market opportunity may become dependent on the continuation of the subsidy for their sustainability. Setting the incentive so that it triggers the desired level of activity without (over) subsidizing activities that would have happened anyway can be tricky.
<i>2.3 Reward-based crowdfunding</i>		
In reward-based crowdfunding, a company (typically a start-up) raises funds through an online platform and offers funders a gift or “perk” in exchange for a financial contribution. Reward-based crowdfunding is sometimes considered a pre-sale, in which individuals, projects, and companies raise finance from backers, who receive a nonmonetary reward or product. The reward may be modest; funders may be motivated by altruism rather than the reward.	Crowdfunding allows companies to raise pre-seed and seed capital, which is often difficult to obtain for early-stage companies and novel products. Crowdfunding provides an opportunity to engage and build on an existing network and solicit buy-in that can be leveraged later. It is significantly faster than applying for a grant.	Reward-based crowdfunding is usually suitable only for early-stage companies or a specific project/deliverable. The campaign maker must demonstrate innovation and actively leverage its network; entrepreneurs lacking suitable networks and relevant technical and marketing sophistication are unlikely to be able to tap this funding source.
3. Debt instruments		
<i>3.1 Term loan</i>		
A term loan is a loan that is repaid at regular intervals (such as monthly or quarterly) within a specific period of time, normally 1–25 years. Interest is paid over the life of the loan. Along with other loan set-up costs, it represents the cost of the loan to the borrower. Term loans are a well-established instrument in most countries. The interest rate charged by the lender can be fixed or floating.	Term loans are well-established and widely used by financial institutions and investors in high-, middle-, and low-income economies. Their availability in the OGS sector would significantly alter its landscape, enabling large-scale scalability.	The vast majority of sector players do not have the financial track record or strength traditionally required for term loans. Negotiating terms and securing a loan can be a lengthy process that requires significant investment of human resources. There is also the risk of delayed disbursement. Many established lenders are unfamiliar with the OGS sector.
<i>3.2 Line of credit</i>		
A line of credit is a flexible revolving loan that can be drawn down, repaid, or redrawn on as needed within a specified period of time. Lines of credit are available to use as and when needed. This flexibility is their main characteristic. Lines of credit are well-established in most countries. They are typically used to fund variable expenses, such as working capital needs. (In contrast, term loans are designed to fund one-time purchases, such as equipment or land.)	Lines of credit can allow OGS companies to match their debt-financing needs to customer demand and repayments. Their flexibility is particularly important given the significant working capital requirements of OGS companies. They are widely issued by financial institutions globally.	Many established lenders are unfamiliar with the OGS market. Most sector players do not yet generate positive operating cashflows and lack the financial creditworthiness traditionally required for a line of credit.

(continues)

Table ES.1: Continued

Description	Key benefit	Key challenges
3.3 Venture debt and bridge round		
<p>Venture debt is a senior term loan that is typically used by emerging growth companies that are backed by venture equity capital and do not meet the requirements for traditional bank debt financing or want greater flexibility. It normally includes warrants that give the holder the right, but not the obligation, to buy the borrower's equity shares at a certain price, quantity, and time in the future. In a bridge round, a company that has already raised one round of equity (typically a seed round) takes on a debt instrument (such as a convertible note) from existing investors before raising its next equity round (typically a Series A). When the next equity round occurs, this bridge loan normally converts to equity at a discount.</p>	<p>Venture debt and bridge rounds provide time for a company to achieve milestones and make progress before the next equity round, sale, or initial public offering or the achievement of profitability while minimizing equity dilution. If the company performs worse than expected, venture debt can buy the company time to get back into shape and avoid a "down round" (when investors purchase shares from a company at a lower valuation than the previous round).</p>	<p>Many OGS players may not yet generate sufficient cash to attract lenders. Venture debt could be combined with equity rounds to attract interests. If debt service (interest plus repayment of principal) exceeds 20 percent of a company's operating expenses, the company may find it hard to attract future equity investors. Companies with little cash would have to accept higher borrowing costs than companies that can comfortably service debt.</p>
3.4 Accounts receivable financing		
<p>Accounts receivable financing is a form of asset-backed lending typically secured by expected future payments from customers. Individual or institutional investors purchase invoices or receivable notes from a company at a discount. The borrower retains ownership of the invoice/receivable, allowing it to free up cash tied up in an invoice or receivable note that has yet to mature.</p>	<p>Institutional investors and accredited investors provide significant funding volumes. Technology allows for transparent verification process. To aid in the verification and credit assessment process, businesses can directly link their existing accounting software, which includes all information on receivables, as a plug-in to the arranger or platform system.</p>	<p>Obtaining good-quality, verifiable data on borrowers may be difficult. Business borrowers must have verifiable business records and at least two years of trading history, something many OGS companies lack. The counterparty (the billed entity/individual) must be of sufficient quality that the financier or platform can assess its quality.</p>
3.5 Securitization		
<p>Securitization is a structured finance technique in which a special purpose vehicle (SPV) is created to raise funds by issuing debt securities, which are sold to investors. The proceeds are used to purchase receivables, which represent rights over financial obligations arising from the obligation of a third party to pay amounts in respect of a debt (for example, a solar home system distributor's customer has an obligation to meet its repayment schedule).</p>	<p>Benefits to the originator include cheaper funding (where receivables are of better quality than the originator), a stronger balance sheet, greater capital adequacy, and an alternative source of capital. Accounts receivable financing diversifies funding sources. Use of a securitization structure will not negatively affect the balance sheet of the borrower.</p>	<p>Transactions costs are high. Establishing an SPV is a costly process requiring specific legal and other expertise as well as commitment by the originating company. Without reaching a critical mass to justify these transactions costs, it is difficult to offer an attractive risk-adjusted return to potential investors.</p>
3.6 Convertible note		
<p>A convertible note is debt that can be converted into company equity at some point in the future. Notes carry a low interest rate until they convert into equity in a later equity round, which determines the valuation. The equity upside normally comes in the form of discounts and a cap. Both reward early investors for taking on more risk than later investors.</p>	<p>Convertible notes provide OGS founders with access to cheap and quick capital that they can use to launch new companies and execute their growth plans while incentivizing both investors and company founders (by minimizing dilution).</p>	<p>The OGS market is still unknown to many established investors, who need to buy into the growth opportunities the market represents.</p>
3.7 Revenue-based mezzanine debt		
<p>Revenue-based mezzanine debt is a loan to a financially viable and growing impact enterprise that provides a flexible repayment schedule that is convertible into equity at a capped multiple. If the company exceeds expectations, the borrower has the option to repay the loan early as a fixed equity multiple. The instrument is designed to allow investors to progressively exit as revenue increases and the borrower pays down principal and interest.</p>	<p>Repayment is linked to performance. The instrument provides flexibility to impact enterprises, in line with their revenue growth. The flexible repayment feature aligns well with seasonality, particularly where generalized drought occurs. In markets with few acquirers and investors, this structure provides a clear progressive exit strategy for investors.</p>	<p>The structure and limited track record of OGS companies may make it difficult to attract some impact mezzanine debt investors. Foreign impact investors are likely to dominate investment, with little interest from financial markets in developing countries.</p>

Description	Key benefit	Key challenges
3.8 Development impact bond		
Evolving from the social impact bond (SIB) model, a development impact bond (DIB) is a performance-based investment instrument intended to finance development outcomes in developing countries. Twenty-eight DIBs have been implemented, contracted, or designed in developing countries.	DIBs provide more options for borrowers to access capital and gain access to large funders who may be interested in lending only through this structure. The structure can be tailored to the requirements of the transaction. By quantifying the development benefits, borrowers can receive additional funding sources.	Given the bespoke nature of each financing arrangement and the multiple parties involved, creating and contracting a DIB can take time to develop and entail high transaction costs.
3.9 Peer-to-peer business lending		
In peer-to-peer (P2P) business lending, a business borrower receives a loan from a group of individuals or institutional lenders, facilitated by a P2P business lending platform. The P2P business lending platform is not the provider of the loan; it acts as an intermediary between the borrower and lenders. The platform must perform sufficiently robust credit and anti-money laundering checks on potential borrowers and fulfill all other legal obligations and fiduciary duties stipulated by the financial regulation.	The nature of P2P business lending allows companies to raise the amount they need when they need it, maximizing efficiencies in procurement and sales while reducing interest. P2P lending allows companies to attract investors otherwise unreachable because of the small size of individual investments, their lack of capacity for due diligence, and geographic distance.	P2P business lending in the OGS market is still nascent, with a two- to three-year track record of loan repayments for relevant loans. Investor behavior is not well understood, which can create difficulties with respect to marketing and outreach. Due diligence practices are uneven. Platform incentives can create conflicts of interest.
3.10 Online debt-based securities		
Online debt-based securities are debt-based securities (typically company-issued bonds or debentures) sold at a fixed interest rate to both retail and institutional investors via an online platform. Platforms typically function as SPVs in which investors participate in green energy or renewable energy projects, such as a mini-grid in their community.	Instrument provides early-stage and growth companies with access to debt capital. Investors, including retail investors, can invest in specific SPVs/ overarching bonds that fund specific energy projects, often in a location they have a connection to.	Legal framework is nebulous. There is confusion regarding how to deal with online debt-based securities from a regulatory perspective. Instrument relies heavily on subsidies. Campaigns tend to do best where projects are linked to tax incentives.
3.11 Data-enabled short-term loan		
In a data-enabled short-term loan, the lender uses customer data from the potential borrower obtained through the lenders' own data set or that of a third party. For example, a payment processor that provides supplementary services such as loans can use its own data on the loan applicant's transaction history to assess creditworthiness and set loan terms. Loan approval and disbursement are almost instantaneous, with disbursement typically made via mobile money.	Local businesses and early-stage companies can borrow up to \$50,000 to meet short-term working capital needs. Loans are based on cashflow and are unsecured. Approvals occur within minutes, because creditworthiness is based on an algorithm.	Loan terms are short and loan sizes small (less than \$50,000), limiting the use of the instrument to short-term working capital and bridge financing. Interest rates can be high. The low-contact nature of mobile lending can create opportunities for identity theft and fraud.
3.12 Government-issued mobile bond		
Some governments and development finance institutions issue retail bonds that can be purchased via mobile phones. These bonds are denominated in local currency with a low minimum threshold (such as \$10). Coupon payments (loan repayments) are made to the investors' phones via mobile money. Bonds can also be registered, traded, and settled through the mobile platform. Current applications target infrastructure and development projects.	Access to local currency debt removes foreign exchange risk and provides an opportunity to raise capital with greater flexibility and fewer conditions than other forms of debt. Bonds provide governments with access to a relatively cheap source of capital and promote the practice of saving among citizens.	The size of the bond issue needs to be large enough to justify transactions costs. The government issuer must have the capacity to channel proceeds through the proper channels to boost the OGS sector in target markets. There is potential for major reputational risk for the bond issuer in the event of default and substantial financial risk for underwriters, where engaged.

(continues)

Table ES.1: Continued

Description	Key benefit	Key challenges
4. Equity instruments		
<i>4.1 Common stock</i>		
<p>Common stock is equity issued to the founders of a business; it may also include common stock issued to family, friends, and early employees. It is usually issued to people who invest their time, effort, and money in the earliest days of a start-up.</p>	<p>Common stock provides the funds required to launch a company, fund product development, carry out proof of concept, launch the product, and secure sales.</p>	<p>Founders need to be able to articulate their vision for scaling their company in order to obtain buy-in from investors. Potential founders need to recognize the growth and profit prospects of the OGS sector, which is still largely unknown to most investors.</p>
<i>4.2 Preferred stock</i>		
<p>Preferred stock confers certain rights that holders of common stock do not have. Holders of preferred stock receive proceeds before common shareholders. Depending on the terms of the liquidation preference, they receive a larger percentage of proceeds than would be dictated by their ownership share.</p>	<p>Growing and scaling businesses requires significant risk capital, which equity investors provide, allowing management to focus on implementing its business plan and rapidly reaching its milestones. Equity investors have significant expertise, market-specific knowledge, and access to networks, which can be very beneficial to the company, helping it make the most of its growth opportunities.</p>	<p>Especially in early-stage companies, impact fund and venture capitalist investors typically seek more than incremental growth. Companies also need to convince potential investors that their business plans are attractive and sustainable and that there is a high likelihood of an attractive exit for equity investors.</p>
<i>4.3 Equity crowdfunding</i>		
<p>Equity crowdfunding is the sale of registered securities, typically of early-stage firms, to both retail and institutional investors via an online equity crowdfunding platform. The platform is typically responsible for conducting due diligence on potential investees and approving campaigns before posting them on their platform.</p>	<p>Equity crowdfunding can provide seed capital for early-stage companies, allowing more of them to reach scale. It is one of the few options available for OGS companies raising early-stage equity, as few funders that are willing to take on the risk of an early-stage company can provide funding at sufficient scale.</p>	<p>Few jurisdictions have an enabling regulatory environment for equity crowdfunding. Many countries have equity crowdfunding regulations that are nebulous at best and restrictive at worst. Investment is illiquid, as there are few secondary markets.</p>
5. Catalytic tools		
<i>5.1 Match funding</i>		
<p>In match funding, a donor or investor provides co-funding to match donations or investments from other investors. Match funding is often applied to P2P lending and crowdfunding campaigns to build momentum and encourage contributions from the crowd. The match ratio is usually 50 percent of the campaign target (for every \$1 contributed by the crowd, the match funding provider co-invests \$1).</p>	<p>Match funding can be used where there is not yet sufficient demand from individual donors or investors to catalyze investment. It can catalyze donations and investments by encouraging donors/investors to contribute more than they would if the match were not in place.</p>	<p>Securing a match funding provider can be difficult. There may be significant lead time to build the relationship, typically with a platform, and to implement match funding. Mechanism may be considered “too frontier” for some funders.</p>
<i>5.2 First-loss guarantee</i>		
<p>A first-loss guarantee is a socially or environmentally driven credit enhancement provided by a grant-maker or other third party. The guarantee provider agrees to bear first losses in order to catalyze the participation of lenders and investors that otherwise would not have entered the deal because of the perception of excessive risk.</p>	<p>First-loss guarantees catalyze commercial funding by reducing the risk to lenders and investors. They enable the transfer and mitigation of risks to parties better able to bear them. They potentially reduce borrowing costs.</p>	<p>An insufficient sector/company track record makes it difficult for companies to obtain credit guarantees.</p>

Description	Key benefit	Key challenges
5.3 Foreign exchange hedge		
A foreign exchange hedge is a tool used by companies or lenders to reduce or eliminate foreign exchange risk by locking in an exchange rate for a transaction that will occur in the future through a forward contract. A foreign currency swap is a more complex tool used to hedge foreign exchange risk. It is an agreement between two parties in which one party borrows one currency and simultaneously lends another to the counterparty. Quasi-hedge mechanisms distribute foreign exchange risk between the borrower and lender.	Foreign exchanges hedges remove or reduce uncertainty. OGS companies can match their debt financing needs to future receivables, which are in local currency. Companies incorporate the foreign exchange hedge cost into their margin, leaving customers unaffected directly by local currency depreciation.	The cost of a hedge can exceed 10 percent of principal (on top of the interest rate). This cost may be prohibitive for some borrowers, who are already paying 10–15 percent annual interest on hard currency debt.
5.4 Tax incentives		
Tax incentives are typically paid to investors who invest in projects or companies that meet specific criteria. They can be applied through established and innovative financing instruments, including P2P business lending and equity crowdfunding platforms and venture capital and equity investment funds. They can also be used to help OGS companies reduce their tax liabilities. Tax subsidies can be used to eliminate or reduce sales and import tax liabilities.	Tax incentives provide early-stage companies with access to capital and encourage the participation of investors that otherwise might not participate. They promote the growth of a broader range of financing instruments, including equity crowdfunding.	It may be difficult to garner the necessary political will to implement tax incentive schemes given the potential of reduced tax revenue, particularly in developing markets. In addition, depending on how the incentive is structured, the tax incentive may be seen as benefiting an elite investor group.
5.5 Collateral buy-back facility		
Local lenders often shun lending to solar home system companies because they do not wish to take on the systems as collateral. In a collateral buy-back facility, a third party commits to buy back any repossessed units from the lender at an agreed price.	A collateral buy-back facility has the potential to engage more lenders. The ability to take on collateral could encourage more lenders to provide debt to solar home system companies and open new financing channels. The mechanism removes uncertainty about recovery value, reducing risk for the lender.	There is a lack of an established second-hand market for solar home system units or clear recovery/resale value. Legal or licensing requirements may need to be met and local authority approvals obtained before units can be repossessed. Repossession is expensive and can hurt a company's reputation.
5.6 Pooling of solar home system units across companies		
Individual business units of a company or individual companies may be unattractive to investors because of the size, volume of transaction, transaction costs, and level of time and resources required per transaction. Pooling business units or companies creates diversification, potentially lowering risks, increasing transaction sizes, and enhancing investor interest.	Leveraging of borrowing capacity through the aggregation of multiple business units in a single transaction increases transaction size and borrower leverage. Pooled risk, larger volume, and credit enhancement potentially reduce transactions costs. Larger transaction size widens the potential investor base.	Pooling can be time and resource intensive to set up; lack of familiarity with the structure may require long lead times. Getting companies to act jointly, commit to the creation of the pool, and agree on credit and other terms is likely to be difficult.
6. Blockchain, distributed ledger technology, and cryptocurrencies		
6.3 Distributed ledger technology–based fundraising channels		
Distributed ledger technology (DLT)-based fundraising channels are innovative financing mechanisms through which energy producers can raise capital. Initial coin offerings (ICOs) are public token sales in which a project or company sells a predetermined number of tokens to investors globally in exchange for cryptocurrencies and/or national currencies. ICOs provide an alternative to traditional equity- or debt-based financing.	DLT-based fundraising allows energy producers/project developers to quickly raise substantial capital: Companies can raise up to eight-figure amounts in a matter of hours or days, generally without issuing equity or taking on debt. DLT-based fundraising widens the potential investor base.	Legal and regulatory framework is unclear. Selling tokens to the general public may be considered an unregistered security offering; regulators could thus hold the issuers in violation of securities regulations. As a result, the ICO market is plagued by a high fraud rate and a lack of sufficient investor protection. Cryptocurrencies are highly volatile and speculative.

(continues)

Table ES.1: Continued

Description	Key benefit	Key challenges
<i>6.4 Distributed ledger technology–based payment systems</i>		
<p>DLT-based payment systems are an alternative means of transferring monetary units between individuals and entities. In most cases, the units transferred are cryptocurrencies and digital tokens, which can be converted into other cryptocurrencies, tokens, or national currencies.</p>	<p>Energy producers can accept cryptocurrencies and tokens as compensation for their services, allowing unbanked consumers to make payments via smartphones and for other people to make payments on their behalf.</p>	<p>Lack of a developed market can result in low to no liquidity in local markets, impeding currency conversion. The high volatility of cryptocurrencies and tokens can compound the problem.</p>
<i>6.5 Distributed ledger technology–based energy trading platform</i>		
<p>A DLT-based energy trading platform enables the creation of an autonomous local energy grid with integrated P2P or business-to-business (B2B) transactions, disintermediating the electricity retailer. The autonomous grid links producers and consumers of electricity; a community's energy trades are recorded on a distributed ledger. The DLT system acts as a matching engine and marketplace for trading energy between peers.</p>	<p>System encourages decentralized energy production. Seamless integration of distributed energy generation within a community allows prosumers to generate value from otherwise latent energy. Economic efficiencies can arise from efficient matching, low-cost transactions and the removal of intermediaries, and/or central operator control.</p>	<p>The costs and benefits of this early-stage technology are not yet clear. Given the fragmented landscape of DLT frameworks, it can be difficult to know which system to implement and when to use the technology (or an alternative).</p>

CHAPTER 1 INTRODUCTION

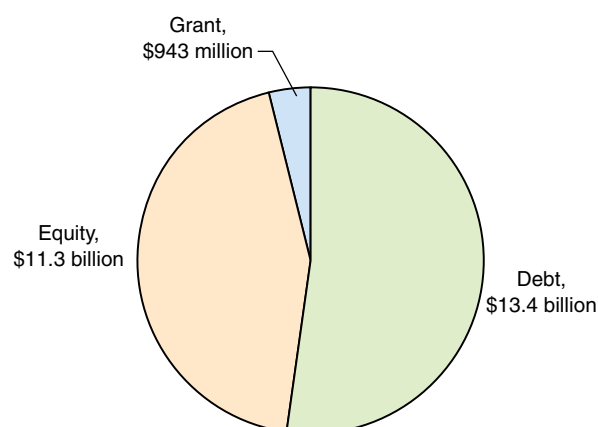
Globally, about 840 million people lack access to electricity, most of them in Sub-Saharan Africa, where three in five persons still live without electricity services (Tracking SDG7 Report 2019). Their lack of access hampers economic development, which holds back improvements in quality of life. More than 80 percent of Nigerian companies cite electrification challenges as the most significant obstacle to doing business, for example (World Bank 2017).

Sustainable Development Goal 7 (SDG7) calls for “access to affordable, reliable, sustainable and modern energy for all” by 2030. Given current and expected progress, this goal will not be achieved. Advances in energy access have been impressive in some regions, such as South Asia, and recently accelerated in Sub-Saharan Africa, where for the first time this century electrification efforts have outpaced population growth. Nevertheless, according to the latest forecasts, the pace of progress is still insufficient to achieve universal electricity access by 2030. As a result, 650 million people globally, and 570 million in Sub-Saharan Africa, are expected to remain without electricity access by 2030 (Tracking SDG7 Report 2019).

1.1 THE POTENTIAL OF OFF-GRID SOLAR SOLUTIONS

Decentralized energy solutions are playing a growing role in enabling energy access to off-grid populations. The off-grid solar (OGS) market provides lighting and energy services to over 200 million people globally and has generated almost \$4 billion in sales as of 2018 (World Bank Group 2018). The sector is estimated to need almost \$26 billion in financing, however, to achieve Sustainable Development Goal (SDG) 7 (“ensure access to affordable, reliable, sustainable and modern energy for all”) by 2030 (Figure 1.1). Substantial new financing sources will need to be identified, sourced, and advanced to allow OGS companies to increase energy access.

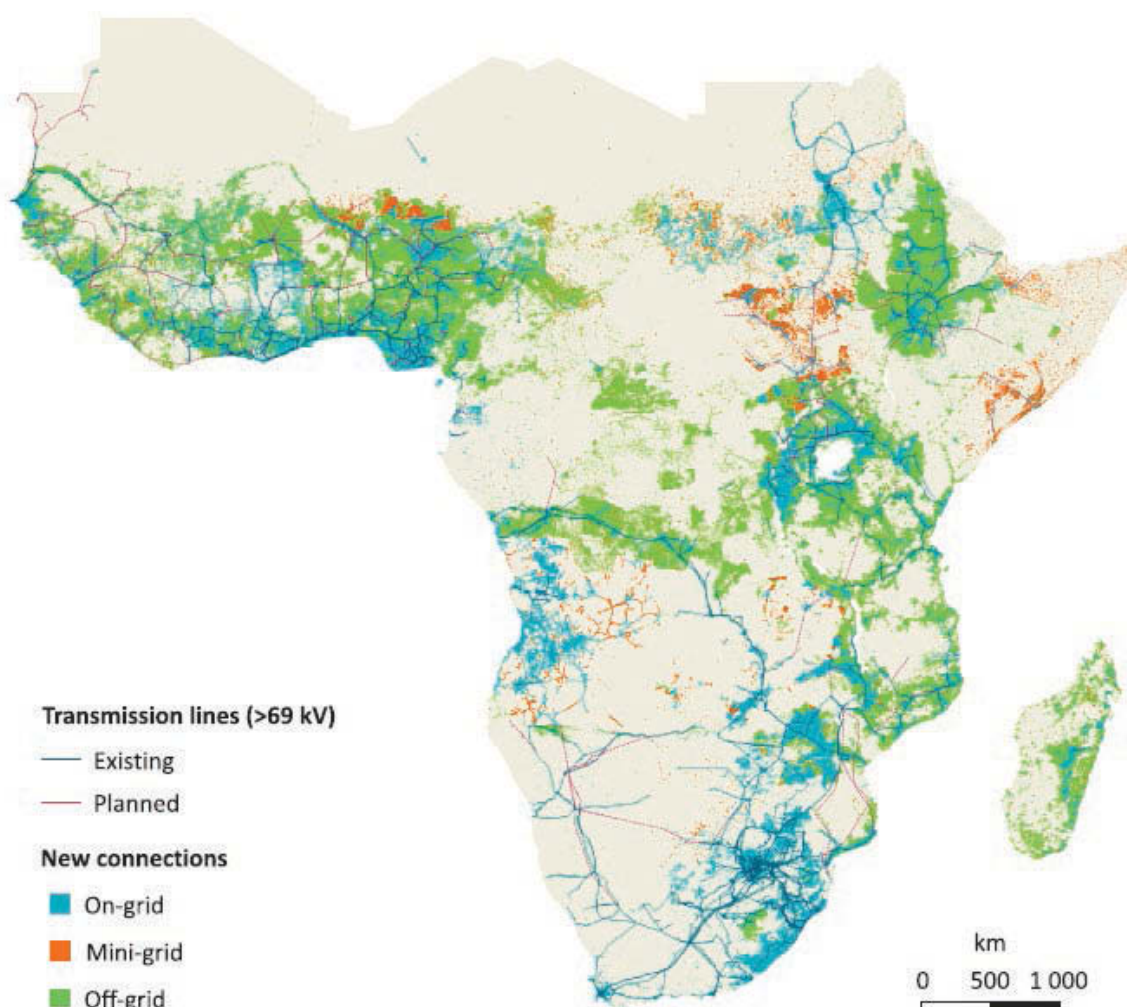
Figure 1.1: Estimated grant, debt, and equity financing of off-grid solar required to meet Sustainable Development Goal 7 by 2030



Source: Shell Foundation 2018.

Bottom-up and geospatially explicit electrification modeling by the IEA indicates that 54 percent of the population of Sub-Saharan Africa could best be connected to electricity via off-grid solutions, predominantly solar, including both mini-grids and solar home systems (SHSs). Map 1.1 and Figure 1.2 show the extent of this potential.

Map 1.1: Planned and existing transmission lines and new connections in Sub-Saharan Africa

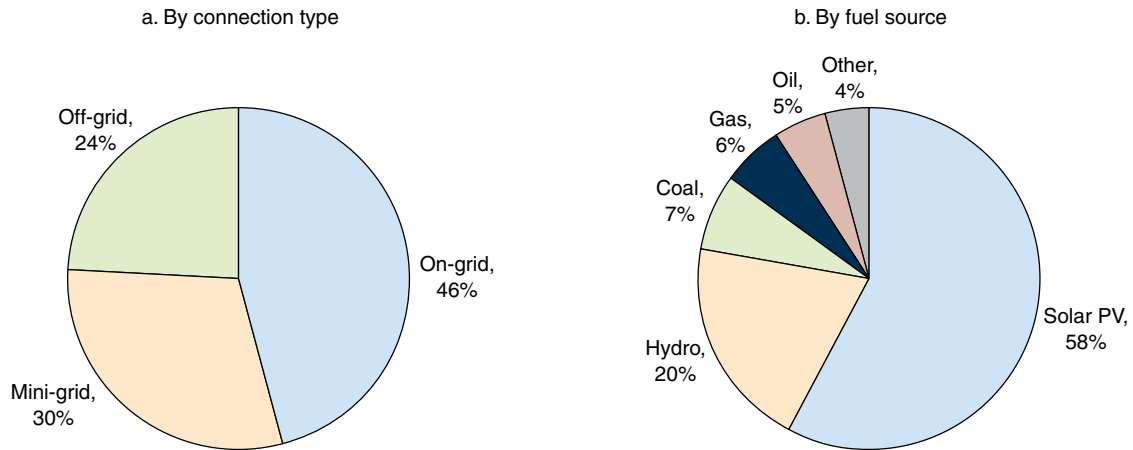


Source: IEA 2017.

Private sector off-grid electrification carries several advantages:

- It lightens the burden on African utilities, many of which are in financial distress (Trimble and others 2016).
- It addresses issues of sustainability of service associated with public-led off-grid schemes.
- It leverages new sources of private investment at scale.

Figure 1.2: New connections for power access needed to provide energy for all by 2030, by connection type and fuel source



Source: IEA 2017.

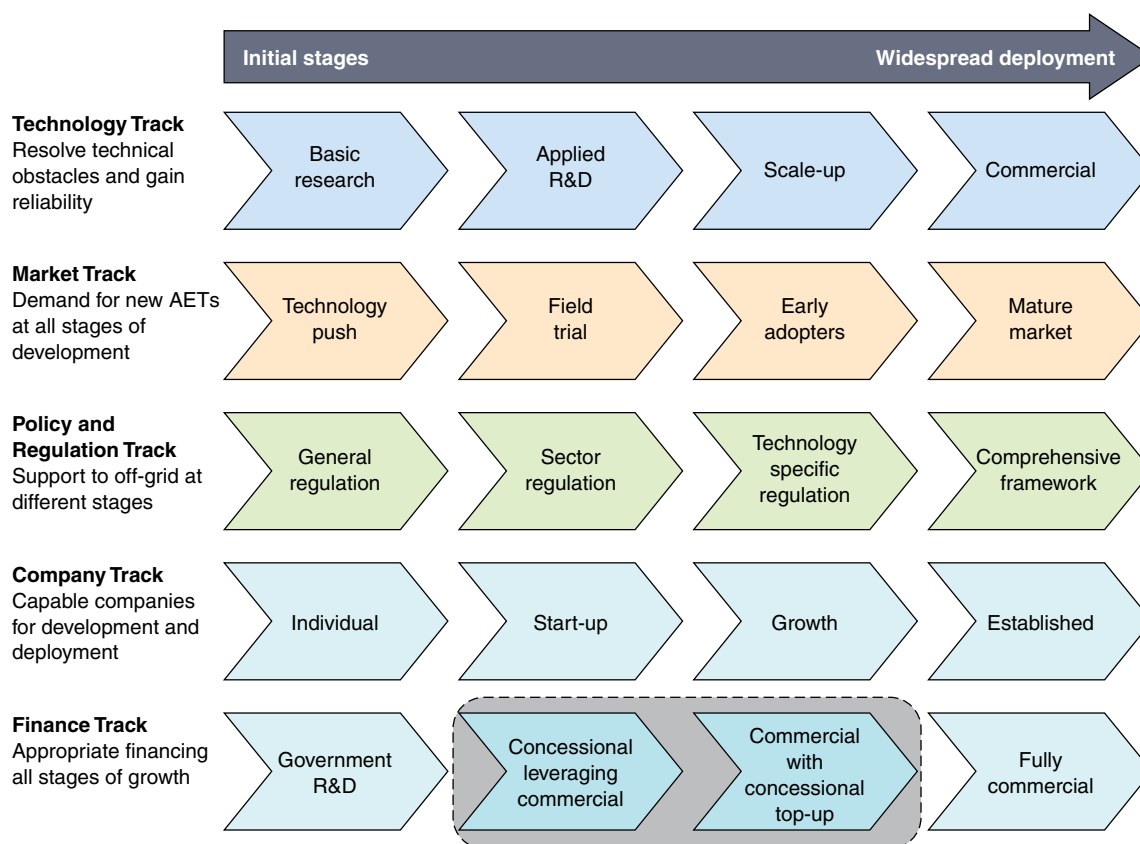
The projections of rapid off-grid scaling by the IEA and others suggest a penetration paradigm more similar to mobile telephony in 2000–10 than traditional utilities. Off-grid energy services have gone to scale in a handful of countries (such as East Africa). In most markets, however, a range of barriers and unvalued externalities impede such services from reaching their potential. Barriers to growth include the following:

- The novelty of the technology and related business models
- Policy and regulatory frameworks that were created for incumbent paradigms
- Customers' lack of awareness of and comfort with the technology
- Inadequate government awareness, experience, and capacity with technologies and business models
- Reliance on uncertain and changing support schemes
- Lack of financing to match the needs of new business models
- Lack of capacity and expertise by private sector actors in new markets

The global public goods of increased energy access and reduced emissions justify government intervention to address these barriers. The positive spillover effect of commercializing innovation further justifies government action.

However, any public intervention must take account of the multidimensional nature of technology commercialization and ensure parallel progress in all facets of the process to scale. Figure 1.3 shows five "tracks" that must be traversed for successful market creation and widespread deployment of a new technology.

Figure 1.3: Tracks for commercialization and scaling of a new technology



Source: Internal World Bank documents.

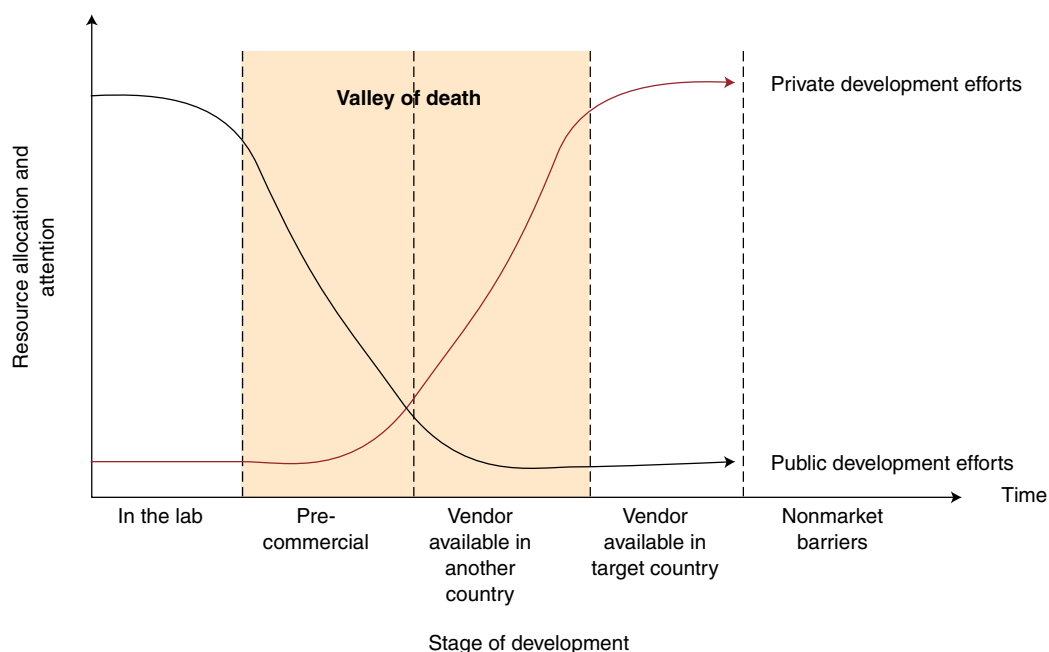
1.2 LACK OF FINANCING AS AN OBSTACLE TO DEVELOPMENT

Although none of the five tracks have advanced fully, substantial progress is being made on most of them. Despite this progress, companies and public stakeholders regularly cite lack of financing as the most pressing impediment to scaling the OGS market. Provision of appropriate and sufficient financing thus represents an important means of increasing energy access. Lack of finance in this space corresponds to the “valley of death” between proof of scientific validity in a lab and full commercial scale-up in markets (Figure 1.4).

Established financing channels are not acting quickly enough to address the financing gaps in the OGS market, largely because of a mismatch between the structure of these instruments and the underlying business models of companies in the sector.

There are important and substantial differences between traditional structures for electricity supply and delivery and the business models deployed for OGS energy distribution (Table 1.1). Traditional structures involve centralized power plants and utilities that transmit electricity over a grid. These companies are large, established, and either owned by the state or heavily regulated. Each market has a small number of players. In contrast, the OGS market is decentralized. It involves many new companies that produce pico-solar and SHSs, with no or very light regulatory oversight. These differences mean that traditional

Figure 1.4: “Valley of death” in financing of emerging technology paradigms



Source: Internal World Bank documents.

Table 1.1: Differences between traditional electricity and off-grid solar markets

Feature	Traditional electricity market	Off-grid solar market
Size of capital investment required	Large	Small
Prices	Regulated	Determined by markets
Investment returns	Often guaranteed (in rate base, for example)	Not guaranteed
Size and age of company	Large, often state-owned	Small, often new
Vertical integration	Yes (generation, transmission, distribution)	Yes (manufacturing, distribution, and financing)
Technology	Established, well-known	Newer
Affordability	Up-front cost can be significant barrier to entry for households	Flexible and affordable payment options for customers
Service or asset	Customers pay for energy as a service	Customers pay for an asset rather than for usage (although some companies offer solar as a service)
Type of customer payment services	Traditional	Innovative
Customer base	Often the wealthiest and most urban	People in remote areas with little or poor financial track records
Obligation to provide service	Yes	No

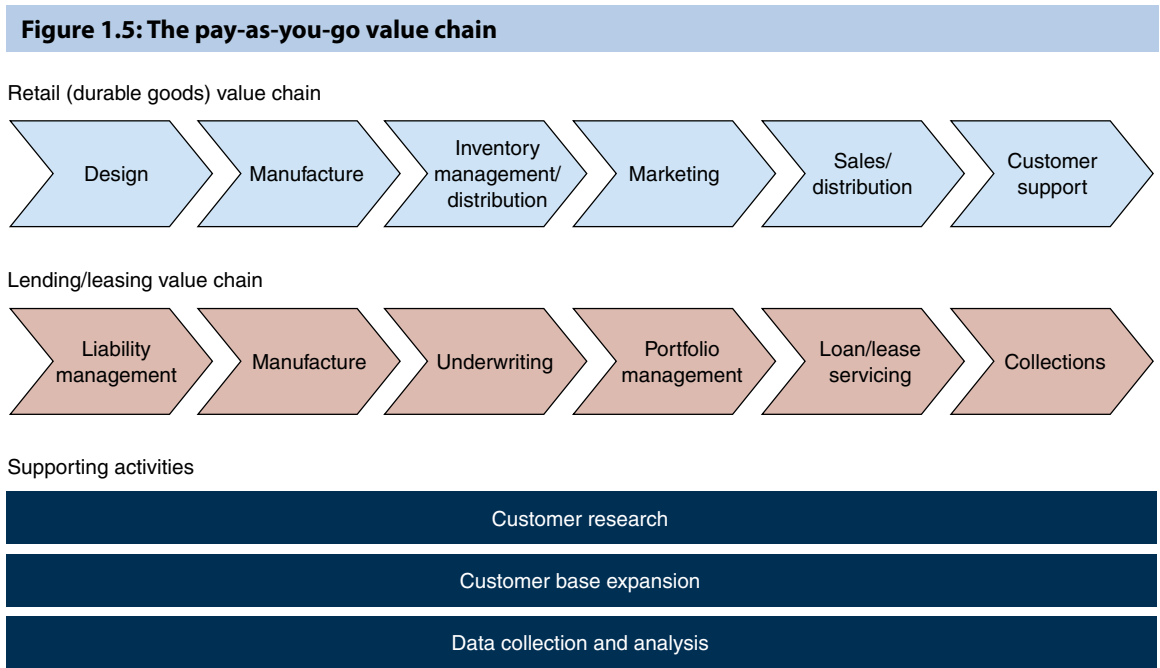
financing methods for traditional energy companies are not always appropriate in the OGS market. Some established financing channels, such as bank finance, remain important to the sector—particularly as OGS companies reach scale—but by large these instruments fail to address the nuanced financing needs of OGS companies across the business lifecycle.

1.3 UNIQUE FINANCING CHALLENGES OF OGS BUSINESSES

The OGS sector and its value chain bring unusual financing challenges. Unlike traditional retail business models, the dominant OGS model is asset-heavy, service-heavy, and consumer finance-heavy. The vertically integrated pay-as-you-go (PAYG) model has added consumer finance to off-grid company functions. The PAYG business model essentially rolls four business functions—product design/assembly, distribution, platform software, and banking—into one business. In this model, therefore, OGS companies provide not only technology and products but also finance.

During the nascent stages of the PAYG industry, most new entrants chose to invest heavily in all parts of the value chain, to compensate for the lack of suitable partners and to control the customer experience as they innovate to find an optimal business model. Because it is difficult to excel in all four areas, however, specialized companies are emerging to operate in a single or several windows of the PAYG value chain (for example, specialized technology providers or specialized financiers). (World Bank Group 2018).

Figure 1.5 maps the core PAYG activities across the value chains of a manufacturer/retailer and a financial institution. Some PAYG companies may look more like off-grid utilities; others will be active in only parts of the value chain. (Sotiriu and others 2018).



Source: Sotiriu and others 2018.

The PAYG model introduces unique financing requirements, as companies must source capital for product development, manufacturing, and operations while juggling intense working capital and accounts receivable financing needs. In the OGS sector, the process of converting inventory into cash may take more than three years. The long cash conversion cycle, which runs from product manufacturing through the customer's final loan repayment, can create a mismatch of credit terms and capital needs and/or restrict participation of financiers to those that are well acquainted with the sector.

The OGS sector presents additional complexity to financiers because of the limited liquidity of OGS assets, which limits their use as loan collateral. In addition to the credit term mismatch outlined above, transactions may be complicated by a currency mismatch between input costs and revenues, as customer repayments are usually fixed in local currency while working capital and accounts receivable financing may be in hard currency. Transactions are also complicated by a currency mismatch between input costs and revenues, as customer repayments are usually fixed in local currency whereas working capital and accounts receivable financing are often in hard currency.

From a traditional financiers' perspective, the OGS market represents a relatively risky investment. The market is relatively new and untested, comprising start-ups and growth-phase companies. These companies serve an untested customer base of remote, low-income households without credit histories.

Another complicating factor is the triple-bottom-line (social, environmental, financial) nature of investment in the sector. Different financiers may prioritize one type of return over another, which can be a problem for loan syndication or blended financing.

OGS sector, therefore, faces unique financing challenges. Finance for the sector has up to now been provided by grant-makers, impact investors, and development finance institutions (mostly in the form of grant and debt facilities). These sources of financing have been essential to nurture and launch the sector. They will be insufficient to scale the sector to potential, however; bringing the sector to scale will require greater participation from commercial equity and debt investors. Some commercial finance sources, such as local banks with specialized units for small and medium enterprises (SMEs), have made investments in OGS firms, but they have yet to fully embrace the sector.

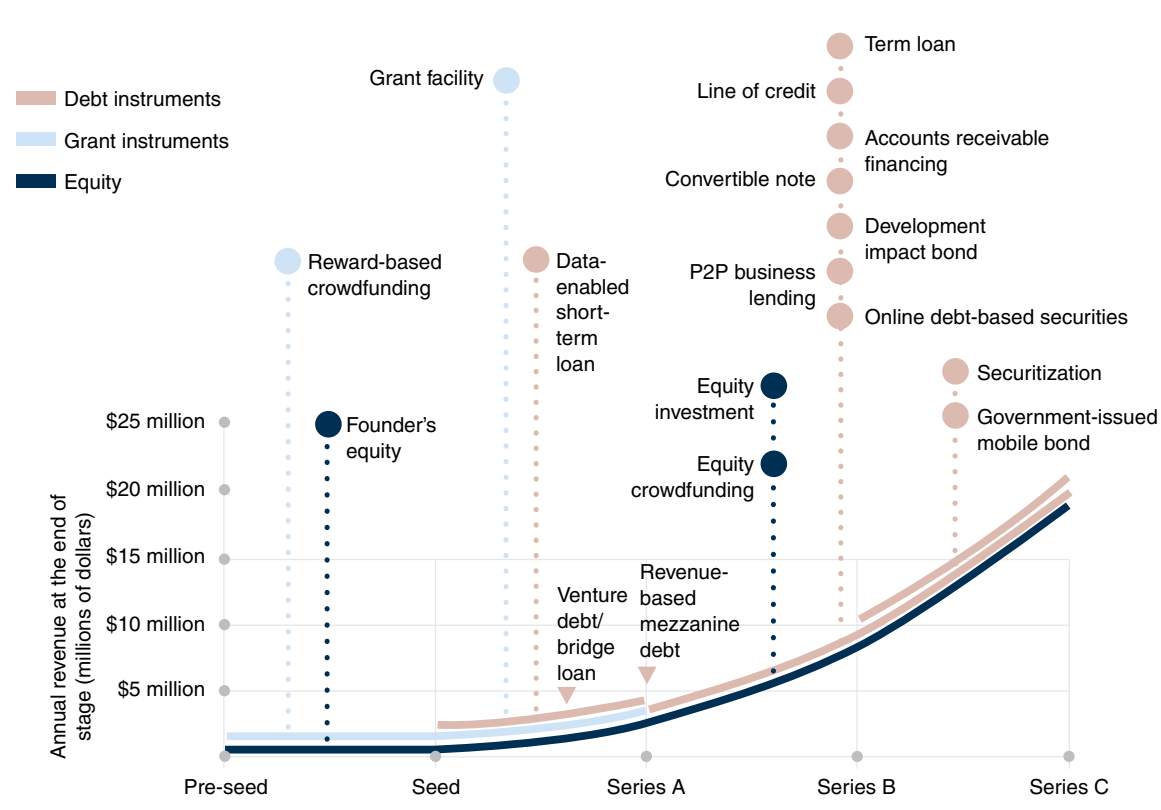
Several promising new financing instruments have recently emerged. They include risk mitigation or guarantee schemes, the securitization of accounts receivable (future customer repayments), foreign exchange hedging, crowdfunding, and peer-to-peer (P2P) lending. These instruments have shown promise, while setbacks have yielded lessons that have allowed for refinement.

Furthermore, the characteristics of OGS markets—distributed, data driven, based on novel technology—match new developments in the finance sector, often termed fintech. Fintech refers to the application of advances in information technology to financial services. It improves financial access for “unbanked” customers and allows for the digitization of relevant data to better understand and allocate risk. It allows companies to reduce transactions costs and connect nontraditional investors to investment opportunities they would not consider through traditional investment mechanisms. These features closely match those of the OGS market, suggesting good potential for applying fintech in the industry.

Innovative financing instruments build on the role of established financing instruments to broaden financial access, reach underserved markets, increase time efficiencies, and reduce the cost of capital.

Instruments such as peer-to-peer (P2P) business lending, for example, can address financing gaps in the OGS market by providing financing during crucial lifecycle phases (Figure 1.6). Innovative instruments are also becoming an important part of the financing mix for more established market players as they seek to diversify funding sources.

Figure 1.6: Financing instruments across the business lifecycle



1.4 ORGANIZATION OF THE REPORT

This report takes a holistic view of the suite of financing instruments that could be applied to the OGS sector. The report examines both established financing instruments with clear application and growing track records in the OGS context and innovative instruments that are in early stages of development or have yet to be fully applied to this market, including innovations developed and tested in other sectors with potential application to the OGS context. The emphasis is on exploring the current and potential use of financial innovation in the sector, with a focus on fintech and alternative financing channels.

The report examines 17 financing instruments, considering each instrument across four core areas: benefits, challenges, required market conditions, and policy and regulatory considerations. Real-world case studies showcase the use of these innovative approaches in financing within the OGS sector and beyond.

The report is organized as follows. Chapters 2–4 examine grant, debt, and equity financing instruments that have been or could be used by OGS companies. Chapter 5 explores “catalytic tools,” such as loan guarantees and investor tax incentives, that can encourage investment in the OGS sector. Chapter 6 examines distributed ledger technology—the technology that underpins blockchain—and cryptocurrencies.

In keeping with the sector’s roots, there will likely be increased adoption of innovative financing channels across the sector. It will be up to the decentralized financiers, platforms, and investees using innovative financing instruments to prove the sustainability and longevity of these frontier financing channels. As fintech-enabled financing channels grow in scale and credibility, they will likely complement more established financing channels, such as investment funds, grants, and traditional debt instruments.

CHAPTER 2 GRANT INSTRUMENTS

This chapter examines three grant instruments used by companies in the off-grid solar (OGS) sector: grant windows, results-based financing, and reward-based crowdfunding. Grant instruments can play a pivotal role for OGS companies during the start-up (pre-Series A) phase, when it can be difficult to obtain financing on commercial terms. Grant instruments also allow more mature companies to take risks by absorbing some of the costs associated with expanding into new markets, launching new products, or serving new customers.

In the OGS market, traditional grant-makers (such as foundations and government donors) may be willing to take on this risk in order to achieve social and/or environmental outcomes. Grant windows and results-based financing initiatives are often linked to a particular objective, such as serving last-mile customers. Grant instruments allow OGS companies to embark on projects that are higher risk but potentially catalytic for the market or certain customer groups. Grant capital can spur innovation and allow OGS companies to evolve with greater speed than they would without access to concessional finance.

Proceeds awarded from grant windows and results-based financing (RBF) initiatives are usually contingent on the delivery of milestones outlined in the grant agreement. Grantees may be required to finance the agreed initiatives up front and receive grant payments in arrears, which can restrict liquidity, particularly for pre-Series A companies. Grant windows and RBF are important financing instruments for innovation, as they allow OGS companies to take risks and explore new markets, customers, and products.

Reward-based crowdfunding introduces a new type of grant-maker to the OGS market. Backers on reward-based crowdfunding platforms are typically individuals that commit cash in return for a reward, such as a T-shirt or a prototype (such as a solar lantern). There is no formal contract between the campaign-backer and the OGS company raising funds via the platform; there is, however, a strong social contract. Most backers are personally connected to the founders or employees of the OGS company.

Reward-based crowdfunding is essentially a way to formalize a family and friends round. Campaigns are typically conducted during the seed and pre-Series A stage of the company lifecycle. Reward-based crowdfunding can play an important role in the early stages, and it can complement grant windows. It has limited applications in the OGS market once companies cross the Series A threshold.

2.1 GRANT WINDOW

- **Borrower profile:** Local and international OGS companies that are unable to access alternative funding sources, often because of the early stage of company development or the novelty of their business model or technology
- **Lifecycle phase:** Pre-seed to seed

- **Ticket size:** \$10,000–\$1 million
- **Currency:** Hard, local

Grants are nonrepayable or repayable funds, products, or services gifted or temporarily gifted by a government agency, foundation, corporation, or individual. They are often used during the pre-seed and seed phases of the business lifecycle to formalize a proof of concept or scale up operations. Growth phase (Series A–C) companies may raise grant funding to launch a new product or expand into a new market. Companies raising capital via grants need to demonstrate a track record to reduce implementation risk to funders.

Grant windows award funds to a company or consortium to achieve a specific set of objectives. The window is typically open for a set time period, with predetermined open and close dates. Some grant windows run on a revolving basis, with opportunities to apply annually or biannually, for several years.

Grant windows can play a catalytic role during the seed phase of the OGS company lifecycle by helping companies secure commercial financing. They can be used to fund activities that may be unable to attract other sources of capital, such as product research and development, proof of concept, market studies, capacity building, technical assistance, and development of regulatory frameworks. Grant facilities may be broad, funding a variety of purposes, or specific, with restrictions on how the money is spent and who qualifies.

The recipient does not usually repay the grant, although in limited cases, grants may be repaid if the recipient establishes a “successful” enterprise and reaches certain predetermined milestones. Returnable grants are appropriate when supporting risky activities that are potentially highly profitable, where no commercial lender will get involved because the repayment risk is too high. The underlying nature of a returnable grant—that it does not require repayment should the venture fail—does not put undue pressure on the company, but if the venture is successful it enables the granting party to reuse the grant money for another recipient.

OGS companies have long received grant support from various sources. Grants have provided vital capital to develop and grow their business models and deploy SHSs across various markets in Sub-Saharan Africa.

Benefits

- Grants fill a gap by providing the funds necessary to develop viable and sustainable business models.
- Grants are small, which may be suitable for early-stage companies not ready to accept the larger amounts provided by debt and equity sources.
- Cost-free financing and lack of repayment requirement (flexible repayment in the case of returnable grant) allow SHS companies to maximize the use of cashflow for product development and business growth.
- Grants support and promote the development of the OGS ecosystem.

Challenges

- Only a small number of noncommercial players provides grants, which are generally for far smaller amounts than required by OGS companies to make a material and sustainable impact.
- Grants are not typically repaid, which limits the recycling of funding. For this reason they are not a reliable source of continuous and sustainable financing.
- Grants can fail to encourage financial rigor in companies where debt loans and equity investments can.
- Grants can distort the market by subsidizing particular companies or products.
- Selection panels that make grant allocation decisions may lack the expertise to select appropriate recipients, especially with regard to commercial potential for growth.
- Grants need to address the issues and needs of the business, not only the grant-makers' objectives.
- Obtaining grants can be time consuming, as each grant window has a unique (and often lengthy) application process.
- Grant windows can be designed to be used for a very specific purpose (for example, a specific technology, with particular product specifications) that may not align with or target the needs of the company.
- Grant windows may not be sufficiently agile or flexible to adapt to a rapidly changing market.

Required market conditions

- Grant-makers must understand the nuances of the OGS market and be interested in supporting it.

Policy and regulatory environment

- Grant-makers and recipients should understand local regulations pertaining to foreign sources of capital, particularly where the grant-maker is a foreign government or agency. The regulatory and tax implications of "gifts" (grants) should also be understood.

Case Study 2.1: Grant window: Solarworks! (Mozambique)

In May 2017, SolarWorks! received a seed grant from the GSM Association (GSMA), a trade body that represents the interests of mobile network operators worldwide, to test machine learning optimization in their SHSs. The system uses weather forecasting and user data to make SHSs "self-learning," in order to minimize system downtime. SolarWorks! aims to improve customer satisfaction and reduce energy cost, resulting in improved repayment rates.

After winning the GSMA grant, SolarWorks! was able to secure a debt facility from peer-to-peer (P2P) business lending platforms Lendahand (the Netherlands) and Energise Africa (United Kingdom). Since establishing the facility, SolarWorks! has reportedly tripled its SHS sales.

2.2 RESULTS-BASED FINANCING

- **Financing instrument:** Grants
- **Typical company stage:** Series A–C
- **Providers:** Governments, industry associations, donors

RBF refers to incentive structures in which payments are made to companies, or directly to customers, triggered ex post by the delivery or installation of a given quota of an output (for example, kilowatts installed). Governments in both developed and developing countries have used RBF to encourage the uptake of renewable energy and energy-efficient technologies.

In the SHS market, quotas can be set to trigger incentive payments on the basis of a range of indicators, such as the number of systems installed, the number of homes or businesses served, or the volume of energy produced. Subsidies may be paid to the installer or to the user; in the OGS sector, most have been channeled through the OGS company. They can be structured as one-time payments upon installation and/or ongoing financial incentives (to incentivize longer-term service provision and/or after-sales services, for example).

Benefits

- RBF can incentivize faster development of a targeted OGS market by increasing affordability, particularly where incentives are paid to end-users. It can target certain geographies, technologies, or consumer groups. It may also help build customer awareness and interest in SHSs.
- RBF can benefit a full range of companies operating in the targeted market, irrespective of their size or growth stage.
- RBF can stimulate investment and interest from financiers in specific renewable energy technologies, as it increases commercial viability for installers and/or affordability for end-users.
- RBF can provide a flexible source of funding to OGS companies and increase liquidity. Although the proceeds are tied to a certain result, there is usually a no strings attached approach to how these funds are spent.
- RBF can be used to direct the market in certain ways. For example, it can attract companies to underserved communities. It allows development institutions to target their financing to geographies or consumer groups that they desire to support.

Challenges

- RBF can introduce market distortions. Businesses that emerge to take advantage of this market opportunity may become dependent on the continuation of the subsidy for their sustainability.
- Setting the incentive so that it triggers the desired level of activity without (over) subsidizing activities that would have happened anyway can be tricky.
- Some enterprises may fraudulently take advantage of RBF (by, for example, installing units to capitalize on the incentive without delivering significant amounts of electricity).
- RBF can be very expensive for the funder if it proves popular. To prevent runaway costs, countries can cap the incentives.
- RBF that pays only against the delivery of results may not be suitable for smaller/earlier-stage companies that do not have the means to prefinance the delivery of the SHSs to the users.

Required market conditions

- Funders (governments, development finance institutions) must have significant capital to be able to fund RBF. RBF schemes often direct the market in some way and therefore support a range of companies and/or customers.

Policy and regulatory environment

- Implementers should be aware of national energy policy and guidelines pertaining to subsidies, which may inform the structure of the RBF program.
- Buy-in from the national government will likely be required for the program to reach scale.

Case Study 2.2: Results-based financing: Energising Development (Tanzania)

Energising Development (EnDev) is a program that supports development through energy access. In 2013, with the support of UK aid and the SNV Netherlands Development Organisation (SNV), it began a five-year RBF project in the Lake and Central Zone of Tanzania. The RBF was structured to provide retailers and distributors with incentives for verified proof of sales of solar products in the target regions. There were two forms of the incentive: a product bonus installment to retailers and a capital bonus installment to suppliers, linked to retail sales volumes.

The RBF was structured so that neither party could earn the incentive without the verified performance of the other party; the incentive was therefore dependent on cooperation between suppliers and retailers. Incentives are paid on Lighting Global–verified solar products and are linked to product performance. They range from €1 (\$1.12) to €40 (\$45); they are capped to limit oversubsidization. By the end of 2017, more than 60,000 Lighting Global–verified solar products had been sold under the RBF, and more than €1.3 million (\$1.46 million) of the RBF fund had been disbursed as incentives.

Case Study 2.3: Results-based financing: World Bank facility for solar home systems under the Kenya Off-Grid Solar Access Project (KOSAP)

KOSAP is a World Bank–funded project, implemented by the government of Kenya, that aims to expand electricity access through off-grid solar products and solar mini-grids in Kenya’s underserved counties—the poorer and more remote regions in north and northeast Kenya. It includes an off-grid solar component of \$42 million, made up of a \$12 million RBF facility and a \$30 million debt facility. SNV and SunFunder were chosen as implementation partners by the government of Kenya, following a competitive selection process. The facilities were launched in June 2019.

This facility competitively awards financial incentives to companies to compensate them for the up-front, ongoing, and opportunity costs associated with expanding into underserved counties. Counties are divided into service territories, and tenders are held for each service territory. Companies bid based on a financing amount per household that they estimate would be required to electrify the household and a sales target they estimate they can reach. The companies with the lowest financing requirements win, assuming they meet eligibility criteria, have proven track records, and can reasonably be expected to stay in the underserved county once the subsidy period comes to an end. For each tender, there is a percent cap for the maximum amount any individual company can receive, in order to ensure that there are multiple, competing companies in each service territory and customers have a meaningful choice of products and suppliers.

Case Study 2.4: Results-based financing: The Renewable Heat Initiative (United Kingdom)

The U.K. government instituted the [Renewable Heat Incentive](#) in 2011, in order to encourage a switch away from fossil fuel-based heating systems. The program subsidized each unit of heat produced from renewable energy. It encouraged commercial, industrial, and residential users to install renewable energy technologies, including biomass boilers, solar water heaters, and heat pumps.

Payments were made to domestic and nondomestic installers on the basis of each kilowatt hour (kWh) their product produced. The initial subsidy was £0.09 (\$0.12) per kWh for heat and £0.10 (\$0.13) per kWh for hot water. The annual subsidy for installers was to last 20 years for commercial installations and 7 years for home installations. On this basis, installers could expect to recover the costs of installation within five to eight years from the incentive. Payments received were tax free.

In 2017 the scheme came under intense scrutiny for overspending, and a public inquiry was launched. During the inquiry, allegations were made that some users installed heating systems to profit from the scheme rather than to meet genuine heating needs. In 2017 the subsidy was reduced, highlighting the risk to installers where payments are made over a long period, during which there is potential for policy change.

2.3 REWARD-BASED CROWDFUNDING

- **Borrower profile:** Entrepreneurs and early-stage companies raising funds to bring a product to market. There are two broad categories of fundraising: campaigns that aggregate contributions from the founder's network (which typically raise \$5,000–\$50,000) and pre-sales-based "mega" campaigns (which typically raise \$100,000–\$500,000).
- **Lifecycle phase:** Pre-seed to seed
- **Ticket size:** \$5,000–\$500,000 (although individual funders may contribute as little as \$10)
- **Currency:** Hard, local

In reward-based crowdfunding, a company (typically a start-up) raises funds through an online platform and offers funders a gift or "perk" in exchange for a financial contribution. Reward-based crowdfunding is sometimes considered a pre-sale, in which individuals, projects, and companies raise finance from backers, who receive a nonmonetary reward or product, such as the technology developed with the funds raised. Depending on the nature of the start-up and project, the reward may be modest; funders may be motivated by altruism rather than the reward. This fintech-enabled instrument formalizes the fundraising process from family and friends.

Crowdfunding platforms based in Africa raised \$3 million in 2015, with an average successful campaign size of \$7,500. OGS companies that have crowdsourced funding from their networks include Okra Solar, Pollinate Energy, and Solaris Off Grid. Several other OGS companies have crowdsourced donations (Box 2.1).

BOX 2.1

What is donation crowdfunding?

Donation crowdfunding occurs when a nonprofit, company, project, or individual raises donations through an online platform. Unlike in reward-based crowdfunding, where donors receive a reward or gift in exchange for their financial contribution, donors receive no tangible benefit. They are typically motivated by their connection to the campaign maker and/or community benefiting from the project.

Several off-grid energy entrepreneurs—including Kenya Green Supply, EcoCharcoal, and Kitui Industries—have used M-Changa, a Kenya-based donation crowdfunding platform, to raise early-stage seed capital. Entrepreneurs typically raise \$5,000–\$30,000 to fund a specific milestone or deliverable.

Benefits

- Crowdfunding allows companies to raise pre-seed and seed capital, which is often difficult to obtain for early-stage companies and novel products. Access to risk capital means that more companies move to the next growth phase—or quickly fail.
- Crowdfunding provides an opportunity to engage and build on an existing network and solicit buy-in that can be leveraged later (for follow-on financing or legal advice, for example). Nonfinancial benefits of reward-based crowdfunding include building product awareness and attracting talent (Kuppuswamy and Roth 2015).
- Crowdfunding is significantly faster than applying for a grant. Reward-based crowdfunding platforms are light on due diligence. Most allow entrepreneurs/start-ups to upload their campaign documents automatically. Campaign planning, execution, and outreach are the responsibility of the campaign maker.

Challenges

- Reward-based crowdfunding is usually suitable only for early-stage companies or a specific project/deliverable. The campaign maker must demonstrate innovation and actively leverage its network; entrepreneurs lacking suitable networks and relevant technical and marketing sophistication are unlikely to be able to tap this funding source.
- Where rewards are offered, it is important to consider the cost of the reward and the postage, as these costs can absorb a significant amount of the funds raised.
- Companies with both local and international backers may have difficulty finding the right platform fit. International backers may not be familiar with local platforms, and international platforms may have limited payment functionality. This problem may create currency, trust, and functionality issues.
- The most prominent reward platforms globally, Indiegogo and Kickstarter, accept contributions only via credit card. Platforms must be suitable for the geography and preferred payment method of campaign backers.

Required market conditions

- Successful reward-based crowdfunding is based on trust and social connections. To succeed, campaign makers need a large, dense network with the capacity to contribute.
- Companies need a novel, innovative product that appeals to campaign backers in the global North.
- Campaign makers need some level of marketing sophistication to engage their network and put together compelling campaign materials, which could include a video. They must be willing to invest financial and human resources in campaign planning and execution.

Policy and regulatory environment

- Reward-based crowdfunding is largely excluded from the remit of financial regulators; platforms have no responsibility to act on behalf of backers that do not receive the reward. Campaign-backers therefore face the risk of nondelivery of reward or milestones, loss of funds, and business failure, with limited opportunity for recourse.

Case Study 2.5: Reward-based crowdfunding: GravityLight (Kenya)

GravityLight is a low-cost light that is powered by kinetic energy. In 2013 its designers embarked on a \$55,000 reward-based crowdfunding campaign to begin field testing their prototype. The rewards offered were linked to the amount of funding campaign backers put forward. They ranged from a “thank you” on GravityLight’s website to the light itself. The campaign raised \$400,000 in 40 days (727 percent of its target) on the Indiegogo platform, allowing the company to pilot the product in 26 countries and produce the next product iteration.

In 2015 the company launched a second reward-based crowdfunding campaign on Indiegogo, with match funding from Ben & Jerry’s. It raised another \$400,000 (128 percent of the target), which the company used to launch a commercial pilot in Kenya that included plans for local product assembly.

GravityLight launched a third campaign on Indiegogo in June 2018. It raised \$115,000 (147 percent of the target) to develop the next-generation GravityLight.

GravityLight launched commercially in Kenya in 2017. There is not yet public evidence of commercial scalability. This novel product may continue to appeal to consumers in high-income countries, where most of its campaign backers are based.

Case Study 2.6: Reward-based crowdfunding: Okra Solar (Cambodia)

Okra Solar is an early-stage Australian start-up piloting a “plug-and-play smart controller” that facilitates power sharing by neighbors. It allows SHS installers to create modular minigrids by enabling a household with an SHS to share its energy production with a neighbor that does not have one. The household with the SHS effectively becomes a “prosumer,” consuming and producing a product. Okra Solar provides the back-end to ensure that there is a record of energy production and consumption, which can then facilitate payments between neighbors.

When Okra Solar launched its reward-based crowdfunding campaign, in December 2016, it had just completed a small-scale pilot to prove the technology. Its demo in Cambodia showed that excess power from a single solar panel and battery could be used to power other houses when there was excess power. The company raised \$45,000 in seed capital through the Australian crowdfunding platform Pozible, which it used to build a prototype. The campaign received more than \$10,000 match funding from the United Kingdom's Department for International Development (DFID). It subsequently won a \$210,000 grant from the Swedish International Development Cooperation Agency (SIDA) and secured pre-seed financing from the Energy Access Ventures (EAV) Fund, which is backed by Schneider Electric, the CDC Group, and DFID, among other investors.

CHAPTER 3 DEBT INSTRUMENTS

This chapter describes 12 debt instruments, most of which have been used to finance off-grid solar (OGS) companies. They include the following:

- Term loans
- Lines of credit
- Venture debt and bridge round
- Accounts receivable financing
- Securitization
- Convertible notes
- Revenue-based mezzanine debt
- Development impact bonds
- Peer-to-peer (P2P) business lending
- Online debt-based securities
- Data-enabled short-term loans
- Government-issued mobile bonds

Many of these instruments are relatively well-established, in the sense that their structure and application is generally understood in the market. Other instruments are frontier financing instruments, developed in response to barriers to financing faced by OGS companies.

The vertically integrated pay-as-you-go (PAYG) financing company—the dominant business model in the OGS sector—brings some unique challenges for debt financing. PAYG companies typically take a 10–20 percent up-front deposit from their customers, with the balance of the loan repaid over a one- to two-year term. As OGS companies expand their product lines to include appliances and productive use technologies, the customer loan term is likely to increase. Therefore, PAYG companies require debt facilities that meet their needs from the manufacturing phase through to the final customer repayment, which may occur almost three years after the product is manufactured.

The PAYG model stretches traditional thinking on asset-based lending instruments, such as term loans. In the OGS sector, collateral may be defined as installed solar assets. Future OGS company cashflows may be made up of thousands of micro-loan repayments over a two-year period.

It is encouraging to see increased flexibility from traditional financiers, such as banks, as they provide financing in the form of term loans, lines of credit, and accounts receivable financing to OGS companies. This section describes established financing instruments, such as term loans, and emerging financing

instruments, such as P2P business lending. It also covers nascent debt financing instruments, which could be applied to the OGS sector but have not yet done so, such as development impact bonds and government-issued mobile payments bonds, such as the M-Akiba bond as issued in Kenya in 2017.

3.1 PURPOSE AND TYPES OF DEBT FINANCING

Growth-phase companies (Series A–C) use debt instruments to raise working and/or investment capital. Working capital finance typically funds inventory and day-to-day operating expenses. In the OGS market, debt instruments are often loans to a company to purchase a certain number of solar home systems (SHSs) from a specific product manufacturer (or to manufacture a specific number of their own units). Capital expenditure is capital spent on physical assets, such as a manufacturing plant, or new ventures, such as expansion into a new market.

In secured debt financing, the borrower pledges collateral (such as land or inventory) that may be repossessed by the lender in the event of default. In unsecured debt financing, a loan is issued based only on the borrower's creditworthiness. Unsecured debt financing generally costs more, because of the higher risk posed to the lender. Many of the instruments detailed in this section can be either secured or unsecured.

One of the greatest challenges for OGS companies raising debt finance is the untraditional nature of the assets that can be used to collateralize loans. The most valuable asset of OGS companies is typically the thousands of SHSs installed in customers' homes (and units on hand), which are difficult to reclaim and value.

3.2 CAPITAL STRUCTURE

As the suite of financing instruments available to OGS companies expands and the sources of capital broadens, it is vital that borrowers and lenders establish a clearly defined capital structure. It determines the seniority of lenders and investors, stipulating who gets what in the event of default and/or company failure.

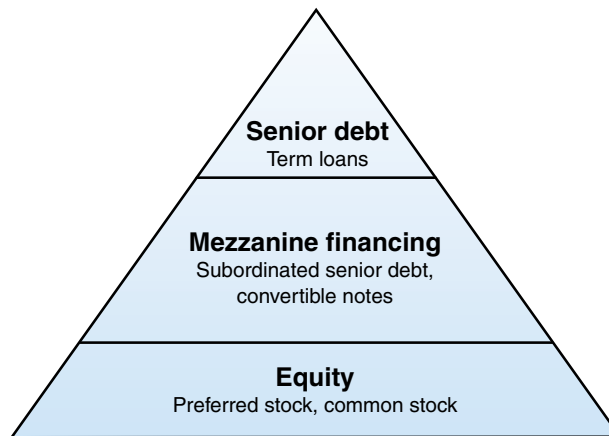
Broadly speaking, there are three levels to the capital structure (Figure 3.1):

- Senior debt is typically secured debt. It takes priority over lower-ranking debt and equity.
- Mezzanine capital includes hybrid financing instruments, such as convertible notes. It is often unsecured.
- Equity includes common and preferred stock.

Within each category are subcategories, which give priority to some lenders over others. The ranking of the instrument is usually determined by structure of the particular deal rather than the instrument itself.

In practice, the financing structure may be a blend of two (or more) financing instruments. The distinction between some instruments (such as peer-to-peer [P2P] business lending and online debt-based securities) may be nebulous, and transactions tend to be bespoke, with their own unique characteristics.

Figure 3.1: Capital structure pyramid



3.3 TERM LOAN

- **Borrow profile:** Businesses with a reasonable expectation of cash generation during the life of the loan that will allow them to pay interest and debt repayments when they fall due
- **Lifecycle phase:** Post-Series C
- **Ticket size:** \$50,000–\$50 million
- **Currency:** Hard, local

A term loan is a loan that is repaid at regular intervals (for example, monthly or quarterly) within a specific period of time, normally 1–25 years. Interest is paid over the life of the loan. Along with other loan set-up costs, it represents the cost of the loan to the borrower. The interest rate charged by the lender can be fixed or floating. Floating rates are based on a benchmark market reference rate such as LIBOR, which adjusts over the life of the loan at preset intervals (for example, monthly or quarterly). Term loans are made in both hard and local currency.

Term loans are a well-established instrument in most countries. They are used to finance working capital and the acquisition of assets such as plant and equipment across the full range of sectors. The tenor of the term loan is normally tied to the useful life of the assets being financed, which are normally used as collateral for the loan: A loan to finance the acquisition of real estate may be for 25 or 30 years, whereas a loan to finance a car would normally be for no more than 5 years. The borrower's ability to repay the loan and the purpose of the loan also affect the loan maturity.

Collateral is intended to ensure that in the event of default, lenders are able to take possession of the collateral and realize its value to repay any outstanding amounts (interest, principal, and any associated costs). In the event of borrower insolvency or dissolution, secured lenders have a senior ranking that gives them rights to the collateral before other creditors.

Term loans often impose limits on what the borrower can do while the loan remains outstanding. They can include restrictions such as limits or prohibition of new indebtedness, the disposal of assets, material changes in business, and the payment of dividends, as well as specific financial covenants that the borrower must maintain and that are regularly tested.

These restrictions are normally designed to maintain the financial health of the borrower and ensure that management must ask the lender's permission to do certain things that may hurt its credit standing or the position of the lender. Any breach of these restrictions normally constitutes a default under the terms of the loan, with negative implications for the borrower, such as penalties and even acceleration of the repayment of all outstanding amounts. Breaches can also result in cross-default of other company debt and higher future financing costs for the borrower, as such behavior is seen as indicative of higher credit risk by lenders.

Benefits

- Term loans are well-established and widely employed by financial institutions and investors in economies of all income levels. Their availability in the OGS sector would significantly alter its landscape, enabling large-scale scalability.
- Funds deployed through term loans can closely match the needs of borrowers in the OGS sector, resulting in efficient use of capital, lower company risk, and improved financial performance.
- Term loans reduce reliance on smaller and less predictable/sustainable sources of capital, such as grants.

Challenges

- Negotiating loan terms and securing a loan can be a lengthy process that requires significant investment of human resources. There is also risk of delayed disbursement.
- Many established lenders are unfamiliar with the OGS sector.
- The vast majority of sector players do not have the financial track record or strength traditionally required for term loans.
- Lenders are often unable or unwilling to take on SHSs or SHS receivables as collateral, because of a combination of factors, including the lack of a well-established secondary market for SHSs, which makes it hard to estimate expected liquidity and value, and the continued reliance on the SHS company for operations and maintenance during the life of the SHS.
- Repossessing SHSs may require that legal or licensing conditions be met and approval obtained by local authorities (in Rwanda authorization may be required from the local mayor or district head).
- The fact that SHSs are sold primarily to low-income households may make it politically difficult to repossess them.
- Assets may be difficult to transfer. Older SHSs may suffer significant devaluation because of technology changes. In addition, there is potential for "rogue" sales (the reselling of used systems as new ones), which may need to be prevented through regulation and enforcement.
- Local currency financing can be very expensive, and hard currency is scarce in some countries. Some countries require central bank preapproval for payments of hard currency abroad, a process that can be slow.

Required market conditions

- Local and foreign financial institutions need better knowledge and understanding of the OGS sector, including well-documented and well-communicated understanding of sector economics; details of the competitive, regulatory, and legal landscape; the underlying risks; the performance and track record of OGS companies; and the challenges, benefits, and potential of the sector. Above all, the risk-adjusted returns and costs of extending a loan must make the transaction attractive to lenders.

- Prospective borrowers need adequate collateral and a proven track record of performance, liquidity, and realizable value.
- Foreign exchange needs to be available and convertible. If hard currency borrowers are unable to freely buy hard currency at competitive rates and without restrictions, they may not be able to meet debt repayments on time.

Policy and regulatory environment

- A sound domestic policy environment is needed, in which collateral and the rights and obligations of the parties are enforced.
- A supportive regulatory environment is needed for repurposing and redeploying SHS units.
- Regulation governing capital adequacy, collateral, and data protection is needed.

Case Study 3.1: Term loan: BBOXX (Rwanda)

In February 2017, BBOXX announced a \$2 million loan from commercial bank Banque Populaire du Rwanda. The loan was unique in that it set aside a fixed portion of BBOXX receivables in an account to which BBOXX customers pay off their SHSs in regular installments. The receivables act as collateral to secure the loan—a first in the OGS sector in Sub-Saharan Africa.

The facility was in local currency, allowing BBOXX to minimize exposure to currency fluctuations by matching the currency of their receivables with the loan. Typically, companies operating in the OGS sector are forced to borrow in hard currencies, because of limited local bank appetite for lending to the sector (as a result of irregular collateral and unfamiliar business models).

This first of its kind loan for a SHS distributor could signal greater participation of local banks in cashflow-based lending to OGS companies.

BBOXX secured another local currency loan in February 2018, a \$4 million facility from Union Togolaise de Banque (UTB). In 2019 it secured an \$8 million local currency financing facility denominated in Rwanda francs, through the Africa Development Bank (ADB)-backed Facility for Energy Inclusion Off-Grid Energy Access Fund (FEI OGEF). BBOXX also announced a \$31 million investment from the Africa Infrastructure Investment Managers (AIIM) fund, Africa's largest project-based investment vehicle.

3.4 LINE OF CREDIT

- **Borrower profile:** Businesses with positive operating cashflows and a reasonable expectation of timely cash inflow from short-term assets such as receivables
- **Lifecycle phase:** Series A–C
- **Ticket size:** \$100,000–\$55 million
- **Currency:** Hard, local

A line of credit is a flexible revolving loan that can be drawn down, repaid, and redrawn on as needed within a specified period of time. Lines of credit are available to use as and when needed; the borrower pays interest only on the amounts drawn. The lender charges a maintenance fee on amounts that remain undrawn. The borrower is able to adjust repayments based on needs, subject to a minimum amount. This flexibility is this instrument's main characteristic. In rare instances, lines of credit can be repaid upon demand of the lender rather than based on minimum repayments.

Lines of credit are well-established in most countries. They are typically used to fund variable expenses, such as working capital needs. (In contrast, term loans are designed to fund one-time purchases, such as equipment or land, and must be used for that purpose.) Line of credits are usually unsecured, although there are situations in which they may be secured. Lines of credit often include financial covenants regarding minimum cash amounts and accounts receivables.

Benefits

- Lines of credit can allow OGS companies to match their debt-financing needs to customer demand and repayments. Their flexibility is particularly important given the significant working capital requirements of OGS companies.
- They are widely issued by financial institutions globally.
- They facilitate the efficient use of capital, lowering company risk and improving financial performance.
- They reduce reliance on smaller and less predictable/sustainable sources of capital, such as donor and soft loans from other sources, enabling more sustained growth, scalability, and longer-term business planning.

Challenges

- Many established lenders are unfamiliar with the OGS market.
- Most sector players do not yet generate positive operating cashflows and lack the financial creditworthiness traditionally required for a line of credit.
- Local currency financing can be very expensive, providing an incentive to opt for hard currency financing, despite the foreign exchange risk.
- Hard currency availability can be an issue in some countries, and there may be restrictions on foreign currency transactions. Some countries require central bank preapproval for payments of hard currency abroad, and the process may be slow.

Required market conditions

- Local and foreign financial institutions need better knowledge and understanding of the OGS sector, including well-documented and well-communicated understanding of sector economics, details of the competitive, regulatory, and legal landscape; the underlying risks; the performance and track record of OGS companies; and the challenges, benefits, and potential of the sector. Above all, the risk-adjusted returns and costs of extending a loan must make the transaction attractive to lenders.
- Hard currency availability can be an issue in some countries, and there may be restrictions on foreign currency transactions. Some countries require central bank preapproval for payments of hard currency abroad and the process may be slow.

Policy and regulatory environment

- A sound domestic policy environment is needed that enforces the rights and obligations of the parties.
- Regulation governing capital adequacy, collateral, and data protection is needed.

Case Study 3.2: Line of credit: M-Kopa (Kenya and Uganda)

In October 2017, M-Kopa Solar announced that it had closed a \$55 million local currency line of credit for its operations in Kenya and Uganda, backed by customer receivables paid via mobile money payment plans. The line of credit syndicate was led by Stanbic Bank (\$9 million) and included the United Kingdom's CDC Group (\$20 million), the Netherlands' FMO (\$13 million), and Norway's Norfund (\$13 million) (M-Kopa Solar 2017). ResponsAbility, Symbiotics, and Triodos Investment Management provided another \$25 million, through a debt facility. The total proceeds of \$80 million can be used over the next three years to finance PAYG solar installations to 1 million new homes. M-Kopa Solar customers pay a \$35 up-front deposit, followed by 365 payments of \$0.45 a day, according to the company.

Case Study 3.3: Line of credit: The Market Development Credit Line (Ethiopia)

The Market Development Credit Line (MDCL) at the Development Bank of Ethiopia was established in 2012 by the government of Ethiopia under the World Bank-funded Electricity Network Reinforcement and Expansion Project. Since 2012 it has been the primary financing mechanism to support the off-grid energy sector in Ethiopia. Through two pilot phases, it has provided access to foreign exchange to enable the importation of renewable energy technologies and products and working capital loans in local currency.

The MDCL was created in response to the need to meet growing demand for off-grid solar products and other renewable energy technologies among customers not connected to the electricity grid. With no local manufacturing, virtually 100 percent of the Ethiopian market required imports. Local importers needed liquidity and access to foreign exchange at affordable rates. Microfinance institutions needed affordable local currency capital to enable their clients to purchase these products through installment payments. In response, the MDCL was designed with two windows. The first provided retail loans to Ethiopian private sector enterprises with guaranteed access to foreign exchange for up to two years (including a six-month grace period), at 12 percent interest. The second provided wholesale loans to Ethiopian microfinance institutions in local currency for up to six years (including a 12-month grace period), at 6 percent interest.

Initial funding of \$20 million was provided in 2012 to jump-start the sector. By 2016, it was fully committed to eight off-grid companies and five microfinance institutions; all loans were fully repaid. The MDCL financed the importation of 829,000 solar lanterns, 806,000 energy-efficient light bulbs, and 10,000 SHSs.

In response to market demand, an additional \$20 million was made available under the MDCL beginning in 2017, with two key changes. A \$4.5 million collateral support facility was created to guarantee up to 75 percent of the loan principal to lenders to smaller companies, and the government adopted the objective of targeting 75 percent of MDCL funding to SHSs, in order to drive the market from smaller pico-solar products to larger SHSs.

The additional \$20 million was oversubscribed in just over a year (mid-2017 to mid-2018). The number of private sector enterprises participating grew from 8 to 30, the number of microfinance institution participating grew from 5 to 14, and the number of loans for SHSs rose from 10,000 to more than 72,000 (they now represent more than 80 percent of total funding to date). All of the loans are performing. The MDCL has been a key contributor to the development of a young off-grid solar market in Ethiopia, providing much-needed working capital in both foreign and domestic currency.

3.5 VENTURE DEBT AND BRIDGE ROUND

- **Borrower profile:** Emerging growth companies backed by venture equity capital that do not meet the requirements of traditional bank debt financing
- **Lifecycle phase:** Seed through Series C
- **Ticket size:** \$50,000 to more than \$5 million
- **Currency:** Hard, local

Venture debt is a senior term loan that is typically used by emerging growth companies that are backed by venture equity capital and do not meet the requirements for traditional bank debt financing or want greater flexibility than bank debt allows. It normally includes warrants that give the holder the right, but not the obligation, to buy the borrower's equity shares at a certain price, quantity, and time in the future. Equity dilution from the warrants can be low (less than 1 percent of the company valuation). The value of the warrants is often calculated as a percentage of the amount lent (for example, 10–20 percent). Venture debt is used more in developed markets than in emerging economies.

Banks, finance companies, and investment funds offer venture debt, usually for a term of 12–48 months, although it can be extended for up to five years. Every financier will have a different focus based on its priorities, which reflect their funding sources and business model.

There are two main types of venture debt: growth capital and equipment financing. Growth capital can be used for any business purpose; it is normally secured by a charge on company assets, which may include intellectual property. Equipment financing is used to purchase equipment; it is secured by the equipment itself.

Venture debt is normally repaid in monthly payments over the life of the loan. In terms of cost, it sits between equity and more established debt instruments.

In a bridge round, a company that has already raised one round of equity (typically a seed round) takes on a debt instrument (such as a convertible note [see page 34]), usually from existing investors, before raising its next equity round (typically a Series A). When the next equity round occurs, this bridge loan normally converts to equity at a discount. The loan may also charge interest.

Many investors see bridge rounds as a sign of trouble, as proceeds are often used on product development rather than growth. As a result, only existing investors (who are already committed) are likely to show interest.

Bridge rounds differ from seed rounds in that they are larger (but not as large as a Series A) and the proceeds tend to be invested in growth (sales and marketing), helping the company achieve the metrics necessary for a Series A issuance.

Benefits

- Venture debt and bridge rounds provide a company with time to achieve key milestones and progress before its next equity round, sale, or initial public offering (IPO) or the achievement of profitability while minimizing equity dilution. If the company performs worse than expected, venture debt can buy the company time to get back into shape and avoid a “down round” (when investors purchase shares from a company at a lower valuation than the previous round).
- They complement an equity round and minimize equity dilution. They are useful for making acquisitions, accelerating growth without taking on new equity, and raising small amounts that may not warrant a new equity round.
- They are quicker to close than a Series A–C round.
- They preserve day-to-day management independence, as lenders do not require board seats.
- They provide an attractive mix of cost and flexibility.
- They widen the sources of capital for young companies, especially companies that rely solely on equity investors and donors.

Challenges

- Many OGS players may not yet generate sufficient cash to attract lenders. Venture debt could be combined with equity rounds to attract interest.
- If debt service (interest plus repayment of principal) exceeds 20 percent of a company’s operating expenses, the company may find it hard to attract future equity investors. Companies with little cash would have to accept higher borrowing costs than companies that can comfortably service debt.
- Structural features may create perverse incentives or limit flexibility. A bridge round is intended to help a company extend the time before its next equity round. Investors typically can convert their loan into equity at a predetermined discount. A pitfall to avoid is “exploding” discounts—discounts that increase by a percentage every month after a specific date (reducing the cost of equity to investors), which can create an incentive to close the next round quickly, resulting in a bad negotiation. The lender’s reputation and history in handling previous clients is important.
- The expense of local currency financing acts as an incentive to opt for hard currency financing, despite the foreign exchange risk. Scarcity of hard currency can be a serious issue; some countries require central bank preapproval for payments of hard currency abroad, which may delay the process.
- Terms should provide enough flexibility to be available when the business needs it most. Parties should agree to a conversion at a reasonable discount in the event that the loan matures before a new equity round is closed rather than having to negotiate at maturity. Default clauses can sometimes be very subjective, allowing the lender to recall the loan for reasons beyond the borrower’s control. Associated covenants should be carefully negotiated to ensure that the company has the cash it needs.

Required market conditions

- Local and foreign financial institutions need better knowledge and understanding of the OGS sector, including well-documented and well-communicated understanding of sector economics; details of the competitive, regulatory, and legal landscape; the underlying risks; the performance and track record of OGS companies; and the challenges, benefits, and potential of the sector. Above all, the risk-adjusted returns and costs of extending a loan must make the transaction attractive to lenders.
- If borrowers are unable to freely buy hard currency at competitive rates and without restrictions, they may not be able to meet debt repayments on time. If hard currency is readily convertible from local currency, the borrowing company is exposed to exchange rate fluctuations.

Policy and regulatory environment

- A sound domestic policy environment with enforceability of investor and investee rights and obligations is necessary to attract early-stage equity investors and venture debt providers.
- Policy must support foreign investment (and potentially hard currency investment) as well as more complex investment structures (such as hybrid instruments).
- The tax treatment of hybrid instruments (instruments with characteristics of both debt and equity) should be determined.

Case Study 3.4: Venture debt and bridge round: The European Investment Bank (Luxembourg)

The European Investment Bank (EIB) has a venture debt product aimed at medium-size companies looking to raise €7.5–€50 million (\$8.4–\$56 million). The loan is nondilutive and available for two to three years, with a repayment period of five years, giving company management the freedom to manage the business day to day. The product combines the advantages of a long-term loan with a remuneration-model based on the borrower's performance. The rank may be senior; subordinated; contingent (for example, dependent on future outcomes); or participating (for example, multiple loans to one borrower). It may be secured or unsecured.

The instrument targets European companies with up to 3,000 employees in the fields of biotechnology and life sciences, software and information and communications technology (ICT), engineering and automation, and renewables and clean technology. During 2017 EIB lent more than €750 million (\$843 million) in long-term venture debt financing, which is expected to create more than 6,500 jobs and €7 billion (\$7.9 billion) in research and development investment.

3.6 ACCOUNTS RECEIVABLE FINANCING

- **Borrower profile:** Businesses with at least two years of trading history and a minimum turnover, as dictated by the arranger, investor, or platform. Business borrowers must be able to demonstrate the quality of their receivables and expected repayments with historical data.
- **Lifecycle phase:** Series A–C
- **Ticket size:** \$1,000 to more than \$1 million
- **Currency:** Hard, local

Accounts receivable financing is a form of asset-backed lending typically secured by expected future payments from customers. Individual or institutional investors purchase invoices or receivable notes from a company at a discount. The borrower retains ownership of the invoice/receivable, allowing it to free up cash tied up in an invoice or receivable note that has yet to mature.

There are several types of accounts receivable financing. A portfolio of receivables (or a bundle of invoices) can be sold, and accounts receivable can be securitized (see page 31). Small and medium enterprises sometimes use online invoice trading to access working capital, especially where a bank overdraft or other business loan is not suitable. The investor (or arranger) conducts due diligence on both the business and the invoice to assess the quality of the receivables. Online invoice trading has emerged through alternative online financing platforms, which allow businesses to sell invoices (or bundles of invoices) at a discount online.

Benefits

- Technology allows for a transparent verification process. To aid in the verification and credit assessment process, businesses can directly link their existing accounting software, which includes all information on receivables, as a plug-in to the arranger or platform system.
- Institutional investors and accredited investors provide significant funding volumes. Although retail investors also use it, accounts receivable financing is largely the domain of institutional or accredited retail investors. Institutional investors can provide significant proportions of funding toward the loan book.
- Government interventions can potentially catalyze investment. The government-backed British Business Bank has funded online invoice trading campaigns in the United Kingdom (British Business Bank 2016). Since 2013 the British Business Bank has invested £10 million (\$13.25 million) through the United Kingdom's largest platform, MarketInvoice, to boost finance through nonbank lenders.

Challenges

- Obtaining good-quality, verifiable data on borrowers can be difficult. Business borrowers must have verifiable business records and at least two years of trading history, something many OGS companies lack.
- The counterparty (the billed entity/individual) must be of sufficient quality that the financier or platform can assess its quality.
- Existing accounting software and digitized records are usually a prerequisite, which may form a barrier for some business models within the OGS market.
- Lack of standardization of consumer portfolio metrics and loan management systems across OGS companies makes it difficult to combine different companies' receivables. It also creates significant barriers to business continuity via a takeover in the event of business failure.
- Borrowers face a potential foreign exchange risk if they receive income in local currency and investors are looking to purchase receivables in hard currency. Building local investor appetite within the country (or currency union) of the receivables, along with sufficient funding volumes, is vital to create a sustainable operation.

Required market conditions

- A pipeline of OGS companies with at least two years trading history and robust back-end tracking and accounting systems to verify accounts receivable is needed.
- Businesses should use accounting software that can be integrated for quick receivable or contract verification.
- Investor appetite is a prerequisite for scaling; there must be a sufficient supply of funds from investors (typically high-net-worth individuals and accredited investors) that are comfortable with this financing instrument,
- A secondary marketplace, in which retail investors can buy and sell portions of their loans, may be required to reach scale.
- Partnerships with accounting firms and software providers are recommended. Partnerships can support deal flow and connect potential investors to appropriate projects.

Policy and regulatory environment

- Arrangers, investors, and platforms should understand the guidelines regarding the treatment of client monies, their prudential and capital requirements, and consumer credit and verification activities.

Case Study 3.5: Accounts receivable financing: SunFunder (Uganda)

SunFunder is a financial intermediary and alternative finance provider servicing solar energy businesses in low- and middle-income countries, mostly in Sub-Saharan Africa. In 2016 it financed a \$2 million loan to SolarNow, a solar company based in Uganda. The product, termed a Structured Asset Finance Instrument (SAFI), is not strictly an accounts receivable financing instrument. It is a bankruptcy-remote asset financing instrument, secured by the underlying SHS inventory purchased with the loan, designed to finance receivables. The nature of PAYG SHS technology allows lenders to assess the strength of customer repayments and the quality of the underlying portfolio.

The customer sale occurs through the bankruptcy-remote SAFI entity (for example, an off-balance sheet special purpose vehicle [SPV]), following a back-to-back inventory purchase from the operating company (for example, SolarNow) to the SAFI. All sales and servicing requirements remain the obligation of the operating company; the receivable is created between the customer and SAFI upon purchase of the system. Customer repayments are made into the SAFI entity. The loan is secured with the underlying assets and a share pledge allowing the lender to take the entire portfolio of receivables at once in the case of a recourse event.

SunFunder provided a second facility to SolarNow in 2017, a \$6 million syndicated SAFI with additional investment from Oikocredit and responsAbility Investments.

Case Study 3.6: Accounts receivable financing: MarketInvoice (United Kingdom)

In 2010 MarketInvoice became one of the first invoice trading platforms, providing business cashflow solutions to small and medium-size businesses in the United Kingdom. The platform conducts due diligence on both the business and the invoice, to assess the quality of receivables (and debtor to the invoice). It has funded invoices and business loans worth more than £2.1 billion (\$2.7 billion).

Businesses tend to use online invoice trading because it provides more than traditional factoring (as there is no obligation to discount the entire debtor ledger or lock in long loan durations) and can be drawn down more quickly. Online invoice trading platforms need to have robust credit analytics and underwriting capabilities, with a verification process for each receivable/invoice.

Online invoice trading platforms generated \$3.4 billion globally in 2016 (Ziegler and others 2018). The typical investor profile is a high net worth retail customer (accredited or sophisticated) or an institutional investor. Investors provide funding to the platform, which syndicates the funds across available loans.

3.7 SECURITIZATION

- **Borrower profile:** SHS companies with proven business models, a clear path to profitability, and a receivables track record
- **Lifecycle phase:** Post-Series C
- **Ticket size:** More than \$500,000 (total facility size must exceed \$1 million to be viable, given high transaction costs)
- **Currency:** Hard, local

Securitization is a structured finance technique in which a special purpose vehicle (SPV) is created to raise funds by issuing debt securities, which are sold to investors. The proceeds are used to purchase receivables, which represent rights over financial obligations arising from the obligation of a third party to pay amounts in respect of a debt (for example, an SHS distributor's customer has an obligation to meet its repayment schedule). Receivables are normally generated by established entities, such as financial institutions or companies (the originator), as part of their normal course of business.

In the OGS sector, accounts receivable securitization is the most relevant form of securitization (securitization is just one of the ways accounts receivable can be financed, as discussed in the previous section). Where a bankruptcy-remote SPV is used, investors do not have recourse to the originator if receivables do not perform. It is also possible to structure the SPV to maintain some level of recourse to the originator to mitigate risks to lenders. Some level of recourse to the SHS distributor in an OGS securitization deal is likely desirable, given the continued reliance on distributors' support for the underlying SHSs during the life of the issued debt securities and any potential impact on consumer default rates as a result of the SHS company's underperformance.

The SPV receives the amounts payable from these receivables, which it uses to cover the debt service on the SPV-issued securities and meet all other costs. The benefits to the originator include cheaper funding (where receivables have a better quality than the originator), a stronger balance sheet, greater capital adequacy, and an alternative source of capital. Receivables that are typically securitized include residential or commercial mortgages, credit card and other consumer lending debt, and corporate loans and bonds.

Benefits

- Receivables normally have better credit quality than the originator, because the debtors behind the receivables have a lower credit risk than the originator and/or various credit enhancement techniques are used. These techniques include overcollateralization, the use of retained spreads (a percentage of accounts receivables) to fund reserves at the SPV level, risk or credit guarantees or insurance, tranching (where senior tranche holders have priority over junior subordinated tranche holders), liquidity support via loan facilities or cash reserve funds, and foreign exchange hedging.
- The diversification of a pool of assets (across companies or countries, for example) can diversify risk for lenders. Accounts receivable financing can diversify funding sources for borrowers.
- Use of a securitization structure will not negatively affect the balance sheet of the borrower, which accelerates cash receipts, improves working capital, reduces leverage, and increases borrowing and the return on capital.

Challenges

- The financing challenges faced by OGS companies and their high working capital requirements require financial support that securitization alone may not provide. The longevity of the SHS company as an ongoing concern is key, as these companies need to service the SHS units of the securitized receivables. Should this support be missing, receivables will underperform, possibly causing the default of the asset-backed securities issued by the SPV.
- The lack of a track record by local financial institutions on securitization may make it difficult to attract interest from investors or other transaction supporters, such as credit enhancement providers.
- The lack of a secondary market for SHS receivables and the resulting lack of liquidity for securities issued by the SPV may limit investors to those with a buy-and-hold strategy.
- Finding an appropriate third party to collect receivables in the event of business failure may be complex. A continuity plan should be put in place to ensure that receivables can still be collected in the event of business failure.
- Transactions costs are high. Establishing an SPV is a costly process requiring specific legal and other expertise as well as commitment by the originating company. Without reaching a critical mass to justify these transactions costs, it is difficult to offer an attractive risk-adjusted return to potential investors.

Required market conditions

- Originators must have a sufficient track record and data on asset performance.
- Local financial institutions must have expertise in and an appetite for securitized assets.
- Collateral must be adequate and enforceable, which can create complications in the OGS context, where collateral is the SHS.
- The credit quality of underlying receivables must be scorable.

- Adequate infrastructure to service the securitization market, such as trustees and credit-rating agencies, must exist.
- The right balance of transactions costs, deal size, and returns must be reached to attract participants.
- Foreign exchange must be available and convertible and/or companies must be able to hedge foreign exchange.
- For hard currency loans, borrower must be able to freely buy hard currency at competitive rates and without restrictions. For local currency loans, foreign investors need to know that they can easily repatriate their money at competitive rates.
- The higher the risks and the more challenging the market/sector are, the more attractive diversification will be. A geographically well-diversified portfolio of SHS receivables reduces the risk of default from exogenous factors.

Policy and regulatory environment

- Regulatory issues for securitization depend on the jurisdictions of the parties involved. Securitization requires regulatory conditions that may not be in place in certain countries jurisdictions. For example, regulations in Rwanda may require that securities be listed on a specific exchange, be sold only to a government institution, and not be marketed abroad. In contrast, Kenya has a more mature financial system without such restrictions but may present other challenges. Regulatory issues may also affect accountancy practices or capital adequacy rules may affect the originator, rules on issuance and trading of securities, the establishment and structuring of SPVs, whether underlying receivables conform to relevant laws and regulations, and data protection considerations.

Case Study 3.7: Securitization: BBOXX (Kenya)

In December 2015, SHS manufacturer and distributor BBOXX raised K Sh 51 million (\$500,000) from Dutch investor Oikocredit through the securitization of 2,400 receivables from off-grid households in Kenya. The company used 12 years of data it had collected from customers to structure notes called Distributed Energy Asset Receivables (DEARs), which represent a pool of receivables with an average value of \$300. The notes were rated by a Kenyan-registered credit rating agency. The collateral offered was worth \$1 million—twice the value of the principal.

The issue experienced a number of challenges. The default rate on the receivables ended up being much higher than the projected rate of 3–4 percent because of exogenous factors, including a ban on fishing in Lake Victoria, where the units were deployed, and the impact of the 2017 Kenyan elections. (World Bank observations suggest that consumer default rates in the sector of 10 percent or higher seem to be the norm.)

This pioneering application of securitization provides several lessons:

- Underlying receivables may benefit from geographic diversification, to protect against external factors such as drought or policy changes.
- Performing loans and assets can be transferred to the SPV about three months after installation, to reduce the impact of technology performance issues on the performance of receivables.

- The originator will likely have a preference to create an off-balance sheet vehicle to separate default risk on underlying receivables from the company's operations.

BBOXX has since raised debt financing using other financing instruments, such as P2P business lending and term loans from local banks. The company remains open to exploring the next iteration of its securitization structure.

3.8 CONVERTIBLE NOTE

- **Borrower profile:** Early-stage OGS companies without sufficient track record or financial strength to attract traditional bank financing but with significant growth and profitability potential
- **Lifecycle phase:** Seed through Series A
- **Ticket size:** \$50,000–\$5 million in local currency equivalent
- **Currency:** Hard

A convertible note is debt that can be converted into company equity at some point in the future. Notes carry a low interest rate until they convert into equity in a later equity round, which determines the valuation. The equity upside normally comes in the form of discounts and a cap. Both reward early investors for taking on more risk than later investors. A discount gives the convertible note holder the right to convert into equity at a discount to the next equity round's valuation, which could be a 20–25 percent discount on shares. A cap, expressed as a multiple, limits the price at which the notes will convert into equity. Warrants may also be used to compensate convertible note holders. A warrant is an option that gives the convertible note holder the right, but not the obligation, to buy the borrower's equity shares in the next equity round at the next round's valuation (see page 26).

Benefits

- Convertible notes provide OGS founders with access to cheap and quick capital that they can use to launch new companies and execute their growth plans while incentivizing both investors and company founders (by minimizing dilution).
- Convertible notes are treated as debt that converts into equity during a subsequent fundraising event. Deferring the valuation to another round may reduce the transaction time, allowing the company to focus on operations and growth.

Challenges

- The OGS market is still unknown to many established investors, who need to buy into the growth opportunities the market represents. There have been various successful post-Series A equity rounds among older OGS companies, which is a good indication of potential, but the possibility of high-return investor exits through a sale or IPO remains to be proven. The 2018 acquisition of Fenix International by global utility ENGIE sends a positive message to investors. One or more such exits would do much to prove potential to would-be investors.

Required market conditions

- OGS companies will attract early-stage investors only if they are likely to exit within a reasonable timeframe at an attractive valuation. The presence of later-stage investors in the sector or the potential for a trade sale or a future IPO is therefore paramount.
- Local and foreign financial institutions need better knowledge and understanding of the OGS sector, including well-documented and well-communicated understanding of sector economics; details of the competitive, regulatory, and legal landscape; the underlying risks, performance, and track record of OGS companies; and the challenges, benefits, and potential of the sector. Above all, the risk-adjusted returns and costs of extending a loan must make the transaction attractive to lenders.
- Hard currency investors must be able to freely buy hard currency at competitive rates and without restrictions.

Policy and regulatory environment

- Tax incentives can have a significant impact on the availability of capital for early-stage companies. Favorable tax treatment (such as tax breaks for investors) may be necessary to attract investment.
- A conducive regulatory environment for early- and growth-stage investors, including contract enforceability and recourse, is needed. The absence of regulations will cause investors to undervalue potential conversion to equity shares.

Case Study 3.8: Convertible note: SunCulture (Kenya)

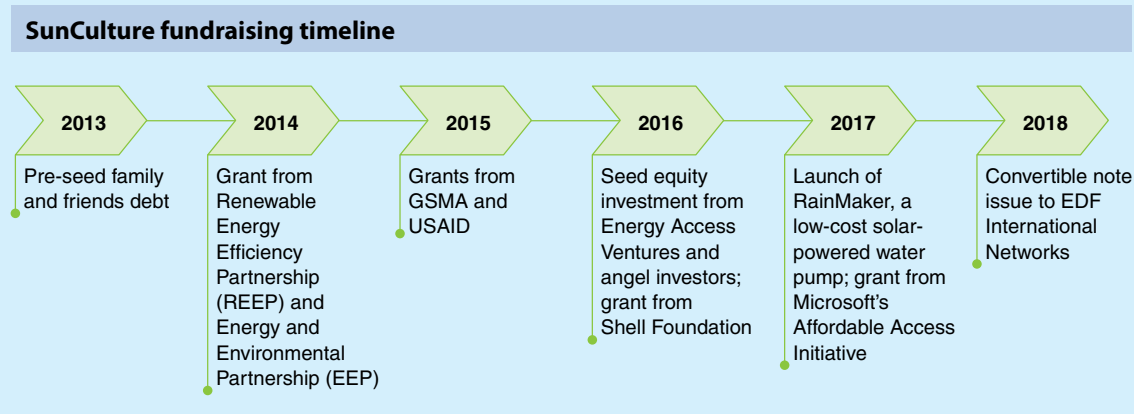
SunCulture is a Kenya-based company providing solar-powered irrigation solutions to farmers in 12 countries across Sub-Saharan Africa. The company launched in 2013, with \$200,000 in pre-seed debt raised through a family and friends round. Its product, an agro-solar irrigation kit, provides a holistic solution to farming by bundling a solar-powered water pump, irrigation supplies, agronomy services, and end-user financing (provided through Equity Bank, Kenya).

In early 2016, SunCulture closed its seed round, announcing equity investment from an impact fund (Energy Access Ventures) and a group of angel investors. Grants from the Shell Foundation, the GSM Association (GSMA), USAID, the multilateral fund Energy and Environmental Partnership (EEP), and the Renewable Energy Efficiency Partnership (REEP) played a pivotal role in growing the business and building scalable product solutions.

In 2017 SunCulture launched the RainMaker, a low-cost solar-powered water pump, bringing the price point of a complete one-acre solar-powered irrigation system down from about \$5,000 to \$500. It provides PAYG customer financing.

In 2018 the company closed a funding round through a convertible note issue to EDF International Networks, a subsidiary of Électricité de France (EDF). Upon conversion, EDF will acquire 20–30 percent of

the equity (EDF 2018). EDF has expanded its footprint in Sub-Saharan Africa's off-grid market in recent years, through investments in SHS distributor, off-grid electric, and now SunCulture.



3.9 REVENUE-BASED MEZZANINE DEBT

- **Borrower profile:** Post-revenue early-growth impact enterprises with clear path to growth and profitability (post-A series)
- **Lifecycle phase:** Series B–C
- **Ticket size:** \$500,000–\$1.5 million
- **Currency:** Local; hard currency may be attractive where repayment schedule is tied to revenue in hard-currency equivalent

Revenue-based mezzanine debt is a loan to a financially viable and growing impact enterprise with flexible repayment schedules (but often with a minimum monthly repayment) that is convertible into equity at a capped multiple. If the company exceeds expectations, the borrower has the option to repay the loan early as a fixed equity multiple. The instrument is designed to allow investors to progressively exit as revenue increases and the borrower pays down principal and interest. This alternative financing structure is designed to address the markets and conditions in which impact enterprises operate.

The key characteristic of this structure is that it incentivizes the borrower to maximize company valuation and repay the debt as quickly as possible while also giving it sufficient flexibility to adjust repayments in line with business performance and market conditions. Although the convertibility option gives investors the potential for equity returns, it usually caps the equity multiple (limiting the investor's upside); the structure is intended to remain a debt instrument throughout its life. In contrast, a traditional convertible note is structured with the intention and expectation that it will be converted into equity at some point; it is intended to become an equity instrument. This difference is a key consideration in identifying potential investors.

Benefits

- Repayment is linked to performance. The instrument provides flexibility to impact enterprises, in line with their revenue growth. For OGS companies, repayments should be clearly tied to cashflow (rather than revenue), in order to better match debt repayment schedules and mitigate the risk of a mismatch between revenue recognition and cashflow. The flexible repayment feature aligns itself well to seasonality, particularly where generalized drought occurs.
- In markets with few acquirers and investors, this structure provides a clear progressive exit strategy for investors. It potentially widens the investor base, attracting a new impact investor type without significant dilution.
- The instrument aligns the incentives of the lender and the borrower, as the lender's internal rate of return increases if the borrower's performance exceeds expectations and the borrower can prepay the loan at a fixed multiple. If the borrower underperforms, the company is not saddled with fixed repayments.

Challenges

- The structure and limited track record of OGS companies may make it difficult to attract some impact mezzanine debt investors. Foreign impact investors are likely to dominate investment, with little interest from financial markets in developing countries.
- More test cases are required to understand performance and scalability.
- The instrument provides a limited upside for investors. Unlike a convertible note, it does not convert to equity. Although investors have a clear upside and prepayment is at a fixed multiple. The cap may turn off some investors.

Required market conditions

- For local currency loans, foreign impact investors or lenders must be willing to take on foreign exchange risk or hedge costs.
- The transaction must reach the right balance of transactions costs, investment impact and return, and ticket size to attract participants.

Policy and regulatory environment

- An attractive framework for foreign investment country is needed, including rules on foreign ownership, foreign currency conversion, and profit/capital repatriation. Foreign exchange availability and convertibility are required. For hard currency loans, borrowers must be able to freely buy hard currency at competitive rates and without restrictions. For local currency loans, foreign investors need to know that they can easily repatriate their money at competitive rates.
- Regulatory or legal issues may affect enforceability and the rights and obligations of the parties.
- An excessive tax burden may make investment unattractive.

Case Study 3.9: Revenue-based mezzanine debt: Adobe Capital (Mexico)

In 2012 Adobe Capital launched a fund that focuses on quasi-debt instruments denominated in local currency targeting alternative energy as well as housing, education, and health care for low-income households in Latin America (Armeni and DeBone 2017). The standard investment structure is a revenue-based loan with flexible schedules, based on a fixed percentage of revenue, with a grace period and a prepayment option without penalty. The loans have a minimum monthly payment and an equity conversion option at a predefined multiple and a capped return of 2.5 times the original loan.

The convertible amount decreases as the principal is repaid, so that a larger proportion of equity remains with the founders as they repay the loan. There is thus an alignment of incentives between the lender and the company: As financial performance improves, the repayment period is shortened, the company's valuation increases, and the lender's equity stake declines. There is therefore less potential for founder dilution.

The fund targets a 24 percent gross internal rate of return in U.S. dollars. Its first exit achieved a 22 percent internal rate of return and a 1.5 multiple.

3.10 DEVELOPMENT IMPACT BOND

- **Borrower profile:** Project implementer, often a nonprofit but could also be a social enterprise
- **Lifecycle phase:** Series A–C
- **Ticket size:** \$100,000–\$15 million
- **Currency:** Bespoke design; often in hard currency but may be denominated in local currency and hedged

Evolving from the social impact bond (SIB) model, a development impact bond (DIB) is a performance-based investment instrument intended to finance development outcomes in developing countries. DIBs allow funders to reduce nondelivery risk by releasing funds after the delivery of a project. DIBs are typically structured so that a company receives funding, often in the form of concessional debt, from an investor to implement a project. Upon successful delivery of the project, a third party—the outcome buyer (for example, a foundation)—refinances the loan and pays out the investor.

Twenty-eight DIBs have been implemented, contracted, or designed in developing countries (Center for Universal Education 2017). Applications have been predominantly in the health sector, as well as in job creation, agriculture, and education. Up-front capital commitments range from \$110,000 to \$7.5 million, with an average commitment of \$2 million.

Benefits

- The mechanism reduces nondelivery risk to donors, because (a) funds are released to the investor only after the delivery of the project and only if the desired outcomes are achieved and (b) one DIB can fund multiple delivery partners (for example, social enterprises or nonprofits).
- It provides more options for borrowers to access capital and gain access to large funders that may be interested in lending only through this structure.

- The bespoke design allows for flexibility. The structure can be tailored to the requirements of the parties involved in the transaction as well as the intervention type and desired outcome.
- By quantifying the development benefits from company activities, borrowers can receive additional funding sources.

Challenges

- Transactions costs are high. Given the bespoke nature of each financing arrangement and the multiple parties involved, creating and contracting a DIB can take more than a year to develop and entail high transactions costs.
- The instrument is nascent and has not yet been used in the OGS sector. Only a handful of DIBs have been issued in developing countries, including just three in Sub-Saharan Africa (in the Democratic Republic of Congo, Mali, and Nigeria), designed to finance physical rehabilitation.
- The lead-time to negotiate is long. Aligning timelines and expectations between the outcome buyer, investor/lender, and project implementer can be challenging, as each has its own objectives and budget timelines.
- It is difficult to identify the outcome buyer. SIBs have a clear outcome buyer—the local government—which reduces spending as a result of outcome delivery. The outcome buyer in a DIB is less obvious. It could be a foreign government or philanthropic organization.
- The averted spending may be less explicit than in a SIB, as local governments may not be tracking spending in the particular area (or at all).
- Both SIBs and DIBs typically partner with nonprofits for project delivery. The structure of social enterprises, as social impact-driven for-profit entities, may create tensions for the outcome buyer and/or investor.
- Measuring outcomes may be costly and time consuming.

Required market conditions

- Social enterprises and/or nonprofits must be able to manage project delivery and attain desired project outcomes.
- An outcome certifier and/or appropriate methodology is needed to measure project impact and outcome delivery. An example is the Gold Standard for the Global Goals, which was designed to measure the impact of climate action on the SDGs (Gold Standard n.d.).
- Outcome buyers (donors) must be interested in committing funds to an outcome. Governments and other outcome buyers that have engaged in results-based financing are likely to understand and have an appetite for doing so.

Policy and regulatory environment

- Contracting between investors, outcome delivery partners, and outcome funders (potentially the government) may be subject to legal constraints governing public-private partnerships, which will be specific to each jurisdiction.
- The selection of outcome delivery partners may be subject to open procurement regulations.
- The complexity of the transaction may be subject to laws pertaining to payment for services not yet delivered (Center for Universal Education 2017).
- The tax implications of the investment must be considered and understood, potentially across multiple jurisdictions, adding an extra level of complexity (and cost).

Case Study 3.10: Development impact bond: Cardano Development (Zambia)

Cardano Development is a nonprofit financial solutions provider focused on frontier economies. Its initiatives include GuarantCo, The Currency Exchange Fund (TCX), and BIX Capital.

The company is in the process of structuring a pioneering clean energy DIB designed to finance “underfinanced social enterprises in clean cooking.” The DIB’s results will be certified by the Gold Standard for the Global Goals, which dictates the methodologies used to verify program results. The Gold Standard also requires independent accredited auditors to validate the program and subsequently verify the results.

The lead investors are likely to be Cardano Development, a subsidiary BIX Capital; the Netherland’s FMO; the International Finance Corporation; the Shell Foundation; Calvert Investments, a family office; and the Overseas Private Investment Corporation.

They will provide loans to cooking enterprises based on off-take contracts with “outcome buyers” (donors or governments seeking development outcomes). Cardano Development is the convener of this DIB, bringing all parties together as well as organizing the certification program under the Gold Standard.

The nascent nature of DIBs, particularly in clean energy, means that outcome buyers have to overcome barriers. There are no examples of a DIB in implementation phase in the OGS market.

3.11 PEER-TO-PEER BUSINESS LENDING

- **Borrower profile:** Local and international OGS companies with a track record of sales and repayments (or payments)
- **Lifecycle phase:** Bridge to post–Series C
- **Ticket size:** \$10,000–\$1 million; several tranches can be raised to increase the facility size (for example, five \$1 million tranches could be raised over a six-month period, resulting in a total facility of \$5 million)
- **Currency:** Hard; several P2P business lending platforms are exploring foreign exchange hedge instruments, hoping to offer local currency loans in some countries

Unsyndicated peer-to-peer business lending

In P2P business lending, a business borrower receives a loan from a group of individuals or institutional lenders, facilitated by a P2P business lending platform. Loans are typically unsecured.

OGS companies raised \$27.5 million via P2P business lending platforms in 2018 (Cogan and Weston 2019). P2P business lending is the leading instrument in the alternative finance market in the United Kingdom, where \$1.59 billion was raised in 2016 (Zhang and others 2015). Africa-domiciled platforms raised \$14 million through P2P business lending in 2016 (Zhang and others 2017). Several platforms based in Europe and the United Kingdom lend to Africa-domiciled businesses by establishing in-country SPVs through a Memorandum of Understanding (MoU) with local financial regulators.

The P2P business lending platform is not the provider of the loan; it acts as an intermediary between the borrower and lenders (or investors). Some platforms also operate a balance sheet to co-invest in parts of or entire loans offered on their platform. In some instances, the platform creates an SPV related to a specific loan and the SPV lends investor funds to the borrower. The platform must perform sufficiently robust credit, know your customer (KYC), and anti-money laundering (AML) checks on potential borrowers and fulfill all other legal obligations and fiduciary duties stipulated by the financial regulator in the jurisdiction in which the platform is domiciled.

Benefits

- P2P lending gives investors the opportunity to participate in social impact investments with a low cost of entry (the minimum investment is typically only about \$30). It allows companies to attract investors otherwise unreachable because of the small size of individual investments, their lack of capacity for due diligence, and geographic distance.
- Eligible companies can access debt finance across the growth cycle, from bridge financing (\$10,000–\$50,000 via the Kiva Direct to Social Enterprise pilot) through multimillion-dollar facilities on platforms like TRINE and Lendahand Ethex, filling crucial financing gaps over the business lifecycle.
- The due diligence process is typically shorter (one to three months) and more transparent than it is for more established financing options.
- The time to fund campaigns by crowd-investors on P2P business lending platforms is usually short (less than 30 days) and the success rates (the probability of the campaign reaching the target) high (100 percent for OGS campaigns to date).
- The nature of P2P business lending allows companies to raise the amount they need, when they need it, maximizing efficiencies in procurement and sales while reducing interest incurred.
- The technological sophistication of some P2P business lending platforms allows the platform to track SHS units from the point of port disembarkation through the final point of sale, as well as customer repayments, increasing the level of transparency and access to data to assess the borrower's financial health.
- P2P business lending platforms often provide unsecured loans; in some cases, loans are collateralized with solar assets, which established lenders do not accept.
- Crowd investors in some jurisdictions benefit from tax incentives by investing in eligible campaigns. For example, the United Kingdom's Innovative Finance Individual Savings Account (IFISA) regime allows lenders in social impact and/or early-stage companies to claim income tax deductions (see page 65).

Challenges

- P2P business lending in the OGS market is still nascent, with a two- to three-year track record of loan repayments for relevant loans. The first campaigns to raise more than \$400,000 were launched in early 2018; repayment data for larger loans is therefore limited. The average loan size on P2P business lending platforms was \$168,000 in 2016 and \$80,000 in 2015 (Cogan, Maffini, and Collings 2018).
- Investor behavior is not well understood, which can create difficulties with respect to marketing and outreach. The results of Energy 4 Impact's survey suggest that a range of factors motivate lenders on P2P business lending platforms, including the investment proposition's alignment with their personal values, its social impact, environmental impact, and financial return (Cogan, Maffini, and Collings 2018).

- Due diligence practices are uneven. P2P business lending platforms active in the OGS employ a range of practices, including independent credit assessment conducted by a local auditor or credit agency; in-house due diligence on company financials and documentation; and access to back-end data on SHS deployments, repayments, and defaults, where available.
- Platform incentives can create conflicts of interest. In the front-end fee model, platforms take the bulk of their revenue up front through an arrangement fee. In the interest rate spread model, most of the platform's revenue is derived from the interest rate spread on loan repayments. Platforms that have revenue models that depend on borrower repayments are more likely to be aligned with lender objectives. In contrast, there may be conflict of interest issues for platforms that do not have "skin in the game" over the duration of the loan. Many platforms active in the OGS market (for example, TRINE, Lendahand, and Energise Africa) depend on the interest rate spread to sustain their operations and are therefore incentivized to complete thorough due diligence. Defaults likely affect platform reputation and investor confidence.
- Borrowers, lenders, and platforms are exposed to foreign exchange risk and may default if the local currency (accounts receivable currency) depreciates against the denomination of the loan. Platforms must incur high up-front costs to establish a hedge facility and must have sufficient loan volume to justify the cost of doing so. In addition, borrowers generally prefer lower-interest, hard currency loans over higher-interest, local currency loans, even where hedging is offered. The cost of hedging can be prohibitively expensive, and it may be difficult to find a hedge provider for some currencies.

Required market conditions

- A pipeline of qualified borrowers—companies that can demonstrate consistent and reasonable customer repayment rates and/or ability to service loan repayments—is needed. To obtain bridge financing or smaller working capital loans via P2P business lending, a pilot with evidence of repayments may be enough. For larger facilities, the platform may require records and financials from several years of operation.
- Crowd investor demand for environmental and social impact investment opportunities is needed, as well as interest in investing in small and medium-size enterprises in low- and middle-income countries. Investor appetite for P2P business loans financing OGS companies in Sub-Saharan Africa is currently strong, with a 100 percent success rate across the four largest P2P business lending platforms operating (TRINE, Lendahand, bettervest, and the Kiva Direct to Social Enterprise).

Policy and regulatory environment

- The platform must be based in a jurisdiction that permits P2P business lending.
- It must fulfill its obligations to the financial regulator in the country or countries of incorporation. Foreign borrowers may face restrictions or additional requirements.
- Loan contracts must be enforceable, with a supportive legal framework and process for legal recourse.
- Some countries provide tax incentives to lenders to increase investment in early-stage businesses and/or social impact businesses via P2P business lending platforms. In the United Kingdom, crowd-lenders investing in eligible campaigns can earn tax-free interest (see page 65).

Syndicated peer-to-peer business lending

P2P lending can be syndicated (provided by a group of lenders or investors that provide a loan to a single borrower). Lenders may include local and international banks, impact funds, and alternative finance. The loan may be provided in a single currency or multiple currencies.

The innovation aspect comes from the syndication group, which can combine traditional and alternative financiers. Growth-phase companies with strong customer repayment records and digitized record keeping can raise larger amounts (\$2–\$5 million) from a syndicate of borrowers or investors by increasing the deal size, creating leverage, and potentially derisking the investment through subordination of debt (typically with public money and/or a concessionary debt facility).

Case Study 3.11: Peer-to-peer business lending: BBOXX (Kenya)

With more than 500,000 customers, BBOXX is one of only 11 companies in the OGS sector in Sub-Saharan Africa that has a scaled deployment (more than 20,000 customers) (Shell Foundation 2018).

In early 2018, TRINE, a P2P business lending platform based in Sweden, launched the OGS sector's largest crowd investment to date, raising the first tranche (\$1.16 million) in a series of six tranches of a loan of almost \$7 million. The first tranche was raised in less than a month. It offers a 6.75 percent annual expected return (on a euro-denominated investment) and a 3.5-year term (Trine Finance Limited, Trine AB, and Sida 2018). A recent survey of 900 crowd-investors by Energy 4 Impact, a nonprofit that supports off-grid energy access, found that investment decisions were driven primarily by "personal values," followed closely by "environmental impact," "social impact," and "financial return" (out of 12 possible choices).

BBOXX opted to raise debt via a P2P lending platform because of the shorter lead time (a few months rather than the one to two years for local bank debt facilities). P2P lending also allowed it to raise significant capital on flexible terms at a competitive cost of capital. The cost of capital on P2P business lending platforms lending to OGS companies in Sub-Saharan Africa is typically 10–15 percent on debt denominated in British pounds or euros. The platform earns the spread between the cost of capital to the borrower and the rate of return to the investor.

In addition to P2P lending, BBOXX is raising debt capital for its operations in the Democratic Republic of Congo, Nigeria, Rwanda, and Togo by issuing online debt-based securities on an online investment platform (Energise Africa) (see page 61).

Benefits

- Growth-phase companies can leverage the syndicate to increase deal size by drawing in investors that would be reluctant to lend as sole investors.
- Borrowers can build relationships with multiple lenders/investors, which may expedite future fundraising.
- Syndication allows investors with different objectives and risk profiles to participate in the same round and may reduce transactions costs for the borrower (or investee).

Challenges

- Local banks may not want to work with other lenders (particularly another local lender) and may lack the sophistication to manage the facility.
- Once a debt provider lends to (or invests in) one company, it may be restricted from lending to other companies in the sector, resulting in cherry picking and a lack of growth across the sector.

Required market conditions

- To justify potential increases in transaction costs as a result of syndication, a pipeline of qualified borrowers seeking sufficient ticket sizes is needed.
- Syndication requires established relationships between P2P lending platforms and investment funds, as well as alignment of objectives and investment mandates.

Policy and regulatory environment

- Syndication requires a legal framework and process that supports more complex financing structures, such as tiered capital structures and investor rights, if recourse is required.
- The marketing of investments and participation of investors may be restricted to sophisticated (or institutional) investors; everyday investors may not be able to participate.

Case Study 3.12: Syndicated peer-to-peer lending: Azuri Technologies SPV (Kenya, Tanzania, Uganda, and Zambia)

In March 2017, Azuri Technologies raised \$4 million, part of a \$20 million off-balance sheet debt facility. To finance the installation of 20,000 SHS units in Kenya through an SPV transaction, the company raised debt from Swedish P2P business lending platform TRINE and EU-related impact fund ElectriFI.

The innovative financing structure included a first-loss loan of 20 percent from Azuri Technologies to the Azuri Technologies SPV, a 50 percent contribution from ElectriFI (junior debt), and a 30 percent contribution from TRINE (senior debt). The blend of public and private money to derisk and create leverage, the participation of a P2P business lending platform, and the off-balance sheet structure make this transaction a pioneer in the OGS market.

3.12 ONLINE DEBT-BASED SECURITIES

- **Borrower profile:** Applications in the renewable energy sector include short- to medium-term investments to support scaling businesses by established companies that require extra investment
- **Lifecycle phase:** Series A–C
- **Ticket size:** \$100,000–\$1 million
- **Currency:** Hard (euros, British pound, dollar); most platforms are based in the United Kingdom or Europe

Online debt-based securities are debt-based securities (typically company-issued bonds or debentures) sold at a fixed interest rate to both retail and institutional investors via an online platform. Platforms typically function as SPVs in which investors participate in green energy or renewable energy projects, such as a mini-grid, in their community. Online debt-based securities have also been used in the OGS sector, where platforms mediate the transaction and sell business bonds to platform members (investors). Globally, debt-based securities platforms raised \$434 million in 2016 (Ziegler and others 2018).

These securities are similar to corporate bonds. They are subject to high levels of due diligence and disclosure. Where the platform serves as the SPV, the burden of due diligence is higher than for most P2P lending and crowdfunding activities. Bonds are generally nontransferable (unless a secondary market exists on the

platform) and not readily realizable, because of the lack of secondary market or difficulty determining value. They offer risk-adjusted returns. Business bond issues in the OGS sector often rank senior unsecured. Some debt-based securities platforms are exploring asset-backed SPV facilities.

Both P2P business lending and online debt-based securities can be used to finance OGS companies, but there are a number of key structural differences between the two instruments (Table 3.1).

Table 3.1: Differences between online debt-based securities and peer-to-peer lending

Feature	Online debt-based securities	P2P business lending
Repayment	Coupon (interest) payments are typically annual or paid out at maturity.	Interest repayments are typically monthly, giving lenders a good indication of loan performance within the first six months.
Typical duration	Long term (up to five years)	Medium term (12–24 months)
Loan use	To support business growth; often used for project finance	To support business growth, working capital
Platform responsibility	As platforms often act as SPVs, they have a greater responsibility to investors and must perform suitability assessments in addition to due diligence.	Platform has less responsibility than online debt-based securities platforms. It acts as a financial intermediary and conducts due diligence.
Due diligence	In addition to conducting due diligence, platforms functioning as SPVs also take on custodianship of the overall investment and are beholden to the retail investor group.	Platform has fiduciary responsibility to perform robust due diligence, including credit assessment of business and stress testing of underlying assets.
Liquidity	Platforms may offer a secondary market; however, a willing counterparty must exist.	Some platforms operate a secondary market, although a willing counterparty must exist. Investment is typically nontransferable, and platforms do not operate a secondary market.
Regulation	Usually considered investment-based crowdfunding, which can create additional layers of platform responsibility.	Usually considered loan-based crowdfunding.

Benefits

- Investors, including retail investors, can invest in specific SPVs/overarching bonds that fund specific energy projects, often in a location they have a connection to.
- Investors may receive tax incentives.
- Instrument provides early-stage and growth companies with access to debt capital.
- Campaigns on Energise Africa have been linked to match funding from government and philanthropic organizations, which catalyze investment.

Challenges

- The legal framework is nebulous. There is confusion regarding how to deal with online debt-based securities from a regulatory perspective (for example, whether traditional loan-based rules or investment-based rules govern them).
- Instrument relies heavily on subsidies. Campaigns tend to do best where projects are linked to tax incentives, such as the Individual Savings Account (ISA) in the United Kingdom. Elimination of tax incentives jeopardizes the success of a project and platform.

Required market conditions

- Robust back-end systems to demonstrate repayment rates on the underlying portfolio of customers are needed to determine creditworthiness, loan terms, and overcollateralization of the loan, where needed.
- A secondary marketplace should be in place, so that retail investors can buy and sell portions of the bonds.
- Partnerships with banks or investment funds can support deal flow and connect potential investors to appropriate projects.
- Online debt-based securities platform must be able to offer borrowers local currency loans, by either fundraising from local investors or through access to a hedge facility.

Policy and regulatory environment

- Regulators in Africa need to develop bespoke regulations to build sound but supportive legal frameworks. The proof-of-concept phase requires regulatory approval on a case-by-case basis. In countries with bespoke regulations, such as the United Kingdom, regulation is considered investment-based rather than loan-based crowdfunding. Platforms must therefore perform suitability tests on investors to ensure that potential retail investors are appropriate for the platform.
- All platforms operating in Africa are based in Europe and authorized by their own national regulator. Without local supervision, they typically create an MoU with the local regulator or create a holding company/SPV based in their home country to ensure that the investment activity is compliant with their license. Virtually all investors are based outside of Africa.

Case Study 3.13: Online debt-based security: Energise Africa (Democratic Republic of Congo, Kenya, Mozambique, Rwanda, and Uganda)

Two P2P business lending platforms—Lendahand (based in the Netherlands) and Ethex (based in the United Kingdom)—joined forces to establish the Energise Africa platform, an online impact investment platform with a P2P feel. Energise Africa works with SHS distributors in Sub-Saharan Africa to secure financing through the issues of “business bonds,” which are purchased primarily by U.K.-based investors. These bonds have a typical annual yield of 5–7 percent and a duration of 18–36 months.

Businesses working with Energise Africa include Sollatek in Kenya and BBOX in the Democratic Republic of Congo, Kenya, and Rwanda. Each business creates a “project” (campaign), which investors fund. Energise Africa has raised almost £10 million (\$13.25 million) since its launch (in November 2017). UK aid and Virgin Unite provided funding for platform development costs, match funding (see page 59), and first-loss guarantees (see page 61). Investments are eligible for tax relief (see page 65) under the United Kingdom’s Innovative Finance Individual Savings Account (IFISA).

3.13 DATA-ENABLED SHORT-TERM LOAN

- **Borrower profile:** Local businesses, early-stage companies, and individuals
- **Lifecycle phase:** Seed
- **Ticket size:** Short-term cash advances, from \$2 for individuals to \$50,000 for business borrowers
- **Currency:** Local

In a data-enabled short-term loan, the lender uses customer data from the potential borrower obtained through the lender's own data set or that of a third party. For example, a payment processor that provides supplementary services, such as loans, can use its own data on the applicant, such as transaction history, to assess creditworthiness and set loan terms.

Loan approval and disbursement are almost instantaneous, with disbursement typically made via mobile money. Data-enabled short-term loans are overwhelmingly for consumer financing. However, some lenders may provide short-term business loans, typically working capital loans. The lender typically lends on balance sheet, using an internally developed algorithm to assess eligibility. Increasingly, lenders are applying machine learning, by gaining permission to access a potential borrower's smartphone to assess borrower eligibility and approve loans instantly.

This type of lending is appropriate for consumers and microentrepreneurs that need to meet short-term capital needs. It is untested in the OGS market, where it could potentially be used to extend credit to customers.

Benefits

- Local businesses and early-stage companies can borrow up to \$50,000 to meet short-term working capital needs. Loans are based on cashflow and are unsecured.
- Approvals occur within minutes, because creditworthiness is based on an algorithm.
- Because creditworthiness is determined based on data on customer transactions rather than a business track record, businesses with a growing customer base that are new to the market can attract financing that traditional investors would be unwilling to extend.

Challenges

- Loan terms are short and loan sizes small (less than \$50,000), limiting the use of the instrument to short-term working capital and bridge financing.
- Interest rates can be high. Branch, for example, charges up to 15 percent a month for microloans to individuals.
- The low-contact nature of mobile lending can create opportunities for identity theft and fraud. After launching in Kenya in 2015, Branch discovered that 5,000 fake accounts had been established (Mannepalli 2017).
- Potential borrowers may not fully appreciate how much information they are sharing with the lender, which raises ethical and privacy issues for users, lenders, and investors.
- Studies of algorithmic lending practices in the United States have raised issues of algorithmic bias, where lenders unintentionally discriminate against minorities (Bartlett and others 2019). Algorithmic lending may have limitations.

Required market conditions

- Lenders must have adequate financial backing to provide loans at scale, as well as the financial and technological sophistication to assess borrower eligibility and loan terms.
- Business lenders and third-party data providers must have a high level of market saturation and be able to source accurate, comprehensive data on company sales.
- Potential borrowers must have the technological sophistication to use mobile-based loan services.
- Strong mobile money uptake and traceable electronic payments are vital, as lean models based on tech-enabled lending have little physical infrastructure.

Policy and regulatory environment

- Privacy and data-sharing regulations must permit the extraction of data for lending purposes. If data are from a third party, such as a mobile network operator, there may be additional considerations about data sharing and privacy.
- It may be difficult for mobile credit providers to obtain licensing, which may affect the legal rights of mobile lenders vis-à-vis financial institutions.

Case Study 3.14: Data-enabled short-term loan: KopoKopo (Kenya)

KopoKopo is a business payment processor based in Kenya that uses customer sales data to assess loan eligibility. Its “Grow” loans are unsecured cash advances of up to \$50,000 made to qualified KopoKopo customers. The company uses historical data (based on payments received by customers through its platform) to assess eligibility within a few minutes. If the loan is approved, funds are immediately deposited in the borrower’s KopoKopo account. Loan repayments are deducted as a percentage of the borrower’s daily sales revenue. KopoKopo Grow loans complement rather than replace other credit sources (Kaffenberger and Nguyen 2017). Several OGS distributors in Kenya have used KopoKopo Grow loans.

Case Study 3.15: Data-enabled short-term loan: Branch (Kenya and Nigeria)

Branch (<https://www.branch.co/about>) is a mobile credit provider started by Kiva co-founder Matt Flannery that utilizes machine learning to assess borrower eligibility. The company provides short-term loans to individuals and microentrepreneurs, determining eligibility via an algorithm that compiles data from the potential borrower’s mobile phone. Loans range from \$2 to \$1,000. Borrowers gain access to larger loans through a ladder-like system. New customers borrow an average of 20 times on Branch in their first year (Loizos 2017).

Potential borrowers’ install the Branch app, giving it permission to access their phone’s data, including the apps they have installed (a gaming app, for example, may indicate that a customer is not a suitable

borrower) and their SMS records (which may reveal the size of their electricity bill, for example). Branch holds the loans on its own balance sheet and does not securitize them (Mannepli 2017).

Since its establishment, in 2015, Branch has lent more than \$100 million, issuing more than 6 million loans to 1 million customers, according to its website. It is backed by high-profile Silicon Valley venture capital money. In March 2018, it raised a \$70 million Series B round (Loizos 2017). This model has not yet been used for asset financing in the OGS sector.

3.14 GOVERNMENT-ISSUED MOBILE BOND

- **Borrower profile:** Tested only by Kenyan government
- **Lifecycle phase:** Series B–C
- **Ticket size:** More than \$1 million
- **Currency:** Local

Some governments and development finance institutions issue retail bonds that can be purchased via mobile phones. These bonds are denominated in local currency with a low minimum threshold (such as \$10). Coupon payments (loan repayments) are made to the investors' phones via mobile money. Bonds can also be registered, traded, and settled through the mobile platform.

These bonds could finance a portfolio of SHS companies, in partnership with the local government. Current applications target infrastructure and development projects. There is also the potential to combine the instrument with tax incentives, providing investors with tax-free coupon payments over the bond duration (see page 65). The bonds could also be (partially) underwritten by a third party (such as a development finance institution) to reduce financing costs. This method could be adapted so that the proceeds could be lent to local banks to on-lend to SHS distributors at much lower rates.

Benefits

- Bonds provide governments with access to a relatively cheap source of capital and promote the practice of saving among citizens. More than 5,000 individuals in Kenya purchased M-Akiba bonds.
- Access to local currency debt removes foreign exchange risk and provides an opportunity to raise capital with greater flexibility and fewer conditions than other forms of debt.

Challenges

- There is potential for major reputational risk for the bond issuer in the event of default, given the sale of the bonds to retail investors. There is also substantial financial risk for underwriters, where engaged.
- The size of the bond issue needs to be large enough to justify transactions costs. Although the cost of capital may be lower than from other sources, the cost to issue will be higher. There may also be a low conversion rate of registered interest to investors.
- Technical issues may hinder the take-up and efficiency of the offer.
- Financing of cross-border investments is difficult, because of differences in currency and investor profiles. A sufficient pipeline of borrowers must therefore exist within a single country.
- The government issuer must have the capacity to channel proceeds from the issuance through the proper channels to boost the OGS sector in target markets. It must also have the political will to resist the urge to use the proceeds elsewhere or put them in the general budget.

Required market conditions

- Smartphone penetration must be high.
- An underwriter, such as a government or development finance institution, must be willing to back the bond, to reduce the risk for investors.
- Partnerships with and buy-in from mobile network operators are needed to enable the issue and trade of securities, as well as the repayment of interest.

Policy and regulatory environment

- Given the nascent stage of mobile-issued bonds, regulations are unlikely to address them adequately. Government and regulator buy-in and cooperation are therefore essential. In the case of M-Akiba, the Central Bank of Kenya, the Nairobi Securities Exchange, the Central Depository and Settlement Corporation, the Kenyan Association of Stockbrokers and Investment Banks, and the Kenya Capital Market Authority were involved in the bond issue.
- Laws pertaining to the issuance and marketing of bonds, as well as the fiscal implications for bond issuers and bond holders, are jurisdiction specific. Regulators typically dictate the minimum amounts required to invest in government-issued bonds and may impose regulations pertaining to investor diversification and/or participation.

Case Study 3.16: Government-issued mobile bond: M-Akiba (Kenya)

In 2017 the Kenyan government, through the Central Bank of Kenya, issued the world's first mobile-only government bond (M-Akiba), targeting retail investors in Kenya. The instrument was designed to lower the entry point for ordinary Kenyans to save and invest in government bonds and to help the country reduce the cost of borrowing for development projects. The minimum investment threshold of K Sh 3,000 (\$30) is well below the K Sh 100,000 (\$990) minimum investment of other Kenyan Treasury bonds (Central Bank of Kenya n.d.).

The bond raised K Sh 150 million (\$1.5 million) for infrastructure and developmental projects from more than 5,000 investors (Kariuki 2018). The government offered a tax-free 10 percent annual return on the three-year bond, about 3 percentage points above the deposit rates of local commercial banks. The first interest payments were disbursed in October 2017. All transactions and interest payments are made through mobile money.

CHAPTER 4 EQUITY INSTRUMENTS

This chapter describes three equity financing instruments relevant to off-grid solar (OGS) companies at different stages of the business lifecycle: common stock, preferred stock, and equity crowdfunding. Common stock is most relevant to companies during the pre-seed and seed stages. Preferred stock and equity crowdfunding typically finance later-stage companies (from Series A onward).

Equity is a prerequisite for growth. OGS companies require equity throughout the company lifecycle. Working capital is usually funded with debt, but it is not uncommon for seed and pre-series A phase OGS companies to use equity to purchase inventory, particularly where access to debt is restricted. This form of financing is notoriously expensive, but it is not uncommon in the OGS sector because of the challenges of obtaining debt finance on the right terms.

A more common (and appropriate) use of equity is capital expenditure—spending on physical assets such as stores or vehicles. It may include setting up operations in a new market. Equity financing is a good match for capital expenditure, as there is an expectation that the investment in physical assets will increase the company valuation. Operating expenditure should be funded with cashflow rather than debt or equity. However, during the early stages, companies often use equity to pay salaries and rent until there is sufficient cashflow to cover operating expenditures.

Common stock is typically issued to founders and key employees during the early stages of the company lifecycle. As OGS companies mature, they may be able to secure equity from a commercial investor, such as an impact fund. Preferred stock is usually issued to these later-stage equity investors, although convertible notes (discussed in Chapter 3) are also common.

Equity crowdfunding allows retail investors to purchase equity in companies. Equity crowdfunding campaigns are not common among OGS companies, partly because of the challenges highlighted in this chapter. However, it may be an underutilized channel to raise equity for OGS companies.

4.1 COMMON STOCK

- **Borrower profile:** Founders, early employees, friends, and family
- **Lifecycle phase:** Pre-seed through Series C
- **Ticket size:** Any
- **Currency:** Hard, local

Common stock is the equity issued to the founders of a business; it may also include common stock issued to family, friends, and early employees. It is usually issued to people who invest their time, effort, and money during the early days of a start-up. Common stock may also be issued to shareholders and can be issued to the public during an initial public offering (IPO) and traded on a stock exchange thereafter.

An important element of common stock is the equity offered to employees, often in the form of an Employee Stock Option Plan (ESOP), which gives employees the right to equity after a vesting period. Employee equity is offered to key start-up employees to incentivize performance, compensate for lower earnings, and retain key staff. For the purposes of this report, employee equity is a form of common stock.

Common stock may provide various rights, including the following:

- *Vesting.* Monthly or quarterly vesting schedule over several years allots equity over time and ensures that only people who stay in the business long enough benefit from the shares (Box 4.1). Should a founder leave the business before full vesting, the company has the right to buy back his or her unvested shares at cost or fair market value, whichever is lower.
- *Co-sale provisions.* Co-sale provisions give the holder of common stock the right to sell the stock if the company is sold to a third party. They are meant to ensure that all founders have the same opportunities. Co-sale provisions are the opposite of rights of first refusal, which give the company and other founders the right to purchase another founder's shares if he or she intends to sell to a third party.
- *Lock-up agreements.* Lock-up agreements limit the ability of the founders to sell the stock for a period of time after an IPO.

Founders bear the greatest risk in the company and stand behind every other provider of capital to the business in terms of their rank. They also benefit from the greatest potential return, as they are likely to be issued stock at the lowest price the stock will ever bear.

BOX 4.1

What is a vesting schedule?

A vesting schedule stipulates when an employee, founder, or investor earns his or her right to shares in the company. It is an important feature, because early on in the life of a company, members of the founding team may leave the company and new members may join. The remaining founders and company want to avoid free riders and preserve the motivation of the people who remain with the company. Vesting schedules are also generally a requirement of future equity investors. A vesting schedule may be accelerated if the company is sold or for "good reason" (described below).

Vesting terms often include various provisions:

- *Single-trigger provision.* If the company is sold, all unvested shares vest at the time of sale, in order to protect the employee. The buyer then has to retain and motivate the team. This provision can be unpopular, because purchasers generally want to maintain talent when acquiring a business.
- *Double-trigger provision.* Vesting accelerates only if the company is sold and an employee is terminated. This provision allows the buyer to retain the management team but also protects employees from being unfairly dismissed.
- *Good reason provisions.* Good reason provisions protect employees from specific events, such as the company moving more than a certain distance from its original location or significantly changing the roles or responsibilities.
- *Cliff.* The vesting period may include a cliff (generally one year), before which no vesting can occur. This provision may not apply to founders but usually applies to employees.

Benefits

- Common stock provides the funds required to launch a company, fund product development, carry out proof of concept, launch the product, and secure sales.
- More founders in the OGS sector translates into more companies investing in the sector, potentially speeding up and spreading adoption across a wider range of markets. The more players in the sector, the more likely they are to attract the interest of other investors, such as angel investors and venture capitalists.

Challenges

- Founders need to be able to articulate their vision for scaling their company in order to obtain buy-in from investors.
- Potential founders need to recognize the growth and profit prospects of the OGS sector, which is still largely unknown to most investors.
- Hard currency availability and restrictions on foreign currency transactions can be issues in some countries. Some countries require central bank preapproval for payments of hard currency abroad, and the process may be slow.

Required market conditions

- Better knowledge and understanding of the OGS market are needed to attract investors.
- An attractive business environment for investors is needed, with growth opportunities and exit opportunities.

Policy and regulatory environment

- Tax incentives may play an important role in attracting founders, given the level of risks involved in the OGS market and the lack of proven business models.
- Regulation should support the OGS business model, particularly in manufacturing, marketing, selling, financing, servicing, and repossessing solar home system (SHS) units.

4.2 PREFERRED STOCK

- **Borrower profile:** Emerging growth companies in or ready for growth stage with potential to scale significantly and provide several multiples of return to investors through eventual trade sale or IPO
- **Lifecycle phase:** Seed through Series C
- **Ticket size:** More than \$200,000
- **Currency:** Hard, local

Preferred stock confers certain rights that holders of common stock do not have. Holders of preferred stock receive proceeds before common shareholders. Depending on the terms of the liquidation preference (Box 4.2), they receive a larger percentage of proceeds than would be dictated by their ownership share. Preferred stockholders also normally have other rights, such as board seats, information rights, and voting rights, which may include special rights to veto or block certain corporate actions, antidilution provisions, and rights of first refusal. Companies often issue preferred stock to investors such as angels, venture capital firms, and impact investment funds.

The terms of preferred stock are normally subject to intense negotiation between common stockholders and would-be preferred investors. A cap (such as two or three times the original investment) is usually set to limit the upside of preferred stockholders. Once these terms are agreed upon, all future investors will insist on them, as they will not want to accept fewer rights than previous investors.

BOX 4.2

What is a liquidation preference?

A liquidation preference refers to the prioritization of investors in the event of liquidation. There are two types of liquidation preference: participating or nonparticipating. A participating liquidation preference gives holders their respective liquidation preferences plus a portion of proceeds after all other liquidation preferences have been paid out, thereby allowing them to share in the common stockholder's proceeds. Nonparticipating liquidation preference holders receive only their liquidation preference.

Benefits

- Growing and scaling businesses requires significant risk capital, which equity investors provide, allowing management to focus on implementing its business plan and rapidly achieving its milestones.
- Equity investors have significant expertise and market-specific knowledge, which can be very beneficial to the company. They can also provide access to networks that can enhance the company's plans and help make the most of its growth opportunities.
- More equity players in the OGS market translates into more companies investing in the sector and potentially faster adoption across a range of markets.
- More players in the market increases the chances of attracting the interest of other investors, as well as interest from the wider capital markets, making a successful IPO a possibility.
- Investment from an investment fund or venture capitalist typically increases the financial rigor and reporting of the company, as well as the rigor of strategy, planning, and execution. Increased supervision and the streamlining of operations may lead to improvements in the business model and scalability.

Challenges

- The number one question potential investors pose to founders is whether the business model can scale. Especially in early-stage companies, impact fund and venture capitalist investors typically seek more than incremental growth of the company. In the OGS sector, financial growth is often considered alongside social and environmental impact; investors may therefore be more patient than they typically are in an early-stage investment. Companies also need to convince potential investors that their business plans are attractive and sustainable and that there is a high likelihood of an attractive exit for equity investors.
- The second-most important question potential equity investors pose is whether the management team can deliver. The availability of high-quality employees and management may be a challenge in some OGS markets.

- Few investors are familiar with the OGS market. Potential investors need to recognize its growth and profit prospects. Difficulties starting and growing a company and doing business in some markets may deter some investors driven by a desire for high growth.
- Hard currency availability and restrictions on foreign currency transactions can be issues in some countries. Some countries require central bank preapproval for payments of hard currency abroad, and the process may be slow.

Required market conditions

- Attractive exit opportunities are necessary to attract large-scale equity investors.
- Local and foreign financial institutions need better knowledge and understanding of the OGS sector, including well-documented and well-communicated understanding of sector economics; details of the competitive, regulatory, and legal landscape, the underlying risks, performance, and the track record of OGS companies; and the challenges, benefits, and potential of the sector. Above all, the risk-adjusted returns and costs of extending a loan must make the transaction attractive to lenders.
- Hard currency investors must be able to freely buy hard currency at competitive rates and without restrictions.

Policy and regulatory environment

- Regulations pertaining to foreign sources of capital should be examined and understood, as they may restrict the participation of international investors.
- The tax regime should encourage early-stage equity investment, given the high level of risks involved in the OGS market and the lack of a proven business model.
- Regulation should support the OGS business model, particularly the manufacturing, marketing, selling, financing, servicing, and repossessing of SHS units.

Case Study 4.1: Preferred stock: PEG Africa (Côte d'Ivoire and Ghana)

PEG Africa began operations in 2011, distributing and financing pay-as-you-go (PAYG) solar home systems (SHSs) in rural and peri-urban areas of Côte d'Ivoire and Ghana. Customers pay an initial deposit of about \$35 and the balance of the system over a 12-month plan, in daily or weekly installments. The company is the first licensee of M-Kopa.

In 2015 Energy Access Ventures (EAV), a Paris-based impact investment fund, participated in PEG's Series A-1 round of \$3.2 million. The following year, it led a \$4.3 million Series A-2 round, along with Blue Haven Initiative, a U.S.-based single-family office. EAV is a venture capital firm that seeks to increase access to electricity by low-income people in Africa. It invests across the electricity value chain, including in mini-grids, SHSs, commercial and industrial space, and ancillary services. Investors include the Netherlands' FMO, the United Kingdom's CDC Group, France's DFI PROPARCO, the European Investment Bank, and Schneider Electric (a French company).

In 2019 PEG Africa announced that it had raised a \$25 million Series C funding round from existing investors CDC Group, SunFunder, and responsAbility.

4.3 EQUITY CROWDFUNDING

- **Investee profile:** Early-stage company with innovative product that owns its own intellectual property and is domiciled in an equity crowdfunding–friendly jurisdiction
- **Lifecycle phase:** Seed through Series C
- **Ticket size:** \$250,000–\$1 million
- **Currency:** Hard, local

Equity crowdfunding is the sale of registered securities, typically of early-stage firms, to both retail and institutional investors via an online equity crowdfunding platform. The platform is typically responsible for conducting due diligence on potential investees and approving campaigns before posting them on their platform.

Most platforms are based in the United Kingdom and Europe. Companies that raise funds via equity crowdfunding typically do so where they have an entity domiciled in an equity crowdfunding–friendly jurisdiction (such as the United Kingdom, which raised \$2.8 billion on equity crowdfunding platforms in 2015 [Ziegler and others 2018]). Uprise Africa, based in South Africa, is one of a small number of equity crowdfunding platforms domiciled in Sub-Saharan Africa.

Regulatory frameworks remain a significant obstacle to equity crowdfunding platforms based in Sub-Saharan Africa. It may be possible to establish an MoU with the local financial regulator, however.

Benefits

- Equity crowdfunding can provide seed capital for early-stage companies, allowing more of them to reach scale (or rapidly fail). It is one of the few options available for OGS companies raising early-stage equity, as few funders that are willing to take on the risk of an early-stage company can provide funding at sufficient scale.
- The due diligence process and time to fund (campaigns usually run for 30 days) is typically shorter than negotiating and structuring equity investment with a fund (if funding is available at all at this stage). Lead time is also usually shorter and the volume of funds raised greater than for grant applications.
- Crowd investors can benefit from tax incentives for investments in eligible campaigns (see page 65).

Challenges

- The success of an equity crowdfunding campaign can be a good proxy for longer-term viability, as crowd investors are considered rational investors (Astebro and others 2017) and would likely be early adopters if all goes according to plan. In the OGS context, the investor (likely based in Europe) is unlikely to be a good proxy for market uptake by off-grid customers in Sub-Saharan Africa.

- Some platform revenue models create conflicts of interest. The revenue model of some equity crowdfunding platforms—which take an up-front fee of about 5 percent of the amount raised—implies that the platform’s financial viability depends on the value of its successful pitches, not the long-term success of the underlying ventures. Therefore, there is a potential conflict of interest, because platforms conduct due diligence on potential campaign makers but are incentivized to maximize the number and value of successful pitches. Other platforms operate co-investment models, which mean they have skin in the game, mitigating this risk. About 10 percent of pitches were accepted onto Crowdcube (the leading equity crowdfunding platform in the United Kingdom), which has an up-front fee model and no skin in the game (Estrin, Gozman, and Khavul 2018).
- Investment is illiquid. There are few secondary markets for shares purchased via equity crowdfunding platforms, and there have been only a handful of liquidity events. The lack of liquidity is amplified by the nature of the OGS sector, which is still nascent and has seen few liquidity events.
- Few jurisdictions have an enabling regulatory environment for equity crowdfunding. Many countries have equity crowdfunding regulations that are nebulous at best and restrictive at worst, limiting the growth of equity crowdfunding platforms, as well as the campaign pipeline and the financial products offered by the platform. Just five OGS companies have raised equity via crowdfunding since 2012. The state of the regulatory environment globally—coupled with investor supply and demand—means that campaigns are denominated in hard currency.

Required market conditions

- A pipeline of equity crowdfunding-ready OGS companies is needed. Companies may need incubation and guidance on the opportunities and requirements of equity crowdfunding to ensure they align with the typical investee profile.
- More could be done to engage investor target groups, such as investors in the diaspora.

Policy and regulatory environment

- Engagement of regulators through education is a necessary first step on the path to bespoke equity crowdfunding regulations. Registration of regulator-acknowledged platforms is important to begin to open the market and build trust before introducing bespoke equity crowdfunding regulation.
- Africa has few domestic equity crowdfunding platforms, and most of them are in South Africa. The lack of a (stable) regulatory framework likely hampers the growth of domestic equity crowdfunding. For example, the Securities Exchange Commission of Nigeria banned equity crowdfunding in August 2016, and Malaik (a social impact-oriented equity crowdfunding platform based in Nigeria) has ceased operating. Regulators in Kenya and Rwanda have expressed interest in enabling equity crowdfunding.
- Participation is limited to companies with a registered entity in a jurisdiction that permits equity crowdfunding and has a fairly dynamic equity crowdfunding market. Campaigns are usually denominated in a hard currency and investee revenue in local currency, creating foreign exchange risk.

Case Study 4.2: Equity crowdfunding: BuffaloGrid (United Kingdom)

BuffaloGrid, a U.K.-based start-up, has developed a mobile phone charging hub for entrepreneurs. The company, which started as a project in 2011, worked on several iterations of a battery for mobile phone charging before settling on the charging hub and launching a proof of concept in India and Uganda.

In February 2016, the company raised £533,000 (\$683,000) via Crowdcube, a U.K.-based equity crowdfunding platform, according to its website. Before launching the campaign, the company had raised almost \$1 million in grants, concessional debt, and angel investment.

The equity campaign allowed the company to bring the next iteration of its charging hub to market and begin mass production. The campaign raised twice as much as its campaign target of £265,000 (\$340,000).

In 2017 BuffaloGrid announced a partnership with Microsoft's Affordable Access Initiative. In early 2018, it launched live trials of the BuffaloGrid Hub in India. In late 2018, BuffaloGrid announced it had closed a €3.8 million (\$4.3 million) financing round led by seed-stage venture capital firm LocalGlobe, along with venture capital funds Hardware Club, ADV, and Seedcamp and a grant from the European Union's Horizon 2020 program.

CHAPTER 5 CATALYTIC TOOLS

This chapter examines tools that have been, or could be, used alongside the grant, debt, and equity financing instruments described in Chapters 2–4. The key difference between financing instruments and catalytic tools is that financing instruments are stand-alone instruments, which provide financing to off-grid solar (OGS) companies whereas catalytic tools are paired with a financing instrument in order to catalyze funding. Catalytic tools can attract investment in the OGS sector by providing incentives or reducing risk to investors.

This chapter examines seven tools: match funding, first-loss guarantee, foreign exchange hedges, tax incentives, collateral buy-back facilities, and pooling of solar home system (SHS) units across companies. These tools are not intended to address the multitude of factors that affect capital flows into the OGS sector (many of which are exogenous). Rather they are intended to encourage the participation of new and existing investors by providing opportunities to reduce the risk of investing in the sector. The tools are structured in a variety of ways, with some providing incentives directly to investors and others providing capital to OGS companies with the goal of improving the financial health of the underlying investees.

5.1 MATCH FUNDING

- **Types of financing to which it can be applied:** Grant, debt, equity
- **Typical company stage:** Pre-seed through Series A
- **Providers:** Governments, foundations

In match funding, a donor or investor provides co-funding to match donations or investments from other investors. Match funding is often applied to peer-to-peer (P2P) lending and crowdfunding campaigns to build momentum and encourage contributions from the crowd. The match ratio is usually 25–50 percent of the campaign target (for every \$1 contributed by the crowd, the match funding provider co-invests \$0.50 or \$1).

Match funding may be provided as a grant or donation to match debt provided by individual investors (through a P2P business lending platform, for example). Where match funding is applied to debt or equity fundraising, it may act as subordinated debt or equity, absorbing the first loss in the event of loan default and/or business failure.

Benefits

- Match funding can be used for proof of concept and in the early stages of a pilot or platform launch. Ideally, it can be used where there is not yet sufficient demand from individual donors or investors to catalyze investment.
- It can be an effective tool to build campaign momentum, as it leverages contributions from other donors and investors by a factor of 1.5–2.
- It can help complete a funding round when there is insufficient retail investment. Retail investors are generally required to meet up to 70 percent of the loan requirement.
- It can catalyze donations and investments by encouraging donors/investors to contribute more than they would if the match funding were not in place.
- By increasing the legitimacy of and effectively endorsing a company, match funding can encourage participation by donors and investors who otherwise would not have invested.

Challenges

- Securing a match funding provider can be difficult. There may be significant lead time to build a relationship, typically with a platform, and implement match funding. Some funders may consider match funding “too frontier.”
- The multiplier on each dollar donated by the match funding provider may not be as high as for other interventions. Gift vouchers issued to potential investors on the TRINE (P2P business lending) platform leveraged nine times the value of the voucher in investment (Cogan, Maffini, and Collings 2018).
- Although match funding can be used for proof-of-concept and in the early stages of a pilot (for example, Kiva DSE), it has limited applicability as companies grow and require larger sums of money on more commercial terms.

Required market conditions

- Platform partners must have sufficient back-end systems to deploy match funding in real time (or at least daily). They must be willing to engage with the match funding provider and fulfill reporting obligations. Platforms should be able to track utilization and funding rates and be in a position to assess the impact of match funding on supported campaigns.
- Where match funding is provided during a P2P lending campaign, an additional layer of due diligence may be required, particularly where match funding may be allocated on an automated basis across a portfolio of loans. The platform needs to prove that it has sufficiently robust mechanisms in place. The funder may also need a mechanism to reclaim funds once the loans are repaid or have an arrangement with the platform on how to allocate or “recycle” match funds.

Policy and regulatory environment

- Where match funding is deployed on P2P lending or an equity crowdfunding platform, regulatory limitations with regard to investment promotion must be respected, as match funding could be considered a form of investment promotion, although no jurisdiction appears to consider it as such.

Case Study 5.1: Match funding: Energise Africa (Democratic Republic of Congo, Kenya, Mozambique, and Rwanda)

Energise Africa, a U.K.-based crowdfunding platform, was launched at the end of 2017 to connect U.K. investors with African businesses selling SHSs. It offers bonds denominated in British pounds that yield 4–6 percent a year. The platform has raised close to £10 million (\$13.5 million) for OGS companies.

UK aid and Virgin Unite have provided match funding to several Energise Africa loans, with the goal of promoting the platform and building momentum by supporting a number of early success stories. Match funding acts as a cornerstone contribution during the live campaign.

Match funding makes up part of the loan capital provided to the borrower. Upon repayment of the loan via the platform, the principal and interest (the match funding component) typically become a grant to the platform. The platform may choose to allocate the funding to further match funding campaigns or a first-loss fund. UK aid and Virgin Unite, for example, provided match funding of 25–50 percent of the company's campaign target. Campaigns by Azuri Technologies, BBOX, SolarNow, SolarWorks!, Sollatek Kenya, and SunTransfer Kenya also received match funding.

Case Study 5.2: Match funding: Kiva Direct to Social Enterprise pilot (Kenya, Myanmar, Pakistan, Sierra Leone, and Tanzania)

In July 2016, P2P microlending platform Kiva launched a pilot providing interest-free working capital loans directly to social enterprises. The original Kiva model worked through financial intermediaries (such as microfinance institutions) to finance individual and group borrowers.

The pilot allows businesses to raise up to \$50,000 for their first loan; subsequent loans can be for as much as \$100,000. Live match funding has been activated on some loans, with a funder (usually a charity or foundation) matching each dollar contributed by individual members of the crowd on a live (real time) basis.

Several OGS solar start-ups—including Azimuth Solar (Sierra Leone), EcoEnergy (Pakistan), Pawame (Kenya), Sikubora (Tanzania), and SolarHome (Myanmar)—have raised debt finance on the platform. These campaigns received 50 percent of their campaign target in match funding from UK aid, through an Energy 4 Impact program designed to support crowdfunding and P2P lending in the off-grid energy sector. The Kiva Direct to Social Enterprise pilot lent more than \$3 million to 70 social enterprises in its first two years, unlocking \$16 million in follow-on funding for its borrowers, according to the enterprise.

5.2 FIRST-LOSS GUARANTEE

- **Types of financing to which it can be applied:** Debt, equity
- **Typical company stage:** Seed through Series A
- **Providers:** Governments, development finance institutions, aid agencies, nonprofits, foundations

A first-loss guarantee is a socially or environmentally driven credit enhancement provided by a grant-maker or other third party. The guarantee provider agrees to bear first losses in order to catalyze the participation of

lenders and investors that otherwise would not have entered the deal because of the perception of excessive risk. Guarantees are typically provided to a financial intermediary by donors or guarantee funds, which often charge a fee for guarantee. The fee can be subsidized or priced at market rates.

In the event of default by the borrower, the guarantor unconditionally and irrevocably guarantees to pay the principal per the original payment schedule. Most guarantees are partial, in order to ensure alignment of incentives between participants and the sharing of risk. When the guarantee is called, the guarantor acquires all rights and security from the lender for the amounts covered under the guarantee.

There are several types of guarantees, including pro rata guarantees (such as first-loss guarantees, which provide partial credit guarantees) and partial risk guarantees (such as guarantees, which carve out political risk). This section focuses on pro rata guarantees.

In a *pari passu* guarantee, the guarantor and lender share losses proportionally up to their respective limits. A guarantee may also cover losses above a certain threshold (excess-of-loss), with the lender taking on the first loss.

Benefits

- First-loss guarantees provide protection against nonpayment and catastrophic loss.
- They catalyze commercial funding by reducing the risk to lenders and investors.
- They enable the transfer and mitigation of risks to parties better able to bear them, bridging commercial constraints. For banks, they reduce bad debt reserves by reducing total risk exposure, allowing them to lend more and use capital more efficiently.
- They potentially reduce borrowing costs, increasing loan size by lenders already willing to lend.

Challenges

- An insufficient sector/company track record makes it difficult for companies to obtain credit guarantees. Most companies in the sector are unprofitable and have significant cashflow shortfalls, significantly increasing the risk of default. The focus should therefore be on how guarantees can complement a wider financing solution that mitigates default risk.
- Traditional private providers active in developed markets largely avoid low- and medium-income countries. Even where providers are willing to support the sector, individual guarantee providers face exposure limits. More providers would allow co-guarantees and risk-sharing arrangements to take place.
- As the scale of commercial guarantees increases, the availability of reinsurance may be desirable, to enable smaller players to underwrite larger contracts without overexposing their balance sheets and to allow them to manage the portfolio balance. The level of risk in some individual African markets may be considered too high for providers.

Required market conditions

- More guarantors in target markets, sectors, and currencies need to be willing to take on the underlying transaction credit risks at a reasonable cost.

- The integrity of the guarantor—its track record, credibility, reputation, and credit standing—needs to be sound to attract interest of potential beneficiaries. If the proposed beneficiary of the guarantee (bank, investor) does not consider the guarantor to be a good credit risk, the guarantee is of little value to it.
- Financial intermediaries or lenders with sufficient track records are needed to attract potential guarantors as partners. Guarantors look for experienced lenders with a strong credit standing that are able to manage the credit. This need for appropriate financial intermediaries is particularly important in transactions such as securitizations, where the originator (and/or lender) may have to actively manage the structure.

Policy and regulatory environment

- A sound domestic policy environment is needed, with enforceability of property rights and the rights and obligations of the parties.
- The financial sector must be developed enough to support private sector financing.
- Macroeconomic stability must be maintained, with inflation controlled and currency movements free.

Case Study 5.3: First-loss guarantee: Pawame (Kenya)

In May 2017, Pawame, an SHS distributor based in Kenya, raised €150,000 (\$169,000) in debt on TRINE, a Swedish P2P business lending platform. At the time, Pawame was an early-stage start-up that had raised \$1 million in equity from a group of angel investors and had just obtained its first loan (\$50,000 interest free) through Kiva's Direct to Social Enterprise pilot.

The loan through TRINE represented Pawame's first commercial debt facility. To secure it, Pawame's supplier, SHS manufacturer Fosera, provided a 30 percent first-loss guarantee. UK aid provided a 20 percent first-loss guarantee, through the Energy 4 Impact's Crowd Power program, bringing the total guarantee level to 50 percent of the loan principal on a declining balance basis.

Case Study 5.4: First-loss guarantee: SIDA portfolio guarantee (Kenya, Rwanda, Tanzania, Uganda, and Zambia)

In April 2018, the Swedish International Development Cooperation Agency (SIDA) announced its commitment to a portfolio-wide guarantee instrument to P2P business lending platform TRINE covering a loan portfolio of €10 million (\$11 million). Its commitment is not a first-loss guarantee but a risk-sharing guarantee of net losses and recovered funds (Trine Finance Limited, Trine AB, and Sida 2018). In the event that a borrower does not repay its loan, the guarantee protects 60 percent of the principal invested. TRINE pays an annual utilization fee to SIDA of 1.66 percent of the average outstanding guaranteed amount, paid semiannually.

The first loans using the guarantee were launched in April 2018. The guarantee has supported loans to BBOX in Kenya and Rwanda and distributors of Azuri Technologies products in Zambia.

5.3 FOREIGN EXCHANGE HEDGE

- **Type of financing to which it can be applied:** Debt
- **Typical company stage:** Series A–C
- **Providers:** Specialist hedge providers

A foreign exchange hedge is a tool used by companies or lenders to reduce or eliminate foreign exchange risk by locking in an exchange rate for a transaction that will occur in the future through a forward contract.

A foreign currency swap is a more complex tool used to hedge foreign exchange risk. It is an agreement between two parties in which one party borrows one currency and simultaneously lends another to the counterparty.

Quasi-hedge mechanisms distribute foreign exchange risk between the borrower and lender. In a typical quasi-hedge, the borrower absorbs local currency depreciation risk up to a certain threshold and the lender absorbs the depreciation risk above the threshold.

Cryptocurrency borrowing is another tool that can be used to hedge foreign exchange risk. It leaves borrowers exposed to cryptocurrency volatility, however, which could be much higher than sovereign currency volatility.

Benefits

- Foreign exchange hedges remove or reduce uncertainty. They can allow OGS companies to match their debt financing needs to future receivables, which are in local currency. Companies incorporate the foreign exchange hedge cost into their margin, leaving customers unaffected directly by local currency depreciation.
- Foreign exchange hedges may make lending by international capital providers more attractive where denominated in local currencies. They can allow impact investment funds and P2P business lending platforms to build a stronger presence in the OGS market.
- Absent foreign exchange hedging, the use of international finance sources lending in hard currency is normally too risky for companies whose revenues are in local currency, eliminating a vital and often available source of capital. Foreign exchange hedging makes these sources suitable for local companies as long as inclusion of hedging costs into consumer pricing does not make products too expensive.

Challenges

- The cost of a hedge can exceed 10 percent of principal (on top of the interest rate), which may be prohibitive for some borrowers, who are already paying 10–15 percent annual interest on hard currency debt.
- Borrowers often favor lower interest rates on hard currency loans over higher interest rates on local currency debt.
- Few foreign exchange hedge providers are active in the countries where OGS companies tend to operate, limiting competition.
- In some places, currency cannot be hedged because of volatility or other limitations.

Required market conditions

- Financial intermediaries (such as P2P business lending platforms) and borrowers must have balance sheets that are strong enough to support the foreign exchange hedge providers requirements, which may include an at-call deposit account and other specifications.
- A certain level of lender and borrower sophistication is required to understand the structure, cost, and implications of a foreign exchange hedge or quasi-hedge. It is important to keep tools as simple as possible.
- Foreign exchange hedge providers are needed that can deliver products in multiple currencies at a reasonable price.

Policy and regulatory environment

- Nebulous regulations can create uncertainty about the treatment of gains and losses as a result of a hedge. Financial regulations may not be sophisticated enough to address the tax implications of foreign exchange hedging.

Case Study 5.5: Foreign exchange hedge: BBOXX (Rwanda)

In October 2017, BBOXX announced the first trilateral debt facility in the OGS sector. Deutsche Bank's social enterprise fund, Essential Capital Consortium (ECC), and a Rwandan commercial bank, Banque Populaire du Rwanda (BPR), funded the \$5 million facility, which allowed it to deploy 150,000 SHSs in Rwanda. BPR provided local currency debt, and ECC provided hard currency debt, which was hedged. The Africa Guarantee Fund and USAID provided a first-loss guarantee.

MFX Solutions, a socially oriented company that provides hedges at market prices, provided a foreign currency swap to hedge against currency fluctuations. According to the company's website, it aims to support the impact investing model by providing hedging products and risk management education. MFX originated as an organization providing microfinance lenders with hedging instruments and education on foreign exchange risk.

5.4 TAX INCENTIVES

- **Types of financing to which it can be applied:** Grants, debt, equity
- **Typical company stage:** Pre-seed through Series A
- **Provider:** Government

Tax incentives are typically paid to investors who invest in projects or companies that meet specific criteria. Investors may receive income tax credits, reduce their income tax liability, or earn a tax-free (or reduced tax) return. Other types of tax incentives, such as import tariff relief for OGS companies, can indirectly influence capital raising.

This section focuses on tax incentives designed to stimulate investment. Tax incentives can be applied to investments through established and innovative financing instruments, including P2P business lending

and equity crowdfunding platforms and venture capital and equity investment funds. They can also be used to help OGS companies reduce their tax liabilities. Tax subsidies can be used to eliminate or reduce sales and import tax liabilities.

Benefits

- Tax incentives provide early-stage companies with access to capital and encourage the participation of investors who otherwise might not participate.
- Tax incentives promote the growth of a broader range of financing instruments, including equity crowdfunding.

Challenges

- It may be difficult to garner the necessary political will to implement tax incentive schemes given the potential of reduced tax revenue for government, particularly in developing markets.
- Depending on how it is structured, the tax incentive may be seen as benefiting an elite investor group.

Required market conditions

- A large proportion of the population must pay taxes.
- The tax system must be sophisticated enough to enable the paying of rebates and credits.
- High-quality investee companies must be in the same jurisdiction as investors, given the complexity of managing cross-border transactions in this context.

Policy and regulatory environment

- Government policies must promote and support an innovative financial sector as well as early-stage capital and social enterprises.
- The government must be willing to provide tax incentives to the OGS sector.

Case Study 5.6: Tax incentives: Venture capital schemes (United Kingdom)

Various tax incentive structures in the United Kingdom encourage the growth of start-ups and small and medium-size enterprises. The government also grants tax relief for investments in social enterprises. Venture capital schemes include the Enterprise Investments Scheme (EIS), the Seed Enterprise Investment Scheme (SEIS), the Social Investment Tax Relief (SITR), and the Venture Capital Trust (VCT).

Incentives allow individuals making an eligible investment to deduct 30–50 percent of their investment from their income tax liability (capped at a nominal amount). The scheme enables early-stage companies to offer equity investors tax relief benefits. They are considered an important driver of equity

crowdfunding in the United Kingdom, the leading market globally. The Innovative Finance Individual Savings Account (IFISA) scheme allows debt investors to earn tax-free returns and capital gains. U.K. investors in loans to OGS companies, such as those via P2P business lending platforms, have benefited from the IFISA scheme.

5.5 COLLATERAL BUY-BACK FACILITY

- **Type of financing to which it can be applied:** Debt
- **Typical company stage:** Series A–C
- **Providers:** Development finance institutions, foundations, nonprofits

Local lenders often shun lending to SHS companies because they do not wish to take on SHSs as collateral. In a collateral buy-back facility, a third party commits to buy back any repossessed units from the lender at an agreed upon price. Various parties, including development financial institutions, foundations, and other grant-makers, could provide the facility, redistributing the repossessed SHS systems in other communities or giving them to other partner organizations. This mechanism has not been implemented, although OGS companies often repossess and redeploy units.

Benefits

- A collateral buy-back facility has the potential to engage more lenders. The ability to take on collateral could encourage more lenders to provide debt to SHS companies and open new financing channels.
- The mechanism removes uncertainty about recovery value, reducing risk for the lender.

Challenges

- The facility requires pilot testing to determine whether it addresses local lenders' reluctance to take on SHS as collateral.
- There is a lack of an established second-hand market for SHS units or clear recovery/resale value. This problem should gradually be overcome as older SHS units change hands and the market continues to grow. Transferability of assets that are branded and/or proprietary may be difficult, however.
- Technological improvements may reduce the value of older SHS assets.
- Legal or licensing requirements may need to be met and local authority approvals obtained before units can be repossessed. In Rwanda, for example, such authorizations are required before repossessing collateral.
- Repossession is expensive and can hurt a company's reputation.

Required market conditions

- OGS companies need to be motivated or obligated to service units and ensure that all repossessed units are in full working order to justify the buy-back cost.
- Product design needs to support the retrofitting and recycling of SHS units. Replacement parts need to be available to support the development of a second-hand market.
- Facility providers need to be able to redeploy repossessed SHS units.

Policy and regulatory environment

- A sound domestic policy environment is needed, with enforceability of collateral and the rights and obligations of the parties.
- Regulator or local government approval may be required for repossession of SHS units.
- The regulatory environment must support the repurposing and redeployment of SHS units.

Case Study 5.7: Collateral buy-back facility: Azuri Technologies (Rwanda)

In 2013 USAID awarded Azuri Technologies and Energy 4 Impact a \$1 million grant to bring pay-as-you-go (PAYG) solar to Rwanda. Azuri Technologies rolled out 10,000 SHSs in Rwanda through the program. Although the project did not employ a collateral buy-back facility, the experience of Azuri Technologies shows the potential to repossess and redeploy units.

The program experienced a number of challenges, including product tampering and customer recharge card supply (Collings and Munyehirwe 2016). As a result of the high number of defaults, a repossession program was put in place to understand the reasons customers were not meeting their obligations.

Independent collection officers were sent to reclaim units of customers that were out of credit for 28 days or more or had tampered with the product. Approvals had to be sought from local authorities before the units were repossessed. This experience highlights the capacity of SHS companies (and/or third parties appointed by a borrower or lender) to reclaim units and potentially generate value from them through refurbishment and/or redeployment.

5.6 POOLING OF SOLAR HOME SYSTEM UNITS ACROSS COMPANIES

- **Type of financing to which it can be applied:** Debt
- **Typical company stage:** Series B–C
- **Provider:** Impact investment funds

Individual business units of a company or individual companies may be unattractive to investors because of the small size and low volume of transactions and the costs, time, and resources required per transaction. The pooling of business units or companies creates diversification, potentially lowering risks, increasing transaction sizes, and enhancing investor interest. The assets of multiple SHS companies can also be grouped under a pooled financing entity (through a special purpose vehicle [SPV], for example), although doing so could create challenges.

Benefits

- Leveraging of borrowing capacity through the aggregation of multiple business units in a single transaction increases transaction size and borrower leverage.
- Pooled risk, larger volume, and credit enhancement potential reduce transactions costs.
- Diversifying the collection of loans across several local currencies and different markets reduces risk.
- Larger transaction size widens the potential investor base.
- Development of a new financing avenue for the sector with greater scaling potential expands options for financing to a wider group of companies.

Challenges

- Pooling can be time and resource intensive to set up; lack of familiarity with the structure may require long lead times.
- Getting companies to act jointly, commit to the creation of the pool, and agree on credit and other terms is likely to be difficult.
- Foreign exchange risks need to be hedged if individual loans are in local currency but the wider facility is in hard currency.
- Identifying companies that are large enough and have a sufficient track record may be difficult. To date the structure has been used by decentralized government institutions, not the private sector.

Required market conditions

- A sufficiently large pool of business units or companies must be willing to use the tool.
- Infrastructure such as trustees and credit-rating agencies needs to be available to service the structure.

Policy and regulatory environment

- The regulatory environment must allow for the establishment and structuring of SPVs and the issuance and trading of securities.

Case Study 5.8: Pooling assets: The Tamil Nadu Water and Sanitation Pooled Fund (India)

The Tamil Nadu Water and Sanitation Pooled Fund (WSPF) was created to target small and medium-size municipalities with large neglected infrastructure needs using a market-driven approach. These smaller urban local bodies often face high transactions costs that make financing solutions from larger financiers, such as banks, prohibitive.

Capital was raised through an unsecured debt obligation in local currency. Credit enhancement was achieved by establishing an escrow account for each body for its revenue, a debt service reserve fund funded by the government, and a partial credit guarantee issued by USAID.

Various elements of the structure helped reduce financing costs:

- The pooling of projects reduced transactions and rating costs, creating a more attractive investment proposition.
- Local currency denomination of the bond avoided currency risk.
- Credit enhancements improved the bond rating.

This approach was later adopted by the government of India at the national level.

CHAPTER 6 BLOCKCHAIN, DISTRIBUTED LEDGER TECHNOLOGY, AND CRYPTOCURRENCIES

This chapter explores the role of distributed ledger technology (DLT)—the technology that underpins blockchain and cryptocurrencies—in the off-grid solar (OGS) market. It examines DLT-based fundraising channels, payment systems, and energy trading platforms.

All of these innovations are nascent. DLT is being tested and cautiously deployed in a variety of sectors and industries. An estimated 3 percent of identified use cases are in the energy and utilities sector (Hileman and Rauchs 2017). Within the OGS sector, a handful of companies are experimenting with DLT-enabled innovations in fundraising and energy trading.

OGS has a number of features that make it suitable for DLT applications, including the following:

- Numerous, diverse market participants that lack established relationships and records of trust
- The need to enact multiple transactions with little friction and minimization of transactions costs
- Market segments and customers that lack access to established infrastructure for monetary transaction
- A premium on the value of the data created through market operation and related transactions

Most DLT-based projects are experimental or at the proof-of-concept stage. The few systems that have been deployed are very small scale and often retain centralized elements (with regard to transaction processing and governance, for example).

In many cases, a community's needs do not require use of a DLT system and would be better served using existing technologies, such as cloud-based architectures and traditional distributed systems. These tools are often cheaper and more efficient than DLT. They have been effectively deployed in related areas, such as the Internet of Things and alternative payment infrastructure.

Much of the focus is on its application to payments, but blockchain and DLT can also catalyze organizational change. They are the driving forces behind reengineering inter-enterprise business processes and the global move toward shared infrastructure. Whether the resulting shared infrastructure will be based on DLT remains to be seen.

6.1 WHAT IS DISTRIBUTED LEDGER TECHNOLOGY?

DLT is an umbrella term that describes shared database systems that are collectively maintained and updated by a set of entities rather than a singular entity. Participating entities create a tamper-evident log of records. Distributed ledgers are often referred to as blockchains (although some observers consider blockchain a subset of distributed ledgers that use a particular data structure consisting of blocks of transactions that are cryptographically linked in order to form a sequential chain of records). This chapter uses the term *DLT systems* to refer to distributed ledgers and blockchain networks.

There are two main types of DLT systems. In a public permission-less system, access to the network is open; anyone can join, leave, and rejoin the system at will. System functionality and security rely on a complex economic incentive design that requires a native cryptocurrency to align incentives of generally pseudonymous actors with different objectives and intentions in order to make it more profitable to play by the rules than to cheat.

In a private permissioned system, access to the network is restricted to vetted participants—generally regulated entities—who are bound by contractual agreements. Private permissioned DLT systems operate in a controlled enterprise environment (within a particular company, for example) and generally do not rely on socioeconomic incentives involving a native token (such as bitcoin) to secure the systems.

6.2 WHAT ARE CRYPTOCURRENCIES AND TOKENS?

Cryptocurrencies are digital currencies that are algorithmically issued based on a transparent schedule on a public permission-less DLT system that has an integrated payment network through which the native cryptocurrency can be transferred. They are not issued or controlled by a central bank, corporation, or other institution.

Cryptocurrencies can be traded and exchanged in dedicated marketplaces and exchanged for other assets (other cryptocurrencies, national currencies, gold). They can also be used to purchase goods and services, although high price volatility restricts their use as a medium of exchange.

Since 2011 many cryptocurrencies and tokens have emerged to serve uses beyond currency and payments. SolarCoin was launched in early 2014 by a group of volunteers to incentivize the generation of solar electricity by distributing one solarcoin per megawatt-hour of energy created. Distribution occurs through a combination of traditional cryptographic proof-of-work mining (which rewards successful miners with newly minted solarcoin for processing transactions) and meter reading certified by local affiliates to the SolarCoin Foundation to prove solar energy creation.

A token is a digital representation of a set of rights conferred on the token holder. Any right and/or obligation (including endless combinations) can be directly encoded into the token and thus automatically enforced by the DLT system. For example, a token can be used to securitize solar energy by serving as a digital representation of actual energy that can be exchanged and traded on a platform. The token holder has the right to consume a corresponding amount of energy in return for the token.

A token is often tied to a particular application (often referred to as a *decentralized application* or *dApp*) that is built on top of an existing DLT system. In contrast, a cryptocurrency generally has its own native DLT system. Cryptocurrencies play an essential role in aligning incentives among pseudonymous and untrusted actors within a decentralized system; tokens do not necessarily perform such a role.

The Jouliette is a blockchain-based token that enables individuals and community members to easily manage and share their locally produced renewable energy via a private micro-grid. It was launched in September 2017 as a pilot project in the Amsterdam community of De Ceuvel to advance the transition toward 100 percent renewable energy generation and create social value within the community. It is distributed proportionally to the amount of renewable energy generated, according to the company's website.

The following sections detail potential applications of DLT systems to the OGS market from a functional perspective. It is important to note the intense energy usage of crypto-mining and the negative externalities it has created (Benetton, Compiani, and Morse 2019). Whether innovation can reduce the massive amounts of energy currently required by crypto-mining remains to be seen.

As DLT systems are still in their infancy, there are few test cases to examine. This section therefore includes case studies from both within and outside the sector.

6.3 DISTRIBUTED LEDGER TECHNOLOGY-BASED FUNDRAISING CHANNELS

- **Innovation type:** Fundraising
- **Company stage:** Pre-seed to seed
- **Participants:** Energy producers, project developers, consumer networks

DLT-based fundraising channels are novel and innovative financing mechanisms through which energy producers can raise capital. In their purest form, initial coin offerings (ICOs) are public token sales in which a project or company sells a predetermined number of tokens to investors globally in exchange for cryptocurrencies and/or national currencies. ICOs represent an opportunity to raise the necessary capital expenses for development costs and provide an alternative to traditional equity- or debt-based financing. In recent years ICOs have attracted attention because of the large number of suspected frauds, which will likely dampen investor enthusiasm.

Recently, there has been a move toward private rounds (pre-sales or pre-ICOs), which are often limited to accredited investors. This trend is driven largely by the uncertain regulatory environment and the risk of public token sales potentially infringing securities regulations and laws.

Tokens can be classified into two main categories (this categorization is based on a legal rather than a functional distinction). Utility tokens are required to access and use a DLT platform or application; they have a utility function beyond mere speculation. As such, a public offering involving utility tokens may not fall under traditional securities laws. Security tokens, referred to as *crypto-securities*, resemble traditional securities. They are subject to securities regulation, which often involves restricting access to the token sale to accredited investors.

Tokens generally do not provide traditional equity rights (at least not yet) and thus do not affect a company's capital structure. It is unclear how tokens will be treated in accounting terms, as the rights conferred on a token holder vary significantly from one token to another.

Benefits

- DLT-based fundraising allows energy producers/project developers to quickly raise substantial capital: Companies can raise up to eight-figure amounts in a matter of hours or days, generally without issuing equity or taking on debt.
- It offers increased flexibility to energy producers for raising funds.
- A successful ICO may be a useful proxy for consumer demand and future success.
- DLT-based fundraising widens the potential investor base, attracting a new type of impact investor (though token sales can be restricted to certain jurisdictions and/or investor types).
- Retail investors can support local and global projects using comparatively small amounts.

Challenges

- The legal and regulatory framework is unclear. Depending on the nature of the token, selling tokens to the general public may be considered an unregistered security offering; regulators could thus hold the issuers in violation of securities regulation and laws. Although several jurisdictions have issued local guidelines, no clear, harmonized regulatory framework has been developed. As a result, the ICO market is plagued by a high fraud rate (scams, misuse of funds) and a lack of sufficient investor protection.
- Cryptocurrencies are highly volatile and speculative. As most revenues from token sales are in cryptocurrency (generally bitcoin and ether, the cryptocurrency used on the Ethereum blockchain), issuers are subject to volatility risk. The high volatility of cryptocurrencies means that the dollar value of the funds raised can fluctuate significantly.
- Tokens can be held for purely speculative purposes rather than to increase the use of renewable energy.
- Many fraudulent ICOs have been identified, which may reduce the viability of this fundraising channel for genuine fundraisers. These cases highlight the limited rights of investors in ICOs.

Required market conditions

- A clear regulatory framework needs to be established in order to create regulatory clarity and certainty, which helps foster innovation. Ideally, regulations governing ICOs should be harmonized across major jurisdictions, given the global nature of token sales. The emergence of self-regulating bodies and organizations could help promote best practices and combat fraud.
- The pool of investors willing to participate in a specific token sale needs to be sufficiently large. They need to be financially educated to understand the massive risks involved.

Regulatory and policy framework

- No clear regulatory and policy framework is in place. Some jurisdictions have issued (rather vague) guidelines, which often differ widely across jurisdictions and in some cases even within countries. China has effectively banned ICOs. National unilateralism will likely prove unsuccessful. The global nature of token sales requires a global regulatory response with harmonized rules.

Case Study 6.1: Distributed ledger technology-based fundraising channels: Powerhive and Sun Exchange (Kenya)

Sun Exchange is a South Africa-based platform that pioneered a cryptocurrency-based solar panel micro-leasing model for off-grid communities. In July 2018, it announced a partnership with Powerhive, solar project developer based in Kenya.

Powerhive will become the exclusive recipient of pre-sales proceeds of the Sun Exchange digital rewards token, a cryptotoken designed and issued by Sun Exchange to catalyze OGS development. It will use the funds to build solar-powered mini-grid projects that focus on revenue generation throughout Sub-Saharan Africa.

The installed solar panels that make up these mini-grids will be offered for sale to Sun Exchange members, who effectively own cells within the projects and earn revenue (akin to dividends) from the energy produced. The partnership aims to catalyze \$23 million in investment and fund about 150 solar-powered mini-grids that will provide power to 175,000 people currently lacking power.

Case Study 6.2: Distributed ledger technology-based fundraising channels: WePower (Lithuania)

WePower is a blockchain-based green energy trading platform in Lithuania that connects energy buyers (households and investors) with energy producers, providing an opportunity for buyers to purchase energy at below-market rates. Renewable energy producers can use it to raise capital by issuing tradable tokens that can be redeemed for energy.

WePower raised \$3 million in an open pre-sale in October 2017 and \$40 million in an ICO in February 2018. It plans to expand its market reach to Australia, Estonia, and Spain. Token holders will be given priority access to participate in auctions for purchasing tokenized energy once the renewable energy plant is connected to the platform.

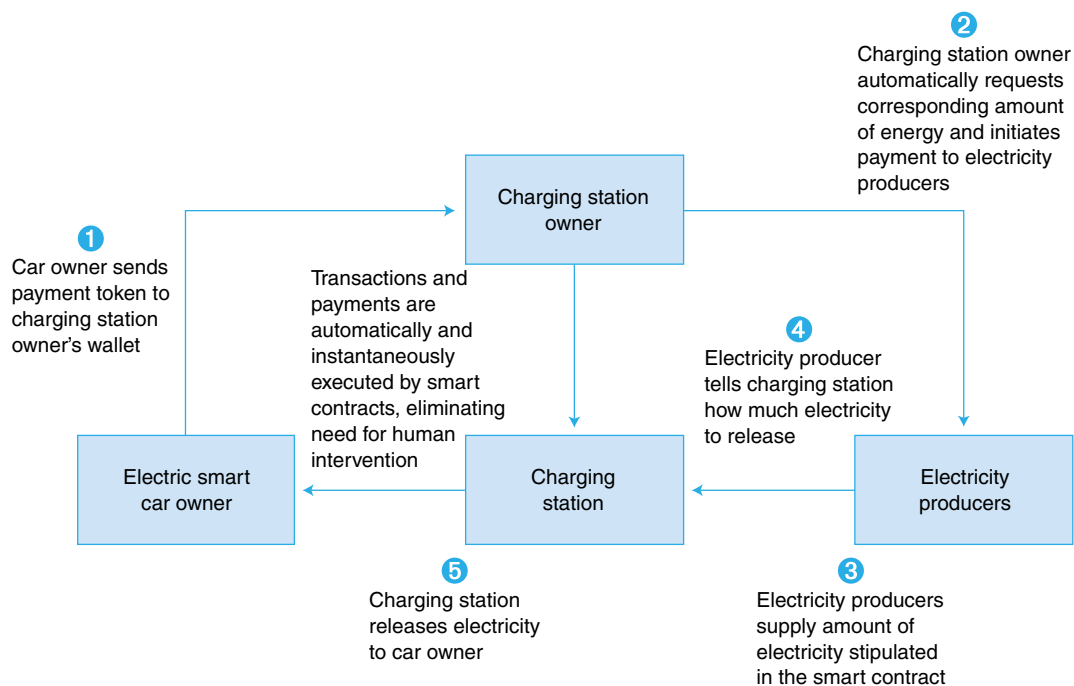
6.4 DISTRIBUTED LEDGER TECHNOLOGY-BASED PAYMENT SYSTEMS

- **Innovation type:** Payments
- **Participants:** Utility providers, consumers

DLT-based payment systems are an alternative means of transferring monetary units between individuals and entities. In most cases, the units transferred are cryptocurrencies and digital tokens, which can be converted into other cryptocurrencies, tokens, or national currencies. Figure 6.1 illustrates the application of DLT for payments at electric vehicle charging stations.

DLT-based payment systems generally enable fast, low-cost, efficient intra-country and cross-border payments. A key advantage of a shared platform is the automatic execution of a set of related processes (for example, message → action → payment), leading to more efficient and frictionless business processes across firm boundaries.

Figure 6.1: Illustrative example of electric vehicle–charging station



Benefits

- Energy producers can accept cryptocurrencies and tokens as compensation for their services, allowing unbanked consumers to make payments via smartphones and for other people to make payments on their behalf.
- Public blockchains, such as bitcoin and Ethereum, can be used to make faster and less expensive cross-border payments to regions that require a less developed financial market infrastructure. For example, BitPesa, a Kenya-based digital foreign exchange and payment platform, is providing business-to-business (B2B) payment services to small and medium-size enterprises in East, West, and Central Africa, using bitcoin as a vehicle currency
- Smart contract payments are automatically executed if a certain set of conditions is met. Complementary products, such as insurance, can be added.

Challenges

- Lack of developed market infrastructure (local exchanges and marketplaces, banks, mobile network operators, mobile money operators, and market makers) can result in low to no liquidity in local markets, impeding currency conversion (from cryptocurrency to fiat currencies). The high volatility of cryptocurrencies and tokens can compound the problem. DLT-based payment networks that support local national currency have not been deployed.
- The nature of public blockchain networks leads to tradeoffs between the level of decentralization and its cost. Generally, the less centralized a system, the more restricted its transaction-processing capacity (low number of transactions per second) and the higher its transactions costs with growing usage.

These limitations may render public permission-less DLT systems unsuitable for large-scale high-volume payment uses.

- Each additional token could add friction to the transaction process, because users are required to acquire an “application” token before being able to pay for a specific service using the token.
- Crypto-mining requires intense energy use. Most of it takes place in China, powered by a combination of coal and hydroelectric power. There is growing uncertainty regarding the government’s position on crypto-mining; the activity could be banned or restricted.

Required market conditions

- Users need smartphones and fast, reliable access to the Internet.
- The DLT-based payment system needs to be connected to the local market infrastructure (for example, local exchanges need to be able to convert the digital currency into the local currency). Ideally, a digital version of the local national currency issued by the central bank would be used to reduce volatility.

Policy and regulatory environment

- Regulations are currently in the early stages of development; regulators are seeking feedback on the risks and benefits of DLT in many developed market economies. Given the early stage of the market, DLT is not subject to bespoke regulations, but it may fall under the remit of existing financial regulations on technology and payments.
- Tax implications must be considered on a per country basis. Vagueness creates uncertainty regarding the treatment of gains and losses as a result of the conversion process and the associated volatility.

Case Study 6.3: Distributed ledger technology-based payment system: Bankymoon (South Africa)

In 2016 South African company Bankymoon introduced a pay-as-you-go (PAYG) system that provides top-up services to prepaid energy meters. Each energy meter has a unique bitcoin address, to which the bitcoin payment is sent. Every time a smart meter receives a bitcoin payment, Bankymoon calculates the tariff and loads the meter.

The integration of bitcoin payments into smart metering systems for modern grids provides the opportunity for users worldwide to send utility services (such as electricity, water, and gas) to recipients anywhere in the world. This technology could allow a donor to provide energy to a hospital or school or an individual to purchase energy on behalf of a family member living in another country.

Bankymoon installed some smart meters in South African schools to test the concept in March 2016. Since then the company appears to have pivoted toward blockchain consulting services, without indicating the results of the trial.

6.5 DISTRIBUTED LEDGER TECHNOLOGY-BASED ENERGY TRADING PLATFORM

- **Innovation type:** Payments
- **Participants:** Local prosumers (producers and consumers of electricity), businesses, and wholesale energy distribution networks

A DLT-based energy trading platform enables the creation of an autonomous local energy grid with integrated P2P or B2B transactions, disintermediating the electricity retailer. The autonomous grid links producers and consumers of electricity; a community's energy trades are recorded on a distributed ledger. Energy consumers can also be producers ("prosumers"). The DLT system acts as a matching engine and marketplace for trading energy between peers. The transactions are certified and followed by a settlement payment, either directly on the platform or using traditional payment services.

Benefits

- This technology encourages decentralized energy production. Seamless integration of distributed energy generation within a community allows prosumers to generate value from otherwise latent energy. Access can be open to all members of a community.
- Economic efficiencies can arise from efficient matching, low-cost transactions, and the removal of intermediaries and/or central operator control.
- Public recordkeeping provides a transparent overview of energy generation, trade matching, and subsequent disbursement via the integrated payment network(s).

Challenges

- The costs and benefits of this technology are not yet clear. Given the fragmented landscape of DLT frameworks, it can be difficult to know which system to implement and when to use the technology (or an alternative).
- Finding a robust, competent development team capable of deploying the system can be difficult.
- Transaction speed and block sizes of public permission-less DLT systems may not be sufficient for supporting substantial transaction volumes. Private permissioned DLT systems enable higher transaction volumes and greater speed, but they introduce governance challenges. Setting up a governance model for a shared infrastructure—determining the roles participating entities will have to perform, establishing the rights and obligations of participating entities, agreeing on the nature and deployment of safeguarding mechanisms in case of unexpected system outcomes, and so forth—is not easy. Dysfunctional governance and a lack of clearly defined responsibilities risks grinding the system to a halt.

Required market conditions

- A functioning grid must exist to which the DLT-based energy platform can connect.
- Local leaders and key influencers should be involved in regular community events and awareness activities that educate people on the benefits and inherent limitations of the system.
- Enterprise-grade DLT system frameworks need to be available in tandem with mature developer ecosystems and support areas. Integrating existing systems should be trivial; interoperability with other energy platforms is desirable.

Policy and regulatory requirements

- A favorable regulatory framework for P2P energy trading needs to be put in place in order to support the proliferation of DLT-based energy trading platforms. The divergent frameworks in place are unclear as to whether P2P energy trading is allowed.

Case Study 6.4: Distributed ledger technology-based energy trading platform: PowerLedger (Australia)

PowerLedger is a P2P marketplace that enables prosumers to produce and sell units of energy by exchanging electrical power for tokens (pegged to the Australian dollar to reduce the price volatility common to most publicly traded tokens). Transactions are validated on the DLT system, and settlements are orchestrated via smart contracts. The platform is designed to allow the development of custom applications, including data analytics and sourcing, whereby consumers can choose which energy source or which producer to buy from.

In January 2018, the company tested the platform in 80 homes in Fremantle, Australia, a town of 30,000 people. It has since been expanded to other sites. The trial was funded by an A\$8 million (\$6.2 million) grant from the Australian government.

Case Study 6.5: Distributed ledger technology-based energy trading platform: SOLshare (Bangladesh)

Bangladesh-based start-up SOLshare uses DLT systems to manage P2P microgrids that deliver solar energy to households and businesses. Labelled “micro-energy transition model 3.0,” SOLboxes are installed in local community households in order to create interconnected solar home systems (SHSs) that allow participants to monetize excess solar energy along the value chain in real time. The platform is connected to a mobile money network, which enables near real-time payments between peers. In 2017 SOLshare received a \$1 million energy grant from the UN Department of Economic and Social Affairs (DESA). In 2018 SOLshare closed a \$1.66 million Series A funding round, led by Singapore-based IIX Growth Fund, as well as a venture capital fund set up by German utility Innogy SE and Portuguese utility firm EDP.

REFERENCES

- Armeni, Andrea, and Miguel Ferreyra De Bone. 2017. *Innovations in Financing Structures for Impact Enterprises: Spotlight on Latin America*. Washington, DC: Inter-American Development Bank.
- Astebro, Thomas B., Manuel Fernández Sierra, Stefano Lovo, and Nir Vulkan. 2017. "Herding In Equity Crowdfunding." <https://ssrn.com/abstract=3084140>
- Bartlett, Robert, Adair Morse, Richard Stanton, and Nancy Wallace. 2019. *Consumer-Lending Discrimination in the FinTech Era*. <http://faculty.haas.berkeley.edu/morse/research/papers/discrim.pdf>
- Benetton, Matteo, Giovanni Compiani, and Adair Morse. 2019. *CryptoMining: Local Evidence from China and the US*. https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2019-af-conference/paper-benetton-compiani-morse-cryptomining.pdf
- British Business Bank. 2016. "UK SMEs Access £100m of Funding through British Business Bank Partner Market Invoice." December 16. <https://www.british-business-bank.co.uk/uk-smes-access-100m-funding-british-business-bank-partner-marketinvoice/>
- Central Bank of Kenya. n.d. Treasury Bills. <https://www.centralbank.go.ke/securities/treasury-bills/>
- Center for Universal Education. 2017. *Impact Bonds in Developing Countries: Early Learnings from the Field*. Brookings Institution, Washington, DC. https://assets.ctfassets.net/bbfox7vx8x8r/6OoT6ya7xCwMAgUKma248k/df187f0db109a7ff5ca995f0f847127a/Impact_Bonds_in_Developing_Countries_report.pdf
- Cogan, Davinia, Irene Maffini, and Simon Collings. 2018. *Crowd Power: Who Is the Crowd?* Energy 4 Impact. <https://www.energy4impact.org/file/2045/download?token=gwYL2uzX>
- Cogan, Davinia, and Peter Weston. 2019. *Crowd Power: Crowdfunding and P2P Lending for Energy Access: State of the Market 2018*. Energy 4 Impact. <https://www.energy4impact.org/file/2094/download?token=H2OMM250>
- Collings, Simon, and Anicet Munyehirwe. 2016. "Pay-as-You-Go Solar PV in Rwanda: Evidence of Benefits to Users and Issues of Affordability." *Field Actions Science Report*. <https://journals.openedition.org/factsreports/4189>
- EDF (Électricité de France). 2018. *EDF Ramps Up Its Business on Africa's Off-Grid Market by Investing in a New Range of Products and in Local Skills*. Paris. <https://www.edf.fr/sites/default/files/contrib/groupe-edf/espaces-dedies/espace-medias/cp/2018/20180718-offgrid-afrique-en.pdf>
- Estrin, Saul, Daniel Gozman, and Susanna Khavul. 2018. "The Evolution and Adoption of Equity Crowdfunding: Entrepreneur and Investor Entry into a New Market." *Small Business Economics* 51 (2): 425–39.
- Gold Standard. n.d. *Gold Standard for the Global Goals: Leveraging Climate Action for Greater Impact in Sustainable Development*. <https://www.goldstandard.org/articles/gold-standard-global-goals>

- Hileman, Garrick, and Michael Rauchs. 2017. *Global Blockchain Benchmarking Study*. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/global-blockchain/#.XAcCOZMzZE4>
- IEA (International Energy Agency). 2017. *Energy Access Outlook 2017: From Poverty to Prosperity*. Paris.
- International Energy Agency (IEA), the International Renewable Energy Agency (IRENA), the United Nations Statistics Division (UNSD), the World Bank, and the World Health Organization (WHO). 2019. *Tracking SDG7: The Energy Progress Report 2019*. Abu Dhabi. <https://www.irena.org/publications/2019/May/Tracking-SDG7-The-Energy-Progress-Report-2019>
- Kaffenberger, Michelle, and Quang Nguyen. 2017. "Responsible Digital Credit for Merchants: Insights from Kenya." CGAP blog, February 8, Consultative Group to Assist the Poor, World Bank, Washington, DC. <https://www.cgap.org/blog/responsible-digital-credit-merchants-insights-kenya>
- Kariuki, James. 2018. "M-AKIBA Investors Get Second Interest Payment." April 10. <https://www.businessdailyafrica.com/markets/marketnews/M-Akiba-bond-investors-get-second-interest-payment/3815534-4380306-gn9k74/index.html>
- Kuppuswamy, Venkat, and Kathy Roth. 2015. *Research on the Current State of Crowdfunding: The Effect of Crowdfunding Performance and Outside Capital*. U.S. Small Business Administration, Office of Advocacy, Tampa, FL.
- Loizos, Connie. 2017. "This Young Lending Startup Just Secured \$70 million to Lend \$2 at a Time." Techcrunch. <https://techcrunch.com/2018/03/28/this-young-lending-startup-just-secured-70-million-to-lend-2-at-a-time/>
- Mannepalli, Aswin. 2017. "Tested by Adversity, Fintech Branch Emerges Stronger (and Better at Risk Management)." *Forbes*, July 24. <https://www.forbes.com/sites/aswinmannepalli/2017/07/24/tested-by-adversity-fintech-branch-emerges-stronger-and-better-at-risk-management/#48c06ad3fdd3>
- M-Kopa Solar. 2017. "Breaking Records in Financing Off Grid." October 10. <http://www.m-kopa.com/breaking-records-in-financing-off-grid/>
- Shell Foundation. 2018. *Achieving SDG 7: The Need to Disrupt Off-Grid Electricity Financing in Africa*. <https://shellfoundation.org/app/uploads/2018/10/Catalyst-Report.pdf>
- Sotiriu, Alexander, Pepukaye Bardouille, Daniel Waldron, and Gianmaria Vanzulli. 2018. *Strange Beasts: Making Sense of PAYG Business Model*. Washington, DC: Consultative Group to Assist the Poor (CGAP). <https://www.cgap.org/research/publication/strange-beasts-making-sense-paygo-solar-business-models>
- Trimble, Chris, Masami Kojima, Ines Perez Arroyo, and Farah Mohammadzadeh. 2016. "Financial Viability of Electricity Sectors in Sub-Saharan Africa: Quasi-Fiscal Deficits and Hidden Costs." Policy Research Working Paper 7788, World Bank, Washington, DC. <https://openknowledge.worldbank.org/handle/10986/24869>
- Trine. 2018. "BBOX 1, Kenya." <https://trine.com/campaign/bboxx%201>
- Trine Finance Limited, Trine AB, and Sida (Swedish International Development Cooperation). 2018. Guarantee Agreement, March 8. <https://drive.google.com/drive/folders/1NM3YWT90n0njGLi3Xv1MgpakuoTSolbo>
- World Bank. 2017. *Program-for-Results Information Document (PID) Concept Stage*. Washington, DC. <http://documents.worldbank.org/curated/en/266341497992825758/pdf/Nigeria-Power-Sector-Recovery-P4R-Concept-Stage-PID-8-3-2017.pdf>

———. 2018. Tracking SDG7: The Energy Progress Report 2018. Washington, DC.

———. 2019. Early-Stage Financing in Green Sectors in Sub-Saharan Africa. Washington, DC.

World Bank Group, GOGLA and Dalberg Advisors. 2018. Off-Grid Solar Market Trends Report 2018. Washington, DC. https://sun-connect-news.org/fileadmin/DATEIEN/Dateien/New/2018_Off_Grid_Solar_Market_Trends_Report_Summary.pdf

Zhang, Bryan, Peter Baeck, Tania Ziegler, Jonathan Bone, and Kieran Garvey. 2015. *Pushing Boundaries: The 2015 UK Alternative Finance Industry Report*. Cambridge Centre for Alternative Finance (CCAF), Judge Business School, Cambridge University. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/pushing-boundaries/#.XAbwTGhKg2w>

Zhang, Bryan, Robert Wardrop, Kieran Garvey, Simon Collings, Tania Ziegler, Garrick Hilmen, Raghavendra Rau, John Burton, Mia Gary, Davinia Cogan, Louise Westerlind, and Alexis Lui. 2017. *The Africa and Middle East Alternative Finance Benchmarking Report*. Cambridge Centre for Alternative Finance (CCAF) and Energy 4 Impact. <https://www.jbs.cam.ac.uk/faculty-research/centres/alternative-finance/publications/africa-middle-east/#.XAbxEGhKg2w>

Ziegler, Tania, Rotem Shneor, Kieran Garvey, Karsten Wenzlaff, Nikos Yerole mou, Bryan Zhang, and Rui Hao. 2018. *Expanding Horizons: The 3rd European Alternative Finance Industry Report*. Cambridge Center for Alternative Finance (CCAF), Judge Business School, Cambridge University. https://www.jbs.cam.ac.uk/fileadmin/user_upload/research/centres/alternative-finance/downloads/2018-02-ccaf-exp-horizons.pdf

Cambridge
**Centre
for Alternative
Finance**



UNIVERSITY OF
CAMBRIDGE
Judge Business School

Cambridge Centre for Alternative
Finance (CCAF)

10 Trumpington St.
Cambridge CB2 1QA, UK
ccaf@jbs.cam.ac.uk



Energy Sector Management Assistance Program
The World Bank

1818 H Street, N.W.
Washington, DC 20433 USA
esmap.org | esmap@worldbank.org



International Finance Corporation (IFC)
2121 Pennsylvania Ave NW
Washington, DC 20433
www.ifc.org

